The Effect of Instructional Group Size

on the

Academic Achievement of Highly Able Third Grade Math Students

by

Megan Purkey

Submitted in Partial Fulfillment of the Requirements for the

Degree of Master of Education

April 2015

Goucher College

Graduate Programs in Education

Table of Contents

Abstract

The purpose of this study was to determine whether third grade students identified as gifted or highly able would have higher levels of achievement on unit tests in mathematics if they were instructed in small groups as opposed to receiving instruction as a whole class. To determine which approach resulted in higher levels of achievement, gain scores on assessments of unit content offered in small groups and in a whole group setting were compared. Students' feelings about the content of the unit and its delivery using the two instructional conditions were assessed using a survey at the end of each unit and at the conclusion of the study. Results indicated that achievement gains were higher for the unit in which students were instructed in small groups. There was no significant difference in perceptions about the units or their content delivery through whole class versus small group instruction. While results suggested that small group instruction had benefits in terms of achievement, additional research controlling for factors which might affect the achievement outcomes and students' perceptions, such as time of year and subject matter, appears to be warranted.

CHAPTER I

INTRODUCTION

The underachievement of gifted and highly able students is a problem that has been well documented. These students may experience boredom, apathy, or a lack of teacher and societal attention. Because previous work in the area of giftedness and mathematics instruction suggests that high levels of engagement, collaboration with peers, and teacher support increase the achievement of highly able students, this study attempts to compare the affective and academic effects of small versus whole group methods of mathematics instruction on highly able third graders. This study builds on previous findings which suggest decreased group size, particularly in the younger elementary grades, positively impacts students' achievement.

Overview

Up to 50 percent of gifted students are estimated to be underachieving academically (Hoover-Schultz, 2005; Rimm, 1997). These students often are ignored or underserved in traditional classrooms, leading to boredom and low performance, as demonstrated by class grades, self reports, and teacher observation. The definition of what high quality instruction entails for this student population has led to discussions about the organization, content, and methods of instruction, specifically in light of budget cuts and growing class sizes. Research suggests that grouping practices and group size may affect how students feel about themselves, the academic content they are studying, and their success (Folmer-Annevelink, Doolaard, Mascareno & Bosker, 2010; Finn, Pannozzo & Achilles, 2003; Hoover-Schultz, 2005; Milesi & Gamoran, 2006).

This researcher became interested in examining the effect of teacher-student ratio on gifted math students' achievement in her role as a third grade teacher. She observed that heterogeneously-grouped general education students tended to achieve better when instructed in small groups. She also found that curriculum shifts and current county-wide initiatives, as observed in workshops and teacher trainings, focused on instruction delivered in small groups. She wished to learn more about the effect of instruction group size on homogeneously-grouped high achieving third grade students' grades in her math class.

Statement of Problem

The purpose of this study was to investigate whether reducing the teacher-to-student ratio by delivering instruction in small groups rather than to a whole class leads to greater achievement gains. Because schools address the whole child, the impact of instructional group size on students' perceptions and affect were also evaluated.

Hypotheses

Due to previous findings on the effect of class size and the call for more individualized instruction, it was hypothesized that students would experience greater growth in scores and report more positive reactions to instruction when they were taught in small groups rather than as a whole class.

Null hypothesis 1: Mean gains on math unit tests with whole group instruction equals mean gains on math unit tests with small group instruction

Null hypothesis 2: Mean perceptions for whole group condition equals mean perceptions for small group condition

Operational Definitions

For the purposes of this study, **highly able third grade students** are defined as those who were reported as having high potential by their current or previous year's teachers, received high grades in Math on the previous year's report card, and performed in the top 20 percent of all current third grade students at the school on a pre-assessment at the beginning of the second quarter of school. **Method of instruction** relates to the way skills or concepts are taught and is further broken down into whole or small group instruction. **Whole group, or whole class, instruction** refers to activities led or initiated by the teacher to all students in the class simultaneously. **Small group instruction** refers to activities led or initiated by the teacher with approximately one-third of the class, or between eight and nine students, while the rest of the students in the class worked independently. **Math achievement** is defined as performance on end of unit assessments developed by Baltimore County Public Schools and parallel pretests developed by the researcher. **Academic growth** refers to the difference

between scores on end of unit assessments and parallel teacher-created pre-assessments. **Affect** refers to the mood, confidence level, effort, and preferences of students. Affect was rated by students using a Likert scale and answering questions describing their experience in each instructional condition (small and whole group).

CHAPTER II

REVIEW OF THE LITERATURE

The term "gifted" refers to students with skills, talents, and abilities who have high potential to develop and benefit humankind (Delou, Cardoso, Mariani, Paixao & Castro, 2014). However, despite these unique qualities, in educational settings, gifted or highly able students often are ignored or expected to succeed academically, regardless of instructional quality or design (Delou et al.; Hoover-Schultz, 2005; Rimm, 1997). This literature review aims to identify reasons for underachievement in math of gifted students and explore the implications of class size and structure on gifted students' achievement and affect. Part One examines the underachievement of able students. Part Two discusses implications of teacher-student ratio for student achievement. Implications of instructional group size as related to student achievement are offered in Part Three of the literature review.

Underachievement of Able Students

Estimates of highly able students who are underachieving in today's classrooms are as high as 50% (Hoover-Schultz, 2005; Rimm, 1997). The instructional setting largely dictates the quality of learning that will occur for all students. High quality classrooms involve varied and active instruction ("A Day in Third Grade", 2005; Hoover-Schultz). Children's knowledge and skills are built through opportunities for higher-order thinking, inference, and discussion of content or analysis ("A Day in Third Grade"). Frequent interactions between the teacher and child are needed to provide individualized feedback or scaffolding ("A Day in Third Grade"; Hoover-Schultz). Gifted students especially need stimulating activities involving the use of creativity, critical thinking, discovery, and experimentation to maintain interest and achieve academic success (Delou et al., 2014; Rimm, 1997).

Several researchers have concluded that "the typical child in the United States is not assured access to high quality education in early elementary school," ("A Day in Third Grade," 2005, p. 319) due to the instructional and emotional climate, the type of activities to which they are exposed, and the educational setting. In a study of early elementary grades, the most frequently observed educational activity was structured, teacher-

directed, whole group instruction followed by independent work, prevalently in the form of worksheets. Inflexible requirements and learning pathways as well as traditionally structured classrooms contribute to students' underachievement (Hoover-Schultz, 2005). In observed classes, the researchers found that 91.3% of students' time was spent listening or watching a teacher solve or demonstrate a skill in a whole class format or doing individual seatwork, with little teacher interaction ("A Day in Third Grade", 2005). Because of the focus on basic skills, and exposure to only one method of instruction, highly engaged or enthusiastic behavior was rarely observed . This indicates that students received minimal variety in their learning experiences and that the instruction they receive primarily consisted of rote activities requiring passive responding . The results of this type of classroom instruction are that students are less likely to be engaged, show low affective displays to the teacher, experience more teacher detachment and over-control, and are less emotionally supported (Hoover-Schultz, 2005; "A Day in Third Grade", 2005; Landis & Reschly, 2013). Low behavioral engagement in primary grades not only leads to low academic achievement, but also predicts later difficulties such as higher risk of high school dropout and decreased career success (Landis & Reschly). High expectations are often missing in today's classrooms; schools in which the focus on athletics or social status is greater than that of intellectual effort diminish students' performance (Hoover-Schultz, 2005; Rimm, 1997).

Problems arise for gifted students in settings where they are not appropriately challenged and experience high levels of boredom (Landis & Reschly, 2013; Preckel, Gotz & Frenzel, 2010; Rimm, 1997). The predominant cause of students' boredom is too little diversity in instructional strategies and teacher personality (Landis & Reschly, 2013; Preckel et al., 2010; Rimm, 1997). Students often experience "underchallenge", in which they already know the skill, or "overchallenge" in which they have difficulties understanding a concept, especially when teachers are 'burnt out' or exposed to pressures of standards-based reform initiatives ("A Day in Third Grade," 2005; Preckel et al., 2010; Rimm, 1997). Gifted children experience boredom more frequently when grouped heterogeneously; however, their self-perceptions in educational settings are shaped in reference to their peers (Hoover-Schultz, 2005; Preckel et al., 2010). Homogeneous class structures, therefore, can present the 'little-fish-big-pond' effect in which students lose their positive self-concept when comparing

themselves to similarly high achieving pupils . Gifted students are more likely to be the victims of bullying and have self esteem or confidence issues than students with average intellectual ability (Delou et al., 2014; Hoover-Schultz, 2005; Neihart, 2006). Decreases in self-concept can affect motivation, academic choices, interest, enjoyment, and achievement (Neihart; Preckel et al.; Rimm). Barriers such as these are rarely addressed for highly able students, since giftedness often is seen as a benefit and gifted students are not considered to be needing specialized care or attention (Delou et al.; Hoover-Schultz).

Implications of Teacher-Student Ratio on Achievement

Smaller class sizes, especially in the elementary school grades, have been found to boost students' academic performance in both reading and mathematics (Finn, et al., 2003; Folmer-Annevelink et al., 2010; Hoover-Schultz, 2005; Milesi & Gamoran, 2006). Specifically, classes of less than 20 pupils appear to improve achievement for early elementary school children. Supporting this finding, the child-teacher ratio in the average school is typically higher in third grade than in lower grades (Finn et al.; "A Day in Third Grade", 2005). Gains in student achievement often are attributed to a higher quality learning environment, higher quality instruction, and greater student engagement (Finn et al.; Folmer-Annevelink et al.; Landis & Reschly, 2013; Milesi & Gamoran; Hoover-Schultz, "A Day in Third Grade").

Smaller class sizes allow for learning spaces that are more flexible, organized, and appropriate for student-centered instruction (Finn et al., 2003; Hoover-Schultz, 2005). An orderly environment, in which there is appropriate space for learning, more time spent on instruction, fewer disruptions, and more opportunities for students to work together positively affects students' ability to learn and retain information (Finn et al.; Landis & Reschly, 2013). Students are more "visible" in smaller classes, and are more pressured to be attentive and to participate (Milesi & Gamoran, 2006). Small classes spend less time on disruptive behaviors and classroom management, contributing to a more positive climate ("A Day in Third Grade," 2005; Finn et al.; Folmer-Annevelink et al., 2010; Landis & Reschly, 2013). Similarly, teachers are more likely to expose children to academic activities when fewer children are present in their classrooms so that greater amounts of time can be spent being on instruction rather than procedural, organizational, or nonacademic discourse (Finn et al.; Folmer-

Annevelink et al.; “A Day in Third Grade”).

Teachers’ attitudes and instructional styles appear to shift with smaller teacher-student ratios, contributing to more meaningful and interesting experiences for their students. Teachers who have small class sizes report increased morale and enjoyment, which improves their interpersonal interactions with individual students and their classes as a whole (Finn et al., 2003; Folmer-Annevelink et al., 2010). Teachers are able to get to know each student more intimately, build relationships, and show a greater tolerance for a range of student behaviors and learning styles (Finn et al.; Folmer-Annevelink et al.). This reflection is especially important as underachieving students often have unfavorable learning styles or coping skills (Hoover-Schultz, 2005). With smaller class sizes, teachers also have more time to attend to the individual needs of students, allowing them to more effectively differentiate and tailor instruction (Finn et al.; Folmer-Annevelink). Folmer-Annevelink, et al. reported that effects of more individualized and frequent teacher-student interactions were observable in students of all attainment levels, from low to high achievers. Smaller class sizes allow teachers to respond to students’ questions more frequently and with greater depth . In classes with less than 20 students, there are twice as many instances of sustained interactions, in which the teacher works with the same individual or group without interruptions for at least two consecutive 25 second units of time, compared to classes with twenty-five or more students . The proportion of students who are addressed individually also is considerably larger; all students, regardless of cognitive or behavioral characteristics, experience more teacher-student interactions when in small classes .

Students also are more engaged in smaller classes (Finn et al., 2003; Folmer-Annevelink, 2010; Milesi & Gamoran, 2006; “A Day in Third Grade,” 2005). Students have a stronger sense of belonging, which encourages them to become, and remain, engaged (Landis & Reschly, 2013; Milesi & Gamoran). Smaller groups of students encourage greater member participation, during which students have a more unified purpose and feel more closely affiliated with the group through opportunities for more support and guidance from teachers or peers (Finn et al.; Landis & Reschly). Reduced class sizes relate to students demonstrating increased positive academic and social behavior including attentiveness, time on task, participation, effort,

initiative, following rules, interacting positively with the teacher, and collaborating with peers (Finn et al.; Folmer-Annevelink et al.). Students also initiate more interactions and respond more frequently in these settings (Folmer-Annevelink et al.). Positive learning behaviors, in turn, are strongly correlated with high academic performance (Finn et al.; Landis & Reschly). Small class sizes help meet students' need for autonomy, challenge, and social support, leading to greater feelings of academic and social competence (Finn et al.). This finding may be related to the observation that teachers use small-group instruction, collaborative group work, and appropriate individual activities more often when they have classes with fewer students, allowing for increased individualized interaction for students in instructional matters (Folmer-Annevelink et al.; Milesi & Gamoran).

Implications of Instructional Group Size for Achievement

Because the effects of class size on student achievement can be variable, research such as that reported by Milesi and Gamoran (2006) has suggested that instructional conditions within these classes affect achievement. Students' engagement is higher in classrooms that provide more emotional and instructional support ("A Day in Third Grade," 2005; Landis & Reschly, 2013; Peterson & Miller, 2004; Neihart, 2006; Rimm, 2013). This instructional response includes scaffolding, autonomy and choice, deep and personal connections with students, caring, positive interactions with individual students, and a positive tone ("A Day in Third Grade"; Hoover-Schultz, 2005; Landis & Reschly). Teacher-directed small group activities are positively associated with student achievement, since they can provide many of the features identified as high-quality instruction (Milesi & Gamoran).

Students, especially high achievers, are more engaged and actively involved when they are provided small group instruction with a teacher (Peterson & Miller, 2004). Whereas students are found to be off-task more often during whole group instruction, they are more likely to be thinking about something on task or related to the task during cooperative learning activities . This response may occur because students perceive cooperative learning tasks to be more important and, as such, having a higher overall quality of experience . In well-constructed cooperative learning activities, students feel as though they make more progress working

together than alone and that sharing their ideas relates not only to the task, but to their future goals, as well (Jansen, 2012; Peterson & Miller). Students also experience greater concentration, less apathy, and higher achievement during small group instruction (Peterson & Miller).

When teaching math, small group instruction tends to be more cognitively challenging for students because teachers ask more probing questions and encourage students to share their use of learned strategies (Jitendra et al., 2013; Peterson & Miller, 2004; "A Day in Third Grade," 2005). Explicit strategy instruction in math improves automaticity of basic facts and the use of strategies with word problems (Jitendra et al.). Subsequent small group interactions that encourage students to think aloud as they engage in mathematics and provide chances for peers to provide feedback on shared strategy use is known to improve student learning . Participation in both whole group and small group discussions increase mathematical learning, motivation, confidence, and problem solving abilities (Yang, D., Lai, M., Yao, R., & Huang, Y., 2014).

Students report that they are better able to complete, understand, and enjoy their work in collaborative small groups (Jansen, 2012). By sharing ideas, coming up with a collective answer, and backing up their answers with explanations, students are given the opportunity to help and question one another to decide upon a correct answer (Yang et al., 2014). Reasoning aloud about their mathematical thinking can help students fill in gaps and further develop their understanding by making connections while explaining their thought process (Jansen). Because they are more collaborative and engaged, students' conceptual understanding, reasoning skills, and procedural fluency are advanced . Additionally, by exploring different ways to enter into and solve problems, students are given more opportunities to demonstrate competency and be viewed by others as competent . Through their participation in small group discussions, students see additional ways to solve, hear mathematical explanations in the language of their peers, view problems from a different perspective, and form a stronger, more flexible understanding of taught concepts; if they are explicitly taught to provide more elaborated conceptual explanations to each other, they also have higher achievement . Small groups encourage positive dispositions, in which students have a high sense of competence, see math as useful and worthwhile, and persist in the face of challenge . Thus, they are more likely to effectively engage with mathematics, put

forth effort, and choose to work on math on their own in the future . Responsibility is transferred to the student, and gains are seen in both autonomy and efficiency (Hoover-Schultz, 2005; Jansen, 2012).

Summary

Highly able students require challenge and collaboration to avoid boredom and underachievement. Perhaps because they are overwhelmed and facing pressures from educational policies, teachers and educational stakeholders often do not attend to the unique needs of gifted students. This review of literature suggests that smaller class sizes help to build teacher morale and enhance teachers' ability to meet the different needs of their students in an effective manner. Structuring class activities to include small, collaborative groups involving direct strategy instruction and student-centered sharing and discussion of ideas has been found to increase student engagement and achievement and may be particularly beneficial in improving gifted students' automaticity, their interest in mathematics, and their ability to apply mathematics skills to academic and real life situations.

CHAPTER III

METHODS

Design

A quasi-experimental design was used to compare student achievement gains and affect after receiving mathematics instruction in small groups or as a whole group. The independent variable was the method of instruction, either whole group or small group. The dependent variables were the difference in pre and post assessment scores (gain scores) for each unit, and student ratings of their affect and perceptions related to the lessons, which were assessed using teacher-created surveys.

Participants

Participants included 25 highly able students in the researcher's third grade Math class. Students were assigned to this class and determined to be highly able through teacher report, the previous year's report card grades, and scores on a pre-assessment which was administered at the beginning of the second quarter of the school year. All students were between eight and nine years of age. There were 12 girls and 13 boys in the class. Of these students, 17 were Caucasian, one was Hispanic, six were Asian, and one was African-American.

Instrument

The end-of-unit assessments and scoring guides were provided by Baltimore County Public Schools. The assessments tested students' mastery of the concepts taught in each unit included in the study: measurement for whole group condition and fractions for the small group condition. Teacher-made pre-assessments were developed which paralleled the two end-of-unit assessments. These measurement tools assessed the same skills with the same types of questions, but used different numbers/examples.

Surveys also were administered at the end of each unit which consisted of 17 teacher-developed questions, for which students rated themselves and their perceptions from low to high using a five point Likert scale. Students were administered a second survey on which they compared the units and answered open-ended items after completing the second unit (fractions).

Procedures

Before beginning each of the two units of mathematics, students took a teacher-created unit pre-assessment independently, without teacher support, other than provision of documented accommodations for students receiving special services through an IEP or 504 plan, such as having a human reader.

For the first unit, which covered measurement, the students were instructed as a whole class. Each day, in a one-hour class period, students were exposed to teacher-led or initiated instruction as a whole class for 30 minutes. This included direct explanation of concepts or skills, modeled problem-solving, guided practice, and time for questions or additional clarification of misconceptions. Students then practiced independently and completed formative assessments of the day's learning for 15 minutes, during which the teacher circulated throughout the classroom and provided support for students as needed. The last 15 minutes of the class were spent on school system-mandated skill practice and review through the use of DreamBox, an individualized technology program that students use on their own without teacher support or guidance.

For the second unit, which covered fractions, students were randomly assigned to one of three small groups of between eight and nine students and completed three rotations for each lesson. One twenty-minute rotation consisted of teacher-led and initiated instruction in the small group. This included direct explanation of concepts or skills, modeled problem-solving, guided practice, and time for questions or additional clarification of misconceptions. Another 20 minute rotation included independent practice and completion of the day's formative assessment. The final 20 minute rotation was spent on DreamBox. All rotations other than the first were completed independently, without support or guidance from the teacher and occurred during the same instructional period. The order of rotations for each student group was varied throughout the unit so that each part of the unit and type of activity was provided in each time slot an equal number of times for each group.

At the end of each unit, students completed an end of unit assessment provided by Baltimore County Public Schools, without teacher support beyond required accommodations. They also completed a teacher-created survey to describe their opinions and perceptions and affect related to the unit (See Appendix A). At the conclusion of both units, students completed an additional survey which compared their perceptions and

feelings about the two units (See Appendix B).

CHAPTER IV

RESULTS

Null hypothesis 1 was that the mean gains on unit tests for the two types of instruction (whole and small group) would not differ significantly. A Paired-Samples t Test was run to compare the mean gains. Results are presented in Tables 1 and 2.

Table 1

Descriptive Statistics for Gain Scores for Units using Whole versus Small Group Instruction

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	**GAIN WHOLE GROUP (Measurement)**	3.72	25	2.354	.471
	GAIN SMALL GROUP (Fractions)	6.84	25	4.325	.865

Table 2

Results of Paired Samples t Test Comparing Mean Gains for Whole and Small Group Instructed Units

Paired Samples Test								
Gains Compared	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
GAIN Whole Group Instruction (Measurement Unit) – GAIN Small Group Instruction (Fractions Unit)	-3.12	3.692	.7384	-4.644	-1.596	-4.225	24	.000

The results indicated that the mean gain for the small group instruction (fractions) unit of 6.84 was 3.12 points greater than the mean gain for the whole group instruction (measurement) unit of 3.72. The t of -4.225 was significant at the $p<.000$ level, meaning that it is highly unlikely that a difference of this size was due to chance. Based on these results, the first null hypothesis of the study, that the mean unit test score gains of the two instructional conditions would be statistically equivalent, was rejected.

The second null hypothesis was that the students' mean ratings of their feelings about the units would not differ significantly across the instructional methods. Descriptive statistics were calculated for the first 15 survey items for the end of unit survey, which was administered after the completion of each unit. The survey items were rated from 1 (I really disagree) to 5 (I really agree). Descriptive statistics follow in Table 3 for the Whole Group condition (Measurement unit) and the Small Group condition (Fractions unit). The means for the small and whole group instructional conditions are plotted next to one another in Figure 1 for visual comparison.

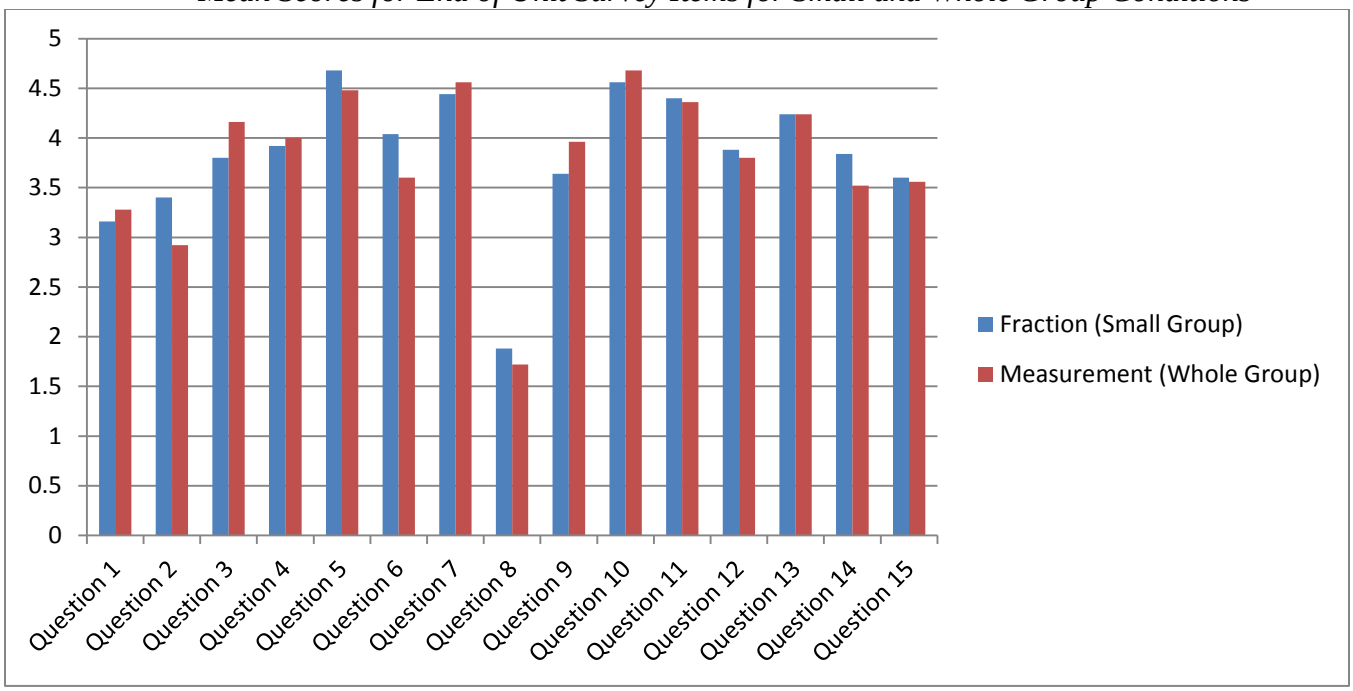
Table 3

Descriptive Statistics for survey items for Whole and Small Group Units

N=25	WHOLE GROUP UNIT (Measurement)			SMALL GROUP UNIT (Fractions)		
	Mean	Range	s.d.	Mean	Range	s.d.
1. I was interested in this unit.	3.28	1-5	1.17	3.16	1-5	1.14
2. I felt that this unit challenged me.	2.92	1-5	1.12	3.40	1-5	1.12
3. I had enough teacher support (help and attention).	4.16	1-5	1.14	3.80	1-5	1.32
4. I felt good about my ability to succeed in this unit.	4.00	2-5	1.00	3.92	1-5	1.15
5. I was able to work positively with others on this unit.	4.48	3-5	.71	4.68	2-5	.69
6. I felt like I belonged in the group/class when doing this unit.	3.60	1-5	1.38	4.04	2-5	1.06
7. I put forth a lot of effort to do well on this unit.	4.56	1-5	.87	4.44	1-5	1.00
8. I wasn't able to concentrate because of others' or my own behavior.	1.72	1-4	.98	1.88	1-5	1.24
9. I had freedom and choice about how to solve mathematical problems and manage my time.	3.96	2-5	.89	3.64	2-5	1.08
10. I followed directions for independent or group work and rules for behavior.	4.68	3-5	.56	4.56	3-5	.65
11. I was focused and on task.	4.36	3-5	.64	4.40	3-5	.58
12. The things we did were important to helping me learn the main points of this unit.	3.80	1-5	1.04	3.88	1-5	1.09
13. During this unit I participated in discussions and classwork.	4.24	3-5	.83	4.24	2-5	.93
14. I had support from my peers in completing the tasks for this unit.	3.52	1-5	1.26	3.84	2-5	1.07
15. I thought this unit was fun.	3.56	1-5	1.45	3.60	1-5	1.44

Figure 1

Mean Scores for End of Unit Survey Items for Small and Whole Group Conditions



Visual comparison of the mean ratings given to each survey item for the two instructional methods in Figure 1 did not suggest any dramatic differences in opinions based on the instructional method or group size used. Average ratings were higher for whole group instruction in the areas of student interest, amount of perceived teacher support, confidence/ability to succeed, effort, behavior, and following directions. Average ratings were higher for small group instruction in the areas of challenge, working cooperatively with others, feelings of belonging, freedom/choice, ability to focus/time on task, importance of learning activities, amount of peer support, and fun. The average rating for amount of participation was equal for both conditions.

For the open ended survey items, items 16 and 17, several themes emerged. Students reported that they enjoyed the projects and working with manipulatives with similar frequency for both conditions and they reported that they didn't like that the units were challenging or boring with equal frequency between the conditions. More respondents reported that they enjoyed working with others and the amount of challenge more frequently for the whole group measurement unit than for the small group Fractions unit: however, three

students stated that they did not like working together as a whole class, so this perception or preference was not shared by all.

Table 4

Frequency of Likes and Dislikes in Student Responses Regarding Whole and Small Group Instruction

Category/Response	Whole Group (Measurement)	Small Group (Fractions)
	frequency	Frequency
LIKED		
Working with others	6	2
Amount of challenge	5	3
Manipulatives	5	5
Specific projects	9	8
Amount of teacher support	1	0
Finishing work on time	0	1
DISLIKED		
Amount of challenge	7	7
Boredom	1	1
Working all together	3	0
Time consuming	1	0
Amount of teacher support	0	1

As the items on the post unit surveys were all rated so that higher responses on the 1 to 5 ratings indicated greater satisfaction with or effort was put forth on the lesson, the item scores were totaled to yield a composite post unit score for both the whole group unit (Measurement) and the small group unit (Fractions) units. These two mean composite scores were compared using a paired samples t test to determine whether either method of instruction yielded significantly higher ratings overall than the other. Results follow in Table 5.

Table 5

Descriptive Statistics for Composite Ratings on Post Unit Surveys

Paired Samples Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
TOTAL whole SURVEY (Measurement)	25	56.84	6.762	1.352
TOTAL small SURVEY (Fractions)	25	57.48	7.843	1.569

Table 6

Results of Paired Samples Test comparing Composite Survey Scores for items 1-15

Composite Survey Score	Paired Differences					T	df	Sig. (2-tailed)
	Mean	s.d.	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Whole Group - Small Group	-.640	7.67	1.534	-3.806	2.526	-.417	24	.680

The results of the paired samples t-test indicated that the mean composite (total) ratings for the whole group condition (56.84) and the small group condition (57.48) differed by -.64, which was not a large enough difference to be found statistically significant ($t=-.417$, $p < .68$). Thus the second null hypothesis, that the mean perceptions of the two instructional conditions would be statistically equivalent was retained.

Finally, a survey was administered to all participants after completing both units to assess participants' relative feelings about the two units and methods. Reponses indicated students' feelings about factors such as which unit the students found more challenging, interesting, and worked hardest on. A copy of the survey is included in Appendix B and the items and tallies of responses are posted in Table 7. The implications of these results are discussed in Chapter 5.

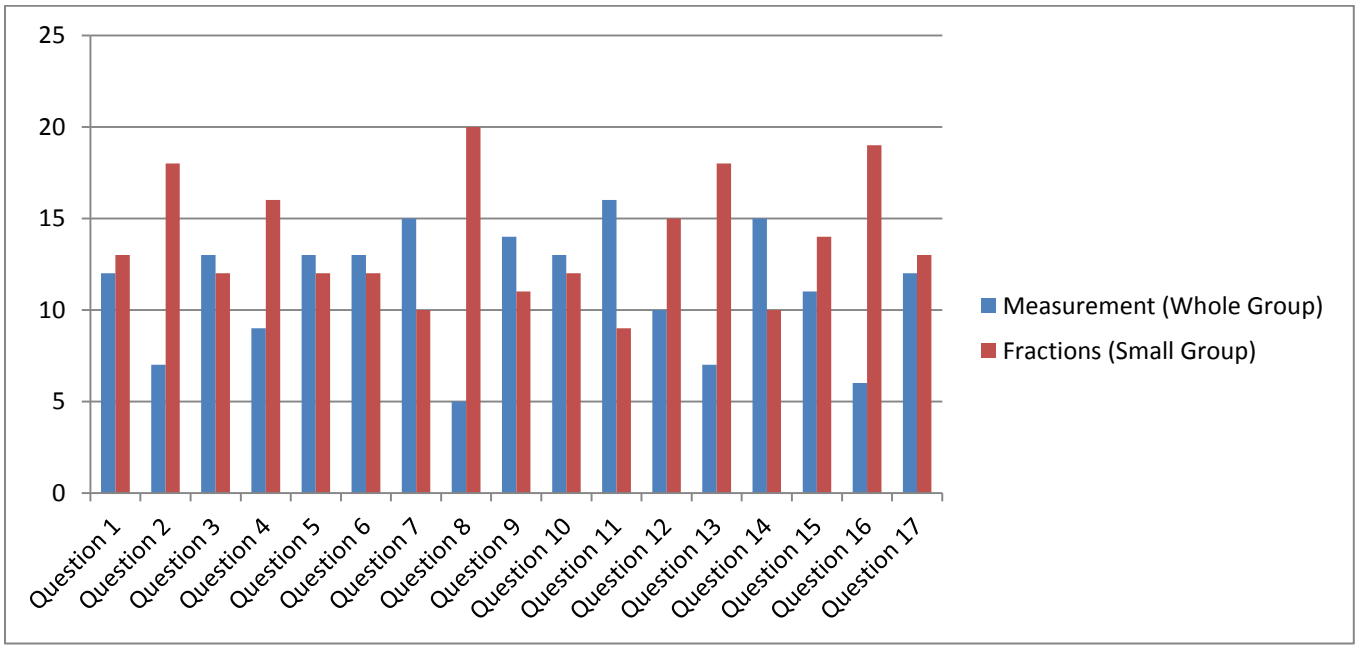
Table 7

Tally of Responses Comparing the Small Group (Fractions) and Whole Group (Measurement) Lessons

Item	Measurement (WHOLE GROUP)	Fractions (SMALL GROUP)
1. Was the measurement or fraction unit more interesting?	12	13
2. Was the measurement or fraction unit more challenging?	7	18
3. In which unit did you get more teacher support (help and attention)?	13	12
4. In which unit did you need more teacher support (help and attention)?	9	16
5. In which unit did you feel best about yourself and your abilities?	13	12
6. In which unit did you work best with others?	13	12
7. In which unit did you most feel like you belonged?	15	10
8. In which unit did you try the most?	5	20
9. Which unit helped you to concentrate and pay attention?	14	11
10. Which unit gave you more freedom and choice?	13	12
11. In which unit did you most follow directions and rules?	16	9
12. In which unit were you more on task?	10	15
13. Which unit was more important to you?	7	18
14. In which unit did you participate the most?	15	10
15. In which unit did you get more support from peers?	11	14
16. In which unit did you need more support from peers?	6	19
17. Which unit did you like the best?	12	13

Figure 2

Frequency of Student Responses Comparing the Small Group (Fractions) and Whole Group (Measurement) Lessons



Item 18 on the final survey comparing the units asked students why they chose a particular unit as their favorite. Below is a listing of responses sorted by themes that emerged.

Table 8

Frequency of Student Responses Regarding Whole and Small Group Instruction

Response Theme	Whole Group (Measurement)	Small Group (Fractions)
	frequency	frequency
Level of Challenge	6	1
Fun	4	6
Specific Projects	2	7
Working with Peers	1	1
Tools/Manipulatives	0	1
Variety of Tasks	0	1
Centers	0	1
Amount of Teacher Support	1	0

Student responses comparing the two units, displayed in Table 7 and Figure 2, indicate that there was little difference in amount of interest, confidence, collaboration, freedom and choice, the amount of teacher support received, or which unit was preferred. However, the measurement unit with whole group instruction was rated higher in the categories of belonging, concentration, following rules, and participation. The fraction unit with small group instruction was rated higher in the following categories: challenge, the need for teacher support, effort, amount of time on task, importance, the need for peer support, and the amount of peer support received. Classroom management types of behaviors had greater frequency for the unit with whole group instruction, where active learning and collaborative behaviors were more frequently reported for small group instruction.

For the open ended survey item (Item 18), students were asked why they preferred a certain unit. Students who favored the Measurement, whole group instruction unit reported that it was easier and that they received more teacher support. Students who chose Fractions as their favorite unit attributed it to being more fun, having specific projects, and the manipulatives, variety of instructional tasks, and centers.

CHAPTER V

DISCUSSION

The purpose of this study was to determine whether third grade students identified as gifted or highly able would achieve more successfully perform better on mathematics unit tests if they were instructed in small groups as opposed to being instructed as a whole class. A quasi-experimental design was used to compare student achievement gains and affect after receiving instruction in small groups or as a whole group.

Null hypothesis 1, that mean gains on math unit tests would be the same for whole group and small group instructional conditions was not supported as the average gain in scores for the fractions unit with small group instruction was significantly higher than that of the measurement unit, with whole group instruction. Null hypothesis 2, that mean perceptions would be the same for whole group and small group instructional conditions was supported based on comparison of end of unit survey responses.

Implications of Results

Student gains in achievement were greater in the unit taught in randomly formed small groups. These results suggest that gifted third grade math students will have higher levels of achievement when they are instructed in smaller groups or classes. Although there were not significant differences in students' overall ratings of their perceptions of each condition, there were themes which emerged when students compared the two units. Students reported that they felt more like they belonged, could concentrate better, participated more frequently, and followed rules and directions more often when they were taught in whole group settings. Conversely, they felt more challenged, needed and received more teacher support, and felt like they were more on task during small group instruction. They also expressed feeling like instructional activities were more important to them during small group lessons. These student reports imply that students' conduct and concentration may have been more positive in whole group settings, but that they may be more active and cooperative learners and experience more challenge in small group settings.

Theoretical Consequences

Most educational theories support the concept that smaller elementary school classes are beneficial, especially for students in primary grades. The results of this study suggest that talented math students in these grades may experience higher levels of engagement and higher levels of achievement if they are taught in a small group setting, where they receive individualized attention and more time for help, if needed. The smaller teacher-to-student ratio prepared students to work independently and productively with peers. Providing smaller chunks of instruction to fewer students, and then allowing time for students to work cooperatively to practice and apply learned skills led to positive results for the participants. These findings may challenge advocacy for traditional, teacher-led direct instruction.

Threats to the Validity

Several factors may have affected the validity of this research. The major threat to validity concerns constraints related to time and logistical constraints of the study. Because of these constraints, counterbalancing the unit content was not possible, so the small and whole group instruction units covered different subjects. The whole group instruction related to Measurement, whereas the small group instruction involved Fractions. More ideally, the design would have been counterbalanced so that both the Measurement and Fractions units were taught with whole and small group instruction to randomly selected groups consisting of half of the participants. Factors such as the activities chosen to instruct each topic, teacher style, and student interest or background knowledge may also have affected the results. Weather-related delays and school closings in the middle of the Measurement unit may have skewed the results as well, as its ultimate duration was seven school days less than that of the Fractions unit.

Connections to Previous Studies and Existing Literature

Prior studies have found that students perform better in smaller classes which employ less direct instruction and more cooperative learning activities (Finn, et al., 2003; Folmer-Annevelink et al., 2010; Hoover-Schultz, 2005; Milesi & Gamoran, 2006). The results of this study supported the conclusion that student achievement is greater when students are taught in smaller groups. Student reports also substantiated literature that credits

increased time on task, collaboration, challenge, and social support to cooperative learning experiences (Jansen, 2012). Students rated the unit taught in small groups as more important to them, which reflects findings of previous studies (Jansen; Peterson & Miller, 2004). Overall, both this study's results and existing literature substantiate the concept that gifted students perform at higher levels and are more engaged in small group settings and these settings are associated with students both giving and receiving peer support and putting forth more effort (Finn et al.; Folmer-Annevelink et al.; Milesi & Gamoran; Hoover-Schultz; "A Day in Third Grade," 2005).

Implications for Future Research

Findings from this study suggest that future research should compare the effect of instructional structures for larger and more diverse samples and make these comparisons over more topics and types of units. This type of research design could limit the effect of individual teacher personality and style, student interests, and outside influences on the results of the research and clarify the implications of using small or whole group instruction to meet particular objectives. Future research on the impact of instructional structures on students other than students identified as gifted would be of value in determining if these findings can be applied to a more general population. It also would be of instructional value to learn if students of different ages or ability levels respond differently to small group instruction, as compared to whole group instruction.

Conclusions

The results of the study indicated that gifted third grade students experienced greater growth in math unit assessment scores when they were instructed in small groups, as opposed to being instructed in a whole group setting. Although ratings of participants' overall perceptions of the units were not statistically significant, students reported that they experienced more challenge, put forth more effort, and were more on task during small group instructional activities as compared to those taught in a whole group format. Students also reported needing and receiving more peer support during small group instruction. While there were positive perceptions associated with both methods, there were benefits in terms of student achievement scores and students'

perceptions when teaching gifted elementary students in small group settings as opposed to teaching to the whole class.

References

A day in third grade: A large-scale study of classroom quality and teacher and student behavior. (2005). *The Elementary School Journal, 105*(3), 305-323. Retrieved from http://search.proquest.com/docview/224517942?accountid=11164

Delou, C. M., Cardoso, F. S., Mariani, R., Paixão, I.,C.P., & Castro, H. C. (2014). Gifted children and adolescents: Exploring the perspective of a group that still needs educational attention in Brazil. *Creative Education, 5*(13), 1224-1234. Retrieved from http://search.proquest.com/docview/1553760878?accountid=11164

Finn, J. D., Pannozzo, G. M., & Achilles, C. M. (2003). The "why's" of class size: Student behavior in small classes. *Review of Educational Research, 73*(3), 321-368. Retrieved from http://search.proquest.com/docview/214116902?accountid=11164

Folmer-Annevelink, E., Doolaard, S., Mascareño, M., & Bosker, R. J. (2010). Class size effects on the number and types of student-teacher interactions in primary classrooms. *The Journal of Classroom Interaction, 45*(2), 30-38. Retrieved from http://search.proquest.com/docview/817731850?accountid=11164

Hoover-Schultz, B. (2005). Gifted underachievement: Oxymoron or educational enigma? *Gifted Child Today, 28*(2), 46-49. Retrieved from http://search.proquest.com/docview/203258945?accountid=11164

Jansen, A. (2012). Developing productive dispositions during small-group work in two sixth-grade mathematics classrooms: Teachers' facilitation efforts and students' self-reported benefits. *Middle Grades Research Journal*, *7*(1), 37-56. Retrieved from http://search.proquest.com/docview/1458788304?accountid=11164

Jitendra, A. K., Rodriguez, M., Kanive, R., Huang, J., Church, C., Corroy, K. A., & Zaslofsky, A. (2013). Impact of small-group tutoring interventions on the mathematical problem solving and achievement of third-grade students with mathematics difficulties. *Learning Disability Quarterly*, *36(1)*, 21-35. Retrieved from http://eds.a.ebscohost.com.goucher.idm.oclc.org/ehost/pdfviewer/pdfviewer?vid=7&sid= 214b3fb2-

e8d8-47ac-9004-10fe4373ae7e%40sessionmgr4004&hid=4103

Landis, R. N., & Reschly, A. L. (2013). Reexamining gifted underachievement and dropout through the lens of student engagement. *Journal for the Education of the Gifted, 36,* 220-249. Retrieved from http://search.proquest.com/docview/1448250474?accountid=11164

Milesi, C., & Gamoran, A. (2006). Effects of class size and instruction on kindergarten achievement. *Educational Evaluation and Policy Analysis, 28*(4), 287-313. Retrieved from http://search.proquest.com/docview/197222121?accountid=11164

Neihart, M. (2006). Dimensions of underachievement, difficult contexts, and perceptions of self: Achievement/Affiliation conflicts in gifted adolescents. *Roeper Review, 28*(4), 196-202. Retrieved from http://search.proquest.com/docview/206700472?accountid=11164

Peterson, S. E., & Miller, J. A. (2004). Comparing the quality of students' experiences during cooperative learning and large-group instruction. *The Journal of Educational Research, 97*(3), 123-123+. Retrieved from http://search.proquest.com/docview/204194809?accountid=11164

Preckel, F., Götz, T., & Frenzel, A. (2010). Ability grouping of gifted students: Effects on academic self-concept and boredom. *British Journal of Educational Psychology 80*(3), 451. Retrieved from http://search.proquest.com.goucher.idm.oclc.org/education/docview/745285949/36FF0E4B191C459FPQ/1?accountid=11164

Rimm, S. B. (1997). An underachievement epidemic. *Educational Leadership, 54*(7), 18-22. Retrieved from http://search.proquest.com/docview/224851569?accountid=11164

Yang, D., Lai, M., Yao, R., & Huang, Y. (2014). Effects of remedial instruction on low-SES & low-math students' mathematics competence, interest and confidence. *Journal of Education and Learning, 3*(1), 1-15. Retrieved from http://search.proquest.com/docview/1513199782?accountid=11164

APPENDIX A

End of Unit Survey (Given twice)

Please answer each question honestly and do your best.
Circle the number that best describes your feelings for each question.
1 – I **really** disagree 2 – I sort of disagree 3 – I don't agree or disagree 4 – I sort of agree 5 – I **really** agree

Unit _____

1. I was interested in this unit.	1	2	3	4	5
2. I felt that this unit challenged me.	1	2	3	4	5
3. I had enough teacher support (help and attention).	1	2	3	4	5
4. I felt good about my ability to succeed in this unit.	1	2	3	4	5
5. I was able to work positively with others on this unit.	1	2	3	4	5
6. I felt like I belonged in the group/class when doing this unit.	1	2	3	4	5
7. I put forth a lot of effort to do well on this unit.	1	2	3	4	5
8. I wasn't able to concentrate because of others' or my own behavior.	1	2	3	4	5
9. I had freedom and choice about how to solve mathematical problems and manage my time.	1	2	3	4	5
10. I followed directions for independent or group work and rules for behavior.	1	2	3	4	5
11. I was focused and on task.	1	2	3	4	5
12. The things we did were important to helping me learn the main points of this unit.	1	2	3	4	5
13.During this unit I participated in discussions and classwork.	1	2	3	4	5
14. I had support from my peers in completing the tasks for the unit.	1	2	3	4	5
15. I thought this unit was fun.	1	2	3	4	5

16. What did you like about this unit?

17. What didn't you like about this unit?

APPENDIX B

SURVEY TO COMPLETE AFTER BOTH UNITS ARE DONE

For each question, circle M for measurement unit and F for fraction unit.

1. Was the measurement or fraction unit more interesting? M F

2. Was the measurement or fraction unit more challenging? M F

3. In which unit did you get more teacher support (help and attention)? M F

4. In which unit did you need more teacher support (help and attention)? M F

5. In which unit did you feel best about yourself and your abilities? M F

6. In which unit did you work best with others? M F

7. In which unit did you most feel like you belonged? M F

8. In which unit did you try the most? M F

9. Which unit helped you to concentrate and pay attention? M F

10. Which unit gave you more freedom and choice? M F

11. In which unit did you most follow directions and rules? M F

12. In which unit were you more on task? M F

13. Which unit was more important to you? M F

14. In which unit did you participate the most? M F

15. In which unit did you get more support from peers? M F

16. In which unit did you need more support from peers? M F

17. Which unit did you like the best? M F

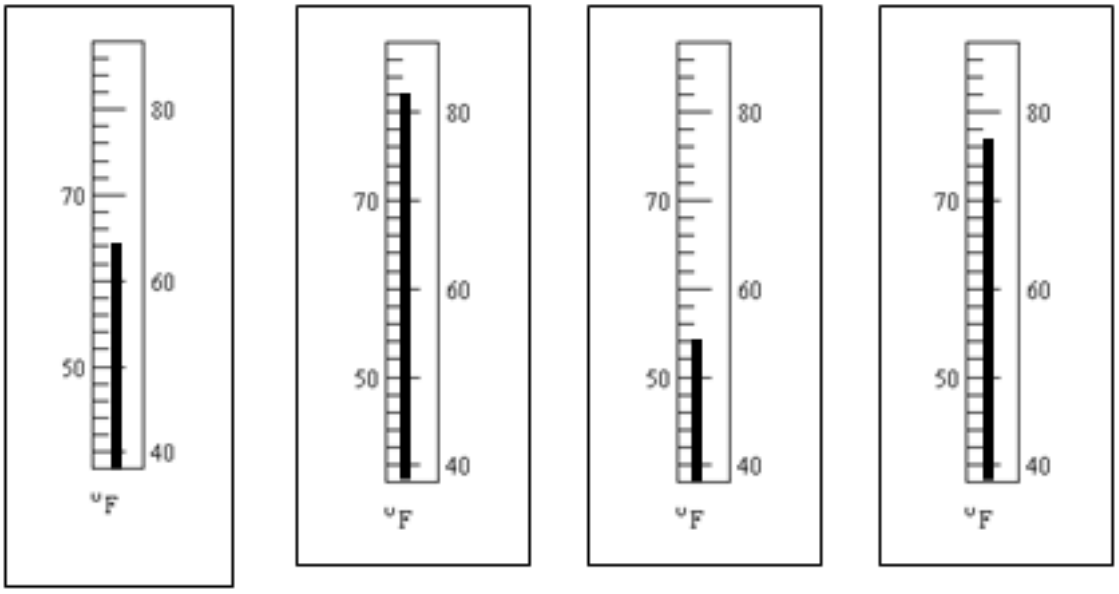
18. Why did you like that unit the best?

APPENDIX C

Measurement Preassessment

Name: _____ Date: _____

The thermometers show the average high temperatures for four days.



Friday Saturday Sunday Monday

1. What was the temperature on Sunday? _____ °F

2. On which day was the temperature 77° F?

- ○ a. Friday
- ○ b. Saturday
- ○ c. Sunday
- ○ d. Monday

3. Complete the statement to show the equivalent lengths.

_____ feet = 2 yards

- ○ a. 18
- ○ b. 24
- ○ c. 3
- ○ d. 6

4. Sarah made a string of beads 15 inches long.

Alex made a string of beads that was 1 foot long.

- Whose string of beads was longer, Sarah's string of beads or Alex's string of beads?

_____

- Explain why your answer is correct.

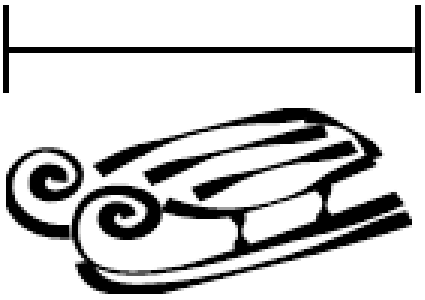
_____

_____

_____

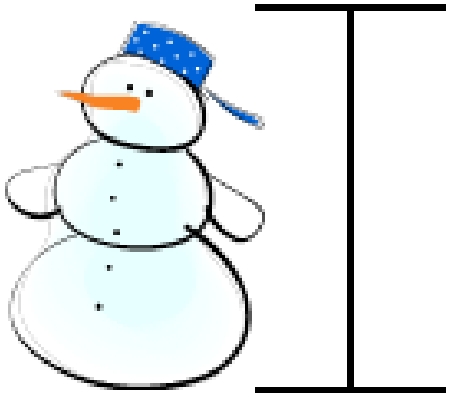
_____

5. Find the length of the picture of the sled to the nearest centimeter.



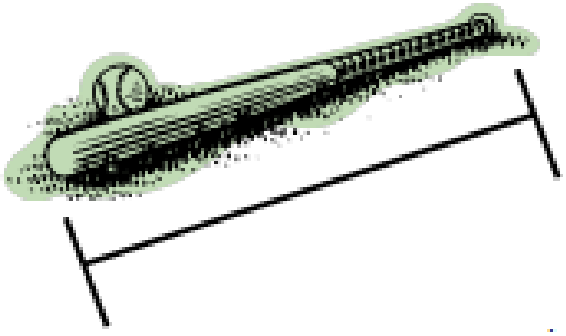
_____ cm

6. Find the height of the picture of the snowman to the nearest centimeter.



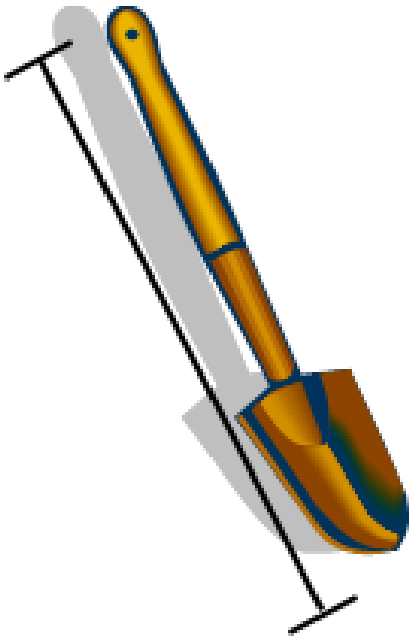
_____ cm

7. Find the length of the picture of the baseball bat to the nearest half inch.



_____ inches

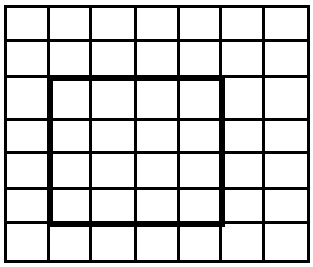
8. Find the length of the picture of the shovel to the nearest half inch.



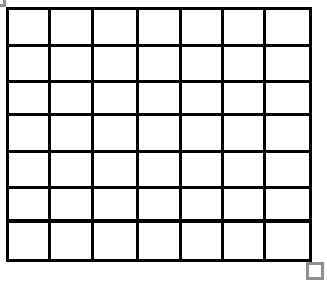
_____ inches

9. Jamal drew a square on a grid.

Create a different figure with the same **area** as Jamal's figure on your grid.

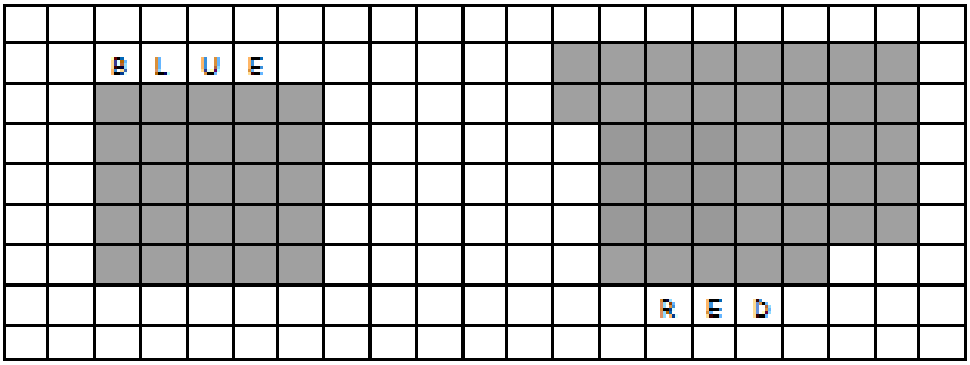


Jamal's Figure



Your Figure

Bill has 3 different colored rugs, as shown on the grid below.



10. Find the perimeter of Bill's blue rug. _____ units

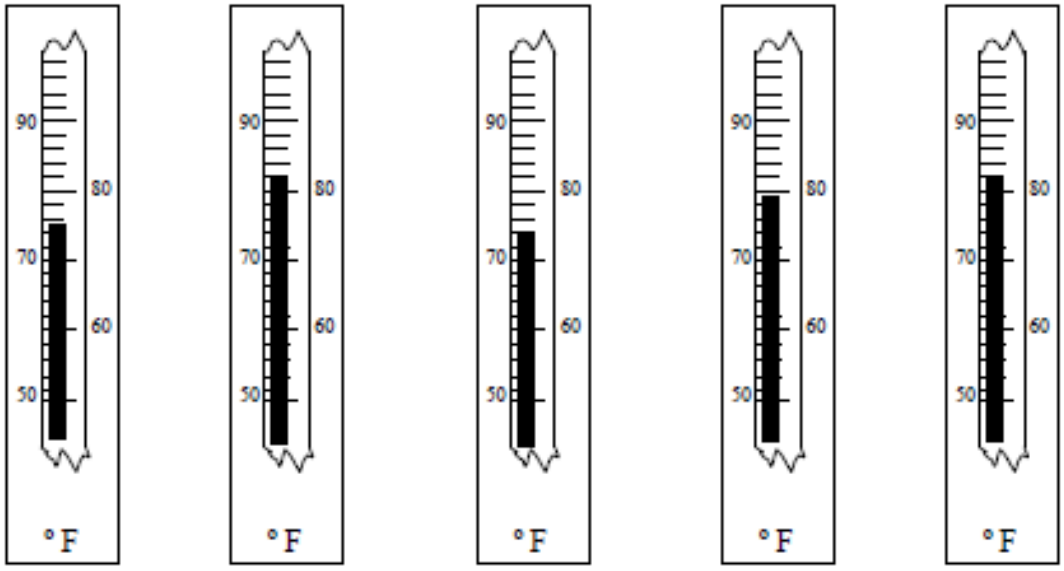
11. Find the **perimeter** and **area** of Bill's red rug.

- The **perimeter** of Bill's red rug is _____ units.
- The **area** of Bill's red rug is _____ square units.

Measurement

Name: _____ Date: _____

The thermometers show the average high temperatures during one school week.



1. What was the temperature on Tuesday? _____ °F

2. On which day was the temperature 79° F?

   ○ a. Monday ○ c. Wednesday

   ○ b. Tuesday ○ d. Thursday

3. Complete the statement to show the equivalent lengths.

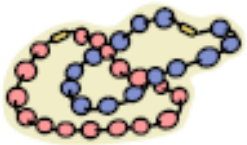
   _____ feet = 1 yard

   ○ a. 36 ○ c. 3

   ○ b. 12 ○ d. 1

Measurement

4. Maria made a necklace that is fourteen inches long.
Pedro made a necklace that is one foot long.



- Whose necklace was longer, Maria's necklace or Pedro's necklace?

_____

- Explain why your answer is correct.

_____

_____

_____

_____

5. Find the length of the picture of the caterpillar to the nearest centimeter.

_____ cm

Measurement

6. Find the length of the picture of the paintbrush to the nearest centimeter.

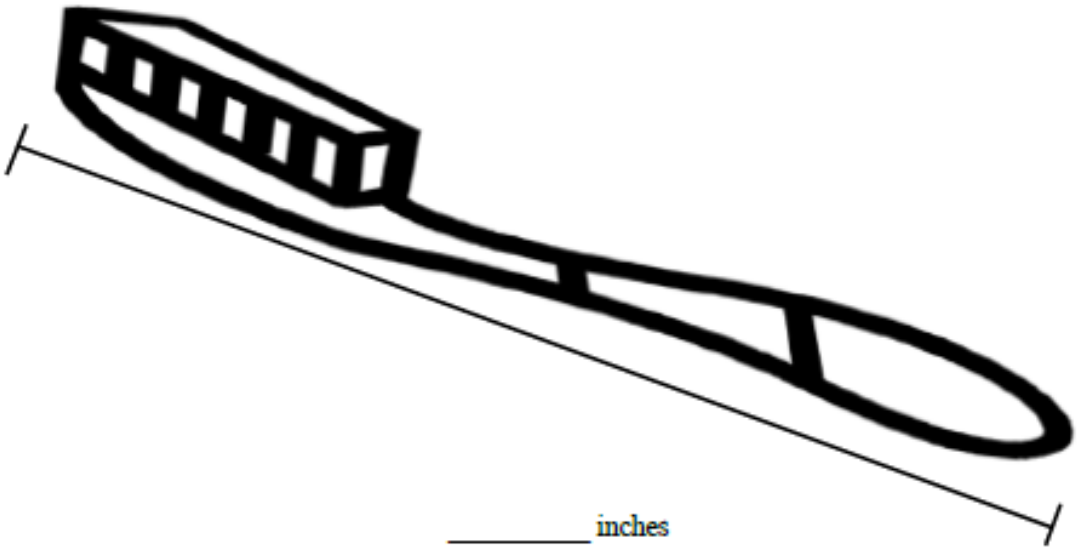
_____ cm

7. Find the length of the picture of the flashlight to the nearest half inch.

_____ in.

Measurement

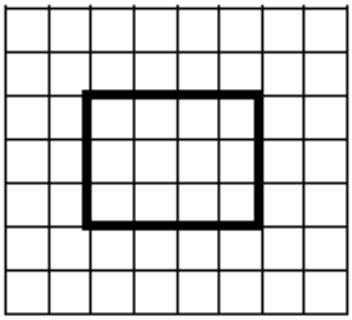
8. Find the length of the picture of the toothbrush to the nearest half inch.



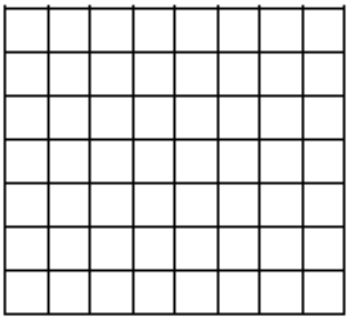
_____ inches

9. Francine drew a rectangle on a grid.

Create a different figure with the same area as Francine's figure on your grid.



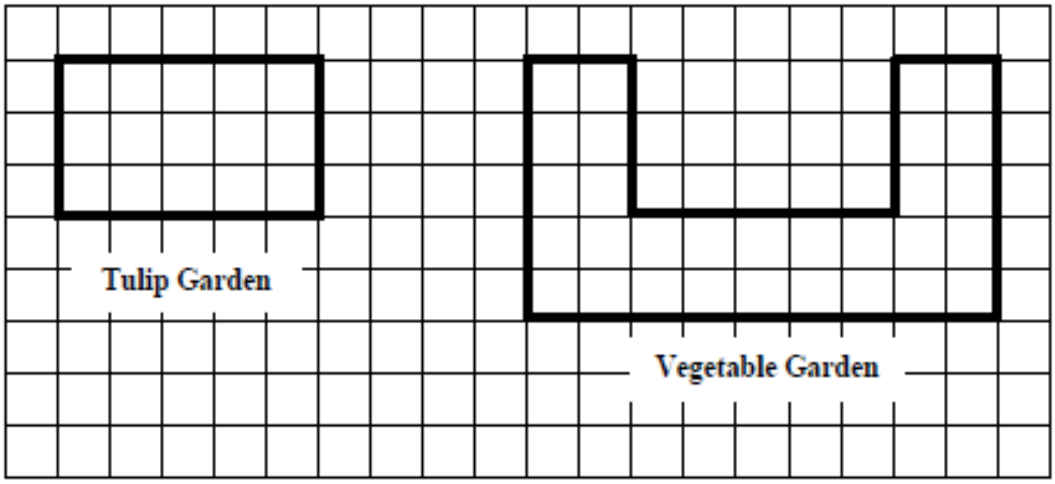
Francine's Figure



Your Figure

Measurement

Rose has a tulip garden and a vegetable garden, as shown on the grid below.

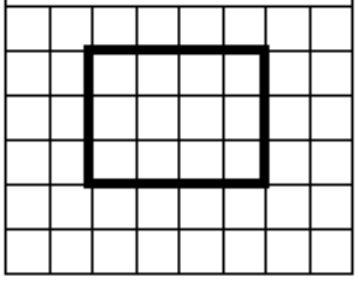
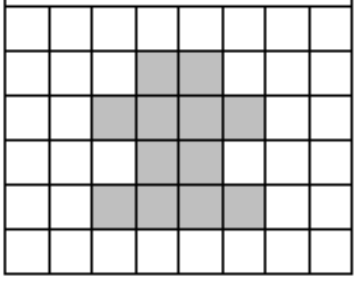


10. Find the **perimeter** of the Rose's tulip garden. _____ units

11. Find the **perimeter** and the **area** of Rose's vegetable garden.

- The **perimeter** of the vegetable garden is _____ units.
- The **area** of the vegetable garden is _____ square units.

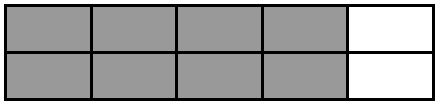
Measurement – Assessment
Answer Key

Item Number	Answer	Point Value
1	82°F	1
2	d. Thursday	1
3	c. 3	1
4	Maria's necklace is longer.	1
	Student explains why their answer is correct by using what they know about equivalent units of length. Following are examples of a 2-point response. *Example 1*: • 12 inches is the same as one foot. • 14 inches is two inches longer than one foot. *Example 2*: • 14 inches is the same as 1 ft 2 in. • Maria's necklace is 2 inches longer than Pedro's necklace.	2
5	8 cm	1
6	6 cm	1
7	$1\frac{1}{2}$ in.	1
8	$6\frac{1}{2}$ in.	1
9	Student draws a figure with an area of 12 square units. The figure should be different than Francine's 3 by 4 rectangle. Francine's Figure  Your Figure - *Example* 	1
10	16 units	1
11	• 34 units • 30 square units	2
	Total points possible	**14**

Fractions Preassessment

Name: _____ Date: _____

1. Write the fraction for the part that is shaded.



_____

2. Choose the picture that represents the fraction $\frac{2}{5}$.

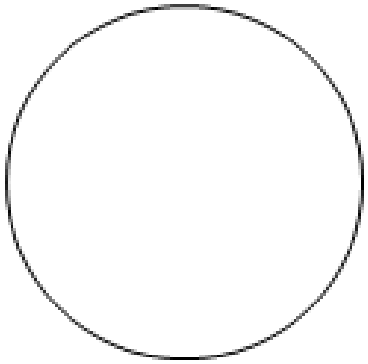
○ a.

○ b.

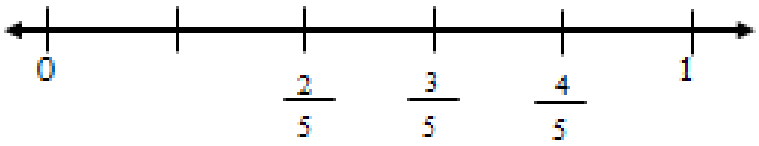
○ c.

○ d.

3. A pie is cut into six equal pieces. Karen and her family eat five pieces in all. Represent the fraction that shows the part of the pie that has been eaten.



4. Label the missing fraction on this number line.



5. If 12 people share 3 brownies equally, how much will each person get?

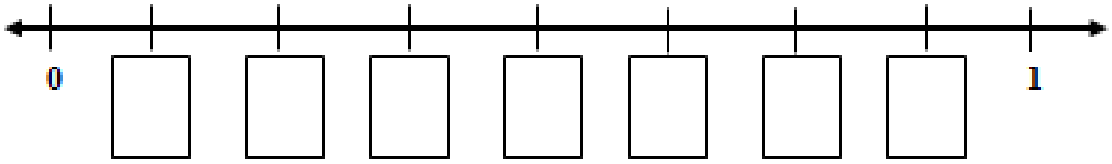
_____

Show how you figured this out.

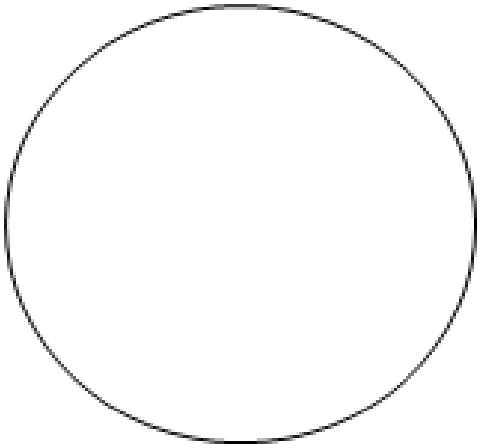
6. A cake is cut into 9 equal parts. Brian and his friends eat four pieces of cake.
   - Represent the fraction that shows the part of the cake that has been eaten.
   - Name the fraction that shows the part of the cake that has been eaten.

_____ **of the whole cake has been eaten.**

7. Label the missing fractions on this number line.



8. Represent the fraction $^{2}/_{3}$ on the circle below.



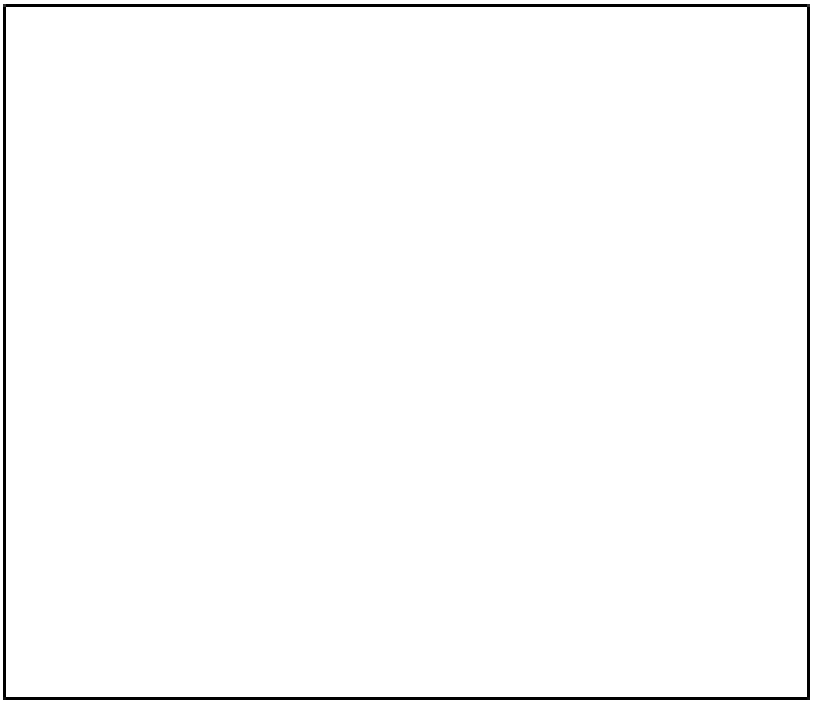
Explain why your answer is correct.

9. Jay is learning about fractions.

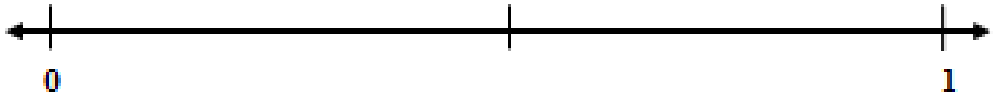
Part A:

- Show Jay how to divide this square into six equal parts.
  Write a fraction that shows how much of the square each part represents.

Each part represents _____.

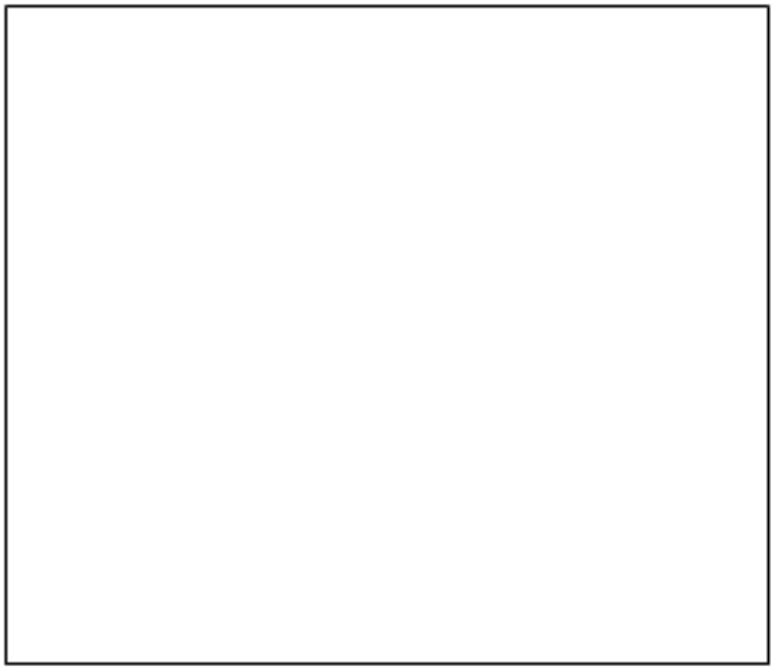


- Now show Jay how to partition this number line into six equal parts by labeling the number line to show how to count by unit fraction $^1/_6$ from 0 to 1.



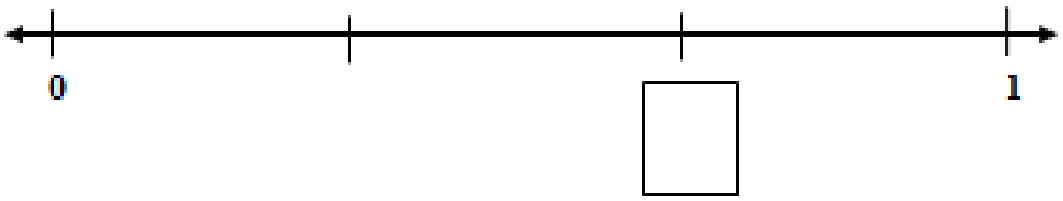
Part B:

- Show Jay how to divide this square to represent the fraction $^{5}/_{8}$.



- Use what you know about fractions to explain why your answer is correct.

Part C:
Jane said that the empty box on the number line is ¾.

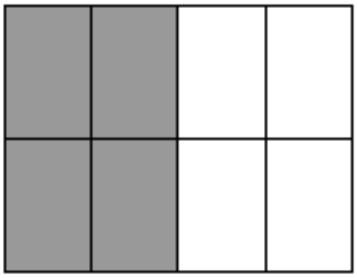


- Explain why Jane is incorrect. The empty box **is not** ¾.

Representing Fractions

Name: _____ Date: _____

1. Write the fraction for the part that is shaded.



_____

2. Choose the picture that represents the fraction $\frac{1}{3}$.

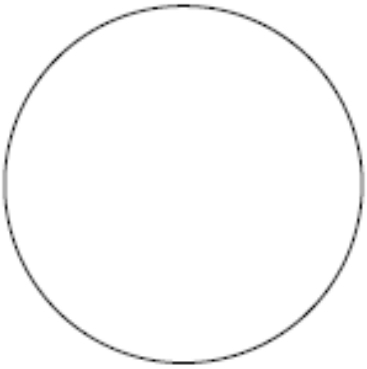
○ a. ○ ● ●
● ● ●

○ c. ● ○ ○ ○

○ b. ○ ○ ●

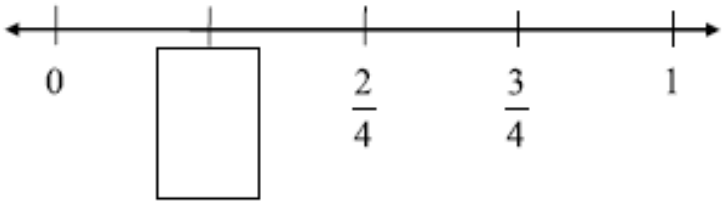
○ d. ● ○

3. A pie is cut into four equal pieces. Joanna and her two friends eat three pieces in all. Represent the fraction that shows the part of the pie that has been eaten.



Representing Fractions

4. Label the missing fraction on this number line.



Name Date

Finding Fair Shares

Assessment: Sharing Four Brownies

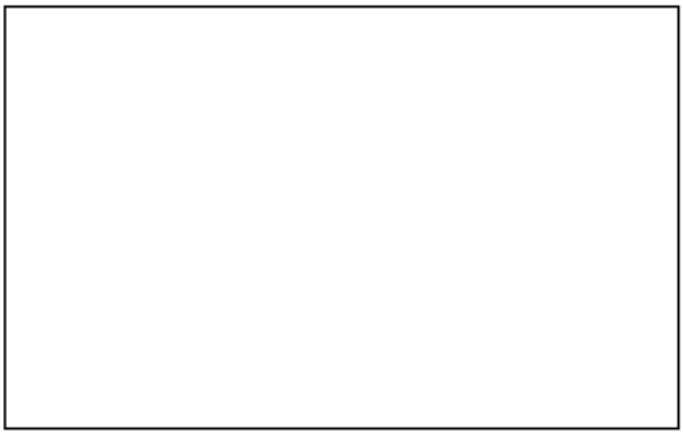
If 8 people share 4 brownies equally, how much will each person get?

Show how you figured this out.

Fractions as Numbers

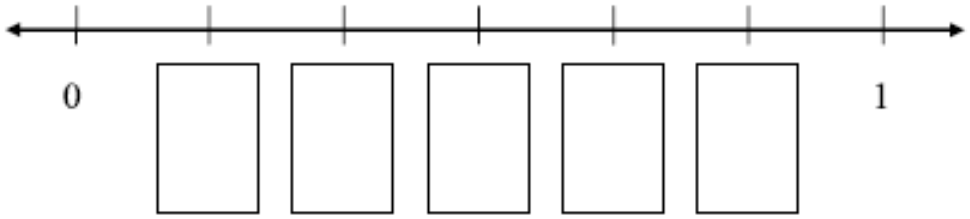
Name: _____ Date: _____

1. A pan of brownies is cut into eight equal parts. Kyrie and her friends eat five brownies.
   - Represent the fraction that shows the part of the pan of brownies that has been eaten.
   - Name the fraction that shows the part of the pan of brownies that has been eaten.



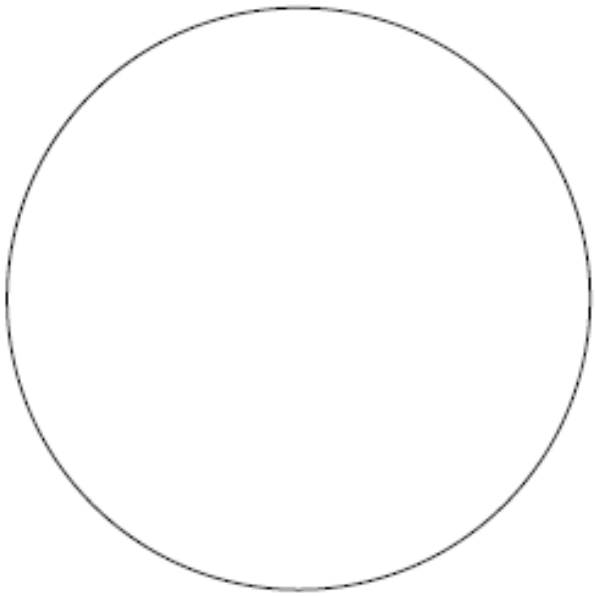
_____ of the whole pan of brownies has been eaten.

2. Label the missing fractions on this number line.



Fractions as Numbers

3. • Represent the fraction $\frac{3}{4}$ on the circle below.



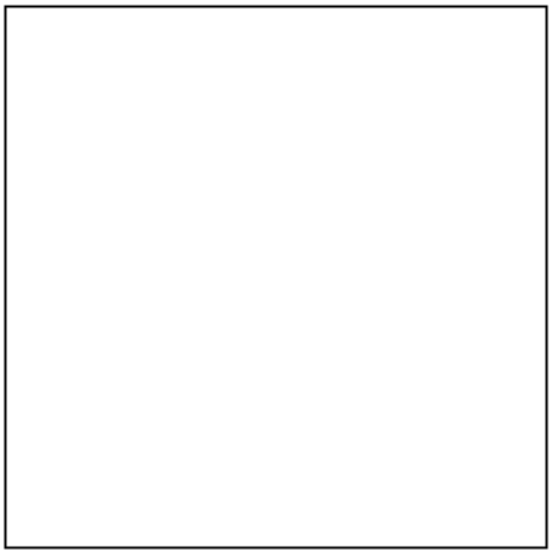
• Explain why your answer is correct.

Jill's Fractions

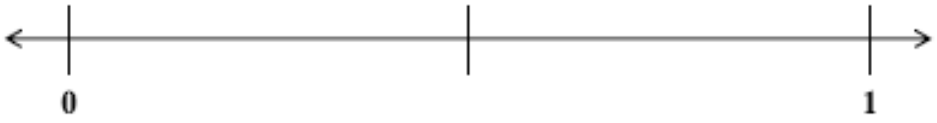
Jill is learning about fractions.

Part A:

- Show Jill how to divide this square into eight equal parts.
  Write a fraction that shows how much of the square each part represents.



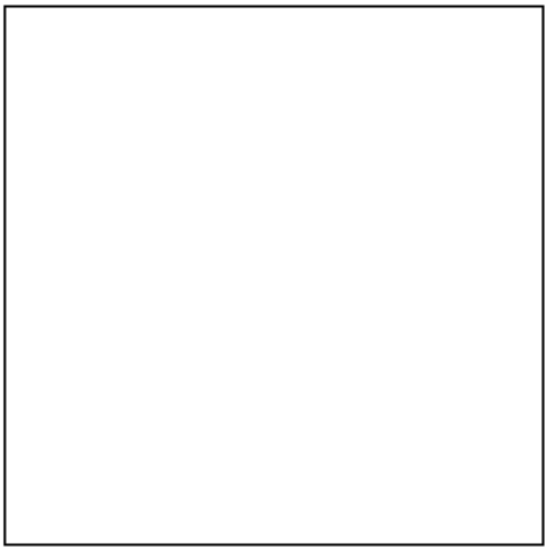
- Now show Jill how to partition this number line into eight equal parts.
  Label the number line to show how to count by the unit fraction $\frac{1}{8}$ from 0 to 1.



Jill's Fractions

Part B:

- Show Jill how to divide this square to represent the fraction $\frac{3}{4}$.

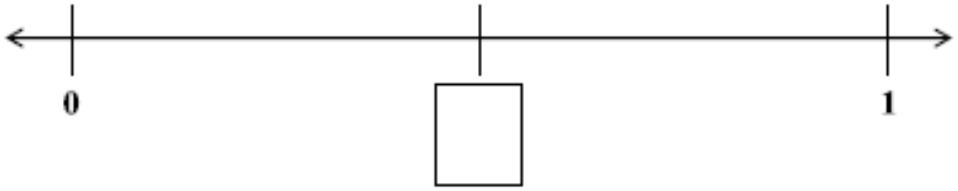


- Use what you know about fractions to explain why your answer is correct.

Jill's Fractions

Part C:

Jack said that the missing number on the number line is $\frac{2}{3}$.



- Explain why Jack is incorrect. The missing number **is not** $\frac{2}{3}$.

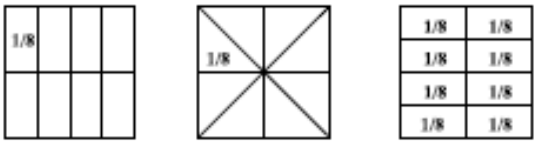
Representing Fractions – Assessment
Answer Key

Item Number	Answer	Point Value
1	$\frac{4}{8}$ or $\frac{1}{2}$	1
2	b. ○ ○ ●	1
3	Student makes a reasonable attempt to divide the circle into four equal parts, and represents the fraction $\frac{3}{4}$.	1
4	$\frac{1}{4}$	1
	Total points possible	**4**

Fractions as Numbers – Assessment
Answer Key

Item Number	Answer	Point Value
1	• Student divides the rectangle into eight equal parts. • Student shades five of the one-eighth size parts. • Student identifies the fraction as $\frac{5}{8}$.	3
2	• Student correctly identifies the denominator as 6 since the number line is divided into six equal parts from 0 to 1. • Student correctly identifies the numerators as 1, 2, 3, 4, and 5, and labels the missing fractions as $\frac{1}{6}, \frac{2}{6}, \frac{3}{6}, \frac{4}{6}, \frac{5}{6}$. *Note that some students may also correctly identify the missing fractions as $\frac{1}{6}, \frac{1}{3}, \frac{1}{2}, \frac{2}{3}, \frac{5}{6}$.	2
3	• Student makes a reasonable attempt to divide the circle into four equal parts. • Student shades three parts and represents the fraction $\frac{3}{4}$.	2
	Student explains why their answer is correct by using what they know about the number of parts needed and the size of the parts. Following are examples of a two-point response: *Example 1*: I divided the circle into four equal parts, so each part shows one-fourth. I shaded 3 parts because I counted $\frac{1}{4}, \frac{2}{4}, \frac{3}{4}$. *Example 2*: The fraction three-fourths tells me that there are three parts and the size of the parts is $\frac{1}{4}$. So, I divided the circle to show fourths by cutting it into four equal parts, and I shaded three of the parts.	2
	Total points possible	**9**

Jill's Fractions – Scoring Tool

Part	Solution	Points	Maximum Points Possible
A	Student makes a reasonable attempt to divide the square into eight equal parts, and labels at least one or all eight parts as $\frac{1}{8}$. For example: 	2	4
	Student makes a reasonable attempt to divide the number line into eight equal parts, and labels the number line as follows: $\frac{1}{8}, \frac{2}{8}, \frac{3}{8}, \frac{4}{8}, \frac{5}{8}, \frac{6}{8}, \frac{7}{8}$.	2	
B	Student makes a reasonable attempt to divide the square into four equal parts, and represents $\frac{3}{4}$. For example: 	2	4
	Student explains why their answer is correct by explaining the meaning of the 3 and the 4 in the fraction $\frac{3}{4}$. *For example*: $\frac{3}{4}$ means that the square is divided into four equal parts. I counted three of those parts to shade to represent three-fourths.	2	
C	Student explains why Jack is incorrect by explaining why the missing number is not $\frac{2}{3}$. *For example*: The number line is divided into two equal parts. So Jack needs to count by halves. The missing number on the number line is $\frac{1}{2}$.		2
	Total points possible		**10**