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# Small Group Math Instruction in the Middle School Classroom

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# Abstract

This study includes the impact of small group instruction in the middle school classroom. This study takes place at Dakota Meadows Middle School in Mankato, MN. The participants included 24 seventh grade students who are only partially proficient in math according to their standardized state assessments. Data was collected using a pretest, formative assessments, posttest and a student survey (See Appendices A, B, C, D). There was growth from the pretest scores to the posttest scores as well as growth in formative assessment scores. The student survey indicated most students felt the small group instruction benefitted them positively. Small group instruction will continue to take place in the middle school classroom to individualize instruction and improve assessment scores until proficiency is met.

Small group instruction is used in the educational setting in many ways. Small group instruction is used to differentiate instruction, reinforce new topics, and create a community feel between a small number of students with similar needs. Differentiating instruction by working in a small group allows the teacher to break down the lesson into smaller steps for students who need to learn in a different way. Working with students in a small group allows the instructor to hone in on the ways the students learn best. Reinforcing topics work well when teaching in a small group because the instructor can really understand what the students are missing or need to work on from the lesson. The community feel that a small group brings allows students to open up to the instructor about their needs and the gaps they have within the lesson.

Math instruction can be enriched and extended for students when looked at using small group instruction. Mathematics is a spiraled subject that requires previous knowledge to perform new tasks. Often in an entire class of students, there will be gaps that certain students are missing when it comes to previous knowledge. Small group instruction allows the instructor to take the small number of students that have gaps in their knowledge and work on those gaps within the small group. Using small group instruction to address these gaps will not take away or disengage the students who are not missing these pieces because they can be working on the assignment at their level while those in the small group are also trying to meet the same objective at their level.

This research determined the impact of using small group instruction with students who are considered our "partially meets" math students at Dakota Meadows Middle School. Partially meets means these students have not met proficiency on their standardized tests they have been taking the past few years. This small group instruction

used personalized learning and inquiry strategies to raise the ability of these students into proficiency. Personalized learning within the small group focused on the students' math abilities.

The partially proficient students are within reach of meeting the standard and are at the tipping point in their educational career where math is building a foundation for their future classes. The 7th grade students who are partially proficient makeup 22.4% of this grade level and is a much larger percentage of students than those who do not meet the standard. Small group instruction will be implemented and studied in the math classroom with the hopes of helping these students become proficient in their math abilities.

Small group instruction has not been studied for many years at the middle school level. There are several studies done with small group instruction in the elementary classrooms. The small group work is most often found in language arts and reading. There are also some studies done in math as well, but again, this is only at the elementary level. The few studies that have been done with math and at the middle school level were done more than ten years ago.

Technology has improved, and curriculum has come so far in the last ten years. This study of small group instruction in math at the middle school level will bring clarity to the topic with this particular age group.

***Research Question***

The study will address the the following research question:

To what extent will small group instruction after the whole group lesson impact "partially meets" students' learning and assessment scores?

# Review of Literature

## Introduction

Many theories propose that middle school students thrive in math in a small group environment (Rowan-Kenyon, Swan & Creager, 2012). The literature suggests many different strategies yet had several common themes (Re, Pedron, Tressoldi & Luncangeli, 2014; Wasik 2008; Sloane, 2007). This review will focus on the academic benefits to putting students in a small group in a math classroom and the importance of a purpose for the small group. The number of students to have in the small group will also be addressed as well as the influence of assessing the small group, reflecting on the process, and making changes to the small group. The literature covered many different age levels and subjects, but this review will focus on the effects of a small group in a middle school math classroom.

## Small Group Benefits

The literature gave several reasons why students thrive while working in a small group (Wasik, 2008; Rowan-Kenyon, Swan & Creager 2012; Fry, Ketteridge & Marshall 2009). Wasik (2008) notes that small group instruction can benefit the lesson and the assessment due to the amount of attention students get in a small group. The amount of attention students are getting is due to the small number of students in these groups (Wasik, 2008). Specifically, middle school students find these small numbers give them a voice and a safe place to learn (Fry, Ketteridge, & Marshall, 2009). Rowan-Kenyon, Swan and Creager (2012) state that early adolescents, middle school students, find math more rewarding when working in small groups on engaging tasks. They are better able to master math concepts when collaborating with others in a cooperative learning

environment (Rowan-Kenyon, Swan & Creager, 2012). Support from working in a group gives students a sense of belonging (Rowan-Kenyon, Swan & Creager, 2012).

Students' social skills tend to improve when working with their peers in a small group (Rowan-Kenyon et al., 2012). Students are engaged learners and collaborators in small groups (Fry et al., 2009). Fry, Ketteridge and Marshall (2009) explain that small groups are a crucial way to discover essential skills that the student has. Self-confidence and communication skills build within small groups (Fry et al., 2009).

**Set Goals and Outcomes**

When putting together small groups in a math classroom, it is vital to have a purpose and a focus for the small group (Wasik, 2008; Sloane, 2007). One needs to know why this group was put together in the first place (Wasik, 2008). Sloane (2007) states that when putting together the small groups to consider the big ideas and objectives found in the math curriculum and standards. Wasik (2008) agrees noting there needs to be an intended purpose and organization to the groups. The goal/objective of the lesson should determine the number of students in the group (Wasik, 2008). Fry, Ketteridge and Marshall (2009) agree that planning out and having a purpose for small groups is important, but they also note that students need to be prepared for the knowledge of the subject taught in the small group. The size of the small group can be determined based on the learning outcomes that are identified in this planning process (Fry, Ketteridge, & Marshall, 2009). Re, Pedron, Tressoldi and Luncangeli (2014) agree with Fry, Ketteridge and Marshall (2009) that students need to be presented with the task and goal of the small group. Students need to be given several methods for solving the math using several different learning preferences (Re et al., 2014). Students should then be able to follow

the method that fits them best or coming up with their own method to solving the problems (Re et al, 2014). This process helps the students to understand the purpose behind working in the small group (Re, et al., 2014).

**Carefully Construct Groups**

The number of students to include in a small group was the most controversial topic mentioned in the literature (Sloane, 2007; Wasik 2008, Fry et al., 2009). Sloane (2007) explains the need to assess the knowledge and ability levels of the students to decide how many small groups are needed and what each will be studying. Conferences should be held with the students in order to provide guidance while choosing a group to join (Sloane, 2007). Sloane (2007) was the only author who stated that students should choose their group. Fry, Ketteridge and Marshall (2009) agreed the size of the group is significant. The learning outcomes should be used to determine the size of the small group as well as the members of the small group (Fry, Ketteridge & Marshall, 2009). Wasik (2008) was the most specific on the number of students to have in a small group and recommends keeping the number to five or fewer students. Wasik (2008) also stated that it is more useful to teach content to small groups versus teaching content in whole group instruction.

Hollis and Dick (2000) implemented collaborative small groups in a college setting to help students gain extra study time for the actual math class. They included students of all different abilities, genders, and minorities into the small study groups (Hollis & Dick, 2000). The students in the small groups collaborated during this study on various math problems and strategies. The students in the diverse small study groups overall improved in the class due to the extra practice and engagement with others (Hollis

& Dick, 2000). Wiedmann, Leach, Rummel and Wiley (2012) agree with Hollis and Dick (2000) that small groups should include students of all different abilities and there should be at least one member with higher math skills in each group. Re, Pedron, Tressoldi and Lucangeli (2014) disagreed with this model and instead took all students with math deficiencies and had them undergo a learning level assessment. They took the information from these evaluations to create learning profiles for each student (Re et al.,2014). They ended up grouping the students together based on their deficiencies, and the most prominent deficiency was focused on in the small group (Re et al., 2014).

**Reflect and Respond**

Once small groups goals are put together and the members of the group identified, the small group must be observed and reflect upon what is working and what is not functioning in the small group (Re et al., 2014). Sloane (2007) mentions that the educator should facilitate meetings with each small group as well as observe and document what the students are doing in the group and what they are learning. To make all of these observations, teachers need to play an active role in the small group to keep it working efficiently (Wasik, 2008). Re, Pedron, Tressoldi and Lucangeli (2014) mention that the teacher should discuss and compare strategies with any other adults or leaders who are helping with the small groups. They also say that all work done in the small group should be summarized first by the student, then by the adult or leader (Re et al., 2014).

**Assess and Reflect**

To know if the small groups were useful, the teacher needs to assess the students to decide if they have met the goal set at the beginning of the unit (Sloane, 2007; Re et

al., 2014). Re et al. (2014) believes in students completing a self-assessment about the small group and where they are at based on what they accomplished in the small group. The assessment can also include the observations made by the teacher (Sloane, 2007). This assessment should include what is going on in the groups behavior-wise as well as what they are learning (Sloane, 2007). Hollis and Dick (2000) and Re et al. (2014) noted the change in grades due to the implementation of the small group. Observing the changes in grades is another way of assessing the changes made in student performance (Hollis and Dick, 2000; Re et al., 2014).

**Social Constructivism Theory**

Small group instruction framework is aligned with the social constructivism theory. The social constructivism theory states that students construct and build new knowledge based on previous knowledge and experiences (Constructivism, Situated Learning, and Other Learning Theories, n.d.; Johnson, n.d.). The social constructivism theory aligns with math specifically because math is a spiraled subject in which you build new knowledge based on previous knowledge (Constructivism, Situated Learning, and Other Learning Theories, n.d; Johnson, n.d.). Constructivism, Situated Learning, and Other Learning Theories (n.d.) stated that "Mathematics is much more than counting and simple arithmetic. It is a cumulative science in which new results are built upon and depend on earlier results" (p.8). According to Schreiber and Valle (2013), the social constructivism theory correlates with five pedagogical techniques. The techniques to use in small group math instruction include assigning group membership thoughtfully, test students individually and in groups, as well as use student collaboration (Schreiber and Valle, 2013). Schreiber and Valle (2013) also explain that it is best practice for the social

constructivism theory to use a grading system that includes individual, group, and peer evaluation assessment. The social constructivism theory format enhances learning because students are able to direct their own learning and share with their peers during the small group instruction (Johnson, n.d.).

**Conclusion**

Small group instruction is effective in math classrooms (Sloane, 2007; Wasik, 2008; Rowan-Kenyon et al., 2012; Wiedmann et al., 2012; Fry et al., 2009; Vadasy et al., 2007; Re et al.,2014) . The small group is successful when there is a goal or purpose (Wasik, 2008; Sloane, 2007). As the teacher, it is important to be mindful of the size of group and the members of the group (Sloane, 2007; Wasik 2008, Fry et al., 2009). Lastly, the group needs to be observed, accessed, and changes need to be made upon reflection (Sloane, 2007; Re et al., 2014).

## Methodology

This study used a descriptive design. This descriptive design looked at a causal relationship between student's assessments before receiving small group instruction and after the instruction is implemented. Data was retrieved from pretests, posttests, formative assessments and survey results. Survey results indicated the student's perspectives on the impact of the small group instruction on their math abilities.

The population for this action research study was seventh grade students on the Mahkato trail enrolled at Dakota Meadows Middle School (N = 137). The sample was 25 seventh graders enrolled in pre-algebra in the first and second quarter. The sample features 13 females and 12 males. This course is required of the students. The sample

population was a representative of students who have only been partially proficient on their standardized exams in the 2016/2017 school year.

Pre- and post-assessments were used when determining the impact of the small group instruction. There was also formative assessment data to determine the effectiveness the study. This went along with a student survey to better understand the student's perspective on math and the small group instruction process.

Students were given a pretest before the standard is studied. Formative assessments were given as bell ringers throughout the unit to monitor student progress. Each lesson taught in the unit included whole group instruction. The whole group instruction included Cornell notes where the students defined vocabulary words, wrote down steps to solving the math problems, solved sample problems, and summarized the main points in the lesson. Once the Cornell notes were finished, students broke into peer groups as well as the small group that worked to complete the practice work. In the small group instruction, inquiry strategies were used to reiterate the steps needed to solve the math problems. Each student took turns verbally giving the steps needed to solve the math problems. Other strategies such as visual representation and hands-on activities were used in the small group to better understand the concept of the lesson.

The students were given a posttest after the unit had been covered that is graded using a four-points scale rubric. Each rubric was given at the top of the assessment along with a description on how to earn each value. A one means the student did not meet the standard, a two means the student partially met the standard, a three means the student has met the standard and a four means the student has exceeded the standard. The goal is for the small group instruction students to meet the standard.

## Analysis of Data

The purpose of this study was to analyze the impact that small group instruction has on 7th grade math students who are not reaching proficiency. The data found a causal relationship between student's assessments before receiving small group instruction and after the instruction is implemented. Data was retrieved from pretests, posttests, formative assessments and survey results. Pretests, posttests, and formative assessments measured their academic performance. Survey results indicated the student's perspectives on math and their abilities after receiving small group instruction.

The subjects for this study were 7th grade students at Dakota Meadows Middle School. They were all enrolled in pre-algebra and have only been partially proficient on their standardized math exams in the past year. As shown in Table 1, 24 students in four different classes were studied in the 2017/2018 school year. These 24 students included 13 females and 11 males.

Table 1

*Sample Demographics*

| Period | Males | Females |
|---|---|---|
| 2 | 3 | 2 |
| 3 | 1 | 2 |
| 5 | 1 | 2 |
| 7 | 6 | 7 |

### Setting Goals and Outcomes

The small group instruction research process includes setting goals and outcomes. The goal that is set for your small group instruction gives direction and helps to decide if the instruction was effective. To measure the goal of proficiency, students are assessed on a four-point scale (one is the does not meet category, the two is the partially meets proficiency category, the three is the meets proficiency category, and the four is the exceeds proficiency category). The goal for these students will be for them to score threes on their assessments and reach proficiency.

**Reflect and Respond**

Determining the success of the small group is important to do throughout the process. Figuring out the effectiveness of the small group instruction helped to answer the research question.

Formative assessments throughout the unit helps to determine the effectiveness of the instruction. Google forms were given as formative assessments to the students during the beginning of the lesson as bell ringers. This took place periodically throughout the unit. The formative assessments are studied, and changes were made based on the results. The formative assessments revealed whether the concepts were understood or whether the concepts needed to be retaught to the small group students.

**Assess and Reflect**

The goal of the research question is to determine the effectiveness of the small group instruction both mentally and academically with the middle school students. To determine the complete academic success of the small group instruction, the students were assessed. Students were given a pretest assessment before the unit and were given a

final assessment at the end of the unit. These assessments are standards based and scored using a four-point rubric. The two assessments determined if the goal was met by the students showing proficiency.

The effectiveness of the small group instruction also dealt with how the students felt the small group instruction impacted their learning. A student survey was filled out by the students in the small group. This survey analyzed how they felt about being a part of the small group and how they felt the small group has affected their performance in pre-algebra.

Table 2

*Summative Assessment Results*

| | Period | Males | Females |
|---|---|---|---|
| Pre-Test (mean) | 2 | 1 | 1 |
| Post-Test (mean) | 2 | 2.67 | 2.75 |
| Pre-Test (mean | 3 | 1 | 1 |
| Post-Test (mean) | 3 | 2 | 3.5 |
| Pre-Test (mean) | 5 | 1 | 1 |
| Post-Test (mean) | 5 | 3 | 2 |
| Pre-Test (mean) | 7 | 1 | 1 |
| Post-Test (mean) | 7 | 3.08 | 3.43 |

Table 2 shows the growth that 7th grade pre-algebra students made between their pretest that was given to them at the beginning of the unit and the post test that was given when the unit was complete. Each class period had a different number of males and females that fell in the partially proficient category and therefore at times there were only one or two members of each gender in that class in which to gather data. There is growth shown in this table. Students fell below and above the goal of proficiency in their summative assessment as the goal was to get them to complete proficiency at a 3, which is 85% accuracy.

Table 3

*Formative Assessment Results*

| | Males | Females |
|---|---|---|
| Formative Assessment 1 | 2.64 | 2.54 |
| Formative Assessment 2 | 2.64 | 2.69 |
| Formative Assessment 3 | 3.09 | 2.92 |
| Formative Assessment 4 | 2.9 | 2.85 |
| Formative Assessment 5 | 2.9 | 3 |

The five formative assessments were given using google forms throughout the unit. As shown in Table 3, the students improved on their formative assessments as the unit continued and showed the most proficiency towards the end of the unit. These formative assessments used the same four-point scale and were used to guide instruction

in the small group. Topics that needed more attention were focused on during the small group to be successful in the later topics of the unit.

Table 4

*Student Survey Results*

| Survey Question | Positive | Negative | No Change |
|---|---|---|---|
| After participating in the math small group, do you believe being a part of the small group instruction had a positive effect on your math performance, a negative effect on your performance, or no change in your math performance? | 80% | 0% | 20% |
| Has being in the small group positively, negatively, or not at all impacted your learning process when solving math problems? | 80% | 0% | 20% |

As shown in Table 4, a small, random sample of students were given a survey to evaluate the impact of the small group instruction on their math performance. The students were asked a series of multiple choice questions and short answer questions. The multiple-choice questions included in the table also had a short answer explanation question that followed as to why they chose that answer. There were also two short answer responses asking the students their favorite activity in the small group as well what they would have done to improve the time spent in the small group. The two questions in Table 4 show that most students found the small group instruction positively impacted them and their learning process. On the contrary, two students responded that the small group

instruction did not impact their math abilities and learning process positively or negatively. This survey was beneficial in evaluating the impact that the small group instruction had on the 7th grade students.

## Action Plan

Based on the findings of this study, the following conclusions were drawn:

- Small group instruction played a role in helping partially proficient 7th grade students improve from their pretest to their posttest. The average assessment score fell into the proficient range.

- Formative assessments helped partially proficient 7th grade students improve on their math abilities throughout the unit.

- Student surveys given to students who participated in the small group showed that students most appreciated being a part of the small group instruction and the individualized instruction benefited them in their learning.

The literature helped guide the research and led to conclusions that aligned directly with the commonalities found within the literature. Setting a goal and having outcomes in mind helped guide the daily discussion with the small group instruction (Sloane, 2007 & Wasik, 2008). When putting together the members of the small group, it was important to carefully create this list with a common denominator between them all and personalities that worked well with one another (Re et al., 2014). The research

concluded that the more involved the teacher is in the small group, the more effective it will be for the students (Wasik, 2008). The literature also agreed with the research when it comes to giving the students a self-assessment. The research concluded this is a good way to understand whether students are getting what they need out of the small group instruction (Re et at., 2014). The small group instruction research included many ideals found in the literature and was effective when including these pieces.

Based on the findings and conclusions of this study, the following actions will be taken:

- To help partially proficient 7th grade students become proficient on their standardized assessments, small group instruction will be given to help individualize instruction and break down information in new ways.
- Formative assessments will be given throughout the unit to determine the effectiveness of whole group instruction as well as small group instruction.

There are some variables that may have affected the research. There was only a sample of students selected to take the student survey and if they had all been asked, data may have swayed in a different direction. The students were given a limited time to complete their formative assessments as this was a bell ringer and therefore might have done better given more time to finish the problems. Students also were completing their formative assessments via google forms which is hard to do if they are not willing to write down their work on a piece of paper. Students who are not motivated to write their problem on paper and work through the steps, may have found clicking an answer to be

their method to solving the problems. Lastly students could collaborate when working on their practice work throughout the unit and could not collaborate with others when taking the summative assessment. Many students benefit from collaboration and for various reasons do not work well on their own. This also could have skewed the data a bit. Overall, I feel the data is strong and doesn't contain too many variables.

In the future, it would be beneficial to complete further small group instruction research. It would be interesting to see the impact of small group instruction when targeting students who do not meet proficiency at all as well as with students who are exceed proficiency and need to be challenged in their math abilities. The small group instruction would be interesting to study in a stations type setting if more educators were involved in the process. These different scenarios would be great information to have available when researching small group instruction.

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**Appendix A**

**Pre-test A&B**

## Chapter 1A Pre-Test  Name: _____

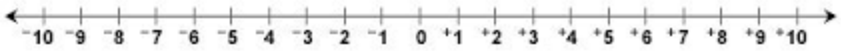
**4B, 5, 6, 7A, 7B**

**1-4B**

Simplify each expression.

1. Simplify the expression $|4|$ _____

2. If $|n| = 5$, graph all possible solutions for n on the line graph.




3. Simplify the expression $|5 - 14|$ _____

4. The absolute values of the elevations of two cities are the same. One is above sea level and one is below sea level. What does this tell you about the relationship between these values?

_____

**1-5**

5. Add 7 + 16 _____

6. Add -22 + 8 _____

7. If a bank deposit is a positive number and a bank withdrawal is a negative number, write an addition expression for Suleiman if he started with $250, deposited $15 and $25 while withdrawing $10 and $40? _____

8. How much money does Suleiman have now? _____

**1-6**

9. Subtract -22 - 6 _____

10. Subtract -16 - (-31) _____

11. Sabrina was in a boat when she dropped her cell phone 8 feet. If she was 3 feet above the surface of the water when she dropped it, write an expression for finding the new height of the cell phone, in reference to the water surface._____

12. What is the height of the cell phone now? _____

**1-7A**

13. Multiply 5 x (-3) _____

14. Evaluate the expression 6fg for f = -2 and g = -5 _____

15. The temperature was -4 degrees for 5 days, and then it was 7 degrees for 3 days. Write an expression to determine what the total amount of degrees was for those eight days. (Expression should have negatives and positives) _____

16. What was the total amount of degrees for those days? _____

**1-7B**

17. Divide $\frac{25}{-5}$ _____

18. Divide $\frac{-5(12)}{-4}$ _____

19. Each one of 4 friends owed the same amount of money to the school. Since debts are negative amounts they together have -$28. Write an expression to determine how much money each friend owes. _____

How much does each friend owe? _____

**Chapter 1B Pre-test** **Name:_____**

**1A, 1B, 4-1, 2, 3**

**1-1A /4**

Evaluate each expression for the given value of the variable.

1. 5 - p for p = 9 _____

2. 2(6 + m) - 9 for m = 2 _____

3. 2x + 7y for x = 8 and y = 3 _____

4. The number of diagonals of a polygon with n sides can be found using the equation (n(n - 3)) / 2. How many diagonals are in a 6-sided polygon (hexagon)? _____

**1-1B /4**

Using Order of Operations, evaluate each.

5. [12 - (6 + 9)] _____

6. 2 x [5 + (9 - 2)] _____

7. 4(4m - 3 x 7) for m = 8 _____

8. 5 + (3 x (s - 2) - 3t) for s = 10 and t = 6 _____

**4-1 /4**

9. Evaluate the the power $3^3$ _____

10. Write in Exponential Form $5 \cdot 5 \cdot 5 \cdot x \cdot x \cdot x \cdot x$ _____

11. Evaluate $3\,(11 - 3 \times 2)^{\,2}$ _____

12. Evaluate $x^3 - \frac{2y^2}{3}$ for x = 2 and y = -3 _____

**1-2 /4**

13. Write an algebraic expression for the difference of 7 and m_____

14. Write an algebraic expression for the quotient of y and 5 increased by 9

_____

15. List three ways to say the algebraic expression x + 5

_____ _____ _____

16. As a plumber, Frank charges $50 for a job and an additional $25 per hour for labor. Using h for the number of hours, write an algebraic expression for the amount Frank will charge. _____

**1-3 /4**

17. Use the commutative property to write an equivalent expression for 3 + 5. _____

18. Use the distributive property to write an equivalent expression for 4(x - 7). _____

19. Use the commutative property to write an equivalent expression for 4(x - 7). _____

20. Evaluate the following algebraic expression using the **order of operations** and then using the **distributive property**.
List both answers and show your work.
4(m - 5) for m = 14 _____ & _____

**Appendix B**

**Formative Assessments**

# 1-1 Formative Assessment

Answer the following questions based on today's lesson.

Evaluate the expression for the given variable: x + 7 when x = 23

Evaluate the expression for the given variable: 7t + 2 when t = 5

Evaluate the expression for the given values of the variables: 4x + 7y when x = 9 and y = 3

Evaluate the expression for the given values of the variables: 4m - 2n when m = 25 and n = 2.5

Rectangular shapes with a length-to-width ratio of approximately 5 to 3 are pleasing to the eye. This ratio is known as the golden ratio. A designer can use the expression 1/3(5w) to find the length of such a rectangle with a given width w. Find the length of such a rectangle with a width of 6 inches.

# 1-2 Formative Assessment

Answer the questions to the best of your ability based on today's lesson.

Write an algebraic expression for each word phrase: 1 more than the quotient of 5 and n.

Write an algebraic expression for each word phrase: 2 minus the product of 3 and p.

Write a word phrase for the algebraic expression: 142 - 19t

Write a word phrase for the algebraic expression: 16g + 12

A community center is trying to raise $1680 to purchase exercise equipment. The center is hoping to receive equal contributions from members of the community. Write an algebraic expression to evaluate how much will be needed from each person if 10, 12, 14, or 16 people contribute.

# 1-4 Formative Assessment

Answer the questions to the best of your ability based on the lesson today.

Find the additive inverse (the opposite) of the integer: 9

A. 9
B. 10
C. -9
D. 18

Simplify the expression: |7| + |-14|

A. -21
B. 22
C. 21
D. 7

-5 + 9

A. 14
B. -14
C. -4
D. 4

-10 + -13

A. -23
B. 3
C. -3
D. 23

During a very cold week, the temperature in Philadelphia was -7 degrees Fahrenheit on Monday, 4 degrees Fahrenheit on Tuesday, 2 degrees Fahrenheit on Wednesday, and -3 degrees Fahrenheit on Thursday. Use <, >, or = to compare the temperatures on Wednesday and Thursday, and then list the days in order from the coldest to the warmest.

# 1-7 Formative Assessment

Answer the questions to the best of your ability based on today's lesson.

## Multiply or Divide: -3(-7)

A. -10
B. 21
C. -21
D. -10

## Multiply or Divide: 72/-6

A. 12
B. 66
C. -12
D. -9

## Simplify: 12(9 - 14)

## Simplify: -13(-2 - 8)

A student puts $50 in the bank each time he makes a deposit. He takes $20 each time he makes a withdrawal. What is the net change in the student's account when he makes 4 deposits and 5 withdrawals?

# 1-9 Formative Assessment

Answer the question to the best of your ability based on today's lesson.

## Solve and Check: 3d = 57

A. 15
B. 16
C. 19
D. 20

Solve and Check: j/8 = 12

A. 80
B. 4
C. 12
D. 96

Solve: 6x - 5 = 7

Solve: n/-3 - 4 = 1

Fred gathered 150 eggs on his family's farm today. This is 1/3 the number he usually gathers. Write and solve an equation to determine the number of eggs (n) that Fred usually gathers.

# Appendix C

## 7.2.3 Assessment

Name_____

7.2.3 Apply understanding of order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions.

| 1 - Does Not Meet | 2 - Partially Meets | 3 - Meets | 4 - Exceeds |
|---|---|---|---|
| I can list the order of operations and attempt to evaluate algebraic expressions. | I can correctly apply the commutative, associative, OR distributive property using order of operations. | I can correctly apply order of operations and algebraic properties. | I can identify, analyze, and correct errors in problems involving order of operations and algebraic properties. |

Our 7th grade Pre-Algebra class is learning about order of operations. Two students solved the same problem and have different answers. Look at the student's work and determine if either student is correct. Identify which, if any, errors student A and student B made when solving.

$$5^2 + 4(3 - 2x) \text{ for } x = 3$$

| Student A | | Student B | |
|---|---|---|---|
| Step 1 | $5^2 + 4(3 - 2(3))$ | Step 1 | $5^2 + 4(3 - 2(3))$ |
| Step 2 | $5^2 + 4(3 - 6)$ | Step 2 | $5^2 + 4(3 - 6)$ |
| Step 3 | $25 + 4(-3)$ | Step 3 | $25 + 4(-3)$ |
| Step 4 | $29 (-3)$ | Step 4 | $25 + (-12)$ |
| Step 5 | $-87$ | Step 5 | 13 |

Error(s) found and explanation:

Now, evaluate the same expression using the distributive property. Show your work.

$$5^2 + 4(3 - 2x) \text{ for } x = 3$$

## Appendix D

### Student Survey

## Small Group Student Survey

After participating in the math small group, do you believe being a part of the small group instruction had a positive effect on your math performance, a negative effect on your performance, or no change in your math performance?

A. Positive
B. Negative
C. No change

Why did you answer question #1 the way that you did? Please be specific.

Has being in the small group positively, negatively, or not at all impacted your learning process when solving math problems?

A. Yes
B. No
C. No change

Why did you answer question #3 the way that you did? Please be specific.

What activity in the small group has been the most helpful for you?

What activity in the small group has been the least helpful for you?

In your opinion, how can the small group instruction be improved?

What have you learned as a result of participating in the small group?

Please put any other comments that you have about working in the small group below.