COOPERATIVE LEARNING: A SIXTH GRADE MATHEMATICS CURRICULUM FOR TEACHING ADDITION OF FRACTIONS

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PROJECT

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COOPERATIVE LEARNING: A SIXTH GRADE MATHEMATICS CURRICULUM FOR TEACHING ADDITION OF FRACTIONS

A Project

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Abstract

of

COOPERATIVE LEARNING: A SIXTH GRADE MATHEMATICS CURRICULUM FOR TEACHING ADDITION OF FRACTIONS

by

Erin R. Teske

Statement of the Problem

Mathematics proficiency is an important aspect of education of for today’s youth. In order to be successful in today’s society students need to have more developed math skills. Currently, students in the United States are not keeping up with students from other countries. Additionally, students in California are falling behind other states. One key area of math instruction that needs more support is fractions. Fractions are the gatekeeper to Algebra, which is required for all eighth grade students in California.

With the lagging achievement scores, educators need to find a way to make math instruction more engaging and accessible for students. Current math instruction typically follows a direct instruction model with memorization of algorithms and practice on worksheets. This project will help students become engaged with the math lessons, which will, in turn, increase mathematics achievement. Students will have
opportunities to discuss their learning and work together in order to develop a deeper understanding of fraction concepts.

Sources of Data

The Review of Literature examines three key areas. The first is current problems with math, including student achievement scores, curriculum, and student motivation. Next is an analysis of current teaching strategies. Within these strategies is direct instruction and self-discovery. The review of literature also includes research-based aspects to consider when implementing cooperative learning. Sources of data used were professional journals, books, and websites.

Conclusions Reached

Sixth grades students have been working with fractions since third grade and still have not developed proficiency. Students need learning activities that are engaging and encourage them to take an active role in their learning. This project will provide teachers with a guide to implement hands-on and group based activities in their classrooms that will increase student achievement with fractions.

_____________________________, Committee Chair
Rita M. Johnson, Ed.D.

_____________________________
Date
ACKNOWLEDGMENTS

My project is dedicated to my grandfather, Delmar Pluim. He passed away when I first went back to school in order to complete my masters program. Thank you Grandpa for always encouraging me and believing in me when even I thought I couldn’t do it. Even though you could not be here to see me complete this project, I know you are smiling down from heaven and so proud. I will always love you!

I also owe a huge thank you to my parents, Rick and Donna Teske. You raised me to set high standards for myself and to never give up. I appreciate you both for the value you placed on education when I was at such a young age. I couldn’t be here today without your undying love and support. You are always there for me when I need you and willing to give a helping hand. Not to mention, always a warm shoulder to cry on or a good ear to listen. Thank you for your encouraging words and your belief in me! I love you both very much.

Finally, my thanks goes out to all of my family and friends. You have believed in me and seen more in me than I can see in myself. Thank you for your patience and understanding. You all have encouraged me along the way and picked up the pieces when I didn’t think I could. I couldn’t have made it without all of your love!
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Chapter 1

INTRODUCTION

“Human beings learn more, flourish, and connect more when they’re cooperating and less when they’re competing or working in isolated fashion” (Johnson & Johnson, 2002, p. 1). Cooperative learning is a powerful teaching strategy that can benefit students in many ways. During cooperative learning, students work together in order to maximize their learning and each other’s learning. Students’ academic achievement can increase while they develop their social skills and confidence. The use of language can help create an understanding that is personal to each individual, while social skills are fostered. Cooperative learning has the ability to reform mathematics instruction and give students opportunities to learn in an innovative and exciting way.

Statement of the Problem

Students today are challenged with the ever-changing demands of a global market place. Infused within the changing economy, comes the responsibility of educators to prepare students to be life-long learners, as well as, independent and critical thinkers. Currently, students in the United States are lagging behind other countries in mathematics and with the age of accountability, teachers also need to increase students’ test scores. Educators are faced with preparing children to become successful members of society while also increasing student achievement along the way. Students will use mathematics throughout their daily lives; therefore, it is important that they understand the skills and concepts being taught. It is the
responsibility of teachers to maximize student interest in order to develop positive
learners and increase mathematical achievement. Educators need to implement
methods within their mathematic classrooms that not only increase test scores, but also
encourage students to become self-motivated learners.

Purpose of the Project

The purpose of this project is to create a sixth grade resource guide that will provide teachers with curriculum ideas for teaching addition and subtraction of fractions with cooperative learning. The primary goal for this project is to help limit the amount of remedial practice that is used to teach addition and subtraction of fractions, by helping increase the level of understanding through the use of social interaction and cooperative learning.

Significance of the Project

This project is important because it gives teachers strategies to implement in their classrooms in order to increase student achievement. With current No Child Left Behind regulations, state test scores, and teacher accountability, educators need access to effective teaching strategies in order to make sure that all students are learning. Many elementary teachers are at a loss with how to make math concepts, especially fractions, more accessible to their students; therefore, they continue with their instruction the same way they always have.

The author teaches sixth grade mathematics. Year after year, students have struggled with fraction concepts, primarily addition and subtraction. The children have been taught how to add and subtract fractions in grades three and four, reviewed this
in grade five, yet they do not seem to understand these concepts by sixth grade. Traditional methods of direct instruction have not been effective. This project provides an alternative method for educators to use during instruction in order to increase student understanding and achievement.

Theoretical Base

The theoretical base for this project uses cooperative learning in order to actively involve students in the learning process. Students have opportunities to work together towards a common goal. They share their ideas and help one another in order to solve problems. Individual accountability also plays a vital role. All students are responsible for their team portion as well as their individual portions. Because of the support of their team, students will be able to reach higher levels of success than previous mathematical experiences. Not only will they have increased academic achievement, but also increased self-confidence and better social and communication skills.

Definition of Terms

*Cooperative Learning:* A teaching strategy used in which students work together in order to achieve a common goal.

*Direct Instruction:* A teaching strategy in which the teacher explicitly teaches a set of skills systematically through lectures and demonstrations.

Limitations

This project is limited to teachers, grades four through six, that implement curriculum using the 2010 California Mathematics State Standards. Even though the
resource guide is written for sixth grade teachers as re-teaching of fraction concepts, it
can be utilized in earlier grade levels instead of direct instruction. The project is also
limited to teachers who have a desire to implement different types of teaching
strategies in their classrooms. Therefore, this project may not appeal to all teachers.

Organization of Project

Chapter 1 contains the statement of the problem, purpose of the project,
significance of the project, theoretical base, definition of terms, limitations, and
organization of the project.

Chapter 2 contains a review of literature. The chapter begins with discussing
current problems in mathematics, including student performance, curriculum, and
student motivation. It also includes an analysis of current strategies used during math
instruction and determines which is most effective. The strategies include direct
instruction, self-discovery, and cooperative learning. The chapter concludes with a
summary of important aspects to consider when implementing cooperative learning.

Chapter 3 highlights the project’s methodology, organization, and
implementation. Chapter 4 contains the summary, conclusion, and recommendations
for implementation. The Appendix contains the practical component of the project,
which is a cooperative learning unit for teaching addition and subtraction of fractions.
The unit consists of lesson plans with class activities and blackline masters.

The final section contains references that were used in the project.
Chapter 2

REVIEW OF LITERATURE

This project will focus on the development of a cooperative learning curriculum in order to teach fractions to sixth grade students. Presented in this chapter is the review of the related literature, which will provide a research-based context for the mathematics content and methods. The review begins by discussing current problems in mathematics, including student performance, curriculum, and student motivation. The next section analyzes current strategies used during math instruction and determines which of those strategies are most effective according to research. The chapter concludes with a summary of important aspects to consider when implementing cooperative learning.

Current Problems in Mathematics

Educators are often faced with the question on how to motivate students to become lifelong learners. More specifically, it can be very difficult for students to be motivated to learn math if they are faced with math anxiety. Often students will try to avoid the subject and when they have to face it, they put in little effort because they lack confidence (Shore, 2005). Mathematical concepts are essential for students to develop in order to become successful members of society. Teachers are faced with developing students into mathematical thinkers, when many do not enjoy or feel very unsuccessful in the subject. Many students do not have an inherent interest in mathematics (Lesser, 2000). It is the responsibility of educators to draw the interest
out of students in order to develop positive learners and increase mathematical achievement.

**Student Performance**

Mathematics is an important part of curriculum that students encounter on a daily basis. Math concepts are such an important aspect of learning; therefore, it is a problem when students perform below achievement standards. According to Pinzker (2001), American students are lacking proficiency in mathematics. The Mathematics Framework for California Public Schools (California Board of Education, 2006) states, “To compete successfully in the worldwide economy, today’s students must have a high degree of comprehension in mathematics” (p. 15). The job market has shifted in the 21st century towards a world economy and globalization. With this shift, new skills are required for individuals to be successful and produce economic growth within the country. Students are not learning the mathematical skills in order to be productive in society. Of those entering college in the United States, only 54% complete a degree, which is lower than the Organization of Economic Cooperation and Development’s average of 71% (Schleicher & Stewart, 2008). The United States is falling behind on college graduation rates, which lowers the job marketability for U.S. citizens. They are in competition for jobs with countries that have more dynamic and successful educational systems.

The United States as a whole is not ranking well amongst other countries. The Program for International Student Assessment (PISA) is administered every three years to 30 countries in order to demonstrate how U.S. students compare academically
with other countries. This assessment does not merely ask students to regurgitate their learning through a series of applied algorithms, but it gives them opportunities to demonstrate their learning by applying it to new situations. In other words, it can assess students’ critical thinking and problem solving skills, which are necessary in today’s work place. The results of the PISA show that in the area of mathematics, the United States ranked 25th of the 30 countries that participated and the U.S. score of 474 was below the average of 498. In addition, more than one quarter of the students performed below the baseline level (as cited in Schleicher & Stewart, 2008). Based on the results of the PISA, United States students’ mathematical thinking is lagging behind that of other countries.

In addition to the PISA, the United States is also being outperformed on the Trends in International Mathematics and Science Study (TIMSS). This assessment is an international comparison of student achievement throughout various participating countries. It measures the mathematics and science skills for fourth, eighth, and 12th graders. The 2007 results show that U.S. students are lagging behind other countries as they progress through the grade levels. Fourth graders scored higher than 23 of the 35 countries and eighth graders scored higher than 37 of the 47 countries. On the other hand, 14 out of the 20 participating countries outperformed U.S. 12th graders. The United States began above the national average in fourth grade, but demonstrated a decline in student achievement throughout the grades. One significant change in the test from fourth to eighth grades is the percentage of the test that is focused on the number domain. In fourth grade, 52% of the assessment is number-based, while only
29% on the eighth grade test is based on number, with 30% devoted to algebra. As algebra becomes the increasing focus, student proficiency begins to decline. Students in the United States are lacking the mathematical skills in order to be successful in both algebra and therefore higher levels of mathematics.

Not only do other countries outperform the United States, but California is falling behind other states. The 2007 National Assessment of Educational Progress (NAEP) shows that California was one of 17 states that made no significant progress in comparison with 2005. Thirty-three other states demonstrated growth in fourth grade, eighth grade, or at both grade levels. In addition, California’s eighth graders ranked 45th amongst the nation with an average score of 270; below the national average of 280 (National Center for Education Statistics, 2007).

New legislation in California has made it mandatory for all eighth graders to take Algebra I. Recent NAEP and TIMSS scores have shown a drop in student proficiency in mathematics from fourth to eighth grades. According to the 2007 National Report, 30% of fourth graders were at or above proficient while 24% of eighth graders were at or above proficient (National Center for Education Statistics, 2007). As the grade levels increase, students are demonstrating less and less proficiency both in comparison of the U.S. to other countries and in comparison of California to other states.

The decline in student achievement poses a problem because mathematical skills and thinking continue to get more difficult throughout grades K-12. Brown and Quinn (2007) noted that there are three key components that students need to master
within the mathematical realm: the idea of the unit 10, understanding fractions, and grasping the concept of the unknown. In addition, Steen (2007) suggested that fractions and algebra are the two critical, yet most struggled areas for students in mathematics. Fraction proficiency and success in algebra are closely related; with fraction concepts being foundational. Algebraic thinking is based on a true understanding of rational number concepts (Lamon, 1999; Wu, 2001). According to Brown and Quinn (2007), “Vague fraction concepts and misunderstood fraction algorithms will ultimately be generalized into vague algebraic concepts and procedures” (p. 29). If students are going to have success with Algebra I, they need to have firmly grasped fraction concepts. With increased accountability for all students in California to take Algebra I in eighth grade and California students lacking the necessary skills, educators need to find ways to make the curriculum, primarily fractions and algebra accessible, to all students.

Curriculum

The curriculum in the schools has an impact on student success. Results from the Third International Math and Science Study indicate:

Math instruction in the U.S. can be characterized as a mile wide and an inch deep. That is, it sips many dozens of topics, but pauses little to drink of their essences. In general, U.S. students’ number sense lagged behind the average of other countries mainly because focus on procedures over true math thinking and problem solving in classrooms. (Wahl, 2009, p.1)
Research suggests that one common problem in mathematics instruction has been that the instruction typically focuses on computational strategies rather than understanding (Aksu, 2001; Brown & Quinn, 2006; Steen, 2007). Teachers today have a plethora of standards to cover so students are being taught many concepts at a surface level. Cossey (1999) concurs that U.S. curriculum covers too many topics in order to go in depth. Table 1 displays the number of mathematical concepts covered at each grade level in the U.S.

Table 1

<table>
<thead>
<tr>
<th>Grade Level</th>
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<td>K</td>
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<td>51</td>
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With so many topics to cover, school children have difficulty acquiring a deep understanding of content areas (Bednar, Coughlin, Evans, & Sievers, 2002).

With an abundance of standards to cover, math instruction has traditionally been paper and pencil exercises. Bernero (2000) noted that many students find math boring because it tends to be individualized work with repetitive assignments. Bednar et al. (2002) stated, “traditional approaches to instruction do not allow every student
the opportunity to reach his or her full potential” (p. 21). Direct instruction places emphasis on memorizing algorithms and skills. Pinzker (2001) noted that when students are taught to follow specific procedures to solve problems, they are not learning and understanding the concepts involved. Often, teachers explain steps or a procedure to solve problems, before students fully grasp the meaning behind what they were doing. Before students are able to perform algorithms with proficiency, they need to be able to understand meaning, especially with the mathematical concept of fractions (Asku, 2001). Teachers should be able to teach mathematical concepts in such a way that students can apply their knowledge to real life situations.

**Student Motivation**

Student attitudes about mathematics can also hinder their success. Researchers agree that student perceptions about their mathematical abilities and their beliefs about mathematics directly relate to their understanding of concepts and success in mathematics (Pinzker, 2001; Schoenfeld, 1992). According to Pinzker (2001), students who do not understand new mathematical material the first time they see it, frequently they think they will never understand it. Some students develop the “I know I can’t do it so there is not point in trying” syndrome (Cornell, 1999). Once students feel they cannot solve math problems, they will begin to stop trying. If students feel unsuccessful, their negative perceptions of mathematics begin to form and many develop a feeling of math anxiety, or a fear of math. Students develop this anxiety at a young age as they begin to feel unsuccessful. Rasmussen (1999) found that once students develop feelings of math anxiety it can be difficult to overcome them. This in
turn can lead to a negative belief about mathematics; therefore, students have a lack of motivation and their achievement levels are negatively impacted.

Student motivation is a major problem in classrooms today (Crump, 1995). Students are more apt to learn material that interests them (McKeachie, 1994). In terms of education, Crump (1995) defined motivation as “exciting the mind of the student to receive the instruction” (p. 3) Teachers need to find a way to motivate students to become lifelong learners. Many students are bored, inattentive, and unable to see much connection between schoolwork and their lives outside the classrooms (Crump 1995). Boredom diminishes attention, lowers achievement, and is a likely reason for dropping out of school (Hootstein, 1994). As students become more motivated, in turn, they will become more engaged in the learning process. According to Park (2005), student engagement was a significant predictor of students’ success in school. The more engaged a student is, the more successful they are. As well as, the more successful they are; the more motivated they are to keep learning. If they feel they have accomplished a goal they have more incentive to keep learning. Unless a student feels satisfaction from schoolwork, s/he will have not reason or motive to continue to pursue learning (Green, Kandyba, McDonald, & Stevens, 2000).

Construction of Knowledge

Piaget proposed that there are four stages of development in children. They included Sensorimotor Stage (Infancy), Pre-operational stage (Toddler and Early Childhood), Concrete operational stage (Elementary and early adolescence), and Formal operational stage (adolescence and adulthood). Students are typically in the
Concrete Operational Stage approximately during ages 7-11 and Formal Operational Stage at ages 12 and up. A significant difference between the two stages is that during the Concrete Operational Stage students are still thinking in relationship to concrete objects. In contrast, during the Formal Operational Stage, students begin to relate concepts to abstract objects (Piaget, 1950). When modeling a school based on Piaget’s thinking, it is recommended that concepts beyond students’ cognitive levels are not taught until they are ready (Huit & Hummel, 2003).

According to the 2006 Mathematics Framework for California Public Schools, by the end of fifth grade, students should be proficient in their four basic arithmetic operations for both fractions and decimals. Fractions are introduced in second grade and built on every year. By the end of fifth grade, proficiency should be reached, but in reality it is not achieved. Fraction operation standards appear again in sixth grade, but at a more complex level. Because fifth graders are not entering sixth grade with the necessary background in fractions, teachers must revisit basic fractions and teach more of the same. Basic addition of fractions is remedial work for sixth graders, but proficiency is necessary for future math development.

Brown and Quinn (2006) conducted an error analysis study. They administered a 25 question test to five algebra classes that were composed of primarily ninth graders. Students were encouraged to show all of their work and were not able to use calculators. Brown and Quinn hand scored each problem in order to analyze common errors. The study found that most students used algorithms to solve fraction problems and when students were unsure how to solve a problem, they resorted back to
previously memorized algorithms, whole numbers, that they were more familiar with. The algebra students lacked experience with fractions and did not have conceptual knowledge. Brown and Quinn (2006) stated, “Algorithms that are taught when the concept is beyond the learner’s cognitive development force the learner to abandon his or her own thinking and resort to memorization” (p. 29). Students will not be able to develop conceptual understanding about math if their minds have not reached an abstract stage of development. Therefore, with fractions being an abstract concept, students should not be introduced to them until their developing minds are cognitively ready. Because students were taught fractions before they reached the Formal Operational Stage, they began to grasp some of the basic fraction concepts, but could not understand the depth of rational numbers. According to Brown and Quinn (2006), if students are not ready to learn fractions, they can memorize the producers for solving the problems, but they don’t have the time or cognitive development to construct understanding of fraction concepts and therefore will not be able to develop a complete understanding that will stay with them.

Lev Vygotsky viewed children’s developmental stages in a different light. He constructed his theories based on social construction and development. In contrast to Piaget, Vygotsky believed that children learn from social interactions. He placed a strong emphasis on language and its critical role in cognitive development (Vygotsky, 1934). In addition, Vygotsky believed that students could reach a higher level of achievement than independently possible through the use of effective scaffolding techniques. Unlike Piaget’s theory that students’ developmental stages precede their
learning, Vygotsky theorized that children’s social learning preceded their development. “In other words, children learn by solving problems with the help of the teacher, who models processes for them and his or her peers, in a classroom environment that is directed by the teacher” (Dahms et al., 2007). Because students learn through a series of developmental stages, it is the role of the teacher to help guide them.

Strategies for Mathematics Instruction

Vygotsky’s (1934) theory suggests that the use of strategic instructional strategies can impact student learning and achievement. Because educators have no control over which standards are taught when, teachers need to find ways to guide student learning through social interactions in order for students to achieve mastery. Brown and Quinn (2006) argue that fractions are taught before students are cognitively ready, but according to Vygotsky’s social interaction theory, students can achieve higher levels of critical thinking with the proper support and guidance.

One way teachers can motivate learners and increase student achievement is to rethink the structure of their classrooms and their instructional strategies. The intensity of the changing job markets and American students lagging behind in test scores has increased teacher pressures. It is more important that educators design lessons so all students can become proficient in their grade level mathematics standards. Teaching strategies range on a spectrum from teacher guided direct instruction to little teacher involvement, also known as self-discovery. Reform in mathematics education has called for an increased emphasis on meaningful experiences in mathematics and a
decreased emphasis on the repeated practice of computational algorithms (National Council of Teachers of Mathematics [NCTM], as cited in Pinzker, 2001).

Traditional approaches for teaching mathematics created passive students (Bednar et al., 2002). The typical math classroom transferred knowledge from the teacher to the students. In the United States, direct instruction is commonly implemented and students spend 96% of their time doing seat-work and practicing algorithms (Bernstein, 1997). Students are not actively involved throughout the learning process. They listen to teachers model and demonstrate sample problems and then they attempt to follow same steps in order to solve similar problems on a worksheet. With passive students, also come students who do not understand the concepts behind what they are doing. Brown and Campione (1990) found that classrooms emphasized “skill training” through explicit instruction. With this training, students could perform algorithms, but were unable to understand the significance behind what they were doing. This level of understanding is necessary for students to develop into independent, high-level learners. As Bernero (2000) noted, “A cause of math anxiety and low interest is the lack of variety in the teaching process” (p. 7).

On the other side of the effective teaching strategy spectrum is self-discovery. It is also referred to as problem-based, experiential, and constructivist learning. This strategy is when students engage in inquiry and discover the intended content and concepts for themselves. Research suggests that discovery learning is not an effective strategy when used solely because students need guidance, structure, and goals. Mayer
(2004) conducted a historical review for discovery teaching methods and he found no support that the pure discovery method was more effective than guided methods.

Additionally, Kirschner, Sweller, and Clark (2006) conducted an analysis of research that compared guided and unguided instruction and their findings concurred with Mayer (2004). The researchers found that discovery learning was less effective than guided learning because students did not have support cognitively for the learning that must take place. Constructivist theory allowed for students to make sense of material by synthesizing it and organizing it within the working knowledge that learners have already created (Mayer, 2004). In order for students to create their knowledge, they needed to be given opportunities to interact and reflect on their learning, but research supports that teacher guidance is still a critical component.

With the current education status of American students in comparison to other countries, direct instruction is not as effective as one may hope. Additionally, reforming mathematics to student guided lessons is also not the answer to higher levels of achievement. Educators need to find a way to increase student achievement levels while maintaining student motivation to become life long learners.

Cooperative Learning

Cooperative learning is one strategy that can increase the engagement, motivation, and achievement of their students. It falls on the teaching strategy spectrum midway between direct instruction and discovery learning. Teachers guide student learning, but also give time for groups to discuss and reflect on their learning.
Additionally, it models interactions and instructional designs that move students away from individual pen-and-pencil worksheets.

The positive achievement effects of collaborative learning have been demonstrated over time (Bernero, 2000; Klebosits & Perrone, 1998; Pinzker, 2001; Slavin, Leavey, & Madden, 1984). For example, a classic study done by Slavin, Leavey, and Madden (1984) supported the idea that cooperative learning increases student achievement more than traditional whole group instruction. The study was conducted over eight weeks on a group of middle class third, fourth and fifth graders. The results were analyzed based on a pre and post Comprehensive Test of Basic Skills (CTBS). Students were either a part of Team-Assisted Individualization where they had opportunities to check and discuss their work with peers, Individualized Instruction where they were able to check the progress of their work, but they did not have opportunities to discuss their work, or the control group where they received traditional whole-class lectures with text books. The students who received Team-Assisted Individualized demonstrated a higher level of achievement in the CTBS testing. They gained two times more grade equivalents than the control group.

A more recent study affirms these findings. Bernero (2000) studied a second-grade math classroom of African American and Hispanic students. Students participated in a cooperative learning math environment twice a week and reflected on their experiences through journal writing. The students evaluated themselves as individuals and as a group. Before the implementation of cooperative learning, 45% of the class had negative or neutral feelings towards math and two-thirds of them
preferred to work alone. After participating in cooperative lessons throughout the year, 90% of the class had positive feelings about math and over three-fourths of them preferred to work in cooperative groups. Student growth was also noted academically. Forty-percent of the class was performing at or above average before cooperative learning in comparison to the 80% that performed at or above average after implementation. The teacher also noted that the classroom became a more positive environment in which students showed unity and caring for one another. The results demonstrated that students were more interested in math and enjoyed it more. Additionally, the students improved their social skills and acceptance of each other.

Cooperative learning encourages group interaction with assigned roles, with each member sharing responsibility for the group and work produced (Bernero, 2000). Students are able to help each other and work together to achieve a common goal. Throughout the process, students need to communicate with each other and help others that may not understand the concepts. Kennedy and Tipps (1994) noted many positive benefits that are associated with cooperative learning:

1. academic achievement
2. self-esteem and self-confidence
3. intergroup relations
4. social acceptance of mainstreamed children
5. ability to use social skills (when taught)

A study by Klebosits and Perrone (1998) confirmed these findings. Their study was conducted with suburban junior high and high school students. The researchers
implemented cooperative learning activities with like-gender and mixed-gender grouping patterns. The purpose was to determine which grouping patterns were more effective in Spanish and math classrooms. They found that while working in cooperative groups students increased their academic achievement, social skills, and self-esteem at the same time. In addition, students were able to develop the life skill of communicating with others in order to complete a task.

Not only does cooperative learning create a positive and engaging mathematical environment, but it can also increase academic achievement (Bernero, 2000; Klebosits & Perrone, 1998; Pinzker, 2001). Pinzker (2001) found that increasing the engagement and understanding of concepts in turn, increases students’ achievement. One reason cooperative learning increased achievement was because students were able to learn from their peers and be taught the concepts in different ways than originally done by the teacher. Students learned more effectively when they learned from each other instead of against each other or apart from each other (Kohn, 1999). Students were able to ask questions, share ideas, and explain their thinking to their peers. In order to be successful, students needed to explicitly state their opinions, be able to listen to each other, and work together to compromise. This process led to a deeper understanding of concepts because students are not simply repeating a process that has been modeled directly by the teacher. Slavin (1991) found that there was a strong positive correlation between the ability to think critically, and to think more creatively when learning occurred during group settings. As students worked together
in groups, they developed deeper level problem solving skills that they may not have previously exhibited.

When working individually on math problems, students tended to give up when concepts and tasks become difficult (Pinzker, 2001). If students have each other to use as resources, they are more inclined to step up to the challenge and persist with trying to work on a problem. Students can work together and share ideas in order to increase how much they get done, as well as how much they understand the material presented to them.

In addition to fostering a positive environment, collaborative learning also increases self-confidence for individual students. As students increase their self-confidence, they begin to develop more positive perceptions about mathematics. Hannula, Maijala, and Pehkonen (2004) examined the correlation between self-confidence and mathematical achievement. The researchers conducted a longitudinal study with fifth to eighth graders over two years. Students completed the survey when they were in fifth grade and a follow up survey one and one half years later. Each survey contained math tasks and questions asking students to estimate their success and success confidence with a belief scale. Hannula et al. (2004) found that achievement was a predictor of self-confidence. The amount of confidence that students had determined future confidence and achievement on the follow up survey.

In order to avoid feeling isolated and alone, students must develop relationships and be able to identify themselves as a member of a larger group (Crump, 1995). Collaborative learning gives students a feeling of community rather
than a bunch of individuals sitting in a classroom. It makes them feel more positive about themselves, about each other, and about the subject they are studying (Pinzker, 2001). One reason self-confidence increases is because students begin to feel successful. With the help of their group, they are able to complete a mathematical investigation of concepts and are able to demonstrate their learning. By experiencing successful group encounters, students are given the confidence to accept the challenge of future higher-level tasks (Klebosits & Perrone, 1998). As students felt more successful, they took more risks and began to accomplish given math tasks on their own.

Lastly, cooperative learning creates social interactions between students on a regular basis. These social interactions simulate future interactions students will experience throughout their lives; therefore, preparing students to become productive members of society. Klebosits and Perrone (1998) found that while working in cooperative groups, students were able to experience the life skill of working and communicating with others. Cooperative learning gives students access to academic knowledge through social interactions. In turn, they are developing both their psychological and social sides of learning.

*Implementation of cooperative learning.* In order for cooperative learning groups to be effective, there are five main and essential components. The components include positive interdependence, individual and group accountability, student face-to-face interaction, interpersonal and small group skills, and group processing (Johnson, Johnson, & Holubec, 1994). Putting students into groups and having them work in the
same workspace is not considered cooperative learning. Artzt and Newman (1997) discussed previous research on necessary factors to consider when developing cooperative learning lessons. They concluded that students needed to feel a part of a team, solve a group problem, discuss all problems with one another, and that students need to have a clear understanding that their individual work affects that groups’ success.

*Student grouping.* Students can be grouped in either heterogeneous or homogeneous groups. These groups can be designed by gender, ability, or even student choice. Research supports the idea that heterogeneous grouping has its advantages (Artzt & Newman, 1997; Marzano, Pickering, & Pollock, 2001). Further, a study done by Jacqueline Leonard (2001) supports previous findings. The purpose of the study was to determine if heterogeneous or homogeneous groupings were a factor in student achievement. Leonard conducted her study over a two-year period with 177 sixth-grade math students. In order to determine results, Leonard compared students’ scores on the Maryland Functional Mathematics Test. The results found that group composition did affect student achievement. Students placed in a heterogeneous group demonstrated higher levels of achievement on the posttest.

An academic achievement gain during heterogeneous grouping is typically demonstrated with grade-level and underachieving students. Linchevski and Kutscher (1998) studied heterogeneous grouping by ability with junior high students. The goal of the study was to determine the achievement differences of students in heterogeneous groups versus homogeneous groups. Linchevski and Kutscher found
that lower achieving students demonstrated more growth when working in heterogeneous groups, while there was no difference in high achieving students’ academic growth. Research supports that heterogeneous grouping has its advantages for lower achieving students, yet higher achieving students are sometimes not pushed above and beyond. All students need to be maximizing their learning. Leonard (2001) states, “If teachers are to address issues of equity in the classroom and ensure that all students have the opportunity to learn, then they must consider how grouping influences the learning and achievement of all students” (p. 196). Teachers can vary how they group students in order to maximize the learning of all students in their classroom.

Group dynamics. In order for a cooperative learning group to be effective, all members need to be participating and contributing to the common goal of the group. In order to engage students and guide them towards maximum participation, individual accountability needs to be in place. Each individual is responsible for his/her portion until the final group task is completed. The students have an understanding that their work is necessary in order to enable the group to complete its task (Artzt & Newman, 1997). This positive peer pressure can help motivate students to complete their portion because the success of the group depends on it.

Conclusions

This literature supports the use of well-structured cooperative learning in order to increase student achievement in mathematics. Mathematical understanding plays a crucial role in society and future successes for students. The foundation is formed at a
very young age and students either begin to love math or hate it. Once they have negative feelings, they begin to feel they do not have the ability to ever be successful or understand math. Teachers have the responsibility to develop lifelong learners. In order to do that, teachers need to create and foster an environment that is conducive to positive mathematical perceptions, social interactions, and directed at the needs of each individual student. As research shows, students are more motivated when they feel successful and the concepts taught are related to their lives. The use of cooperative learning is a powerful way teachers can create an engaged community of learners. It allows students to develop positive feelings about themselves as learners and experience success in mathematics while understanding higher-level concepts. Additionally, when fostered in a classroom and implemented strategically, cooperative learning promotes students taking an active role in their education through participation and involvement. This can enhance each students learning and lead to higher levels of achievement.
Chapter 3

METHODOLOGY

The first step in the development of this project was the review of literature, which covered current problems in mathematics education. In addition, an analysis of current instructional practices identified well-developed cooperative learning as an effective teaching strategy in order to guide students to higher levels of math achievement. Cooperative learning gives students access to state standards while increasing their self-confidence and social skills.

The project has been developed using the Mathematics Framework for California Public Schools, Kindergarten through Grade Twelve. The sixth grade standard for Number Sense strand 2.0 states, “students can calculate and solve problems involving addition, subtraction, multiplication, and division of fractions” (California Board of Education, 2006, p. 161). Because students were taught addition and subtraction in the third and fourth grades, the sixth grade standard expects increased proficiency when solving fraction problems. However, incoming sixth graders frequently are lacking the essential prerequisite skills when adding and subtracting fractions so this project approaches teaching the concepts from a new strategy, which is a focus on cooperative learning.

The project is organized with a series of lesson plans in order to effectively implement a cooperative learning unit. Appendix A is composed of five key areas of fractions in order to guide students to proficiency with adding and subtracting fractions. By the end of the cooperative learning unit students will be able to:
• Understand the concept of a fraction
• Create and identify equivalent fractions
• Express a fraction in lowest terms
• Find the sum for like, as well as, unlike fractions
• Solve word problems involving fractions

Some of the essential skills will require more than one lesson in order for students to reach proficiency; therefore, those skills will have multiple days' worth of instructional material. All lessons will include any student worksheets and materials, as well as, black line masters of any teacher reproducibles. If teachers need to prep materials that cannot be copied, the black line master will serve as a template in order to guide the educator towards what the finished product should look like.

In addition to lesson plans, Appendix A also includes a pre and post-test for addition of fractions. Each of the essential skills is assessed separately in order to help the teacher identify in what areas students demonstrate a lack of proficiency. If teachers need to revisit addition and subtraction of fractions after the unit is complete, the assessments will guide the instructor to the specific areas that students are having difficulty.

Classroom Implementation

The addition of fractions unit will require students to work in cooperative groups. The classroom will be arranged in heterogeneous groups of four that are teacher-assigned. In assigning groups the teacher will pay close attention to leaders,
behaviors, English-Language Learners, and students’ academic levels in order to make sure that the groups are created with a mixture of students. In order for the students to get to know each other, the first lesson is an icebreaker activity. In addition, it is an opportunity to teach students’ the procedures for working with groups. Students will practice how to keep their noise levels appropriate and how to rely on each other when they have questions.

During each lesson throughout the unit, each member of each group will have an assigned role. The roles include materials manager, timekeeper/checker, recorder, and facilitator. The roles are specifically stated and modeled at the beginning of the unit. If teachers do not assign specific roles, students are simply sharing materials and workspace, which is not cooperative learning. Assigning roles prevents students from dominating an assignment, as well as ensuring that each member contributes in his/her own way to the final outcome of the project. The groups will be successful when all students work together in order to complete the specific task at hand.

In addition to group work, each lesson will also have individual accountability. For their independent practice, students will have to complete their own task that is similar to the one completed with the group. The problems will be similar, but not the same numbers. Additionally, students will have independent practice to take home or begin in class, which simulates the problems on their assessments.

Steps for Incorporating Cooperative Learning

The implementation of this project will begin during the fall as teachers are coming back to school. One in-service day before school starts will be dedicated to
cooperative learning. The objective of the workshop is to train teachers on how to effectively implement cooperative learning and to give them work time to prep the cooperative learning materials for each lesson. The morning is dedicated to training. Teachers will learn how to organize effective groups, assign student roles, assess cooperative group work, and how to train students to become effective leaders and team members. After an introduction to the unit, the afternoon is dedicated to teacher work time. Teachers will work together in their grade level teams in order to prep materials for the entire fraction unit. Teachers have time to design cooperative group templates and run any necessary black line masters.

After teachers have time to get to know their students, both their personalities and academic abilities, one afternoon in-service will be provided in October. The objective of this in-service is to have teachers design their cooperative groups with the help of their grade level teams. Teachers will also discuss the icebreaker lesson in order to teach students how to work in cooperative teams. The educators will participate in an icebreaker themselves during the in-service in order to fully understand what cooperative groups look, sound, and feel like. By the end of the second in-service, teachers will be ready to fully implement the cooperative learning fraction unit.

One final afternoon in December before winter break will be an in-service that is dedicated to teacher reflection. Teachers will discuss student scores for both the pre and post assessments in order to identify growth and future student needs. Additionally, teachers will review the cooperative learning unit in order to discuss any
challenges they faced and identify any changes that need to be made for the following year.
Chapter 4

SUMMARY, RECOMMENDATIONS, AND CONCLUSIONS

Summary

Changes in education, primarily math instruction, need to be made as the global market continues to evolve. Current U.S. students are falling behind academically in comparison to other countries. Due to the lagging U.S. scores, math typical math instruction needs to be restructured. It is the responsibility of educators to find a way to engage students while motivating them to participate actively in their education. Current math instruction usually follows a direct instruction model, which creates passive students. Students follow a teacher directed algorithm and conceptual understanding of math concepts is lost. Students are not able to visualize the deeper meaning of the processes that they are following. Educators need to shift away from traditional models of math instruction and implement engaging teaching strategies. One positive benefit of varying teaching strategies and implementing cooperative learning includes an increase in students’ academic achievement.

In addition to students being academically prepared to enter society, they also need to be able to communicate effectively in order to become productive members of society. Direct instruction does not allow students opportunities to develop their social skills and intergroup relations. Students are typically working individually at their desks on paper and pencil tasks. This leaves little opportunity for students to work with others and communicate their thoughts. In order to become productive citizens, students also need to be able to communicate, problem solve, and work with others.
One way teachers can increase student engagement and academic achievement while developing students’ social and communication skills is through the implementation of cooperative learning. Cooperative learning allows students an opportunity to work together in order to complete a task. Students learn from each other and help their group while utilizing each member’s strengths in order to reach a common goal. As students are successful they also increase their self-esteem and have positive math learning experiences.

The main goal of this project is to create opportunities for students to become proficient when solving problems involving addition of fractions by providing a series of cooperative learning lessons that teachers can use. Fractions are considered to be the gateway to Algebra. Each student needs to pass Algebra in order to graduate. Therefore, students need to be proficient in fraction concepts if they are to be successful in higher levels of math.

Recommendations

Teachers play a vital role in the implementation of cooperative learning. It is imperative that teachers understand their students’ strengths and weaknesses in order to create and maintain an environment that nurtures trust and teamwork. Students need to feel safe to share their ideas and know that they will not be laughed at or put down if their answers are incorrect. Each cooperative group also needs to have leaders that are able to keep the team on task and focused. Teacher-created cooperative groups and teachers helping to develop a sense of family amongst students are essential to each
team’s success. In order to effectively design the setting, teachers need to take the time to get to know their students both academically and socially.

In addition to creating a risk-free classroom, the physical setting is also very important. Students’ desks need to be arranged in such a way that they can move freely throughout the group without disrupting individual students’ materials. Additionally, team members should be facing each other so they can communicate clearly without having to raise their voices too loudly. It is also beneficial if students’ desks are arranged in groups that share a common workspace because students are able to easily share materials during cooperative learning lessons.

Teachers are also responsible for guiding student learning. There needs to be a balance between instruction and cooperative group activities. Cooperative learning lessons will require extra time so when planning, teachers need to build extended math periods into the schedule. The teacher needs to be aware that effective cooperative learning takes training for the students. Therefore, teachers need to model communication skills and respectful group interactions throughout the school year. It is also important that teachers begin implementing cooperative groups for smaller activities in order to guide students in developing their cooperative group skills.

Conclusions

The U.S. test scores are falling behind other countries. In addition, U.S. children are falling academically behind each other. Not all students are demonstrating proficiency in math concepts. Educators cannot keep utilizing the same instruction that they have been over the years if they expect math proficiency amongst students to
improve. Implementing cooperative learning will increase students’ academic achievement. Underachieving students do not simply need to hear concepts taught a little bit louder and a little bit slower. Instead, educators need to change the approach taken in classrooms and present concepts through a variety of strategies in order to increase student engagement and achievement.

Cooperative learning provides an opportunity for all students to feel successful. Not only do achievement levels increase, but students also develop social skills while their self-esteem increases. All students feel included and valued, because without their part, the team could not succeed. Imagine a classroom filled with students actively engaged in the curriculum and little behavior management occurring by the teacher. All students are learning through discussion and questioning amongst their peers. As an educator, one’s hard work pays off as students begin to take charge of their learning and take ownership of their achievement. Students and teachers both will begin to realize that learning is something that students are doing, not something that teachers do to them.
APPENDIX A

Assessments
Pre-Test

(Adapted from McDougal Littell and Problem Solving Strategies)

Concept of a fraction

1. Write a fraction that is represented by the following shaded region?

2. Write a fraction for the shaded region.

3. Is the following a good model for the fraction 6/12? Explain why or why not.

4. Draw a picture that represents 2 3/5.

5. Visually represent the fraction 7/4
Equivalent Fractions

1. Write two equivalent fractions for 8/12
   a. _____________   b. _____________

2. Write two equivalent fractions for 18/30
   a. _____________   b. _____________

3. Write two equivalent fractions represented by the fraction model.
   a. _____________   b. _____________

4. Identify whether or not the following are equivalent
   2 2/3 and 16/6

5. Identify whether or not the following are equivalent
   96/8 and 12

Express the following in lowest terms

1. 52/91
   2. 18/33
   3. 9/27
4. \[ \frac{21}{9} \]

5. \[ \frac{4}{8/6} \]

Adding Fractions

1. \[ \frac{4}{10} + \frac{2}{10} = \]

2. \[ \frac{4}{9} + \frac{5}{6} = \]

3. \[ \frac{7}{12} + \frac{7}{8} = \]

4. \[ \frac{3}{2/7} + \frac{1}{4/5} = \]

5. \[ \frac{4}{3/8} + 13 = \]
Problem Solving

1. You are making a fruit salad for a party. You need ½ pound of watermelon, 2 2/3 pounds of strawberries, and 1 ¼ pounds of kiwi. How much total fruit do you need?

2. John ran 1 3/8 of a mile and Kara ran 2 4/9 of mile. How many total miles did John and Kara run?

3. Rachael wrote in her diary every night. On Monday she wrote 2 1/3 pages, Tuesday she wrote 3/5 of a page, and on Wednesday she wrote 17/30 of a page. How many pages did she write all together?

4. Jessica made bracelets for her and her friends. Each bracelet had 2/7 blue beads and 3/5 green beads. The rest of the beads were red. What fraction of the beads was red?

5. The coach keeps basketballs, footballs, and volleyballs available for athletes to use during recess. He took inventory and realized that 4/15 was basketballs and 6/15 was footballs. What fraction of the balls were volleyballs?
Post-Test

(Adapted from McDougal Littell and Problem Solving Strategies)

Concept of a fraction

1. Write a fraction that is represented by the following shaded region?

![Shaded Region Image]

2. Write a fraction for the shaded region.

![Shaded Region Image]

3. Is the following a good model for the fraction 4/8? Explain why or why not.

![Model Image]

4. Draw a picture that represents 3 5/6.

5. Visually represent the fraction 12/7
Equivalent Fractions

1. Write two equivalent fractions for 15/45
   a. _____________  b. _____________

2. Write two equivalent fractions for 10/12
   a. _____________  b. _____________

3. Write two equivalent fractions represented by the fraction model.

   a. _____________  b. _____________

4. Identify whether or not the following are equivalent
   3 3/4 and 30/8

5. Identify whether or not the following are equivalent
   208/4 and 13

Express the following in lowest terms

1. 35/63

2. 72/96

3. 13/39
Adding Fractions

1. \( \frac{7}{12} + \frac{2}{12} = \)

2. \( \frac{3}{7} + \frac{2}{3} = \)

3. \( \frac{5}{6} + \frac{8}{13} = \)

4. \( 1 \frac{2}{9} + 1 \frac{5}{8} = \)

5. \( 3 \frac{7}{11} + 18 = \)
Problem Solving

1. Last week Tim jogged 2 1/3 miles on Monday, 3 ¼ miles on Wednesday, and 2 3/8 miles on Saturday. How far did she jog in all last week?

2. On Monday, Maria spent 3/8 of her time studying. John spent 4/7 of his time doing homework. How much of their time did Maria and John spend all together?

3. Mary bought a new photograph album with 8 pages. She can fit 6 photographs on each page. If she fills the entire album, what fraction of the total photographs will go on each page?

4. Lynn is making trail mix with peanuts, raisins, and chocolate chips for the party. The recipe calls for 3/8 peanuts and 1/3 raisins. What portion of the trail mix is chocolate chips?

5. Carl is baking cookies and brownies for his mom’s birthday. He needs 2 1/3 cups of flour for the cookies and 1 ¾ cups for the brownies. How much total flour does he need?
APPENDIX B

Lesson Plans
Lesson 1

Fraction Concepts

Time Allotment:

Grade: 6<sup>th</sup>

**Standard:** Students can solve problems involving fractions

**Academic Objective:** Students can identify fractions as parts to a whole by illustrating fractions and describing fractions from diagrams.

**Background:** This lesson is review from previous years and is the introductory lesson for the unit. A small mini lesson is important in order to give the definition of a fraction to students. Students need to understand that a fraction is a part to a whole that have been broken into equal parts. Additionally, students should have some review on how to represent one whole as a fraction.

**Materials:**

- Fruit Loops (or some item with pieces that can be sorted)
- Cups
- My Fraction Sort Worksheet
- Team Fraction Sort Worksheet
- Independent Practice
1. After the short fraction mini lesson, pass out a cup of Fruit Loops to each student. Have students sort their cereal on their My Fraction Sort Worksheet. They need to count how many they have of each color and record it. The write the amount of each color as a fraction.

2. After each team member has completed their individual cups the team needs to come together in order to complete the Team Fraction Sort Worksheet.

3. Team members need to have one recorder and each person shares out the total number they had of each color and the fraction that represented each color.

4. Together the team then writes fractions for their team’s total amount of Fruit Loops. After finishing the Team Fraction Sort Worksheet, they need to transfer the information onto large paper in order to present it to the class.

5. Once a team has finished the teacher can check their work and individual students may begin their independent practice.

**Closure:**

Teams can share their data about their Fruit Loops with the class. Together the class can also make a class fraction for the total number of Fruit Loops used. It can also lead to a discussion about why there is not always the same amount of each color in a box of Fruit Loops.
My Fraction Sort Worksheet

Total Number of Fruit Loops in my cup:

<table>
<thead>
<tr>
<th>Color</th>
<th>Number</th>
<th>Fraction</th>
<th>Picture</th>
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</table>
Team Fraction Sort

Total Number of Fruit Loops in the team:

<table>
<thead>
<tr>
<th>Color</th>
<th>Member A</th>
<th>Member B</th>
<th>Member C</th>
<th>Member D</th>
<th>Team</th>
</tr>
</thead>
<tbody>
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</table>
Independent Practice

Fraction Concepts

Find the fraction that is represented by the following pictures:

1. 

2. 

Draw a fraction model for the following fractions:

3. \( \frac{7}{8} \)

4. \( 2 \frac{3}{5} \)

Is the following a good model for a fraction? Be sure to explain why or why not.

5. 

6. 

Solve:

7. John is collecting coats, shoes, and shirts to donate. If \( \frac{3}{10} \) is coats and \( \frac{1}{10} \) is shoes what fraction is shirts?

8. Maggie is writing an interactive children’s book. After completing it she realized that \( \frac{7}{15} \) is pictures and \( \frac{3}{15} \) is touch and feel icons. How much of the book is words?
Lesson 2

Converting Improper Fractions and Mixed Numbers

Time Allotment: 1 hour
Grade: 6th

**Standard:** Students can solve problems involving fractions.

**Academic Objective:** Students will be able to convert between improper fractions and mixed numbers.

**Background:** The previous lesson exposed students to fraction concepts. They understand that fractions are a part to a whole. Model how to convert between improper fractions and mixed numbers on the board. Give students a few examples to refer to as they play the game.

**Materials:**
- Whiteboards for each student
- I Have, Who Has? cards: Improper Fractions to Mixed Numbers (blue cardstock)
- I Have, Who Has? cards: Mixed Numbers to Improper Fractions (yellow cardstock)
- Changing Improper Fractions to Mixed Numbers Student Template
- Changing Mixed Numbers to Improper Fractions Student Template

**Procedures:**
1. Pass out the Changing Mixed Numbers to Improper Fractions I Have, Who Has? cards to each team and the corresponding student template to each student.
2. The team needs to distribute the cards evenly amongst themselves.
3. Using the whiteboards, have students find the improper fractions for the mixed numbers on their cards so they are ready to play the game. All of their work should be shown on the whiteboard.
4. If students are having difficulty, have them refer to the examples on the board and get help from their teammates.

5. Play the game. The first student begins if they are holding the card that states “I have the first card”. Each time an improper fraction is read students need to highlight it on their student template.

6. After groups have finished have them mix their cards up and redistribute them amongst their team. Students again solve their problems on their whiteboards.

7. Have all teams begin at the same time and race to see which team finishes first.

8. Another variation is to have teams time themselves and try to beat their fastest time.

9. Repeat the game with the other set of I Have, Who Has? cards. This time students will be practicing changing Improper Fractions to Mixed Numbers. Again, students need to highlight the mixed numbers on their student template each time one is read.

10. This game can be played several times throughout the unit in order to give students continual practice.

**Closure:** For independent practice, students can complete the bottom portion on both of their Student Templates from the first round. There are 15 boxes on each that were not used during the game and they need to covert them on their own.
I Have, Who Has Cards

Changing Improper Fractions to Mixed Numbers

I have the first card.
Who has the mixed number for $\frac{1}{4}$?

I have $4\frac{1}{2}$.
Who has the mixed number for $\frac{11}{8}$?

I have $3\frac{3}{8}$.
Who has the mixed number for $\frac{3}{4}$?

I have $2\frac{1}{8}$.
Who has the mixed number for $\frac{11}{3}$?

$2\frac{1}{2}$.
Who has the mixed number for $\frac{3}{10}$?

I have $2\frac{3}{4}$.
Who has the mixed number for $\frac{19}{5}$?

$3\frac{1}{8}$.
Who has the mixed number for $\frac{15}{9}$?

I have $2\frac{5}{6}$.
<table>
<thead>
<tr>
<th>I have 3⅛.</th>
<th>I have 5⅝.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the mixed number for 1⅞?</td>
<td>Who has the mixed number for 4⅝?</td>
</tr>
<tr>
<td>I have 3⅝.</td>
<td>I have 4ⅎ</td>
</tr>
<tr>
<td>Who has the mixed number for 1⅞?</td>
<td>Who has the mixed number for 1⅗?</td>
</tr>
</tbody>
</table>

- I have 12⅔.
  - Who has the mixed number for 6¿/10?
- I have 6⅔.
  - Who has the mixed number for 1⅓?
- I have 3⅓.
  - Who has the mixed number for 2⅔?
- I have 5⅝.
  - Who has the mixed number for 3⅝?
### Changing Improper Fractions to Mixed Numbers

<table>
<thead>
<tr>
<th>I have 12½.</th>
<th>I have 8¼.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the mixed number for 1¾?</td>
<td>Who has the mixed number for 5½?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have 5½.</th>
<th>I have 8¾.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the mixed number for 3¾?</td>
<td>Who has the mixed number for 7½?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have 7⅓</th>
<th>I have 5½.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have 5⅔.</td>
<td>Who has the mixed number for 3⁵/₇?</td>
</tr>
<tr>
<td>I have 11⅔</td>
<td>Who has the mixed number for 7½?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have 2⅔</th>
<th>I have 12½</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have 2⅔</td>
<td>I have 12½</td>
</tr>
</tbody>
</table>
Changing Improper Fractions to Mixed Numbers

I have $4\frac{3}{4}$.
Who has the mixed number for $\frac{37}{12}$?

I have $2\frac{1}{5}$.
Who has the mixed number for $\frac{26}{25}$?

I have $3\frac{1}{2}$.
Who has the mixed number for $\frac{33}{2}$?

I have $2\frac{2}{5}$.
Who has the mixed number for $\frac{217}{50}$?

I have $10\frac{1}{4}$.
Who has the mixed number for $\frac{31}{8}$?

I have $4\frac{17}{20}$.
Who has the mixed number for $\frac{7}{5}$?

I have $7\frac{3}{7}$.
Who has the mixed number for $\frac{27}{16}$?

I have $3\frac{1}{2}$.
Who has the mixed number for $\frac{69}{11}$?

I have $3\frac{1}{8}$.

I have $8\frac{1}{11}$.

Who has the first card?
### Changing Improper Fractions to Mixed Numbers

Directions: Follow the path by highlighting the answers as your classmates identify them.

<table>
<thead>
<tr>
<th>8 (\frac{1}{1})</th>
<th>8 (\frac{1}{1})</th>
<th>3 (\frac{1}{1})</th>
<th>3 (\frac{1}{1})</th>
<th>2 (\frac{1}{1})</th>
<th>4 (\frac{1}{1})</th>
<th>3 (\frac{1}{1})</th>
<th>8 (\frac{1}{1})</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (\frac{1}{2})</td>
<td>10 (\frac{1}{2})</td>
<td>3 (\frac{1}{2})</td>
<td>6 (\frac{1}{2})</td>
<td>7 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>12 (\frac{1}{2})</td>
<td>10 (\frac{1}{2})</td>
</tr>
<tr>
<td>2 (\frac{1}{2})</td>
<td>4 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>3 (\frac{1}{2})</td>
<td>9 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>3 (\frac{1}{2})</td>
<td>7 (\frac{1}{2})</td>
</tr>
<tr>
<td>3 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
<td>5 (\frac{1}{2})</td>
<td>6 (\frac{1}{2})</td>
<td>3 (\frac{1}{2})</td>
<td>2 (\frac{1}{2})</td>
</tr>
</tbody>
</table>

Highlighted in the table above. Rewrite them as improper fractions.

Choose 15 of the mixed numbers that are not highlighted.

<table>
<thead>
<tr>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>7.</td>
<td>8.</td>
<td>9.</td>
<td>10.</td>
</tr>
</tbody>
</table>
I Have, Who Has Cards

Changing Mixed Numbers to Improper Fractions

<table>
<thead>
<tr>
<th>I have the first card.</th>
<th>I have ( \frac{1}{2} ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for ( 2\frac{1}{2} )?</td>
<td>Who has the improper fraction for ( 2\frac{1}{2} )?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have ( \frac{1}{2} ).</th>
<th>I have ( 1\frac{1}{2} ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for ( 5\frac{1}{2} )?</td>
<td>Who has the improper fraction for ( 2\frac{1}{2} )?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have ( 1\frac{1}{3} ).</th>
<th>I have ( 1\frac{1}{6} ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for ( 3\frac{1}{2} )?</td>
<td>Who has the improper fraction for ( 1\frac{1}{2} )?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have ( 1\frac{1}{3} ).</th>
<th>I have ( \frac{17}{6} ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for ( 6\frac{1}{2} )?</td>
<td>Who has the improper fraction for ( 2\frac{3}{2} )?</td>
</tr>
</tbody>
</table>

| I have \( 20\frac{1}{3} \). | I have \( \frac{17}{2} \). |
Changing Mixed Numbers to Improper Fractions

I have $3\frac{1}{2}$.
Who has the improper fraction for $4\frac{1}{2}$?

I have $\frac{9}{2}$.
Who has the improper fraction for $3\frac{3}{4}$?

I have $\frac{13}{2}$.
Who has the improper fraction for $9\frac{1}{2}$?

I have $4\frac{5}{9}$.
Who has the improper fraction for $8\frac{8}{9}$?

I have $\frac{5}{9}$.
Who has the improper fraction for $6\frac{2}{3}$?

I have $\frac{3}{2}$.
Who has the improper fraction for $2\frac{3}{4}$?

I have $\frac{10}{3}$.
Who has the improper fraction for $10\frac{3}{4}$?
Changing Mixed Numbers to Improper Fractions

<table>
<thead>
<tr>
<th>I have $\frac{19}{5}$.</th>
<th>I have $\frac{39}{5}$.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for $5\frac{3}{5}$?</td>
<td>Who has the improper fraction for $11\frac{3}{5}$?</td>
</tr>
<tr>
<td>I have $\frac{29}{5}$.</td>
<td>I have $\frac{34}{5}$.</td>
</tr>
<tr>
<td>Who has the improper fraction for $6\frac{1}{5}$?</td>
<td>Who has the improper fraction for $2\frac{3}{5}$?</td>
</tr>
<tr>
<td>I have $\frac{49}{5}$.</td>
<td>I have $\frac{84}{25}$.</td>
</tr>
<tr>
<td>Who has the improper fraction for $5\frac{4}{5}$?</td>
<td>Who has the improper fraction for $11\frac{3}{5}$?</td>
</tr>
<tr>
<td>I have $\frac{33}{4}$.</td>
<td>I have $\frac{23}{2}$.</td>
</tr>
<tr>
<td>Who has the improper fraction for $7\frac{3}{5}$?</td>
<td>Who has the improper fraction for $3\frac{3}{10}$?</td>
</tr>
<tr>
<td>I have $\frac{36}{5}$.</td>
<td>I have $\frac{39}{10}$.</td>
</tr>
</tbody>
</table>
## Changing Mixed Numbers to Improper Fractions

<table>
<thead>
<tr>
<th>I have (\frac{25}{3}).</th>
<th>I have (\frac{7}{10}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for (3\frac{1}{3})?</td>
<td>Who has the improper fraction for (9\frac{2}{3})?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have (\frac{27}{9}).</th>
<th>I have (\frac{29}{5}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for (12\frac{1}{2})?</td>
<td>Who has the improper fraction for (3\frac{3}{4})?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have (\frac{79}{15}).</th>
<th>I have (\frac{37}{6}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for (1\frac{3}{4})?</td>
<td>Who has the improper fraction for (2\frac{1}{4})?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have (\frac{7}{4}).</th>
<th>I have (\frac{13}{6}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for (5\frac{1}{10})?</td>
<td>Who has the improper fraction for (5\frac{3}{10})?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>I have (\frac{58}{11}).</th>
<th>I have (\frac{3\frac{1}{16}}{16}).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Who has the improper fraction for (5\frac{4}{11})?</td>
<td>Who has the improper fraction for (3\frac{1}{16})?</td>
</tr>
</tbody>
</table>
**Student Template**

**Changing Mixed Numbers to Improper Fractions**

*Directions*: Follow the path by highlighting the answers as your classmates identify them.

<table>
<thead>
<tr>
<th></th>
<th>27/4</th>
<th>26/5</th>
<th>45/9</th>
<th>25/2</th>
<th>23/3</th>
<th>39/10</th>
<th>7/4</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td>25/6</td>
<td>19/5</td>
<td>23/4</td>
<td>30/6</td>
<td>34/25</td>
<td>28/3</td>
<td>7/5</td>
<td>23/10</td>
<td></td>
</tr>
<tr>
<td>32/9</td>
<td>12/6</td>
<td>36/8</td>
<td>36/9</td>
<td>34/3</td>
<td>77/20</td>
<td>29/5</td>
<td>73/10</td>
<td></td>
</tr>
<tr>
<td>48/3</td>
<td>57/6</td>
<td>42/4</td>
<td>91/6</td>
<td>32/3</td>
<td>37/3</td>
<td>13/6</td>
<td>58/41</td>
<td></td>
</tr>
<tr>
<td>67/8</td>
<td>15/5</td>
<td>80/25</td>
<td>9/5</td>
<td>11/9</td>
<td>89/5</td>
<td>20/5</td>
<td>17/5</td>
<td></td>
</tr>
</tbody>
</table>

Choose 15 of the improper fractions that are not highlighted in the table above. Rewrite them as mixed numbers.

9. 
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Lesson 3

Equivalent Fractions

Time Allotment: 1 hour
Grade: 6th

Standard:

Academic Objective: Students can find equivalent fractions

Background: Students already have background knowledge on finding the GCF of two numbers. The teacher begins with a mini-lesson on how to find equivalent fractions using both manipulatives and finding the GCF.

Materials:
- Fraction Problem Template for each pair of students
- Different color pencil for each pair of students

Procedures:
1. This lesson plan follows the Kagan Rally Coach Structure. Students work together solving each problem while providing feedback and praise. If partners need to correct each other, they do so and then give praise.
2. The pair of students has the Fraction Problem Template in front of them and sign their names in their designated colors.
3. Using the blank sheet of paper, partner A shows their work and finds an equivalent fraction to number one while partner B watches, listens, checks, and praises.
4. Using the manipulatives, partner B then constructs the two equivalent fractions with manipulatives while partner A watches, listens, checks, and praises.
5. Once the pair is in agreement on the picture, partner B draws a picture on the Fraction Problem Template in his/her designated color.

6. Using their individual color, partner B then shows their work and finds an equivalent fraction for number two while partner A watches, listens, checks, and praises.

7. Using manipulatives, partner A constructs the two equivalent fractions with manipulatives while partner A watches, listens, checks, and praises.

8. Once the partners agree, using their identified color, partner A draws a picture of the two equivalent fractions on the Fraction Problem Template.

9. The trading off continues until the pair has completed the entire Fraction Problem Template is complete.

10. In order to check their answers, the pairs meet up with their team members (group of 4) and compare their Fraction Problem Templates. If there are any disparities, teammates discuss and explain answers. Once all team members are in agreement, they sign off each other’s papers and turn them in to their teacher.

11. Students may then begin their independent practice.

**Closure:** In order to check for understanding, put one fraction problem on the board and have students find two equivalent fractions to the given fraction. They can put their work on an index card to be collected as the students leave the classroom. This card gives immediate feedback in order to design the next steps for individual student’s learning.
<table>
<thead>
<tr>
<th>Work</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 2/3</td>
<td></td>
</tr>
<tr>
<td>2. 10/12</td>
<td></td>
</tr>
<tr>
<td>3. 3/6</td>
<td></td>
</tr>
<tr>
<td>4. 4/9</td>
<td></td>
</tr>
<tr>
<td>5. 3</td>
<td></td>
</tr>
<tr>
<td>6. 1 3/5</td>
<td></td>
</tr>
<tr>
<td>7. 8 2/12</td>
<td></td>
</tr>
<tr>
<td>8. 5</td>
<td></td>
</tr>
</tbody>
</table>
Independent Practice

Equivalent Fractions

Directions: Find two equivalent fractions for the following fractions. Be sure to show all of your work.

1. 3/5

2. 7

3. 9/5

4. 1  6/18

5. 2  5/10

6. 8

7. 5/6

8. 7/14

9. 12/16

10. 8/9
Lesson 4

Simplifying Fractions

Time Allotment: 1 hour
Grade: 6th

Standard:

Academic Objective: Students can determine the most simplified form of a given fraction.

Background: Students have knowledge on how to determine the GCF of given numbers and how to find equivalent fractions. Do not begin the lesson with direct instruction. Students will construct their own algorithm based on their prior knowledge with equivalent fractions.

Materials:

- Algorithm Detective Worksheet (one per student)
- Team/Class Algorithm
- Sage and Scribe Template
- Independent Practice

Procedures:

1. Students need to solve problem number 1 on the Algorithm Detective Worksheet independently.

2. After the entire team finishes, the groups shares each of their answers in order to determine a team algorithm for simplifying fractions. One team member writes their team algorithm down on the Team/Class Algorithm and then together the team solves number two on the Algorithm Detective Worksheet in order to test their team algorithm.
3. After all teams have finished the teacher leads a discussion in which all teams share their algorithms. Using input from each team, guide students to a final consensus and team algorithm. Students should come to the agreement that you can simplify fractions with either the GCF or by dividing the numerator and denominator by common factors until no more common factors exist other than one. This algorithm needs to be written down at each team on the Team/Class Algorithm sheet.

4. The teacher then models a four example problems using the team algorithm. Each student in the team takes a turn writing one of the examples down while the rest of the team follows along with the teacher.

5. Using Kagan’s model, students complete the Sage and Scribe worksheet.

6. For problem one, student A is the sage and student B is the scribe. After folding the Sage and Scribe Worksheet in half, students write their name on their respective half.

7. The sage (student A) gives the scribe (student B) step by step instructions on how to evaluate problem number one. Student B records the solution step-by-step in writing on student A’s side of the paper.

8. If the sage is correct, the scribe praises the sage. If incorrect, the scribe corrects and sage and then praises and celebrates the correct answer.

9. The students switch roles each problem until the entire Scribe and Sage worksheet is correct.

10. Students may begin independent practice as soon as they are finished with the in class assignment.
Closure: Split the class into two sides and put two fractions on the board that need to be simplified. Have half the class solve problem A on the board and the other half solve problem B. Once all students have evaluated their problems and checked with their surrounding teammates in order to insure that they have the correct answer, have an A partner up with a students that solved problem B. The students take turns explaining and teaching their problem to their partner.
Algorithm Detective Worksheet

Directions: Solve problem number one on your own. Show all of your mathematical work and be sure to explain your steps in words below the problem. Once all group members have finished be prepared to share how you solved your problem.

1. Simplify the following fraction:

42/56

Explain the steps you took:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

Test out your team algorithm by simplifying the fraction below. Follow the steps that your team came up with and recorded.

2. 40/120

Explain the team algorithm you used:

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________
Team/Class Algorithm

**Team Algorithm:**

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

**Class Algorithm:**

_____________________________________________________________________
_____________________________________________________________________
_____________________________________________________________________

**Class Examples:**

(Each team member needs to take a turn writing one down as the teacher explains it.)

1. 42/63

2. 36/14

3. 4 18/6

4. 36/65
Sage and Scribe Worksheet

Name: ________________________ Name: ________________________

1. 12/16

2. 13/39

3. 25/10

4. 48/36

5. 55/44

6. 2 7/5

7. 4 16/10

8. 6 18/8
Independent Practice

Simplifying Fractions

Directions: Simplify the following fractions. Be sure to show all work.

1. $\frac{60}{80}$

2. $\frac{24}{42}$

3. $\frac{7}{21}$

4. $\frac{13}{52}$

5. $\frac{28}{21}$

6. $\frac{64}{56}$

7. $\frac{2}{9/8}$

8. $\frac{13}{8/6}$

9. $\frac{7}{16/10}$

10. $\frac{125}{300}$
Lesson 5

Adding Like Fractions

Time Allotment: 1 hour
Grade: 6th

Standard: Students can solve problems involving fractions.

Academic Objective: Students will be able to add like fractions and will be able to graphically represent why only the numerators are added.

Background: Students have created fraction models and understand a fraction represent a part to a whole. Students will construct their knowledge of adding fractions as they play the Find the Missing Piece game so no direct instruction is necessary.

Materials:
- Find the Missing Pieces student worksheet (one per team)
- Labeled index cards (refer to the blackline master)
- Colored Pencils
- Find the Missing Pieces independent practice worksheet

Procedures:
1. This needs to be played in an open space. It may be best if played outside.
2. Put of the labeled index cards in the center of a large circle that is created by all the teams.
3. The goal is for the teams to solve all 8 problems on their Find the Missing Pieces worksheet. They need to find the fraction problem, answer, simplified answer if necessary, and the picture representation in order for one problem to be completely solved.
4. Students need to rotate roles as being recorders and runners after they finish each problem. Two runners should alternate while two others wait and put their heads together to solve the problems.

5. When you say go, one runner runs to the center and grabs an index card. Students need to decide which problem it matches too on their worksheet.

6. A different runner then runs back to the center to find an index card that matches the beginning problem.

7. Students may only carry one index card at a time and can only work on one problem at a time. If they choose a card that doesn’t match the problem they are currently working on, the runner brings it back and tries again. Only one runner goes at a time. Once a runner returns, the next may set out to choose an index card.

8. If a team believes they have completed a problem, they need to all sit down and raise their hands. The teacher will sign off on their problem if it is correct and tell them to try again if it is incorrect.

9. Once the problem is signed off they need to switch runners and recorders. The new runners need to bring all of the index cards back to the middle (it is okay to carry all of them at once for this) and mix them up so another team cannot easily find them.

10. After the first runner brings back the index cards from the completed problem, s/he may choose one index card from the pile in the center and begin the next problem.

11. The first team to complete all 8 problems wins the round.
Closure: Students may begin their Find the Missing Pieces independent practice worksheet once their team finishes the game. Some parts are filled in already and students need to complete what is missing in order to complete the assignment.
Find the Missing Pieces

Index Card Blackline Master

Glue each box on the back of an individual index card. Be sure to mix them up before putting them in the center of the game. They are currently in order by problem.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$4/9 + 2/9$</td>
<td>$6/9$</td>
</tr>
<tr>
<td>2</td>
<td>$4/15 + 3/15$</td>
<td>$7/15$</td>
</tr>
<tr>
<td>3</td>
<td>$2/7 + 6/7 =$</td>
<td>$8/7$</td>
</tr>
</tbody>
</table>
4

\[
\frac{11}{30} + \frac{7}{30} = \frac{18}{30} = \frac{3}{5}
\]

5

\[
\frac{5}{12} + \frac{3}{12} = \frac{8}{12} = \frac{2}{3}
\]

6

\[
\frac{8}{11} + \frac{3}{11} = \frac{11}{11} = 1
\]

7

\[
\frac{11}{20} + \frac{7}{20} = \frac{18}{20} = \frac{9}{10}
\]
8.

11/18 + 11/18 = 22/18

1 2/9
Find the Missing Pieces

Independent Practice

Directions: Find the solution for the following problems and draw a picture in order to visually represent the problem.

<table>
<thead>
<tr>
<th>Problem:</th>
<th>Solution:</th>
<th>Picture:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $\frac{2}{5} + \frac{1}{5} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. $\frac{7}{8} + \frac{5}{8} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. $\frac{5}{12} + \frac{4}{12} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. $\frac{1}{6} + \frac{5}{6} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. $\frac{7}{11} + \frac{8}{11} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. $\frac{2}{3} + \frac{4}{3} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. $\frac{2}{9} + \frac{4}{9} =$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. $\frac{7}{10} + \frac{5}{10} =$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Lesson 6

Adding Unlike Fractions

Time Allotment: One hour
Grade: 6th

Standard: Students can solve problems involving fractions

Academic Objective: Students can add unlike fractions

Background: Teacher will model, using direct instruction, two sample fraction problems before beginning group work. One model problem will be left on the board in order to support those learners that need to refer to it.

Materials:
- Chart paper with the templates drawn
- Student cards in order to complete each problem (see Student Card master)
- Tape
- Pack of washable markers per team
- Independent Practice Sheets

Procedures:
1. Teacher pulls the class to the floor and models how to solve addition problems using the given template. While solving the problem the teacher thinks aloud on how to find a common denominator, add the fractions, and simplify the answer.
2. Teacher models one more fraction problem but gives students opportunities to pair-share with their partners and think through the steps of the problem before showing it on the board. This problem is left on the board during the cooperative learning time.
3. Excuse students to their teams and explain that they will be working together to fill in templates with their cooperative teams. Each team is responsible to solve two problems using the student cards. The cards should be color coordinated so students can identify which cards go to the first problem and which cards go to the second problem. Each student should have 4-5 cards and they are responsible for placing their card in its appropriate place and describing why it belongs there.
   The student roles are as follows:
   - Materials Manager: Collect and return all necessary materials
   - Facilitator: Guide the discussion and make sure all students are sharing their cards
   - Recorder: Raises hand to have cooperative group work checked
   - Timer: Keeps the group on track to finish the task

4. After the teams have completed two and had them checked they will complete one problem using no template or cards. The fraction problem is 5/6 + 8/9. Each student uses a different color marker and each needs to have an equal amount of completion in order to solve the given problem. Students need to discuss their steps and take turns completing portions of the problem. Before moving onto independent practice, each team needs to have their final problem checked.

5. This problem will become the first example on the independent practice sheets. Once the team’s work is completed thoroughly, students begin their independent work. The first problem is recorded from their teamwork so they have a reference when they get home. The practice sheet has 3 problems with a template and 5 problems without.
**Closure:**

Give each student an index card to solve one unlike fraction problem on and they can solve it before leaving. This exit card is used as formative assessment in order to provide support for those students before they go home with their homework. Additionally, assess student learning after correcting homework in order to determine whether or not students need additional support.
Student Cards

Set One: (blue)

On a full size 5x7 index card and using a blue marker, vertically write the fractions 2/3 and 4/5.

Cut 8 additional index cards in half. On each half vertically write the following numbers: 3, 3, 5, 5, 10, 10, 12, 12, 15, 15, 15, 15, 15, 22, 1 7/15

You should now have 17 index cards, with two of them being full size. These are the cards that students will use in their cooperative groups in order to solve the fraction problem on their template.

Set Two: (orange)

On a full size 5x7 card and using an orange marker, vertically write the fractions 7/8 and 5/12.

Cut 8 additional index cards in half. On each half vertically write the following numbers: 2, 2, 3, 3, 21, 21, 10, 10, 24, 24, 24, 24, 24, 31, and 1 7/24.

You should now have 18 index cards with two of them being full size. There are the cards that students will use in their cooperative groups in order to solve the fraction problem on their template.
Cooperative Fractions Template

Write the following template on two pieces of chart paper per group:

\[ \cdot \quad \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_ \]

\[ \cdot \quad \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_ \]

SO

\[ \_\_\_\_\_\_\_\_\_ + \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\]

(The final line is not necessary for Problem 1 on the student cards because it does not need to be simplified further)
Independent Practice Worksheet

Adding Unlike Fractions

1. \( \frac{5}{6} + \frac{8}{9} = \)

\[ \begin{align*}
\text{• } \underline{\phantom{0000}} & = \underline{\phantom{0000}} \\
\text{• } \underline{\phantom{0000}} & = \underline{\phantom{0000}} \\
\end{align*} \]

SO:

\[ \underline{\phantom{0000}} + \underline{\phantom{0000}} = \underline{\phantom{0000}} = \underline{\phantom{0000}} \]

2. \( \frac{5}{6} + \frac{1}{9} = \)

\[ \begin{align*}
\text{• } \underline{\phantom{0000}} & = \underline{\phantom{0000}} \\
\text{• } \underline{\phantom{0000}} & = \underline{\phantom{0000}} \\
\text{• } \underline{\phantom{0000}} & = \underline{\phantom{0000}} \\
\end{align*} \]

SO:

\[ \underline{\phantom{0000}} + \underline{\phantom{0000}} = \underline{\phantom{0000}} = \underline{\phantom{0000}} \]
3. \( \frac{3}{8} + \frac{2}{7} \)

\[
\begin{align*}
\text{• } \underline{\hspace{1cm}} &= \underline{\hspace{1cm}} \\
\text{• } \underline{\hspace{1cm}} &= \underline{\hspace{1cm}}
\end{align*}
\]

SO:

\[
\underline{\hspace{1cm}} + \underline{\hspace{1cm}} = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}
\]

4. \( \frac{1}{5} + \frac{2}{3} \)

5. \( \frac{7}{18} + \frac{5}{6} \)

6. \( \frac{4}{5} + \frac{5}{8} \)

7. \( \frac{3}{7} + \frac{2}{5} \)

8. \( \frac{2}{15} + \frac{4}{9} \)
Lesson 7

Adding Unlike Mixed Numbers

Time Allotment: 1 hour
Grade: 6th

**Standard:** Students can solve problems involving fractions.

**Academic Objective:** Students will be able to add fractions, mixed numbers, and whole numbers.

**Background:** Students are able to add like and unlike fractions. Additionally, they can simplify fractions and mixed numbers.

**Materials:**
Fraction pieces cut out of construction paper
Show-Show-Solve Partner Worksheet
Independent Practice

**Procedures:**
1. The teacher needs to prep different fraction pieces out of colored construction paper. Use a rectangle strip for one-whole and then cut ½, ¼ pieces, 1/6 pieces, 1/8 pieces, and 1/12 pieces. Each of the different sizes should be on a different color of construction paper in order to make it visually apparent for the students.
2. To start the game each time needs to have a pile of all the different shapes in the middle of their group. Be sure to have enough variety and fraction pieces so the whole group can share.
3. In order to complete the Show-Show Solve worksheet, students work in partners.
4. Each student pulls out fraction pieces in order to create a fraction. It can be a mixed number, whole number, or fraction. Once both partners have created their fraction they show each other what they have created.

5. Students take turns writing their fractions on the Show-Show-Solve Partner worksheet. For number 1 Student A writes both fraction problems down and creates an addition problem. Student B solves the problem while Student A encourages, praises, and corrects if necessary.

6. Students return their fraction pieces to the pile and choose new ones in order to create a new addition problem. Once the partners have created their new fraction they show each other. This time Student B writes the fraction problem and Student A solves the problem while B encourages, praises, and corrects if necessary.

7. Once the partners have finished their Show-Show-Solve worksheet, they may begin their independent practice until the other set of partners in the team have finished their Show-Show-Solve worksheet.

**Closure:**

After all teams have finished their Show-Show-Solve worksheets, teams can create addition problems all together. Each student creates a fraction, whole number, or mixed number from the colored fraction pieces. All students in the team show their numbers. Each person in the team takes a turn solving the addition problem while the rest of the team praises, encourages, and corrects. After all four team members have had a chance to solve a team problem the paper is ready to be checked by the teacher. In order to increase individual accountability, it may be helpful to have students write in their own color.
### Show-Show-Solve Partners

Directions: You and your partner each need to create whole numbers, fractions, or mixed numbers with the pieces given to your team. Once you have created yours, you and your partner show each other. Take turns writing the fractions as an addition problem and solving the addition problem that you two created together. Record your problems and answers below.

<table>
<thead>
<tr>
<th>Addition Problem</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td></td>
</tr>
</tbody>
</table>
Independent Practice

Adding Mixed Numbers

1. 5 2/5 + 2 1/3 =

2. 4 7/8 + 2 =

3. 2 4/9 + 7/13 =

4. 3 6/7 + 2 2/3 =

5. 5/12 + 1 1/3 =

6. 2 9/10 + 4/7 =

7. 3 + 6 29/30 =

8. 6 3 8/7 + 2 5/6 =
Lesson 8

Problem Solving

Time Allotment: 1 hour
Grade: 6th

Standard: Students can solve problems involving fractions.

Academic Objective: Students will be able to solve word problems that contain fraction concepts or adding fractions.

Background: Students understand how to add fractions and the concept that fractions are parts to a whole. They will need some direct instruction on how to pull out important information from word problems and how to identify key words in order to determine the appropriate method for solving the word problems.

Materials:
- Problem Solving Template
- Partner Problem Solving worksheet
- Problem Solving Practice
- Wet erase markers (two colors per pair)
- Baby wipe (one per pair in order to erase their template each time)

Procedures:
1. Model how to complete word problems using the fractions template. Students will need to practice identifying key words and how to mathematically set up the problem. Do an example for both fraction concepts and adding fractions. Leave the examples up so students have a reference if they need it.
2. Students are to work in pairs so pass out one problem-solving template per pair. Each student pair also needs two different colors of wet erase markers.

3. When completing the template, students need to take turns writing. They may help each other, but equal amounts of work from each person needs to be on the template when it is checked by the teacher.

4. Students work through the template in order to solve the word problems on their Partner Problem Solving worksheet. They need to begin with number one and when they think they have correctly solved it they may discuss the problem with the other pair in their team. Once a team believes that they all have the correct answer they raise their hands.

5. The teacher will look over their templates and if both pairs have the correct answers and completed work on the template they may record the answer on their Partner Problem Solving worksheet.

6. The pairs may then move on to problem number two. They cannot discuss the problems with their team until both pairs have completed the problems on their templates.

7. Repeat the process until students have completed the entire Partner Problem Solving worksheet.

Closure:
Have students independently complete the Problem Solving Worksheet. They need to follow the same process from their partner work in class. The following day in class give a word problem as a warm-up in order to check for understanding across the class.
Problem Solving Template

Write each of these templates on a large piece of construction paper and leave enough room between each heading in order to allow students to write underneath them.

Laminate them so students can then write on them with wet erase markers and they may be used several times.

This template helps students chunk out the word problems in order to make them more understandable.

Important Information:

Restate the Question:

Plan (operation or idea to solve):

Set Up the Problem (label all fractions):

Solve:
Partner Problem Solving

1. For the art project at school each student received \(\frac{9}{10}\) of an ounce of water and \(\frac{7}{8}\) of an ounce of paint. How much total fluid did each student receive for the art project?

2. A baby fox weighs 2 ½ pounds and an adult fox weighs 7 3/7 pounds. How much do the foxes weight all together?

3. Mona jogged 3 ¼ miles on Monday, 2 1/3 miles on Tuesday, and 3 miles on Wednesday. How many total miles did she jog in the three days?

4. John is building a fort out of popsicle sticks, glue, and paper. If \(\frac{2}{7}\) of the fort is paper and \(\frac{2}{3}\) is popsicle sticks, how much of the fort is glue?

5. Marie’s favorite diner is chicken and rice. The rice is made up of water, rice, and seasonings. In order to make the rice she needs \(\frac{8}{15}\) rice and \(\frac{5}{7}\) water. How much is left for seasonings?

6. The Andersons took a road trip on a beautiful Sunday afternoon. They used \(\frac{11}{12}\) of a gas tank on the way to the mountains and \(\frac{5}{8}\) of a tank on the way home. How much of a gas tank did they use round trip?
Problem Solving Practice

Directions: Be sure to show all work when solving each of the following word problems. Reminder: Use the problem-solving template for each problem.

Important Information:

Restate the Question:

Plan (operation or idea to solve):

Set Up the Problem (label all fractions):

Solve:

1. Henry biked 8 miles, 2 1/3 miles, and 5 4/7 miles during the week. How many miles did he bike in all?

2. The punch recipe calls for sherbet, 7-Up, and whip cream. If 2/5 is soda and 3/7 is sherbet, how much is going to be whip cream?

3. Monica spent 5/12 of her afternoon studying and Dylan spent 5/6 of his afternoon studying. How much of their afternoons did they spend all together?

4. In order to build a bracelet, Julie needs 2/7 to be red and 3/7 to be blue. How much is left for yellow beads?

5. Riley went for a swim, bike, and a run. She swam 6 miles, ran 2 4/5 miles, and biked 7 2/9 miles. How many miles did she run and bike?
REFERENCES


National Center for Education Statistics. (2007). *National Assessment of Educational Progress*. Washington, DC:


