

Cognitively Guided Instruction strategies for strengthening fifth-grade  
students understanding of fraction concepts

by

Hao Li

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Capstone project facilitator: Karen Moroz

Content Expert: Weiyi Qian

## PROJECT OVERVIEW

### Introduction

For this capstone project, I have created eight mini lessons with teaching/learning activities to be used as mini lessons in math class or math support time. Those activities all focused on enhancing students' understanding of fraction concepts. When creating those lessons, I use the fraction related portions of fifth-grade math standard of an upper Midwest state as teaching goals or desired learning outcome. The format of those mini lessons was designed to be used in various settings with limited time, they were meant for teachers to use them as quick mini segments during regular math lessons, those mini lessons can also be used as additional support learning activities for students in math support groups. I currently teach fifth grade math, which helped me refine the grade that this is for along with giving my project a definite audience and stronger purpose. During my research project, I am in pursuit of answering the question: *How to design math activities that will increase fifth-grade students' understanding of fraction concepts.* Fraction has been challenging for fifth grade math teachers to teach, I was hoping to examine the topic with new strategies to see if there are more ways to help students understand fraction concepts better.

This project required reflection on myself as a math teacher and my goals as a teacher moving forward. There was also a review of existing literature on concepts such as fraction's role in fifth grade math learning, fifth graders' problem in learning fraction concepts, the uniqueness of learning

fraction with the Chinese language, the current existing approach of teaching fraction concepts, math anxiety in learning and teaching, and Cognitively Guided Instruction (CGI) in math instruction. I also examined an instructional framework of a upper Midwest school district to gain more design ideas of student needs as an effective teaching activity/lesson/curriculum.

In this capstone project, I have identified three fifth-grade state math standards in number operations that related to fraction concepts (Minnesota Depart of Education, 2008):

5.1.1.1 Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.

5.1.2.3 Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.

5.1.2.4 Recognize and generate equivalent decimals, fractions, mixed numbers, and improper fractions in various contexts.

When designing the learning activities, the idea of Cognitively Guided Instruction (CGI) will be incorporated in lesson models and activities. CGI strategies support children to make connections between the problem and their own skill level for themselves. The process of exploring children's thinking provided the opportunity to deepen their own mathematical knowledge along with their own ability to think flexibly and creatively about mathematics

problems. With CGI strategies, I will be able to:

1. Building meaning for fractions through problem-solving and discussion
2. Understanding the progression of children's strategies for solving fraction and decimal problems
3. Designing instruction integrating algebra into the teaching and learning of fraction

During my research, I noticed researchers have found that teachers' teaching strategies have significant impacts on students' math anxiety. When designing my capstone Project, how to reduce Math Anxiety is one significant perspective. Blazer (2011) has suggested the following approaches could help students reduce math anxiety.

1. *Develop strong skills and a positive attitude toward math.*
2. *Relate math to real life*
3. *Encourage critical thinking*
4. *Encourage active thinking*
5. *Accommodate students' varied learning styles*
6. *Place less emphasis on correct answers and computation speed.*
7. *Organize students to cooperative learning groups.*
8. *Provide support and encouragement*
9. *Avoid putting students in embarrassing situations*
10. *Never use math as a punishment*
11. *Use manipulatives*
12. *Use technology in the classroom*

*13. Use manipulatives*

*14. Use technology in the classroom*

*15. Dispel harmful but popular misconceptions*

*16. Use a variety of assessments*

*17. Prepare students for high-stakes testing sessions. (Blazer, 2001)*

Those suggestions were integrated into my project design, when creating teaching activities.

When deciding the level of complexity, an upper Midwest school district's teaching and learning framework suggested taking those questions into consideration:

- Where are students currently in their understanding?
- What are the learning objectives and goals for the lesson/unit?
- What level of complexity will best move students toward a deeper understanding of the content?

Based on the framework's suggestions from Minnetonka Public, S. (2016)

Cognitively Guided Instruction fits three of the frameworks at a high level:

Authentic and Real-World Learning: Students are engaging in authentic and real-world learning when they define and develop solutions to problems they have encountered or are likely to encounter in their lives or when they complete a task for which they have not received explicit instruction.

Critical Thinking: Students are thinking critically when they systematically go beyond knowledge reproduction to analyze, synthesize, evaluate, or organize information in ways that generate understanding that is new to them.

Personalized Learning: Students are personalizing their learning when they choose the content, product, and or process for their learning, and when they set and monitor their own learning goals.

This upper Midwest public schools' instructional framework has provided a strong scaffolding when working on the design of teaching activities. It will guide me through the process of making useful learning activities for fraction instruction.

When designing of lesson plan, I utilized Grant Wiggins and Jay McTighe's Understanding by Design curriculum design from their book titled, Understanding by Design (2005). This is also the curriculum design that the school that I currently teach at has us use as we look over an upcoming unit and lesson plans in our mathematics, English language arts and Chinese language arts. UbD design will be appropriate for designing small activities for its understanding focused framework along with strong method assessing students' progress.

This capstone project is a product of research and creativity to help fifth grader be more successful in math learning about fraction concepts. On other hand, I will be learning if strategy of CGI can meet the varied needs of students through the types of discussions that occur as students explain their mathematical thinking as CGI strategies guided. Hopefully, this project will also help fraction learning with the math classroom with students from different level.

Next, I will lay out detailed lesson plans formatted in a backwards design template which allowed me to focus on my end of lesson goals I had for my students and plan with that in mind. It was planned for four mini lessons for reviewing fraction concepts identified by a upper Midwest state math academic standard. For each review mini lesson, there will be a sharing and discussion lesson follows. The total lessons planned in this project will be eight lessons. Those mini lessons are planned for ten-to-twenty-minute time periods. Those activities are intended to be used in various settings including one on one group or small group or a regular math class if needed. Therefore, the use of those mini lessons will be flexible. The appendix shares the resources I have mentioned in the lessons and there is a reference list at the end as well.

**Lesson Topic: Fraction concepts    Grade level: fifth grade**  
**Length of lesson: Nine mini lessons**

| <b>Stage 1 – Desired Results</b>   |  |
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| <p><b>Content Standard(s):</b><br/>           Minnesota State Standard:</p> <p>5.1.1.1 Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.</p> <p>5.1.2.3 Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.</p> <p>5.1.2.4 Recognize and generate equivalent decimals, fractions, mixed numbers, and improper fractions in various contexts.</p> |  |
| <p><b>Understanding (s)/goals</b><br/>           Students will understand:</p> <ul style="list-style-type: none"> <li>• Their way of problem solving to make connections with previous knowledge.</li> <li>• Recognize that quotients can be represented in a variety of ways, including, a fraction.</li> <li>• Fractions can be compared with certain criteria.</li> <li>• Find out fractions that are equivalent in value.</li> </ul>   | <p><b>Essential Question(s):</b><br/>           Student will be considering:</p> <ul style="list-style-type: none"> <li>• What does a fraction mean?</li> <li>• How can we write quotients in fraction model?</li> <li>• How do we compare fractions?</li> <li>• What is equivalent fractions and how do we get equivalent fractions?</li> </ul> |
| <p><b>Student objectives (outcomes):</b><br/>           Students will be able to:</p> <ul style="list-style-type: none"> <li>• Define fraction in their own math understanding</li> <li>• Identify different part of a fraction number</li> <li>• Place fraction on number line to represent value of fractions</li> <li>• Use strategies to compare fractions' value</li> <li>• Express fraction's value with different method</li> <li>• Find equivalent fractions for given fractions</li> </ul>  |  |
| <b>Stage 2 – Assessment Evidence</b>   |  |
| <p><b>Performance Task(s):</b><br/> <i>Students will show that they really understand by evidence of</i><br/>           building solid meaning of fractions concepts through problem solving and show case during discussion.<br/>           Identify their problem-solving strategies by sharing.</p>   | <p><b>Other Evidence:</b><br/> <i>Students will show they have achieved stage 1 goal by...</i></p> <ul style="list-style-type: none"> <li>• Completing in class tasks</li> <li>• Participating discussion</li> <li>• Sharing problem-solving strategies</li> <li>• Completing other task during lessons</li> </ul>                               |



| <b>Stage 3 – Learning Plan</b>   |  |
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| <b>Learning Activities (20-25 minutes block, small group, or whole class):</b>   |  |
| <ul style="list-style-type: none"><li>- Solving multidigit number division question with fraction as quotient</li><li>- Identifying different parts of a fraction number</li><li>- Share and discuss their problem-solving strategies</li><li>- Identify different types of fractions: fraction, improper fractions, and mixed number</li><li>- Placing fraction on number line to represent value of fractions</li><li>- Share and discuss their problem-solving strategies</li><li>- Use strategies to compare fractions' value</li><li>- Share and discuss their problem-solving strategies</li><li>- Express fraction's value with different method</li><li>- Find equivalent fractions for given fractions</li><li>- Share and discuss their problem-solving strategies</li></ul> |  |



**Lesson 1**  
**Division and fraction**

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| <b>Standard:</b>  | <b>3.1.2.3 5.1.1.1</b> Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.  |
| <b>Student Objective/Goal:</b>                          | I can reflect on my math experience<br>I can define a fraction in different ways   |
| <b>Driving Question</b>                                 | <i>How do we divide multi-digit numbers, how do we put quotients in fraction mode?</i><br><br><i>What is a fraction? How do you identify a fraction?</i>   |
| <b>Warm up/ question of the day</b><br><b>5 minutes</b> | <p><b>Q1:</b> There are 225 students in a choir group going to a singing contest, school has arranged transportation for the trip. If one bus can take 25 students at the most, how many buses does the school need for all students?</p> <p><b>Q2:</b> Frank has 5 bags of birdseed. He wants to put the birdseed into 15 bird feeders equally. How much of the bags will go in each feeder?</p> <ul style="list-style-type: none"> <li>- Ask students to solve problem with steps by themselves. Teacher will not provide any prompt or specify types of solution (decimal, fraction or other)</li> <li>- After students done, peer share solution and problem-solving strategies with neighbor or partner.</li> <li>- During the work time, teacher will observe different strategies students used. Teacher will highlight solution with fraction as answer</li> </ul> |
| <b>Guided lesson</b><br><b>10 minutes</b>               | Teacher will present today's discussion: <b>How do we use fraction for division question solution? What is a fraction?</b> <ul style="list-style-type: none"> <li>- Teacher will reflect on warm up question, guide students</li> </ul>  |

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|  | <p>thinking about their experience on solving the problem</p> <ul style="list-style-type: none"> <li>- Teacher will highlight the connection between division and fraction</li> <li>- Student will reflect on how they understand about fraction and name of each part of a fraction</li> <li>- Student will establish/review the meaning of each part of a fraction number and types of fractions after sharing</li> <li>- Teacher present new discussion word problem with requirement of using fraction as solution</li> <li>- Students solve the word problem with their own strategies</li> <li>- Teacher guided peer share; student will complete problem solving record sheets</li> </ul> |
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| <p><b>Independent Work Time</b><br/><b>5 minutes</b></p> | <ul style="list-style-type: none"> <li>- Students will complete the problem-solving recoding sheet</li> <li>- Students can start iXL work assignment</li> </ul>  |
| <p><b>Closing</b><br/><b>5 minutes</b></p>               | <ul style="list-style-type: none"> <li>- Teacher: We have reviewed our understanding of fractions today; hope you now have more than one way that you can solve those problems.</li> <li>- Play BrainPop review video: fraction</li> <li>- Teachers assign iXL learning assignments for reinforcement</li> <li>- Teacher will collect students' problem-solving sheet and use CGI student work analyzing and planning sheet to prep next lesson</li> </ul> |

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| <b>Resources:</b> | Teaching slides <a href="#">Link</a><br>Students' problem solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill <a href="#">K.1 Fractions review</a> ; <a href="#">K.2 Fractions of a whole: word problems</a> ; <a href="#">K.16 Relate division and fractions</a><br>BrainPOP review video <a href="#">Link</a> |
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**Lesson 2**  
**Reflection and discussion**

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| <b>Standard:</b>  | <b>3.1.2.4 5.1.1.1</b> Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal.   |
| <b>Student Objective/Goal:</b>  | I can reflect on my choice of problem solving for division problem with fraction as quotient.<br><br>I can define a fraction in different ways.   |
| <b>Driving Question</b>   | <i>How do we divide multi-digit numbers, how do we put quotients in fraction mode?</i><br><br><i>What is a fraction? How do you identify a fraction?</i>  |
| <b>Setup/preparation</b><br><b>Before lesson</b>                                  | After first lesson, teacher will collect all students' Problem solving recording sheet. Teacher will use CGI 'Analyzing Your Students' Work and planning a Strategy Discussion' worksheet to analyze student typical strategies. (Part A; Part B)<br><br>Teacher will collect strategies from students and identify student individuals that teacher will individually conferencing (Part C). |
| <b>Independent work time/individual conferencing time</b><br><b>10-15 minutes</b> | Teacher will start the lesson by letting the class know that for the first 15 minutes of the mini lesson students will have independent work time.<br><br>Students' tasks including:  |

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|  | <ul style="list-style-type: none"> <li>- Finish unfinished class work from last lesson</li> <li>- Work on math practice work</li> </ul> <p>Teacher will use the time to have individual strategies conferences with student individual identified during preparation time for the lesson.</p> <p>Teacher's goal for individual conferences will include:</p> <ul style="list-style-type: none"> <li>- better understand students' skill and strategy choices</li> <li>- identify students willing to share during whole class/whole group strategies discussion</li> <li>- recommend an effective strategy other than students already process or students that didn't process a clear problem-solving strategy based on analyzation of students' work</li> </ul> |
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| <p><b>Sharing and discussion</b><br/><b>10 minutes</b></p> | <p>Teacher will lead whole class/group discussion.</p> <p>Teacher: we have talked about how to solve division problem with fraction as quotient. We also discussed fraction itself. Today we will reflect on how we can solve those problem and look into different strategies.</p> <p>Based on students' work, teacher might identify possible strategies not limited to:</p> <ul style="list-style-type: none"> <li>- equal share division</li> <li>- measurement division</li> <li>- area model</li> <li>- or more</li> </ul> <p>During discussion, pay attention to the difference between problem solving strategies and number operation.</p> |
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| <b>Closing</b><br><b>5 minutes</b> | <ul style="list-style-type: none"><li>- Teacher: We have discussed our understanding of fractions today. Hope everyone had one strategy that you can use for sure for problem solving.</li><li>- Ask students take notes on their math journal or any type of math notes.</li></ul>   |
| <b>Resources:</b>                  | Teaching slides <a href="#">Link</a><br>Students' problem solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill <a href="#">K.1 Fractions revie</a> ; <a href="#">K.2 Fractions of a whole: word problems</a> ; <a href="#">K.16 Relate division and fractions</a><br>BrainPOP review video <a href="#">Link</a> |

**Lesson 3**  
**Representing and locating fractions**

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| <b>Standard:</b>  | <b>5.1.2.3</b> Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.   |
| <b>Student Objective/Goal:</b>                          | I can identify fraction, mixed numbers, and improper fractions.<br>I can use different model to represent value of fractions.<br>I can locate fractions on a number line.   |
| <b>Driving Question</b>                                 | <p><i>What is mixed number, improper fraction? Can we convert fractions between mixed number, improper fraction?</i></p> <p><i>How do we use different models to represent a fraction?</i></p> <p><i>What can we do to put fractions on a number line?</i></p>  |
| <b>Warm up/ question of the day</b><br><b>5 minutes</b> | <p><b>Q1:</b> Two friends want to share 3 apples so that they each get the same amount. How much would each friend get?</p> <p><b>Q2:</b> How many ways can you think of to represent a given fraction? Can you give one example for each way you know?</p> <p><b>Q3:</b> Can you draw a number line with fractions on it?</p> <ul style="list-style-type: none"> <li>- ask students to solve problem with steps by themselves. Teacher will not provide any prompt or specify types of solutions.</li> <li>- After students done, peer share solution and problem-solving strategies with neighbor or partner.</li> <li>- During the work time, teacher will observe different strategies students used. Teacher will pay attention to students have multiple strategies.</li> </ul> |
| <b>Guided lesson</b><br><b>15 minutes</b>               | <p>Teacher will present today's discussion: <b>Types of fractions include fraction, improper fraction, and mixed number. What are ways we can represent value of a fraction? Can you locate fractions on a number line?</b></p> <ul style="list-style-type: none"> <li>- Teacher will reflect on warm up question, guide students thinking about their experience on solving the problem with</li> </ul>  |



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|  | <p>their own strategies.</p> <ul style="list-style-type: none"> <li>- Whole group/class review types of fractions together</li> <li>- Student will share and reflect on ways to represent a fraction in multiple ways: <ul style="list-style-type: none"> <li>o Area model</li> <li>o Set (counter) model</li> <li>o Number line (length model)</li> <li>o And more</li> </ul> </li> <li>- Teacher will highlight the number line model of representing a number, how locate fractions on a number line</li> <li>- Students work on today's reflective problem of locate fractions on a number line</li> <li>- Teacher guided peer share; student will work on problem solving record sheets</li> </ul> |
| <p><b>Independent Work Time</b><br/><b>5 minutes</b></p> | <ul style="list-style-type: none"> <li>- Students will complete the problem-solving recoding sheet</li> <li>- Students can work on assignment</li> </ul>  |
| <p><b>Closing</b><br/><b>5 minutes</b></p>               | <ul style="list-style-type: none"> <li>- Teacher: Today we have talked about different types of fractions and how to represent them in different models. We also talked about number line with fractions. How you have walked away with some good strategies to solve those problems.</li> <li>- Play BrainPop review video:</li> <li>- Teachers assign iXL learning assignments for reinforcement</li> <li>- Teacher will collect students' problem-solving sheet and use CGI student work analyzing and planning sheet to prep next lesson</li> </ul>   |

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| <b>Resources:</b> | Teaching slides <a href="#">Link</a><br>Students' problem-solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill <a href="#">K.6 Convert between improper fractions and mixed numbers</a> ;<br><a href="#">K.8 Graph and compare fractions on number lines</a><br>Review video for converting between types of fractions: <a href="#">Link</a> |
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**Lesson 4**  
**Reflection and discussion**

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| <b>Standard:</b>  | <b>5.1.2.3</b> Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.  |
| <b>Student Objective/Goal:</b>  | I can identify fraction, mixed numbers, and improper fractions.<br>I can use different model to represent value of fractions.<br>I can locate fractions on a number line.  |
| <b>Driving Question</b>   | <p><i>What is mixed number, improper fraction? Can we convert fractions between mixed number, improper fraction?</i></p> <p><i>How do we use different models to represent a fraction?</i></p> <p><i>What can we do to put fractions on a number line?</i></p>   |
| <b>Setup/preparation<br/>Before lesson</b>  | <p>After first lesson, teacher will collect all students' Problem-solving recording sheet. Teacher will use CGI 'Analyzing Your Students' Work and planning a Strategy Discussion' worksheet to analyze student typical strategies. (Part A; Part B)</p> <p>Teacher will collect strategies from students and identify student individuals that teacher will individually conferencing (Part C).</p>   |
| <b>Independent work<br/>time/individual<br/>conferencing time<br/>10-15 minutes</b> | <p>Teacher will start the lesson by letting the class know that for the first 15 minutes of the mini lesson students will have independent work time.</p> <p>Students' tasks including:</p> <ul style="list-style-type: none"> <li>- Finish unfinished class work from last lesson</li> <li>- Work on math practice work</li> </ul> <p>Teacher will use the time to have individual strategies conferences with student individual identified during preparation time for the lesson.</p> <p>Teacher's goal for individual conferences will include:</p> |

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|  | <ul style="list-style-type: none"> <li>- better understand students' skill and strategy choices</li> <li>- identify students willing to share during whole class/whole group strategies discussion</li> <li>- recommend an effective strategy other than students already process or students that didn't process a clear problem-solving strategy based on analyzation of students' work</li> </ul> |
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| <p><b>Sharing and discussion</b><br/><b>10 minutes</b></p> | <p>Teacher will lead whole class/group discussion.</p> <p>Teacher: we have talked about types of fractions and how to present fractions from last lesson. Today we will reflect on how we can solve those problem and look into different strategies.</p> <p>Based on students' work, teacher might identify possible strategies for representing a fraction, not limited to:</p> <ul style="list-style-type: none"> <li>- Area model</li> <li>- Set model</li> <li>- Length model (number line)</li> <li>- or more</li> </ul> <p>Ask students to share their strategies and teacher will lead the discussion</p> <p>Teacher will highlight number line model and have this model fully discussed with the class.</p> |
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| <b>Closing</b><br><b>5 minutes</b> | <ul style="list-style-type: none"><li>- Teacher: We have discussed our strategies of representing fractions and number line with fractions today. Hope everyone had one strategy that you can use for sure for future problem solving.</li><li>- Ask students take notes on their math journal or any type of math notes.</li></ul>  |
| <b>Resources:</b>                  | Teaching slides <a href="#">Link</a><br>Students' problem-solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill <a href="#">K.6 Convert between improper fractions and mixed numbers</a> ;<br><a href="#">K.8 Graph and compare fractions on number lines</a><br>Review video for converting between types of fractions: <a href="#">Link</a> |

**Lesson 5**  
**Order and Comparing fractions**

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| <b>Standard:</b>  | <b>5.1.2.3</b> Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.   |
| <b>Student Objective/Goal:</b>                          | I can locate fractions on a number line.<br>I can use different strategies to compare fractions' value.   |
| <b>Driving Question</b>                                 | <i>How to put fractions on a number line?</i><br><br><i>What can you do to compare values of fractions?</i>   |
| <b>Warm up/ question of the day</b><br><b>5 minutes</b> | <p><b>Q1:</b> Can you put <math>1/2</math>, <math>8/9</math>, <math>1\ 1/2</math>, <math>3/1</math>, and <math>24/10</math> on a number line?</p> <p><b>Q2:</b> Which fraction is larger? <math>3/5</math> or <math>4/8</math>? How about <math>4/3</math> and <math>5/6</math>?</p> <ul style="list-style-type: none"> <li>- ask students to solve problem with steps by themselves. Teacher will not provide any prompt or specify types of solutions.</li> <li>- After students done, peer share solution and problem-solving strategies with neighbor or partner.</li> <li>- During the work time, teacher will observe different strategies students used. Teacher will pay attention to students have multiple strategies.</li> </ul> |
| <b>Guided lesson</b><br><b>15 minutes</b>               | <p>Teacher will present today's discussion: <b>How to compare fractions? Order fractions according to their value? Can you locate fractions on a number line?</b></p> <ul style="list-style-type: none"> <li>- Teacher will reflect on warm up question, guide students thinking about their experience on solving the problem with their own strategies.</li> <li>- Student will share and reflect on ways they have used for order and comparing fractions: <ul style="list-style-type: none"> <li>o Setting landmarks strategy (watch for students trying</li> </ul> </li> </ul>   |

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|  | <p>convert fractions to decimal for comparing)</p> <ul style="list-style-type: none"> <li>○ Graphic model strategy (watch for setting the unit of model as the same value)</li> <li>○ Number line strategy (connection to today's third discussion question)</li> <li>○ And more</li> </ul> <ul style="list-style-type: none"> <li>- Teacher will highlight the number line model by locating fractions on a number line</li> <li>- Students work on today's reflective problem of locate fractions on a number line then order and compare fraction</li> <li>- Teacher guided peer share; student will work on problem solving record sheets</li> </ul> |
| <p><b>Independent Work Time</b><br/><b>5 minutes</b></p> | <ul style="list-style-type: none"> <li>- Students will complete the problem-solving recoding sheet</li> <li>- Students can work on assignments</li> </ul>  |
| <p><b>Closing</b><br/><b>5 minutes</b></p>               | <ul style="list-style-type: none"> <li>- Teacher: Today we have discussed the value of fraction and how can we use different way to represent value of a fraction. We use number line as a tool to help us order and comparing fractions.</li> <li>- Play review video: <a href="#">Compare and order fractions with different numerators and denominators</a></li> <li>- Teachers assign iXL learning assignments for reinforcement</li> <li>- Teacher will collect students' problem-solving sheet and use CGI student work analyzing and planning sheet to prep next lesson</li> </ul>  |
| <p><b>Resources:</b></p>                                 | <p>Teaching slides <a href="#">Link</a><br/> Students' problem-solving recoding sheet <a href="#">Link</a><br/> CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br/> iXL learning 5<sup>th</sup> grade math skill <a href="#">K.7 Least common denominator</a>; <a href="#">K.11 Put fractions in order</a><br/> Review video <a href="#">Link</a></p>  |

**Lesson 6**  
**Reflection and discussion**

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| <b>Standard:</b>  | <b>5.1.2.3</b> Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.   |
| <b>Student Objective/Goal:</b>  | I can locate fractions on a number line.<br>I can use different strategies to compare fractions' value.   |
| <b>Driving Question</b>   | <i>How to put fractions on a number line?</i><br><br><i>What can you do to compare values of fractions?</i>   |
| <b>Setup/preparation<br/>Before lesson</b>  | After first lesson, teacher will collect all students' Problem-solving recording sheet. Teacher will use CGI 'Analyzing Your Students' Work and planning a Strategy Discussion' worksheet to analyze student typical strategies. (Part A; Part B)<br><br>Teacher will collect strategies from students and identify student individuals that teacher will individually conferencing (Part C).   |
| <b>Independent work<br/>time/individual<br/>conferencing time<br/>10-15 minutes</b> | Teacher will start the lesson by letting the class know that for the first 15 minutes of the mini lesson students will have independent work time.<br>Students' tasks including:<br><ul style="list-style-type: none"> <li>- Finish unfinished class work from last lesson</li> <li>- Work on math practice work</li> </ul> Teacher will use the time to have individual strategies conferences with student individual identified during preparation time for the lesson.<br><br>Teacher's goal for individual conferences will include:<br><ul style="list-style-type: none"> <li>- better understand students' skill and strategy choices</li> </ul> |



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|  | <ul style="list-style-type: none"> <li>- identify students willing to share during whole class/whole group strategies discussion</li> <li>- recommend an effective strategy other than students already process or students that didn't process a clear problem-solving strategy based on analyzation of students' work</li> </ul> |
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| <p><b>Sharing and discussion</b><br/><b>10 minutes</b></p> | <p>Teacher will lead whole class/group discussion.</p> <p>Teacher: we have talked about the value of fraction and how can we use different way to represent value of a fraction. We used number line as a tool to help us order and comparing fractions. Today we will reflect on how we can solve those problem and investigate different strategies.</p> <p>Based on students' work, teacher might identify possible strategies for representing a fraction, not limited to:</p> <ul style="list-style-type: none"> <li>- Setting landmarks strategy (watch for students trying convert fractions to decimal for comparing)</li> <li>- Graphic model strategy (watch for setting the unit of model as the same value)</li> <li>- Number line strategy</li> <li>- And more</li> </ul> <p>Ask students to share their strategies and teacher will lead the discussion</p> <p>Teacher will highlight number line model and have this model fully discussed with the class.</p> |
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| <b>Closing</b><br><b>5 minutes</b> | <ul style="list-style-type: none"><li>- Teacher: we have discussed how to order and compare fractions. We talked about different models and focused on number line model. Hope everyone had one strategy that you can use for sure for future problem solving.</li><li>- Ask students take notes on their math journal or any type of math notes.</li></ul>                      |
| <b>Resources:</b>                  | Teaching slides <a href="#">Link</a><br>Students' problem-solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill <a href="#">K.7 Least common denominator</a> ; <a href="#">K.11 Put fractions in order</a><br>Review video <a href="#">Link</a> |

**Lesson 7**  
**Equivalent fractions**

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| <b>Standard:</b>  | <b>5.1.2.4</b> Recognize and generate equivalent decimals, fractions, mixed numbers, and improper fractions in various contexts.   |
| <b>Student Objective/Goal:</b>                          | I can recognize fractions with different numerator and denominator but have same value.<br>I can rename fractions into another equivalent fractions.   |
| <b>Driving Question</b>                                 | <i>How can we tell if two fractions have same value?</i><br><br><i>What are some ways that we can rename fractions that are equivalent to a given fraction?</i>  |
| <b>Warm up/ question of the day</b><br><b>5 minutes</b> | <b>Q1:</b> Can you draw graphs for fractions $1/2$ , $2/4$ and $6/12$ , what did you notice?<br><br><b>Q2:</b> Which fraction is larger? $3/5$ or $9/15$ ? How about $8/9$ and $4/3$ ? How can you tell?<br><br><ul style="list-style-type: none"> <li>- ask students to solve problem with steps by themselves. Teacher will not provide any prompt or specify types of solutions.</li> <li>- After students done, peer share solution and problem-solving strategies with neighbor or partner.</li> <li>- During the work time, teacher will observe different strategies students used. Teacher will pay attention to students have multiple strategies.</li> </ul> |
| <b>Guided lesson</b><br><b>15 minutes</b>               | Teacher will present today's discussion: <i>How can we tell if two fractions have same value? What are some ways that we can rename fractions that are equivalent to a given fraction?</i><br><br><ul style="list-style-type: none"> <li>- Teacher will reflect on warm up question, guide students thinking about their experience on solving the problem with their own strategies.</li> <li>- Student will share and reflect on ways they have used for recognizing fractions with similar value</li> </ul>   |

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|  | <ul style="list-style-type: none"> <li>○ Simplify/multiply fractions to same denominator (some students might already acquired this strategy)</li> <li>○ Making graphs</li> <li>○ Putting fractions on a number line</li> <li>○ And more</li> </ul> <ul style="list-style-type: none"> <li>- Teacher will review fraction and division conversion</li> <li>- Teacher will review the concept of both denominator and numerator of fraction multiply/divided by same number situation</li> <li>- Students work on today's reflective problem rename more fractions into equivalent fractions</li> <li>- Teacher guided peer share; student will work on problem solving record sheets</li> </ul> |
| <b>Independent Work Time</b><br><b>5 minutes</b> | <ul style="list-style-type: none"> <li>- Students will complete the problem-solving recoding sheet</li> <li>- Students can work on assignments</li> </ul>   |
| <b>Closing</b><br><b>5 minutes</b>               | <ul style="list-style-type: none"> <li>- Teacher: Today we have discussed fractions with different denominator and numerator can have same value. We also tried different strategies that we can rename fractions to another fraction but has same value.</li> <li>- Play review video: <a href="#">Equivalent Fractions</a></li> <li>- Teachers assign iXL learning assignments for reinforcement</li> <li>- Teacher will collect students' problem-solving sheet and use CGI student work analyzing and planning sheet to prep next lesson</li> </ul>   |
| <b>Resources:</b>                                | <p>Teaching slides <a href="#">Link</a></p> <p>Students' problem-solving recoding sheet <a href="#">Link</a></p> <p>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a></p> <p>iXL learning 5<sup>th</sup> grade math skill K4 <a href="#">IXL   Equivalent fractions   5th grade math</a></p> <p>Review video: <a href="#">Equivalent Fractions</a></p>   |

**Lesson 8**  
**Reflection and discussion**

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| <b>Standard:</b>  | <b>5.1.2.3</b> Order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line.  |
| <b>Student Objective/Goal:</b>  | I can recognize fractions with different numerator and denominator but have same value.<br>I can rename fractions into another equivalent fractions.   |
| <b>Driving Question</b>   | <i>How can we tell if two fractions have same value?</i><br><br><i>What are some ways that we can rename fractions that are equivalent to a given fraction?</i>  |
| <b>Setup/preparation<br/>Before lesson</b>  | After first lesson, teacher will collect all students' Problem-solving recording sheet. Teacher will use CGI 'Analyzing Your Students' Work and planning a Strategy Discussion' worksheet to analyze student typical strategies. (Part A; Part B)<br><br>Teacher will collect strategies from students and identify student individuals that teacher will individually conferencing (Part C).  |
| <b>Independent work<br/>time/individual<br/>conferencing time<br/>10-15 minutes</b> | Teacher will start the lesson by letting the class know that for the first 15 minutes of the mini lesson students will have independent work time.<br>Students' tasks including:<br>- Finish unfinished class work from last lesson<br>- Work on math practice work<br>Teacher will use the time to have individual strategies conferences with student individual identified during preparation time for the lesson.<br><br>Teacher's goal for individual conferences will include: |

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|  | <ul style="list-style-type: none"> <li>- better understand students' skill and strategy choices</li> <li>- identify students willing to share during whole class/whole group strategies discussion</li> <li>- recommend an effective strategy other than students already process or students that didn't process a clear problem-solving strategy based on analyzation of student work</li> </ul> |
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| <p><b>Sharing and discussion</b><br/><b>10 minutes</b></p> | <p>Teacher will lead whole class/group discussion.</p> <p>Teacher: we have talked about the value pf fraction and multiple fractions can have same value. We also talked about how can we rename fractions with similar values. Today we will reflect on how we can solve those problem and investigate different strategies.</p> <p>Based on students' work, teacher might identify possible strategies for rename equivalent fractions, not limited to:</p> <ul style="list-style-type: none"> <li>- Simplify/multiply fractions to same denominator (some students might already acquire this strategy)</li> <li>- Making graphs</li> <li>- Putting fractions on a number line</li> <li>- And more</li> </ul> <p>Ask students to share their strategies and teacher will lead the discussion</p> <p>Teacher will focus on strategy of using multiply and division algorithm to generate fractions.</p> |
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| <b>Closing</b><br><b>5 minutes</b> | <ul style="list-style-type: none"><li>- Teacher: today we have discussed equivalent fractions and how can we rename fractions to equivalent fractions. Hope everyone had one strategy that you can use for sure for future problem solving.</li><li>- Ask students take notes on their math journal or any type of math notes.</li></ul>                              |
| <b>Resources:</b>                  | Teaching slides <a href="#">Link</a><br>Students' problem-solving recoding sheet <a href="#">Link</a><br>CGI student work analyzing and strategy planning discussion sheet <a href="#">Link</a><br>iXL learning 5 <sup>th</sup> grade math skill K4 <a href="#">IXL   Equivalent fractions   5th grade math</a><br>Review video: <a href="#">Equivalent Fractions</a> |

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