



Fraction Quest

Unit Summary

Students are assigned to a profession that uses fractions on the job. They research, summarize, draw conclusions, and present their findings to the class answering questions such as, *Does accuracy really matter that much?* and *How are fractions used on the job and are they needed to get the job done right?* Students learn to add, subtract, multiply, and divide fractions to help answer the Unit Question, *How can understanding fractions make your life easier?* As a culminating activity, students reflect on the importance of knowing fractions in the assigned profession and in their own lives both now and in the future.

Curriculum-Framing Questions

- **Essential Question**
Does accuracy really matter that much?
- **Unit Questions**
Are fractions important or would we be better off without them?
How are fractions used on the job and are they needed to get the job done right?
How can understanding fractions make your life easier?
- **Content Questions**
What is a fraction?
How do you add, subtract, multiply, and divide fractions?
What is the difference between a numerator and a denominator?

Assessment Plan

Assessment Timeline

This timeline shows in chronological order the different types of formal and informal assessments that occur during the unit. The table below explains how each assessment is used and who uses it for what purpose.

At a Glance

Year/Form: Year 2 to Year 4

Subject: Math

Topics: Fractions

Higher-Order Thinking

Skills: Problem Solving, Making Inferences, Generalizing

Key Learnings: Fractions, Problem Solving, Research Techniques

Time Needed: 20 sessions, 45 minutes per session, plus time for individuals and small groups to work on computers

Things You Need

Instructional Procedures Standards

Assessment Timeline

Before project work begins

- Journal

Students work on projects and complete tasks

- Collaboration Checklist
- Poster Checklist

- Project Rubric
- Presentation Checklist
- Research Checklist

- Conferences
- Storyboard
- Questioning

After project work is completed

- Presentation Checklist
- Project Rubric

- Chart
- Reflections

Assessment	Process and Purpose of Assessment
Journal	Students answer prompts in their math journals related to the Unit Questions and the fraction activities. Teachers review for understanding and provide additional lessons as necessary.
Poster Checklist	Students use the checklist to ensure they have included all requirements for the poster. Teachers use the checklist to assess the completed posters.
Collaboration Checklist	Students use the checklist to monitor their collaboration skills as they work together on the poster. Teachers review with students during conferences and prompt students to refer to it during group work.
Project Rubric	Students use the rubric to help guide them through the entire project. Teachers use the journal, checklists, storyboard, conference notes, and reflections to assess conceptual understanding using the rubric as a guide.
Presentation Checklist	Students use the checklist to help them through the drafting and writing phases of the presentation. The teacher uses the checklist to assess content integration and the overall effectiveness of the presentation.
Research Checklist	Students use the checklist to self-assess their progress during the research process. Teachers check during conferences to ensure students are on track.
Conferences	Teachers schedule individual conferences to assess the students' mathematical understanding, critical thinking, collaboration, and the research process. Conferences allow time for feedback, clarifying misunderstandings, or providing additional lessons as necessary. Questions and notes provide documentation for final project assessment.
Storyboard	Students use the storyboard to plan and monitor work on the presentation. Teachers review during conferences to ensure all requirements have been met.
Questioning	Teachers use questioning strategies to monitor student progress, probe for understanding, and engage students in higher-order thinking. Teachers also return to Curriculum-Framing Questions throughout the project to analyze student understanding.
Chart	Teachers record students' answers to the Unit and Essential Questions after each presentation. This helps students revisit their learning, make connections, and prepare for the final reflection.
Reflections	Students reflect on their learning by relating how knowing fractions helps them now and in the future. Teachers review final reflections to assess student growth in understanding.

Credits

David Frankle participated in the Intel® Teach Program, which resulted in this idea for a classroom project. A team of teachers expanded the plan into the example you see here.

Note: The hyperlinked support documents are not part of the PDF. They can be downloaded and printed individually.

Instructional Procedures

Introducing the Unit

1. Begin the unit by posting the Unit Question, *Are fractions important or would we be better off without them?* Elicit students' initial responses and have them record their thoughts in their **math journals**.
2. To help students understand fractions in a concrete way, involve them in a variety of hands-on experiences working with real-life fractions. Have them decorate cookies as fractional parts, divide paper cookies among friends, examine fractions in everyday life, and create their own fraction models. Ask students to reflect on the activities in their math journals. Review journals for understanding and present additional lessons as necessary.
3. Move on to more hands-on experiences dealing with fraction notation and equivalency. At the end of these activities, divide students into groups and assign each group to create a poster board summarizing one of the fraction activities they've worked on. Post the completed posters on the wall for students to refer to throughout the unit. Pass out the **poster checklist** and **collaboration checklist** to help guide the process.

Presenting the Project Scenario

1. Post the Unit Questions, *How are fractions used on the job and are they needed to get the job done right?* and *How can understanding fractions make your life easier?*
2. Inform students that in order to uncover the answers to these questions and the Unit Question presented earlier, they will each be taking on the role of a worker in a profession that uses fractions. Their task is to find out just how important fractions are to a profession and how the ability to work with fractions affects job performance. Finally, students must solve real-world fraction problems that relate in some way to the professions and draw conclusions about how the problems translate into their own lives.
3. Assign or allow students to choose a profession that uses fractions daily on the job. After each student has a profession, pass out the **project rubric** and **presentation checklist**, and discuss project requirements and assessment criteria. Check to be sure students understand the assigned tasks.

Researching and Collecting Information in a Variety of Ways

1. Provide students with a list of Web sites to use for researching their assigned professions as well as a **research checklist** to help students organize their work for the upcoming presentations.
2. Demonstrate interview techniques and discuss the importance of collecting information from experts in the field. Together generate a list of interview questions that might be important to ask an expert in order to help address all of the project criteria and answer the Unit Questions. Discuss how email can be used as an effective tool to communicate with experts.
3. Allow several days for students to conduct research and interviews with experts and review the **research checklist** during conferences with students to ensure students are collecting adequate information.

Creating Presentations

1. Ask students to refer to the **presentation checklist** and **project rubric** to help guide them while they work on their presentations.
2. Provide **storyboard templates** to students so that they can visually plan their presentations. Each storyboard should include slide titles and a bulleted list of key points.
3. Remind students that their presentations should answer the following Unit Questions:
 - *Are fractions important or would we be better off without them?*
 - *How are fractions used on the job and are they needed to get the job done right?*
 - *How can understanding fractions make your life easier?*
 - Presentations should also include an answer to the bigger, Essential Question, *Does accuracy really matter that much?*
4. While students work, ask **probing questions** to encourage them to make connections and draw conclusions to add to their presentation. Also set up **conferences** to help focus students on thinking skills they are using.
5. Have each student come up with a real-world fraction problem that demonstrates a connection to the profession they've researched. Inform students that they need to state their real-world problems and show, step by step, how to solve them. Student should also address and include the answer to the following Content Questions:

- *What is a fraction?*
 - *How do you add, subtract, multiply, and divide fractions?*
 - *What is the difference between a numerator and a denominator?*
 - *How do you change a mixed numeral into an improper fraction?*
6. Meet with the students individually as **storyboards** are completed to discuss the presentations and suggest any edits. Once a student's storyboard has been approved, allow the student to begin creating slides. Guide and assist students as necessary as they create their presentations.

Wrapping Up

1. Break students into pairs and have them practice their presentations with each taking a turn being the interviewer and the other the expert presenter. Give students a period or two to come up with interview questions and practice presentations. The interviewer (student helper) asks the questions and the expert (student presenter) responds to the questions using slides to support the talking points.
2. Allot several days for students to present their projects to the entire class. Assess the presentation using the **project rubric**. Facilitate a brief discussion following each presentation and ask students to use the information just presented to answer the following questions:
 - *Does accuracy really matter that much?*
 - *Are fractions important or would we be better off without them?*
 - *How are fractions used on the job and are they needed to get the job done right?*
 - *How can understanding fractions make your life easier?*
3. Post four chart papers with each question at the top. Record student responses on each chart and refer to them throughout the presentations.
4. After all of the presentations have been delivered, ask students to reflect in their journals on the importance of knowing fractions in their own lives both now and in the future.

Targeted Content Standards (Curriculum Specifications) and Benchmarks

California Mathematics Standards for Grade 5 (Year 4)

2.0 Students perform calculations and solve problems involving addition, subtraction, and simple multiplication and division of fractions:

2.3 Solve simple problems, including ones arising in concrete situations, involving the addition and subtraction of fractions and mixed numbers (like and unlike denominators of 20 or less), and express answers in the simplest form.

2.4 Understand the concept of multiplication and division of fractions.

2.5 Compute and perform simple multiplication and division of fractions and apply these procedures to solving problems.

National Educational Technology Standards

Technology productivity tools

- Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.

Technology communications tools

- Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.

Technology research tools

- Students use technology to locate, evaluate, and collect information from a variety of sources.

Student Objectives

Students will be able to:

- Deliver "Ask the Expert" interviews and oral presentations that answer specific questions
- Use multimedia software to create slides to visually support oral presentations
- Learn how fractions are used in a variety of professions and how important accuracy is to the success of job tasks
- Use fractions to solve real-world problems
- Work in teams to prepare a poster summarizing math concepts

Collaboration Checklist

Use this checklist to monitor your collaboration skills while you work together in your group. Be prepared to share your self-assessment during conference time.

	Date	Example
I can do many things within the group		
I accept a division of tasks		
I complete all of my assigned tasks		
I can agree on a plan even if it's not my own		
I accept other's ideas		
I express my ideas clearly		
I try to help others understand		
I encourage the members of my group		
I ask questions to get clarification		
I offer feedback in a constructive and friendly way		
I listen when someone is talking		
I try to solve problems		

Fraction Quest Presentation Checklist

_____ I used the storyboard planner to write a draft of my presentation.

_____ I answered these questions:

- Does accuracy really matter that much?
- Are fractions important or would we be better off without them?
- How are fractions used in my profession and are they needed to get the job done right?
- How can understanding fractions make my life easier?

_____ I came up with a real-life problem and wrote detailed and clear procedures for solving the problem.

_____ I answered these questions:

- What is a fraction?
- How do you add, subtract, multiply, and divide fractions?
- What is the difference between a

Comments:

numerator and a denominator?

How do you change a mixed numeral into an improper fraction?

_____ My visual representation helps my explanation.

_____ I used correct mathematical terminology and notation.

_____ My use of graphics, fonts, and backgrounds add visual appeal to my presentation.

_____ I checked my presentation for spelling, grammar, and accuracy.

Fraction Poster Checklist

	Check when complete
We have represented the fraction problem accurately with no mathematical errors.	
We have included a visual model to help explain the fraction problem.	
We have step-by-step instructions on how to solve the problem.	
We have included a common mistake students make when solving the fraction problem and explained why it is incorrect.	
We have used correct mathematical terminology and notation.	
We have a conclusion describing why knowing how to solve this fraction problem is important.	
Our poster is visually appealing (appropriate spacing and balance, use of color, title, easy to read).	
We have asked another group for feedback on our draft and used the suggestions to improve our poster. Suggestions:	Group Members:

Fraction Quest Project Rubric

Criteria	4	3	2	1
Presentation Content	<p>My explanation of how fractions are used on the job and of the importance of accuracy to job performance is detailed and complete.</p> <p>All key points and conclusions are supported by research. My research has been gathered from a variety of sources as well as from experts in the field.</p> <p>The procedures used to arrive at the solution to my real-world fraction problem are detailed and clear and include all of the steps required to solve the fraction problem.</p> <p>The Essential Question and all Unit Questions are addressed in the presentation and supported with research.</p> <p>Several Content Questions are addressed and thoroughly answered in the presentation.</p>	<p>My explanation of how fractions are used on the job and of the importance of accuracy to job performance is clear.</p> <p>Most key points and conclusions are supported by research. My research has been gathered from a variety of sources.</p> <p>Explanation of my real-world fraction problem and how knowing fractions helped to solve the problem is clear.</p> <p>The Essential Question and all Unit Questions are addressed and answered in the presentation. Most questions are supported with research.</p> <p>One or more Content Questions are addressed and thoroughly answered in the presentation.</p>	<p>My explanation of how fractions are used on the job and of the importance of accuracy to job performance is unclear but includes critical components.</p> <p>Some key points and conclusions are supported by my research.</p> <p>Explanation of my real-world fraction problem and how knowing fractions helped to solve the problem is a little difficult to understand but includes critical components.</p> <p>The Essential Question and all Unit Questions are addressed and answered in the presentation, but they are not adequately supported with research.</p> <p>One or more Content Questions are addressed in the presentation.</p>	<p>My explanation of how fractions are used on the job and of the importance of accuracy to job performance is difficult to understand and missing several components.</p> <p>Key points and conclusions are not supported by my research.</p> <p>Explanation of my real-world fraction problem and how knowing fractions helped to solve the problem is difficult to understand and is missing several components.</p> <p>The Essential Question or some Unit Questions have not been addressed or answered in the presentation. My research is lacking to support answers.</p> <p>Content Questions are not addressed or answered in the presentation.</p>
Mathematical Concepts	My explanation shows complete	My explanation shows substantial	My explanation shows some	My explanation shows very limited

	understanding of the mathematical concepts used to solve the fraction problem.	understanding of the mathematical concepts used to solve the fraction problem.	understanding of the mathematical concepts needed to solve the problem.	understanding of the underlying concepts needed to solve the problem.
Graphs and Visuals	My graphs, animation, and other visuals are clear and greatly add to the audience's understanding of the mathematical procedures used to solve the fraction problem.	My graphs, animation, and other visuals are clear and easy to understand.	My graphs, animation, and other visuals are somewhat difficult to understand.	My graphs, animation, and other visuals are difficult to understand or are not used.
Mathematical Terminology and Notation	I always use correct mathematical terminology and notation, making it easy to understand.	I usually use correct mathematical terminology and notation, making it fairly easy to understand.	I use correct mathematical terminology and notation, but it is sometimes hard to understand.	I use inappropriate mathematical terminology and notation.
Oral Presentation	My presentation is interesting and well-rehearsed, with smooth delivery that holds the audience's attention.	My presentation is relatively interesting and rehearsed, with a fairly smooth delivery that usually holds the audience's attention.	My delivery is not smooth but holds the audience's attention most of the time.	My delivery is not smooth, and the audience's attention is lost.
Poster Content	Our summary of the fraction activity includes many details and examples. Our representation of the activity is insightful, original, and includes a clear explanation of a common mistake.	Our summary of the fraction activity includes some details and examples. Our representation of the activity includes an explanation of a common mistake.	Our summary of the fraction activity includes a few details or examples. Our representation of the activity and the common mistake are included but they are hard to follow.	Our summary of the fraction activity includes few or no details and examples. Our representation of the activity and the common mistake are unclear, unsupported, or not included.

Questions to Encourage Making Connections and Drawing Conclusions

Questions	Notes
How is _____ an example of the importance of fractions?	
Why is that information significant?	
What evidence did you find to support using fractions on the job?	
How does that compare with _____?	
What ideas can you add to _____?	
What might happen if you didn't know how to use fractions on this job?	
What is most important about _____?	
How does that apply in this case?	
How does that relate to your life?	
How has your thinking changed since doing this research?	

Fraction Quest Presentation Storyboard

Use this storyboard to plan your presentation. Add and rearrange slides as necessary.

Title Slide	Introductory Slide
Fractions on the Job	Accuracy
Importance of Fractions	Relating to Me
Fraction Problem	Fraction Problem
Fraction Problem	Makes My Life Easier
Conclusion	Sources

Example Mathematics Journal Prompts

What are the fraction ideas in this problem?

Write another problem related to the one you worked on today.

Describe the pattern you discovered today.

Explain what you know right now.

How would you explain the process we worked on today to a younger child?

How would you check that your answer is correct?

Is there a real life situation where this could be used?

Where else would this strategy be useful?

Is there a general rule you can describe?

What was one new thing you learned today?

What is different about the fractions in these two models?

What was your greatest challenge today?

What kinds of problems are still difficult for you?

Research Checklist

	Check When Complete
I select information that answers the questions: <input type="checkbox"/> Does accuracy really matter that much? <input type="checkbox"/> Are fractions important or would we be better off without them? <input type="checkbox"/> How are fractions used in my profession and are they needed to get the job done right? <input type="checkbox"/> How can understanding fractions make my life easier?	
I decide what the most important information is for each question.	
I keep track of my sources (eg. copyright date, title, author, publisher, page or path information, name of interviewee, date).	
I compare the information I collect from various sources.	
I use information from my expert to help answer each question.	
I use a graphic organizer such as a web, a chart, a timeline or a table to help me understand and explain how the information goes together.	
I decide on the most important points and eliminate information I don't need.	
I organize the key ideas in a logical order.	
I analyze the information and draw conclusions.	
I summarize using my own words.	
I think about the best way to show what I found out.	
I clearly communicate my information so others can understand.	

Conference Preparation Self-Assessing Thinking

Assess your skills in generalizing and making inferences before the conference with your teacher and be prepared to give examples of why you've given yourself the ratings you have.

Generalizing Rubric

	4	3	2	1
Identifying Patterns	I find common and unusual patterns in things and numbers to help me understand the world around me.	I find patterns that make sense in numbers and the world around me.	Sometimes the patterns I find are about unimportant things or do not make sense.	I do not see patterns in groups of things.
Interpreting Patterns	I use patterns to make up statements about what is important about a group of things.	Sometimes I can use patterns to make up statements that are true about groups of things.	The statements I make about groups of things usually do not describe all the members of the group.	The statements I think of about groups of things do not describe what the things have in common.
Using Patterns to Generalize	I use the patterns I observe to help me understand unfamiliar things.	I often use patterns I observe to help me understand unfamiliar things.	With help, I sometimes use patterns I observe to help me understand unfamiliar things.	I do not use patterns to help me understand unfamiliar things.

Making Inferences Rubric

	4	3	2	1
Making Connections	I think carefully about new information and use what I already know to make sensible inferences and draw conclusions. I can read and think "between the lines."	I use my background knowledge to make good inferences.	With help, I sometimes use what I already know and what I'm learning to make inferences.	I usually think about the exact information I am studying, and I do not make any inferences about it.
Monitoring	I constantly make new inferences and change old ones if I need to when I get more information.	I can tell when my inferences are incorrect and I make new inferences based on what I know.	When I am reminded, I notice when my inferences are incorrect and make new ones.	I usually do not change my inferences and make new ones.