

Flipping for Fractions: An Action Research Project

Kristel P. de Leon
University of Hawai'i at Mānoa
Kahului, HI, USA
kpdeleon@hawaii.edu

Abstract: Getting young students to understand and enjoy the concept of fractions is one of the challenges I continually face as a classroom teacher. After the Common Core State Standards were adopted, a deeper understanding of operations involving fractions was required in the fifth grade. With that came persistent issues in student engagement and retention, as evidenced by weekly data team meetings with grade level colleagues. To address this need, I developed an action research project to flip my classroom and evaluate how interactive video instruction could impact attention and learning on fraction multiplication. Over the course of two weeks, students accessed a blend of ready-made and teacher-created videos on the Interactive Video Learning Platform (IVLP), PlayPosit. PlayPosit allowed me to turn passive video instruction into a responsive learning environment. Each video was designed to pause at specific timed intervals, which then prompted viewers to answer a multiple-choice or free response question to invite reflection. Subsequently, students received instant feedback and I gathered valuable data to drive instruction. In addition, constructivism was employed to allow students to showcase their learning on collaborative problem solving tasks. This paper will discuss the design of the project. Lessons learned include the importance of curating appropriate video content and testing technology tools prior to implementation. Overall, flipping my classroom using PlayPosit transformed a math module on multiplying fractions into a stimulating learning experience for students.

Introduction

As a classroom teacher with seven years of experience in upper elementary grades, the concept of fraction operations among young learners has always proved a daunting task. Over the last two years, the implementation of data teams has magnified fractions as a consistent concern among fifth grade students. According to school-wide universal screener, i-Ready, only 24% of fifth graders are scoring on or above grade level proficiency in operations involving fractions (i-Ready, 2016). Most of the difficulty lies in the conceptual understanding of fractions, and the solving of multi-step word problems. Despite continuous efforts to address this area, lack of student engagement hinders retention and commitment to learn abstract mathematical skills, and proficiency levels remain low. Given how critical understanding the basic concept of fractions is in math, science, and--most importantly--daily life, the exploration of innovative instructional strategies was imperative. The purpose of this action research project was to evaluate the impact of a flipped classroom model using the Interactive Video Learning

Platform (IVLP), PlayPosit, on engagement and retention of skills on fifth grade students' unit of study on multiplying fractions at a public elementary school in Maui, Hawai'i.

My interest in learning about modern technology in educational settings has led to the pursuit of a career that practices meaningful tech-integration to support student growth. An e-learning intervention was important within my locus of control because of the recent push towards fostering a digital learning environment. That, along with the demands of teaching the multitude of Common Core State Standards, provided the rationale for preparing children to be 21st century learners and citizens. Furthermore, my particular enthusiasm for teaching math was rooted in my own struggle to learn mathematical concepts at an early age, when rote memorization and low differentiation were commonplace. This research project was created to address the needs of students and create an environment where learning is interactive, engaging, and enjoyable.

Literature Review

In classroom teaching, striving for continuous improvement, reflection, and growth is part of one's everyday practice. These mirror the critical components of action research. Action research is a process of identifying an educational problem and addressing it through an intervention to improve teaching (Rust & Clark, 2004). Through the iterative practice of action research, the instructor aims to develop, implement, observe, and reflect on the purpose of a study. After taking note of the results, one applies their learning to make improvements and thus, continues the cycle of taking action to benefit student learning (Hien, 2009).

The constructivist theory highlights student-centered learning. In a constructivist classroom, students are primarily responsible for creating and making use of their own knowledge. Therefore, learning is more active than passive (Ally, 2008). Constructivism also relies heavily on collaboration. Teachers work alongside students and become partners in the formation of new learning (Martin-Stanley, 2007). Students also work with their peers, gathering ideas and solutions that differ from their own (Steenbrugge, Remillard, Verschaffel, Valcke, & Desoete, 2015). When keeping fractions in mind, Steenbrugge et. al's recent study suggests that both collaboration and relevancy to real life can deeply impact students' abilities to learn abstract concepts. Furthermore, a technology-rich learning environment greatly supports the idea of constructivism. Through the access and integration of digital tools, Martin-Stanley suggests that students exhibit increased motivation and learning outcomes (2007).

The advent of increased technology use in educational settings has paved the way for transformative learning methodologies, such as the flipped classroom approach. Flipped learning shifts the traditional role of instruction from school to home, and directs primary ownership of learning from the teacher to the student (Bergmann et al., 2014). Learners are assigned content to absorb outside of class delivered through a vehicle of technology. In the face-to-face setting, the teacher facilitates a deeper application of learned concepts by providing meaningful activities and immediate feedback in a flexible and active learning environment (Bergmann et al., 2014).

When comparing the flipped classroom to the traditional classroom, one significant difference is the use of time (Bormann, 2014). Whereas students in a traditional classroom come unprepared for the day's lesson and spend a large amount of time listening to a teacher-led lecture, the flipped approach aims to provide the lecture the night before. A report by Gilboy, Heinerichs, and Pazzaglia (2014) claims that the face-to-face session should be focused on active learning strategies that focus on applying, analyzing, and synthesizing. In class the following day, students spend a minimal amount of time clearing misconceptions or seeking clarification before attempting to apply the knowledge learning into constructive tasks.

The flipped classroom methodology has evolved with the development of advanced web tools, such as Interactive Video Learning Platforms (IVLP). Unlike the typical video tutorial, IVLPs allow instructors to edit video to meet learning needs. Users can select from a variety of features such as customized trimming, questioning to prompt reflection, and inserting source code to integrate other web content. The use of IVLPs adds a layer of interactivity missing in traditional distance video delivery, thus stimulating curiosity and increasing engagement (Tucker, 2013). IVLPs also enable learners to access the content in their own time and provides viewers with immediate feedback (Cummins, Beresford, & Rice, 2015). However, with the use of video delivery, one must take careful consideration in curating content specific to the audience of learners. Bell and Bull suggests keeping the length of video under five minutes, selecting relevant clips, and previewing each video before distribution (2010). According to Chuang, purposeful use of technology can create an environment that promotes motivation to learn and increases enthusiasm (2014). For young students learning concepts as abstract as fractions, maintaining student interest is key.

Project Design

There were three major elements of my project design: curriculum, technology, and data collection.

Curriculum

After the flipped classroom approach using an IVLP was decided as the means of delivering instruction, I took a deeper look at the content students would be learning. Since I teach in a public school setting, I adhered to the confines of the Common Core State Standards (CCSS) and our state-mandated math program, Origo Stepping Stones. By the end of fifth grade, the CCSS dictate that students know how to multiply fractions with whole numbers and other fractions, represent multiplication equations in visual models, and solve word problems involving mixed numbers. Fortunately, I did not have to recreate the wheel as Stepping Stones provides teachers with a detailed matrix of content and learning targets, as well as step-by-step lesson plans. These formed the basis of my project's curriculum (Figure 1).

ORIGO STEPPING STONES	
Stepping Stones Lesson	
9.1	Multiplying Common Fractions and Whole Numbers
9.2	Multiplying Whole Numbers, Common Fractions, and Mixed Numbers
9.3	Multiplying a Proper Fraction by a Proper Fraction (Area Model)
9.4	Multiplying Improper Fractions (Area Model)
9.5	Multiplying Mixed Numbers (Area Model)

Figure 1. Origo Stepping Stones lesson content and learning targets for lessons 1-5.

Technology

In true flipped classroom fashion, students were assigned one video each night as daily homework, in lieu of a traditional paper/pencil task. I also accounted for work activities for the face-to-face classroom. These were planned for with careful alignment to each standard, lesson, and video content. The objective was that students would showcase their learning from the video on a collaborative problem solving task meant to apply the skill presented from the night before. This would ensure that my time in the classroom was spent supporting students in a new, dynamic learning environment, rather than lecturing in front of the whiteboard.

Initially, students were to watch only teacher-created screencasts as homework. Students were also to be assessed nightly through quizzes on Google Forms. After presenting the initial idea to a panel of University of Hawai'i at Manoa Department of Learning Design and Technology faculty and staff, it was determined that the videos would be a mixture of teacher-created and existing videos already available online. In addition, I decided to use PlayPosit as the platform of choice for an IVLP. PlayPosit was selected due to the free educator's account and its seamless connection to Google Classroom, an application students were familiar with from daily use. Google Forms would no longer be required to collect daily assessment data, as PlayPosit's embedded questions instantaneously aggregated the information for me. Each evening for nine lessons, students accessed a link on Google Classroom that directed them to a video tutorial on PlayPosit.

With the help of Origo Stepping Stones' lesson content matrix, I researched instructional videos that aligned to each of the nine lessons in the module. This was not an easy task as Stepping Stones' lessons were taught as specific and separate skills. For example, the first three lessons were on multiplying common fractions, multiplying mixed numbers,

and multiplying proper fractions using an area model. I was able to find ready-made tutorials that aligned with those lessons, but as the module progressed, I faced difficulty finding videos that clearly aligned. Because I did not want to stray away from our program's sequence, I followed the plans as they were presented. Therefore, for lessons that could not be found online, I created three of my own video tutorials.

A variety of tools were employed to build and record my instructional videos including Google Slides, Quicktime, and the Doceri iPad app. For two of the nine lessons, I created presentations using Google Slides that did not require area models to be drawn (Figure 2). I used Quicktime to record my voice as I explained the content and transitioned from slide to slide.

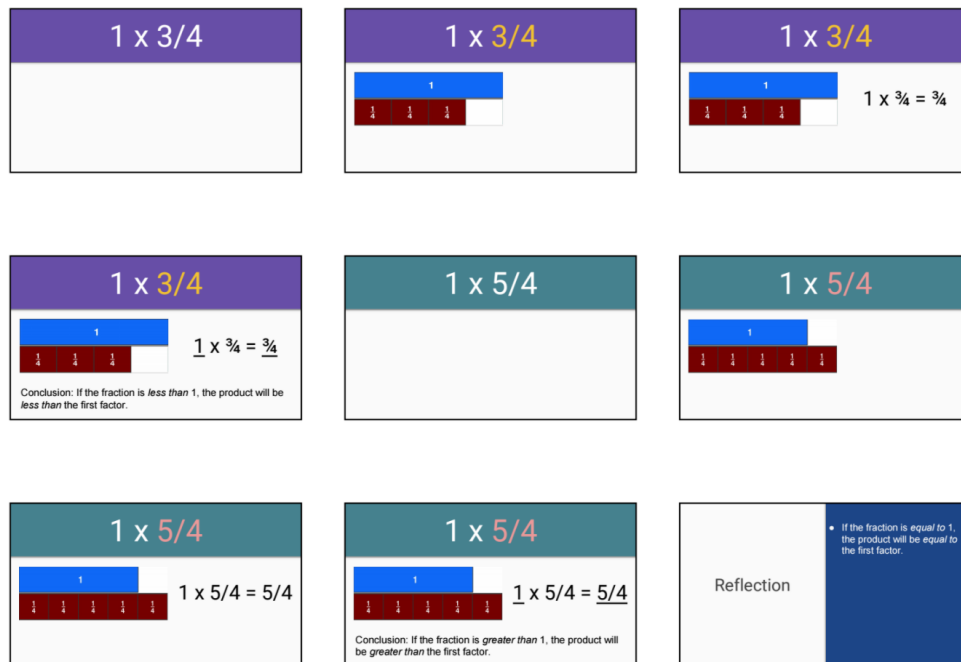


Figure 2. Teacher-created screencast on Google Slides.

One of my lessons required me to use area models to multiply two improper fractions. I quickly realized that I needed to explore avenues outside of Google Slides. One of my biggest successes in this project was discovering whiteboard recording screen apps on the iPad for the first time. I experimented with a few programs before I settled down with Doceri. I found using the iPad much more difficult than using the computer. I felt disappointed in my artistic and penmanship skills using a stylus, and had to overcome a steep learning curve in drawing and narrating simultaneously. Ultimately, I was satisfied with the end product and was thrilled to explore a new tool.

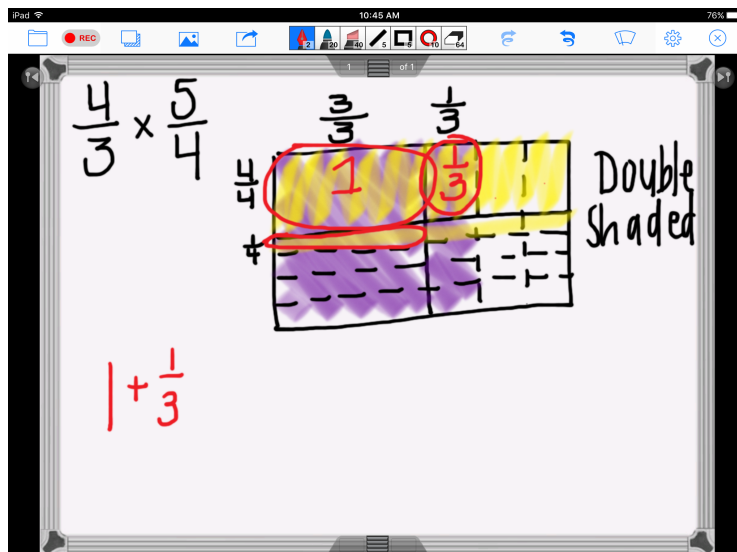


Figure 3. Doceri interactive whiteboard and recording tool.

PlayPosit's free version allowed me to transform videos into an active learning environment by embedding two different types of questions: multiple choice and free response. In addition, it allowed me to insert reflective pauses. All three elements were included in each instructional video (Figure 4).

Figure 4. PlayPosit video editing interface.

The classwork in the face-to-face sessions consisted of tasks that would challenge students' thinking and help them apply the skills from each video through relevant, real-world problems (Figure 5). Resources from Stepping Stones, teacher workbooks, and the web were consulted and selected for each lesson's task. Students worked with their peers in small groups to interpret the problem, justify ideas, and find a solution.

9.8: Solving Problems Involving Fractions and Mixed Numbers (Problem Solving Task)

Brooke is remodeling her bathroom. She plans to cover the bathroom floor with tiles that are each 1 square foot. Her bathroom is $5\frac{1}{2}$ feet wide and $8\frac{1}{4}$ feet long.

- How many tiles will she need to cover the floor? Use an equation to calculate an exact answer that includes the fractions of a tile she will need.
- Each unit square in the figure below has been broken into sixteenths to allow precise measurements. Use the figure to illustrate your answer a 2nd way.

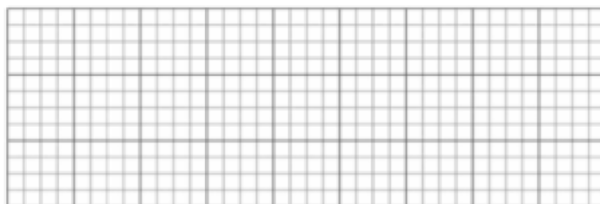


Figure 5. Collaborative problem solving task.

Data Collection

The data provided from the embedded questions on PlayPosit were used to assess students' understanding of the content, assist in planning for small group instruction, and provide quantitative information. For each video, the data were automatically saved by PlayPosit into a spreadsheet that was broken down by each individual student and each individual question (Figure 6).

	Q 01	Q 02	Q 03	Q 04	Q 05	Q 06	Q 07	Q 08	Q 09	
1	🚩	B	B	🚩	🚩	🚩	A	🚩	🚩	😊
2	🚩	A	C	🚩	🚩	🚩	D	🚩	🚩	😊
3				🚩				🚩		
4	🚩	C	C	🚩	🚩	🚩	B	🚩	🚩	😊
5	🚩	B	B	🚩	🚩	🚩	A	🚩	🚩	😊
6	🚩	B	C	🚩	🚩	🚩	A	🚩	🚩	😞
7	🚩	B	C	🚩	🚩	🚩	A	🚩	🚩	😊
8	🚩	C	B	🚩	🚩	🚩	D	🚩	🚩	😊
9	🚩	B	B	🚩	🚩	🚩	B	🚩	🚩	😊
10	🚩	B	B	🚩	🚩	🚩	A	🚩	🚩	😊
11	🚩	B	B	🚩	🚩	🚩	C	🚩	🚩	😞

Figure 6. PlayPosit data collection.

Next, avenues for collecting data on student engagement and perceptions about the flipped classroom approach using PlayPosit were considered. An observation protocol was developed as a means of gathering information on student engagement in the classroom during face-to-face sessions (Figure 7). The observation protocol measured engagement in the classroom through a series of coded on-task and off-task behaviors.

During 15 minute intervals in a single class period, I assessed individual and/or group conduct and noted the observed behaviors. In addition, I used prior teaching experiences to gauge motivation. Retention skills were assessed through formative data collected through PlayPosit and through the daily completion of problem solving tasks in class. A rating scale of Well-Below, Developing, Meets, and Exceeds Proficiency determined levels of mastery. In addition, the end-of-module summative tests at the conclusion of the unit were the final measurement of skill retention. All quantitative data were stored on a spreadsheet and kept secure. Finally, a questionnaire was distributed at the conclusion of the module to assess how the flipped classroom approach affected overall engagement and learning. The questionnaire consisted of 22 Likert Scale and open-ended response questions on Google Forms (Figure 8).

Observation Protocol

Teacher: _____	Date: _____
Observation Focus: <i>Student Engagement</i>	Time of Observation: _____ to _____

Intervals	Student Names						
8:00-8:15							
8:15-8:30							
8:30-8:45							
8:45-9:00							
9:00-9:15							
9:15-9:30							
<i>Total</i>							

Engaged Behaviors: (on-task)	Unengaged Behaviors: (off-task)	Teacher Observations:
B1: Listening attentively B2: Contributing to discussions B3: Working collaboratively w/ others B4: Asking questions B5: Completing tasks B6: Uses technology effectively	F1: Not listening/passive F2: Not contributing to discussions F3: Not working collaboratively F4: Not asking questions F5: Distracted/not completing tasks F6: Uses technology ineffectively	

Figure 7. Daily observation protocol.

Select the best response to the statements about the instructional videos below. *

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I watched the instructional videos for homework each night they were assigned.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked watching the videos.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed the interactive feature of answering questions in the videos.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The videos helped me learn how to multiply fractions.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was focused and engaged while watching the videos.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
If I didn't understand, I rewound or watched it again to help me.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I understood how to multiply fractions through watching the videos.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I liked watching the videos at my own pace.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 8. Post-module student questionnaire.

Conclusion

Implementing the flipped approach was not without its challenges. I discovered on the first day of implementation that PlayPosit failed to load on the student Chromebooks as they were connected to the Department of Education-Student Wireless network that blocked access to certain websites. This was crucial for participants without internet access at home. Subsequent lessons were uploaded onto another IVLP, Edpuzzle, for students to access on their own Chromebooks during school hours. Had I known earlier that PlayPosit would not load on their student computers, I would have been better prepared to accommodate those participants from day one.

Given the option to redo the module with an infinite amount of time and money, I would make a few significant changes. First, I would upgrade to a premium, paid version of PlayPosit. This would allow for more variety in the types of questions. The premium version would also provide advanced access to crop and edit videos. Second, I would have created more original tutorials. When creating my own videos, I had complete creative control over the script. I could purposefully insert specific math-related

vocabulary and language that I wanted students to use and learn. I could also vary the number of examples, depending on learner's needs.

My biggest piece of advice for individuals interested in creating their own videos is to ask for feedback. As opposed to teaching in front of a live audience who can demonstrate understanding with a quick nod of the head, recording a tutorial on a screen can sometimes turn out to be a shot in the dark. In my own module, my colleagues turned into critical friends and made suggestions to help improve the quality of my videos. After implementation, the feedback I received from *students* would also guide me in future planning.

The study of a flipped classroom design using interactive videos allowed me to better understand how a technology-based intervention could impact student engagement and support the learning process for students across all proficiency levels. My next steps are to share the results with my grade level colleagues and school level administration. Throughout the process, they were intrigued and supportive of my project's design and development. The experience has inspired me to potentially apply the flipped approach in future math modules, and across other content areas. I hope that my school will continue to meet the needs of students by providing access to meaningful technology and tools.

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Appendix A: Lesson Content and Learning Targets

Stepping Stones Lesson		Common Core State Standards		Common Core Cluster Heading	Stepping Stones Learning Target
		Math Practices	Math Content		
9.1	Multiplying Common Fractions and Whole Numbers	SMP7	5.NF.4, 5.NF.4a	Apply and extend previous understandings of multiplication and division.	Multiply whole numbers by common fractions
9.2	Multiplying Whole Numbers, Common Fractions, and Mixed Numbers	SMP3, SMP7	5.NF.4, 5.NF.4a, 5.NF.4b	Apply and extend previous understandings of multiplication and division.	Multiply common fractions by whole numbers Multiply mixed numbers by whole numbers
9.3	Multiplying a Proper Fraction by a Proper Fraction (Area Model)	SMP2, SMP7	5.NF.4, 5.NF.4a, 5.NF.4b	Apply and extend previous understandings of multiplication and division.	Multiply proper fractions by proper fractions
9.4	Multiplying Improper Fractions (Area Model)	SMP7, SMP8	5.NF.4, 5.NF.4a, 5.NF.4b 5.NF.5, 5.NF.5b	Apply and extend previous understandings of multiplication and division.	Multiply improper fractions by proper or improper fractions Identify the effects of multiplying by fractions less than or greater than 1
9.5	Multiplying Mixed Numbers (Area Model)	SMP7, SMP8	5.NF.4, 5.NF.4a, 5.NF.4b	Apply and extend previous understandings of multiplication and division.	Multiply mixed numbers by common fractions Multiply mixed numbers by mixed numbers
9.6	Reviewing the Concept of Multiplication as Comparison	SMP4, SMP6	5.NF.5, 5.NF.5a 5.NF.4, 5.NF.4a	Apply and extend previous understandings of multiplication and division.	Represent multiplication (comparison model) Multiply whole numbers and common fractions by whole numbers
9.7	Exploring Multiplication by Fractions Less Than, Equal to, or Greater Than 1	SMP2, SMP8	5.NF.4, 5.NF.4a 5.NF.5, 5.NF.5b	Apply and extend previous understandings of multiplication and division.	Multiply whole numbers and common fractions by common fractions Identify the effects of multiplying by fractions less than or greater than 1
9.8	Solving Word Problems Involving Fractions and Mixed Numbers	SMP1, SMP3	5.NF.6 5.NF.4, 5.NF.4a, 5.NF.4b	Apply and extend previous understandings of multiplication and division.	Solve word problems involving mixed numbers Multiply mixed numbers by mixed numbers
9.9	Solving Multi-Step Word Problems Involving Fractions and Mixed Numbers	SMP1, SMP3	5.NF.6 5.NF.1 5.NF.4, 5.NF.4a, 5.NF.4b	Apply and extend previous understandings of multiplication and division. Use equivalent fractions as a strategy to add and subtract fractions.	Solve word problems involving mixed numbers Add mixed numbers with related and unrelated denominators Multiply mixed numbers by mixed numbers

ORIGO
STEPPING STONES

Grade 5 Module 9 Lesson Content and Learning Targets

Appendix B: Teacher-Created Screencast on Google Slides

Lesson 9.7: Exploring Multiplication by Fractions Less Than, Equal To, or Greater Than 1	Objective To determine if the product will be less than, equal to, or greater than the first factor by thinking about the fraction.	Objective To determine if the product will be less than, equal to, or greater than the first factor by thinking about the fraction. In this lesson, solving the problem is not the final goal.
Examples	$1 \times 4/4$	$1 \times 4/4$ 
$1 \times 4/4$  1×1	$1 \times 4/4$  $1 \times 1 = 1$	$1 \times 4/4$  $1 \times 1 = 1$ Conclusion: If the fraction is <i>equal</i> to 1, the product will be <i>equal</i> to the first factor.
$1 \times 3/4$	$1 \times 3/4$ 	$1 \times 3/4$  $1 \times 3/4 = 3/4$
$1 \times 3/4$  $1 \times 3/4 = 3/4$ Conclusion: If the fraction is <i>less than</i> 1, the product will be <i>less than</i> the first factor.	$1 \times 5/4$	$1 \times 5/4$ 
$1 \times 5/4$  $1 \times 5/4 = 5/4$	$1 \times 5/4$  $1 \times 5/4 = 5/4$ Conclusion: If the fraction is <i>greater than</i> 1, the product will be <i>greater than</i> the first factor.	Reflection <ul style="list-style-type: none"> • If the fraction is <i>equal</i> to 1, the product will be <i>equal</i> to the first factor.

Appendix C:
Teacher-Created Screencast on Doceri

The screenshot shows a Doceri interface on an iPad. At the top, the status bar displays "iPad", "10:45 AM", and "76%". Below the status bar is a toolbar with various drawing and editing tools. The main whiteboard area contains the following content:

- On the left, the multiplication problem $\frac{4}{3} \times \frac{5}{4}$ is written in black ink.
- In the center, a grid model is drawn. The grid is 2 rows by 2 columns. The top row is shaded yellow, and the bottom row is shaded purple. The left column is shaded purple, and the right column is shaded yellow. The intersection of the top row and left column is shaded both yellow and purple. A red circle is drawn around the number "1" in the top-left cell, and another red circle is drawn around the fraction $\frac{1}{3}$ in the top-right cell. A red bracket is drawn under the top row.
- To the right of the grid, the text "Double Shaded" is written in black ink.
- At the bottom left, the mixed number $1 + \frac{1}{3}$ is written in red ink.

Appendix D: PlayPosit Interface

The screenshot displays the PlayPosit interface for a lesson titled "9.2: Multiplying Whole Numbers, Common Fractions and Mixed N...". The video player shows a grid with "5 units" written above it and the equation $5 \times 3\frac{1}{2} =$ and "5 groups of $3\frac{1}{2} =$ ". The video progress bar is at 01:46 out of 05:03. Below the video player are buttons for "Crop Video", "Finish Build", and "Add Question".

The question list on the right side of the interface contains the following questions and answers:

01:05 What would be a reasonable estimate for $5 \times 3\frac{1}{2}$?
 A. Exactly 15. *Incorrect. 5×3 alone is equal to 15.*
 B. A little less than 15. *Incorrect. 5×3 is already equal to 15.*
 C. A little more than 15. *Correct! Since $3\frac{1}{2}$ is a little more than 3, $5 \times 3\frac{1}{2}$ will be a little more than 15.*
 D. $1\frac{1}{2}$ *Incorrect. This is a multiplication problem.*

01:51 Stop and think. Can you see 3 and $\frac{1}{2}$ as the width in the area model?

02:57 Who or what is this number story about? (Answer sentence.)

03:10 Is the area model below appropriate to use for this problem?

Appendix E:
PlayPosit Data Collection

Q 01	Q 02	Q 03	Q 04	Q 05	Q 06	Q 07	Q 08	Q 09	
	B	B				A			
	A	C				D			
	C	C				B			
	B	B				A			
	B	C				A			
	B	C				A			
	C	B				D			
	B	B				B			
	B	B				A			
	B	B				C			

Appendix F:
Observation Protocol

Observation Protocol

Teacher: _____	Date: _____
Observation Focus: <i>Student Engagement</i>	Time of Observation: _____ to _____

Intervals	Student Names						
8:00-8:15							
8:15-8:30							
8:30-8:45							
8:45-9:00							
9:00-9:15							
9:15-9:30							
<i>Total</i>							

Engaged Behaviors: (on-task)	Unengaged Behaviors: (off-task)	Teacher Observations:
B1: Listening attentively B2: Contributing to discussions B3: Working collaboratively w/ others B4: Asking questions B5: Completing tasks B6: Uses technology effectively	F1: Not listening/passive F2: Not contributing to discussions F3: Not working collaboratively F4: Not asking questions F5: Distracted/not completing tasks F6: Uses technology ineffectively	

Appendix G: Post Module Questionnaire

Introduction:

Hi, students! You were selected to complete this questionnaire as a participant in my research project. The purpose of this questionnaire is to understand how the flipped classroom approach using interactive videos impacted your learning. Your responses will be used to improve and guide the future use of the flipped classroom approach using interactive videos.

The survey includes 25 questions and should take no longer than 15 minutes to complete. Responses will be kept anonymous and will not affect your grade. Please be as honest and thorough as possible.

Thank you for taking the time to complete this survey.

Likert Scale Questions

(Strongly Agree--Strongly Disagree)

Select the best response to the statements about the instructional videos below.

- I watched the instructional videos for homework each night they were assigned.
- I liked watching the videos.
- I enjoyed the interactive feature of answering questions in the videos.
- The videos helped me learn how to multiply fractions.
- I was focused and engaged while watching the videos.
- If I didn't understand, I rewound or watched it again to help me.
- I understood how to multiply fractions through watching the videos.
- I liked watching the videos at my own pace.

Select the best response to the statements about the flipped classroom approach below.

- I would rather watch videos for homework than complete pencil/paper assignments.
- I would recommend the flipped classroom approach to a friend in another class.
- I was more motivated to learn in the flipped classroom.
- I would rather watch a video at home than listen to Kumu teach the lesson in class.
- I liked working on challenging math problems during class.
- I understood how to multiply fractions through the problem solving tasks in class.
- I felt more confident about math during this module.
- I enjoyed learning through the flipped classroom approach.
- I was focused and engaged while participating in the activities during math.

Open-Ended Response Questions

- What did you like the most about watching videos at home for homework?
- What did you like the least about watching videos at home for homework?
- What did you like the most about using class time to practice problem solving activities?

- What did you like the least about using class time to practice problem solving activities?
- If you could change one thing about the flipped classroom, what would it be?
- Is there anything else you'd like to share?

Post Module Student Questionnaire

Hi, students! You were selected to complete this questionnaire as a participant in my research project. The purpose of this questionnaire is to understand how the flipped classroom approach using interactive videos impacted your learning. Your responses will be used to improve and guide the future use of the flipped classroom approach using interactive videos.

The survey includes 25 questions and should take no longer than 15 minutes to complete. Responses will be kept anonymous and will not affect your grade. Please be as honest and thorough as possible.

Thank you for taking the time to complete this survey.

<https://goo.gl/cCXqKB>

* Required

Name *

Your answer

Select the best response to the statements about the instructional videos below. *

Strongly
Agree

Agree

Neutral

Disagree

Strongly
Disagree

I watched the instructional videos for homework each night they were assigned.

Appendix H: Student Assent Form

January 2017

Dear Student of G-102,

Hi! As you know, I am Kumu de Leon, your 5th grade teacher at Waihe'e Elementary School. I am also a graduate student at the University of Hawai'i at Mānoa, Department of Learning Design and Technology. In order to get my degree, I am conducting a research project and invite you to participate. I want to learn about what 5th grade students think about watching videos about multiplying fractions to replace traditional paper/pencil homework.

Project Description

In a flipped classroom, you watch videos for homework, instead of working on your Student Journal pages. You will also work on problem solving in class, instead of listening to a lecture.

For approximately two weeks, you will learn each math lesson at home through interactive videos I upload onto our classroom website. The videos will pause occasionally and ask you a question. You may watch the video as many times as you like. This means that you will need access to the internet over the course of the project. The next day in class, you will demonstrate your learning of the lesson through a variety of challenging tasks and projects. If you do not have internet access at home, I will provide you with accommodations to make sure that you still receive the same instruction. This may include providing time in the mornings before school or during lunch recesses to watch the videos.

Participation in this research project means that I will observe behaviors, and collect information through surveys/questionnaires, student work, and test grades. *Should you decide not to be a participant, you will still watch videos for homework and work on problem solving in class and you will be required to complete the same set of homework, class assignments, and projects as your peers. However, I will not use your data in my research project.*

Benefits and Risks

One benefit of this research project is that it may help you improve your math skills and become more engaged with the learning activities in class. In addition, I hope it will help me and other teachers decide how to better use technology to enhance teaching and learning. I don't believe there are any risks to your education or well-being.

Confidentiality and Privacy

Your privacy is very important to me. Any information I collect from this study will remain confidential. When I report results of my research project, I will use a pseudonym (fake name) for you.

Your Rights as a Research Participant

If you don't want to be in the study, you don't have to be. Non-participation will have no effect on your grades or relationship with me or our school. It is also OK to say yes and change your mind later. You can stop being in the research at any time without any consequence. You may ask questions any time. Take the time you need to make your choice.

Remember, if you decide not to be a participant, you will still be required to complete the same set of homework, class assignments, and projects as your classmates, but I will not use your data in my research project.

Is there anything else?

If you want to be in the research after we talk, please write your name below. I will write my name too. This shows we talked about the research and that you want to take part.

Signature of Student Participant

Printed Name of Student Participant

Signature of Researcher

Printed Name of Researcher

Date

Original form to:

Researcher File

Copies to:

Parents/Guardians

Appendix I: Parent Consent Form

January 2017

Dear Parents/Guardians of G-102,

As part of the completion of my graduate program through the University of Hawai'i at Manoa's Department of Learning Design and Technology, I am kindly requesting your permission for your child to participate in my final research project. I hope to learn how flipping the classroom, using an Interactive Video Learning Platform, will engage and improve student learning in mathematical skills involving multiplication of fractions. Your child was selected as a possible participant in this study as a student in our G-102 'Ohana.

Project Description

The flipped classroom shifts the traditional delivery of instruction from school to home. For approximately two weeks, lectures will be administered and watched at home via instructional web videos. This means that your child will need access to the internet over the duration of the project. The videos will automatically pause at certain intervals to check for understanding. Your child will then demonstrate their learning in the following day's class session through a variety of tasks and projects.

Students without internet access at home will be provided with accommodations to make sure that they still receive the same essential instruction. This may include providing time in the mornings before school or during lunch recesses to watch the videos. Most importantly, rest assured that your child will receive the regular instruction and lessons they normally do. Our math curriculum, Origo Stepping Stones, will continue to be the primary source of content and the focus of multiplying fractions is aligned to the Common Core State Standards.

Participation in this research project means that I will observe behaviors, and collect information through surveys/questionnaires, student work, and test grades. *Should you decide not to let your child participate, he/she will still learn the content using the flipped classroom curriculum and will be required to complete the same set of homework, class assignments, and projects as their peers, but I will not use his/her data in my research project.*

Benefits and Risks

While there are no guarantees that your child will receive any benefits from this research, there are also no inherent risks to their education or well-being.

Confidentiality and Privacy

Your child's privacy is very important to me. Any information collected as a result of this study and that can be identified with your child will remain confidential and will be disclosed only with parental permission or as required by law. When I report results of my research project, I will use a pseudonym (fake name) for your child. If you would like a summary of my final report, please contact me at the number listed near the end of this consent form.

Your Child's Rights as a Research Participant

Your child's participation in the research project is voluntary. Your decision whether or not to allow your child to participate will not affect his/her academic performance or relationship with Waihe'e Elementary School. If you decide to allow your child to participate, you and/or your child are free to withdraw consent and discontinue participation at any time without consequence. If you decide *not* to allow your child to participate, your child's data will not be used in my research project.

Questions or Concerns

If you have any questions about the study, please feel free to contact me at 808-727-5300 or at kpdeleon@hawaii.edu. You may also contact my advisor Dr. Grace Lin at gracelin@hawaii.edu. If you have any questions about your rights or the rights of your child as research volunteers, you can contact the University of Hawai'i Human Studies Program, by phone at (808) 956-5007 or by e-mail at uhirb@hawaii.edu.

Please sign below to indicate that you have read and understand the information on this form. You will receive a copy for your records.

 I give permission for my child to participate in the research project entitled Flipping for Fractions: Studying the Use of Interactive Video Learning Platforms. I understand that my child must also agree to participate. I understand that my child can change (his/her) mind about participating at any time. I can change my mind about participating, at any time, by notifying the researcher of my decision to end participation in this project.

 Signature of Student

 Printed Name of Student

 Signature of Parent/Legal Guardian
 Guardian

 Printed Name of Parent/Legal
 Guardian

I consent to the use of my child's work in the research project: _____ (initial)

Date _____

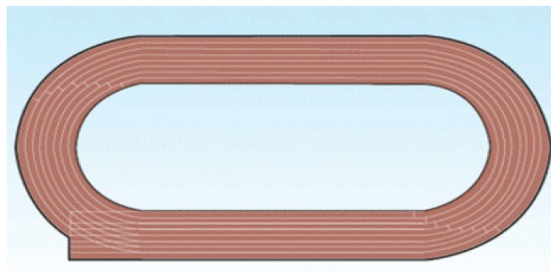
Appendix J:
Problem Solving Tasks

5.NF Mrs. Gray's Homework Assignment

Alignments to Content Standards: 5.NF.B.5.b 5.NF.B.4

Task

1/4 mile Track



1 lap = 1/4 mile

Part One

Mrs. Gray gave a homework assignment with a fraction problem:

Will ran $1\frac{2}{3}$ laps of a $\frac{1}{4}$ mile track. How far, in miles, did Will run? Jenna and Steve worked together on solving the problem. Jenna said that Will ran about $\frac{1}{2}$ mile because $1\frac{2}{3} \times \frac{1}{4}$ is equal to about $\frac{1}{2}$. Steve answered that Will must have run more than $\frac{1}{2}$ mile because when you multiply, the product is always larger than the factors and $\frac{1}{2}$ is not larger than $1\frac{2}{3}$.

- a. Solve the problem. How far, in miles, did Will run?
- b. Is Jenna or Steve correct? Explain your reasoning using words, numbers, and/or pictures.

Part Two

Steve and Jenna continued to work on their homework. The next problems were:

$$\frac{1}{3} \times 5 =$$

$$\frac{1}{2} \times 2\frac{2}{3} =$$

Steve said to Jenna, "Now I get it! When you multiply, the product is always bigger than **one** of the factors. In the first problem, $\frac{1}{3} \times 5$ equals $\frac{5}{3}$ which is bigger than $\frac{1}{3}$. In the second problem $\frac{1}{2} \times 2\frac{2}{3}$ equals $1\frac{1}{3}$ which is bigger than $\frac{1}{2}$."

- c. Is Steve's reasoning correct? Does his rule that the product is always bigger than one of the factors always work?
- d. Give at least two examples to prove that Steve is correct or incorrect.

Appendix K:
Daily Problem Solving Rubric

	1	2	3	4
Strategy	Does not use a strategy to help solve the problem.	Starts with a strategy to solve the problem, but work is not complete.	Uses a sensible strategy to solve the problem and work is complete.	Uses a sensible and creative strategy to solve the problem, not just what was taught, and work is complete.
Understanding	Demonstrate no or very little understanding of the task.	Demonstrates partial understanding of the task; identifies some elements of the problem.	Demonstrates basic understanding of the task; identifies most elements of the problem leading to minor computation errors.	Demonstrates complete understanding of the task; identifies all elements of the problem leading to accurate computation.
Computation	Calculations do not make sense and do not relate to task.	Calculations contain major errors; not all parts are answered.	Calculations mostly accurate and/or contain slight errors that do not interfere with the overall solution, all parts are answered.	Calculations are completely accurate and show higher level math concepts, all parts are answered.
Explanation	Explanations are non-existent or very unclear.	Explanations are not complete or inconsistent with work shown.	Explanations are clear, easy to follow and complete.	Explanations are detailed, accurate and exceed requirements
Total	_____ /16			

Appendix L: Student Data Spreadsheet

Individual Student Data for IVLP/Problem Solving Tasks ☆

File Edit View Insert Format Data Tools Add-ons Help Last edit was on October 16

fx

	A	B	C	D	E	F	G	H	I	J
1		9.1 (Sample)	9.2	9.3	9.4	9.5	9.6	9.7	9.8	9.9
2	5de-1	90								
3	5de-2	100								
4	5de-3	100								
5	5de-4	100								
6	5de-5	50								
7	5de-6	60								
8	5de-7	70								
9	5de-8	80								
10	5de-9	40								
11	5de-10	80								
12	5de-11	70								
13	5de-12	100								
14	5de-13	90								
15	5de-14	80								
16	5de-15	60								
17	5de-16	100								
18	5de-17	90								
19	5de-18	80								
20	5de-19	90								
21	5de-20	50								
22	5de-21	40								
23	5de-22	30								

+ ☰
Interactive Video Questions ▼
Problem Solving Tasks ▼

Appendix M: Instructional Plan

Instructional Plans

Day	Lesson	At-home Instructional Video	In-class Tasks
1	9.1: Multiplying Common Fractions and Whole Numbers Introduce Culminating Project: Multiplying Fractions Using No-Bake Dessert Recipes	Fractions of a Whole Part 1: https://vimeo.com/60930007 Playposit Video: https://www.playposit.com/delivery/247744/501749/91-multiplying-common-fractions-and-whole-numbers	<i>(Module 9 Pre-Test taken prior to start of module)</i> Problem Solving Tasks: <ul style="list-style-type: none"> Fraction Fun With Snacks Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: " First to 50 " T- Technology (IXL Skill M.7, M.8, M.11) H- Hands on Practice S- Stepping Stones Student Journal 9.1
2	9.2: Multiplying Whole Numbers, Common Fractions and Mixed Numbers	Original video Playposit Video: https://www.playposit.com/delivery/247744/496898/92-multiplying-whole-numbers-common-fractions-and-mixed-numbers	Problem Solving Task: <ul style="list-style-type: none"> "Cross Country Training" Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: " First to 50 " T- Technology (IXL Skills M.8) H- Hands on Practice S- Stepping Stones Student Journal 9.2
3	9.3: Multiplying a Proper Fraction by a Proper Fraction (Area Model)	Original video Playposit Video: https://www.playposit.com/delivery/247744/496904/93-multiplying-a-proper-fraction-by-a-proper-fraction-area-model	Problem Solving Task: <ul style="list-style-type: none"> Multiplying Fractions with Area Models Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: " First to 50 " T- Technology (IXL Skill M.11) H- Hands on Practice S- Stepping Stones Student Journal 9.3

4	9.4: Multiplying Improper Fractions (Area Model)	<p>Original video</p> <p>Playposit Video: https://www.playposit.com/delivery/247744/496903/94-multiplying-improper-fractions-area-model</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • Problem Solving 1: Working Backwards <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "First to 50" T- Technology (IXL Skill M.12) H- Hands on Practice S- Stepping Stones Student Journal 9.4</p>
5	9.5: Multiplying Mixed Numbers (Area Model)	<p>Original video</p> <p>Playposit Video: https://www.playposit.com/delivery/247744/496912/95-multiplying-mixed-numbers-area-model</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • Fraction Word Problems <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "First to 50" T- Technology (IXL Skill M.13) H- Hands on Practice S- Stepping Stones Student Journal 9.5</p>
6	9.6: Reviewing the Concept of Multiplication as Comparison	<p>Original video</p> <p>Playposit Video: https://www.playposit.com/delivery/247744/496917/96-reviewing-the-concept-of-multiplication-as-comparison-</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • "Fundraising" <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "Fraction Flip It" T- Technology (IXL Skill M.14) H- Hands on Practice S- Stepping Stones Student Journal 9.6</p>
7	9.7: Exploring Fractions by Fractions Less Than, Equal to, or Greater Than 1	<p><i>Teacher-created</i></p> <p>Playposit Video: https://www.playposit.com/delivery/247744/512901/97-exploring-multiplication-by-fractions-less-than-equal-to-or-greater-than-1</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • "Mrs. Gray's Homework" <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "Fraction Flip It" T- Technology (IXL Skill M.25) H- Hands on Practice S- Stepping Stones Student Journal 9.7</p>
8	9.8: Solving Problems Involving Fractions and Mixed Numbers	<p>Original video</p> <p>Playposit Video: https://www.playposit.com/delivery/247744/496877/98-solving-problems-involving-fractions-and-mixed-numbers</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • "Chavone's Bathroom Tiles" <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "Fraction Flip It" T- Technology (IXL Skill M. 27) H- Hands on Practice S- Stepping Stones Student Journal 9.8</p>
9	9.9: Solving Multi-Step Word Problems Involving Fractions and Mixed Numbers	<p><i>Teacher-created</i></p> <p>Playposit Video: https://www.playposit.com/delivery/247744/512923/lesson-99-solving-multi-step-word-problems-involving-fractions-and-mixed-numbers</p>	<p>Problem Solving Task:</p> <ul style="list-style-type: none"> • Problem Solving 4: Word Problems <p>Small Group Instruction: M- Meet with Kumu (based on IVLP formative qs) A- A Math Game: "Fraction Flip It" T- Technology (incomplete IXL skills) H- Hands on Practice (TBD) S- Stepping Stones Student Journal 9.9</p>
10	Review for Summative Assessment Review Culminating Project: Multiplying Fractions Using No-Bake Dessert Recipes (not part of data collection)	<p><i>Students review instructional videos according to trouble spots.</i></p>	<p>Module 9 review of skills (use <u>pre-test</u> hard copy) Small Group Instruction (if necessary) Project work</p>
11	Summative Assessment		Module 9 Post-Test