

Lesson 3: Math Language Design Challenge

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Grade Level(s)

Grades 3-5

Lesson Overview

In this lesson, students will design ways for their User to understand, think about, and enjoy math.

Learning Objectives

- To learn the design thinking process
- To collaborate
- To problem solve
- To be creative
- To develop empathy
- To listen and take notes

Standards

Utah Core Standards for Mathematics

- Number and Operations in Base Ten (K-4.NBT)

Utah Core Literacy Standards

- Reading Standards for Informational Text (K-4.RI)
- Speak and Listening Standards (5.SL)

Preparation

- Print out of colorful Empathy Map to explain inference (included within lesson).
- Print out one blank Empathy Map per team (included within lesson).
- Print out one User's Need Statement per team (included within lesson).
- Print out of Brainstorming Rules to show (included within lesson).
- Print out "Good Interview/Bad Interview" (included within lesson).
- Print out "Post Lesson Math Survey" (included in Supplementary Materials).

- Loud timer to keep everyone to the time schedule). Have a role playing scene showing good and bad interview(er) ready to go.
- Choose a User for students to design for. (Teacher can decide who the User will be or give the class options: A fellow student, a teacher, students from a lower grade level, or even parents and younger siblings. Also decide on how you want to split up your class. Teams of 2 – 4 are a good size for Design Thinking or students can interview each other.)

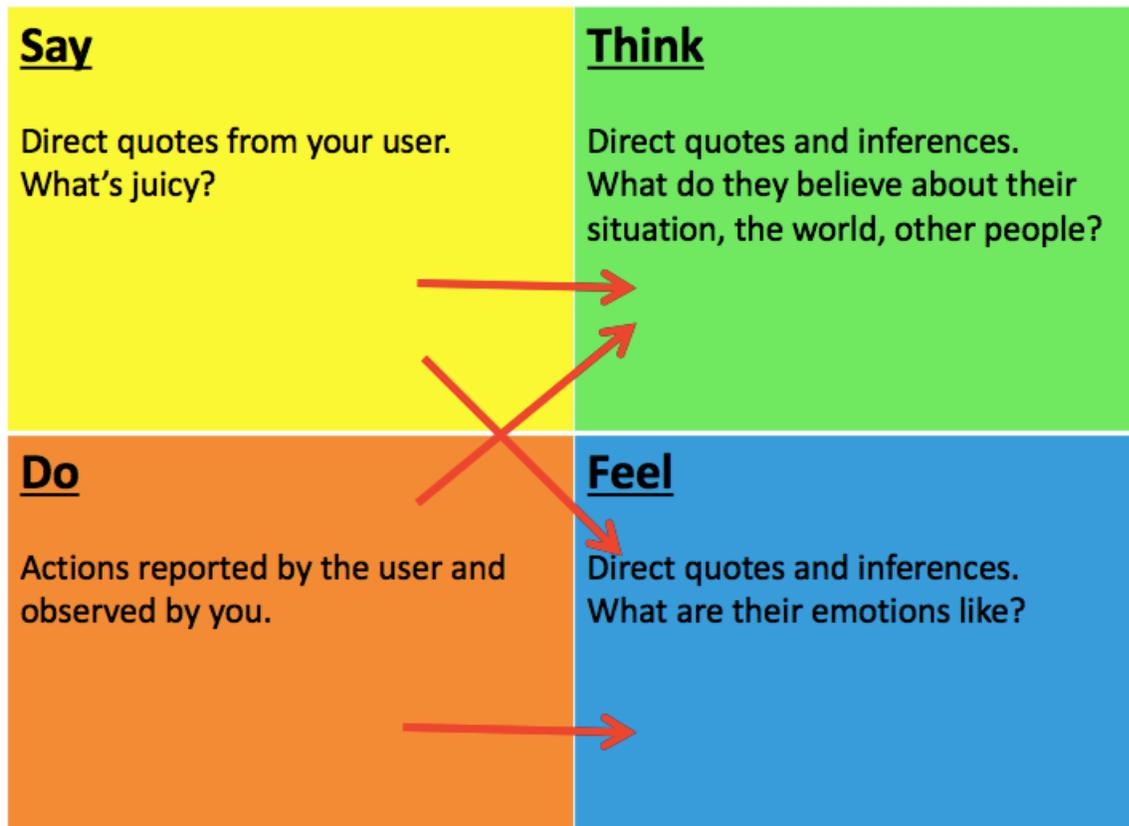
Materials and Resources

- Large piece of butcher paper and sticky notes and markers per team.
- Depending on the User and outcome of the interview and brainstorming process, you might need Prototyping Materials or Lesson/Book/Poster making materials. Prototyping materials would be a box of various simple building materials like paper, cardboard, tape, scissors, markers, paper cups, pipe cleaners, popsicle sticks, sponges, markers, etc. Remember: Free materials can be found in Recycle Bins! Don't forget Leftover Lamination! It's free and a great reusable resource.

Activity 1: Learning Empathy Through Interviewing (60 Minutes)

- After putting your students into teams, begin by announcing: “Now you will learn empathy for your User by interviewing them.”
- Next, model an example of a Good Interview vs. Bad Interview. Model this for your students with another adult. Role-playing interviewing skills in front of students is fun!
 - How to conduct a BAD Interview: Arrive late, do not be prepared, don't look in their eyes, don't smile, look bored, don't take notes, look at your phone. Can you think of other ways to be a BAD Interviewer?
 - How to conduct a GOOD Interview: Be on time, be prepared (with your questions, paper, pen), look in their eyes when talking to them, smile (be friendly), look interested, take notes (or have a note taker), allow the person you are interviewing to do MOST of the talking. Can you think of other ways to be a GOOD Interviewer?
- Give the teams time to come up with good questions, at least one good question per team member. Have one or two team members be the “note taker” while other team members ask the questions. Note takers need to listen for stories, good quotes, and take notes on their body language (Hands waving? Laughing? Happy or sad looking?) Take good notes and/or draw pictures during the interview to help you remember what they said. Compare and compile notes after the interview is over.
- Conduct the interview. Here are a few starter questions:
 - What do you know about math?
 - What would a successful math classroom look like?
 - What is your favorite thing about math?
 - What have you learned about math that made it seem difficult?
 - What have you learned about math that made you love it?
 - If you thought about math as a language, would that help you like it better?

- Now think of more questions: _____?
(Remember: Who, Why, Where, When, How)
- Tell students, “Now that you have interviewed and taken notes your User, now it’s time to make an Empathy Map. (Provide an example to show what an Empathy Map looks like.) Tell them, “You can take what a person said in an interview and infer (guess) what they think. You can also watch their body language and infer (guess) how they feel.” See Empathy Map samples below.



SAY

THINK

DO

FEEL

- Now that you've interviewed your User, taken notes, and created an Empathy Map, it's time to define your User's "needs."
- Demonstrate how to create a User "Needs Statement" (also known as a Point of View Statement. Have an example to show. Use your Empathy Map to help you fill in these blanks.
 - Make a list of adjectives that describe your User
 - Make a list of verbs for "Needs a way to"
 - Make a list of insights "Because..."

Adjectives / User's Name:

needs a way to

because

- Your User "Needs Statement" should not answer the question but be general enough to allow a lot of creativity when you Brainstorm.

Activity 2: Ideating and Prototyping (60 Minutes)

- Explain Ideation (aka. Brainstorming) and go over the "Rules of Brainstorming" with students.
 - Rules for Brainstorming:
 - Do not judge ideas! Every idea is a good idea.
 - Go for wild ideas. The wilder the better!
 - Build on the ideas of others. (YES! And...)
 - Start one conversation at a time.
 - Write or draw your idea on a post-it note.
 - Be concise. Like a headline, short statements.
 - Capture ALL the ideas! The more ideas the better!
 - Use drawings and sketches.
 - Come up with lots of ideas!
- Each team will ideate or brainstorm 25 or more ideas for different ways to meet your user's needs in the User's Needs Statement. (Allow students to come up with their own ideas based on the User's Need Statement. For example: They could make a model, a game, a book, a coloring book, a lesson. The sky's the limit!)
- Help them group similar ideas together. Then say, "Everyone put a check mark by their favorite two (or three) ideas." Have them discuss how their favorite ideas work together. Have them discuss, select one idea, and plan out what they will create.

- Every student loves to prototype! You may need to give them more time if they are being productive.

Activity 3: Testing, Receiving Feedback, and Prototyping (60 Minutes)

- Introduce Testing and Receiving Feedback. Teach students that they need to show (not tell) their prototype to their User. Let their prototype speak for itself. Ask for feedback about the prototype from their User. To the Users: When giving feedback use these positive words: I like = what worked? and I wish = what could be improved? For example: I like... the size of the space. I wish... there was a window here. Never forget to FAIL UP! Failing is a good thing. Failing helps you to improve and do better the next time!
- Take the feedback and go back to prototype. Change things on your prototype based on the feedback of your User. Show what you changed based on feedback to your User and ask User for final feedback.
- Go on a Gallery Stroll: students will walk around and look at each team's prototype. Have each team talk about their prototype to the other teams. Other teams can ask questions.
- Use remaining time for a discussion and reflection on the design challenge:
 - Can you name the steps of Design Thinking?
EMPATHIZE: Understanding the needs of the User through research and interviewing.
DEFINE: Framing the User's needs using a single Statement.
IDEATE: Generating a large range of possible solutions aka. Brainstorming.
PROTOTYPE: Communicating your ideas with a model that the User can see and touch.
TEST and FEEDBACK: Learning what works and doesn't work for the User using the words, I like – and I wish – to improve the solution.
 - How well do you understand each step?
 - What did you like about each step of the process?
 - Is there anything you didn't like?
 - Was your first design the same or different than your final design?
 - When did you get your best idea? Describe the moment.
 - How well did you Define and Prototype your User's needs?
 - How well did you feel that your designer understood you as the User?
 - What did you learn? About yourself? About the Design Thinking process? About your User?
 - Did you like the results?
- Before finishing, give each student a “How I Feel About Math” Post-Lesson Survey.

Troubleshooting

Move frequently about the classroom to answer questions and to provide support to students.

Assessment

Look for the completed Empathy Maps, Needs Statements, Prototypes and post-survey sheets. Compare Pre-Survey and Post-Surveys. Did their answers change? Were they more positive about math in general? Throughout discussions, look for understanding of the many uses of math around them.