



UTeach Maker - Showcase Lesson Overview Mao Leonard (Spring 2019)



Lesson Title	Storytelling with Quadratic Transformations
UTeach Maker	Mao Leonard
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Subject and grade level	9th grade Algebra I
Link to lesson plan and materials	https://maolnrd.wixsite.com/mao-makes/education

Lesson Description:

Students wrote about a change that occurred in the lives of their favorite fictional characters or their own lives. Students chose a parabola that best represented this change and described how it was a transformation of the quadratic parent function. Each student drew the parent function and the parabola they chose on grid paper and taped the paper to the top of a cardboard lid. They then decorated their artifacts to help tell the story of the life of their favorite fictional character or their own life. Students had the option to use a Makey Makey or Silhouette Cameo to add to their artifacts.

On the last day of the lesson, 12 invited guests came to Reagan ECHS to interact with the students during the student showcase. The class was split into two, and each half presented at a time. Presenters received feedback from classmates and guests. At the end of the lesson, students submitted an online reflection to describe their experience.

Lesson Development:

I needed to implement a maker lesson because I am in UTeach Maker. My original plan was to do a lesson that involved planting flowers in the shape of a parabola. However, I looked for other ideas after deciding that it was too time consuming. I brainstormed lesson ideas with Shelly, Stefanie, Kyla who is also a Maker, and my friend Marcus. Making art with quadratics and storytelling came up in the conversation, so I decided to combine the two ideas.

Lesson Implementation:

I implemented this lesson with my freshmen Algebra I inclusion class at Reagan ECHS. This class consisted of 19 students, 15 of which come to school regularly. They had no experience making in the classroom. My cooperating teacher is the

department head, and she also had no experience with maker education. Although it is almost the end of the school year, not everyone in the class knows each other's names.

Connection to important concepts and skills within the discipline and/or across subject areas:

This lesson was created to be a review of quadratics. The TEKS that are addressed are 6 A, B and 7 A, C, which say:

(6) Quadratic functions and equations. The student applies the mathematical process standards when using properties of quadratic functions to write and represent in multiple ways, with and without technology, quadratic equations. The student is expected to:

(A) determine the domain and range of quadratic functions and represent the domain and range using inequalities;

(B) write equations of quadratic functions given the vertex and another point on the graph, write the equation in vertex form ($f(x) = a(x - h)^2 + k$), and rewrite the equation from vertex form to standard form ($f(x) = ax^2 + bx + c$); and

(7) Quadratic functions and equations. The student applies the mathematical process standards when using graphs of quadratic functions and their related transformations to represent in multiple ways and determine, with and without technology, the solutions to equations. The student is expected to:

(A) graph quadratic functions on the coordinate plane and use the graph to identify key attributes, if possible, including x -intercept, y -intercept, zeros, maximum value, minimum values, vertex, and the equation of the axis of symmetry;

(C) determine the effects on the graph of the parent function $f(x) = x^2$ when $f(x)$ is replaced by $af(x)$, $f(x) + d$, $f(x - c)$, $f(bx)$ for specific values of a , b , c , and d .

They used their knowledge of quadratics to describe its key features, such as domain, range, axis of symmetry, equation in vertex form, ordered pair of the vertex, ordered pair(s) of the roots, width, shift, and compression/shift. Students also created a table of values, which they used to accurately draw their parabola on grid paper.

Additionally, this lesson is connected to disciplines other than mathematics. As students investigated what objects tell the Makey Makey to tell the computer play sounds on Scratch, we talked about conductivity and circuits. This lesson could also be easily connected to English class since students basically used a narrative arc to tell their story.

Reflection:

This was my first time implementing a maker lesson, and I think that it went well. The general feedback that I received from students was that they enjoyed the lesson, and they would like to do more activities like it. A few students consistently came to school early to work on their artifacts. However, there were a couple of students who seemed like they were not as interested in the lesson. One of them refused to keep working after a certain point because he thought that his artifact was

decorated enough. I tried encouraging him to adopt a growth mindset and keep improving his design, but he pushed back. I need to think of how I can encourage students to continue to work.

The students were so focused on decorating their artifacts that I didn't have enough time to let them use a Makey Makey in their artifacts. I asked them to come before school or after school to add onto their projects, but only two of them came. When I asked the other 17 students why they didn't show up, some said that they couldn't because they had work, and others said that they didn't have rides. I thought that if I provided the Makey Makeys, all of my students would have access to it, but I was wrong. By implementing a portion of my lesson outside of normal school hours, I prevented a majority of my students from participating. This showed me that I need to be mindful of what students lives outside of the classroom are like. The next time I need to have my students come in before or after school, I will make sure that I will give them the resources to be able to come, whether that is providing bus money or being flexible with my schedule to fit theirs.

I originally wanted all of my students to tell a story about a change that happened in their own lives. However, after spending four months with my students, I knew that there were some students who preferred not to talk about themselves. After giving my students the option to choose between the two types of stories, all of them chose to talk about their favorite characters except for two students. To be honest, I never would have thought that those two would be willing to talk about themselves. I learned through one student's project that she had a rough time dealing with the death of her grandmother, which caused her attitude about life to become negative. She said that she was trying to get better. I learned more about this student than I ever did in the four months prior to this lesson.

The other student who chose to talk about her life explained that she became pregnant at 14, got cheated on by the father of her baby, and went through the pregnancy alone. She said that she is now happily providing for her 10-month-old son. She even took her explanation a step further and said that if she extended her concave up parabola, it would show her graduating from high school and going to college to become a pediatrician.

According to her reflection, this maker lesson provided a platform for her to share something personally meaningful. It allowed her voice and her life story to be heard without people making negative comments. It was incredibly brave of her to share an intimate part of her life with her classmates and to the guests who were strangers to her. Receiving feedback about how people were so proud of her, instilled confidence in her. I asked her if she would be willing to try making again, and she said yes.

Although this lesson required a lot of time to plan and implement, I would do this again. It showed students that math and creativity do not have to be separated. It allowed students to practice skills important in life, such as planning, writing, and public speaking. It also benefitted my cooperating teacher and the guests who came to the student showcase because they had the opportunity to see maker education in action. My cooperating teacher told me that she planned on having her students present more because she saw how beneficial it was to students' understanding of the mathematical content.

Thoughts for the Next Iteration

There are some changes that I made to my lesson during implementation and changes I would make before implementing it again.

1. Online Submissions

I planned to have my students write down on paper their stories, but I was asked by the inclusion teacher to do an online assignment instead. She said it was because it would be easier and faster for students to type their stories instead of writing by hand. This worked well because I think that I wouldn't have been able to read some students' handwritings.

2. Growth Mindset

I expected my students to know about growth mindset since there are posters around the school explaining and promoting it. However, I found that many of them did not know what it was. There was a student who stopped working after he thought his artifact was good enough. I think that he did not want to struggle if he didn't have to. If he knew what growth mindset was, he would have been more motivated to improve his product, even if he thought it was good enough.

The next time that I implement this lesson, I would start by showing them a video about what growth mindset is.

3. Makey Makey

Only two students had the opportunity to include a Makey Makey in their artifacts. I think that if my students had one more day to work, all students would have been able to use a Makey Makey. The next time that I do this, I will extend my lesson by a day.

4. Silhouette Cameo

The reasons why I could not introduce the Silhouette Cameo to my students was because we ran out of time and I could not download the software onto the students' Chromebooks. The next time that I implement this lesson, I will make sure that I bring laptops that can download the software.

5. Rubric

The rubric that I created only listed 3 rating scales, which meant that students could earn a 0,1, or 2 for each criterion. The expectations were too high for some criteria, including the criterion about students' descriptions of their parabolas. The rubric that I had gave students no points for students whose descriptions of their parabola was less than 80% accurate. This didn't seem fair because they should at least get some credit for showing up to class and trying. I modified the rubric so that there were 4 rating scales and change the description of this criterion.

