Digital Design for English Language Learners: Alfredo Case Study

Documenting the diverse stories of English Language Learners was an important part of the Digital Design for ELLs project. Students came in with a variety of backgrounds in mathematical knowledge and in English language proficiency. Some self-identified as persons who enjoyed math and others voiced their everyday struggles in the classroom. These case studies show the possibilities for English Language Learners when using NYSCI's Noticing Tools™ alongside multimodal learning experiences that were developed and tested in NYSCI workshops.

At the time of the Digital Design Workshop, Alfredo was going into sixth grade and was born in the United States, though his family is from Ecuador. He was a confident English speaker with Spanish as his first language, and he thought through what he meant to say before saying it out loud. His two older siblings live in Ecuador, and his little brother and parents live in the United States.

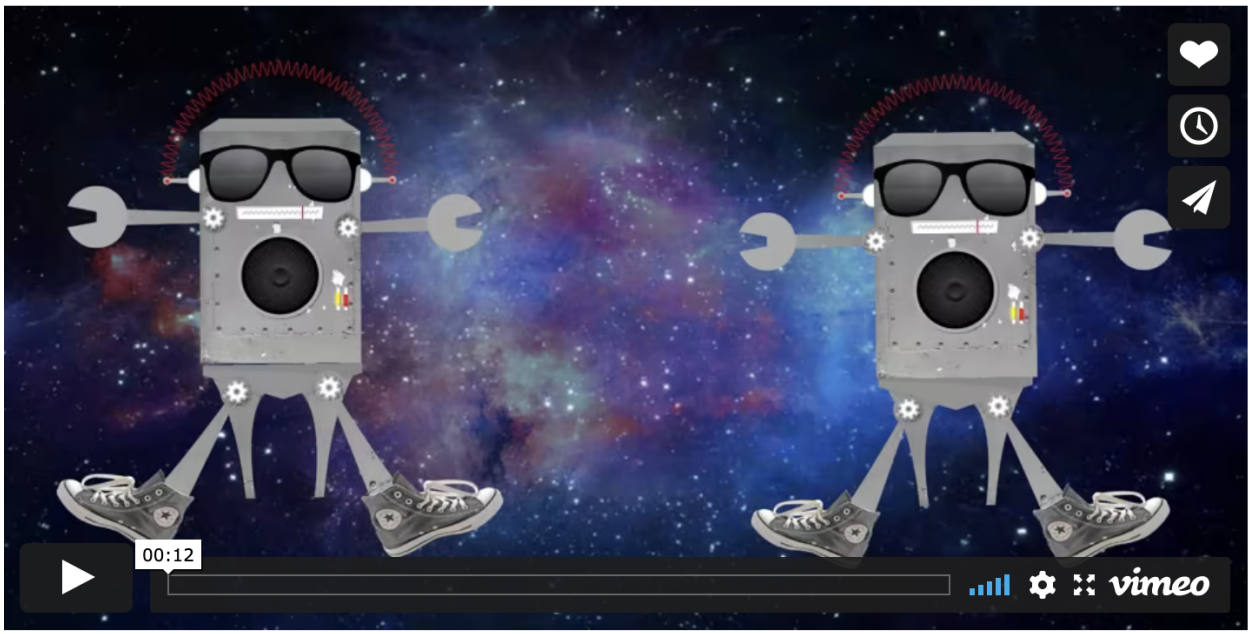
Going deep in mathematics through design and iteration.

Alfredo entered the workshop a day late, joining the activities with enthusiasm. When jumping into the activities, it was apparent that while he lacked some specific academic vocabulary, his non-academic explanations of math concepts were insightful and showed a firm grasp on a subject he enjoyed. For example, within the first day, Alfredo used the number line to explain to another student how ½ could be turned into multiple equivalent fractions by multiplying a whole of a different denominator. He explained this in non-academic terms, kneeling down on the ground with the number line and writing numbers with his finger next to the written "½" on the line:

> *"Like times, and then you put a 2 and a 2. And you like equals, 1 times 2 is 2 … and 2 times 2 equals 4, it's gonna be 2/4."*
>
> *"Or you can times it like this: 1 times 3 equals 3. And then 2 times 3 – what you timesed here – is gonna be a six. It's gonna be 3/6. It's a half."*

During this workshop, Alfredo thrived when given challenges beyond the original parameters for an assigned project. He worked quickly when assigned a project, willing to settle into his work and work out each challenge in the design process. Alfredo alternated between engrossed in his work and seeking out opportunities to share his progress with the facilitators and those around

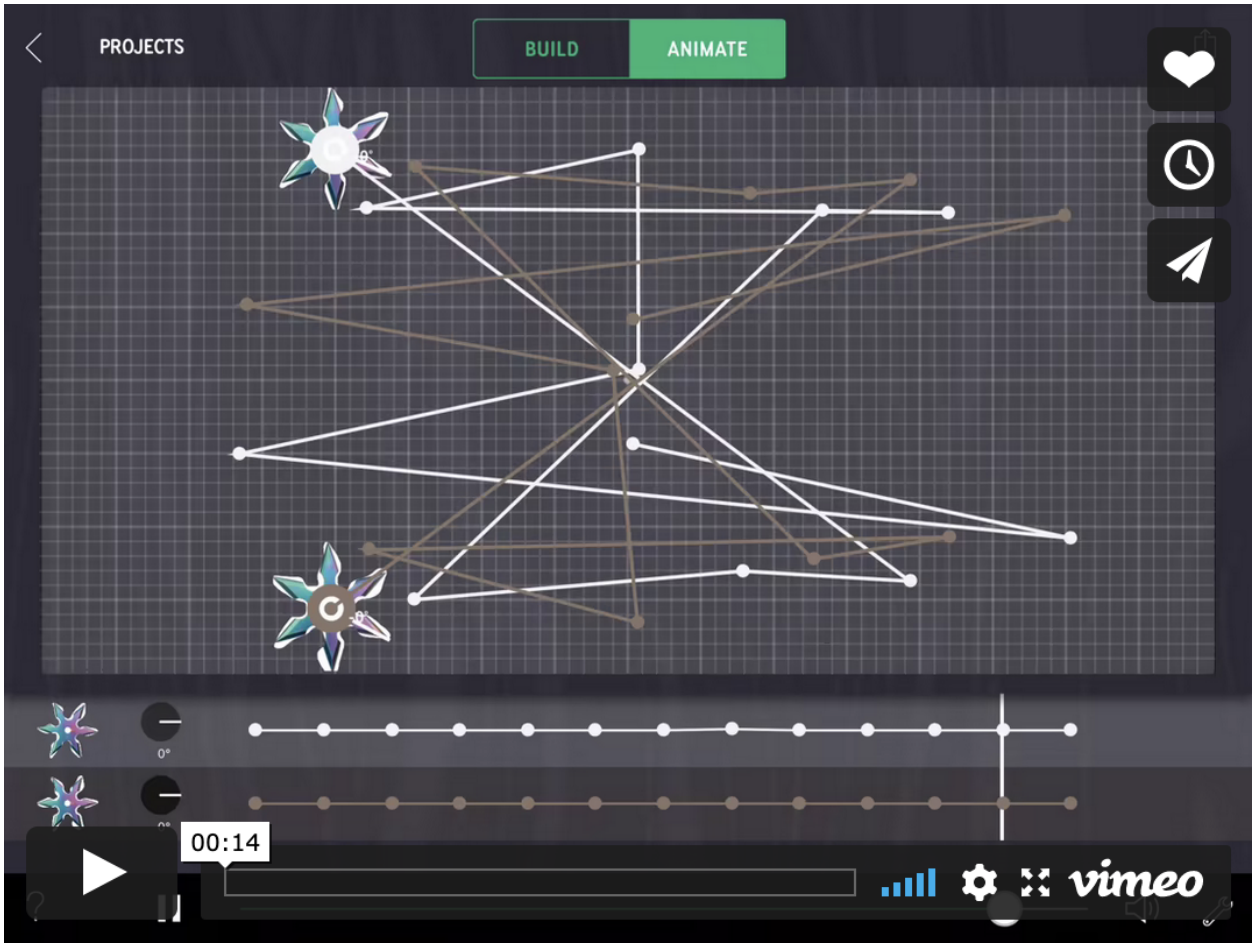
him, explaining how he created his artifacts, where it had been a struggle, and the math concepts involved in their creation. Alfredo was eager to discuss math and design theories with those around him, and after discussions of the concepts and theories would later seek out opportunities to discuss how and where he had used those ideas in his later work. For example, after having discovered that the vertex of an angle on a body looks most realistic when it is placed where a joint would normally be, Alfredo sought out multiple facilitators to explain why his new vertex placement made sense and how the previous placement had not been a good design choice.



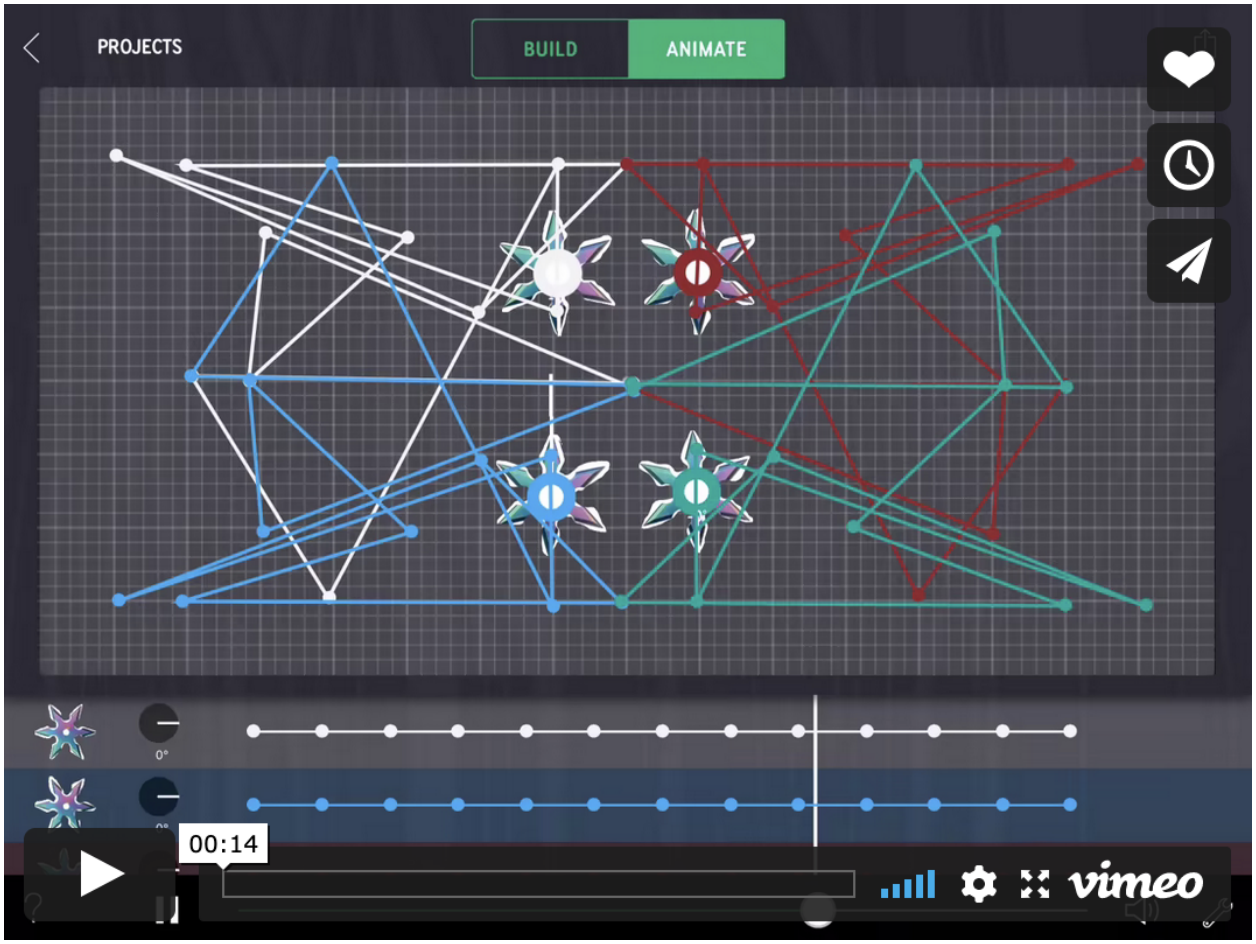
Example 1: Alfredo challenged himself to create a double-figure dance using Choreo Graph for the 'symmetry dance move' activity. Despite being a difficult task, he persisted in trying to get the parts of each dancer moving symmetrically, as well as the full-body rotations.

In the symmetry unit, Alfredo created first a single-figure symmetrical dance and the instructors challenged him to next create a double-figure symmetrical dance. He and another student sat apart from the rest of the group as they worked, and Alfredo was completely engrossed in his work. This second challenge proved to be a struggle for him, and his idea was ambitious. His double-figure dance (Example 1) involved asymmetrical movements on each of the dancing figures, as well as full-body rotations and crossing the line of symmetry. He worked quietly, occasionally needing guidance in how to focus down to first creating one side's movements, then copying it over to the other side. He began using the coordinate plane to match each side and make them perfectly symmetrical. All of these skills in the double-figure symmetry challenge later came to fruition as he created first an abstract two-figure (Example 2), then a four-figure symmetrical animation (Example 3) through translation, complete with figures crossing lines of symmetry while remaining perfectly symmetrical to the other three. Alfredo presented this work at the Family Celebration, explaining the math thinking behind it in non-academic terms and gestures:

"So basically, all there is actually four ninja stars here and all of them are going symmetrical that means … symmetrical means they are going like the same, the opposite direction of one. Like if you stand in the mirror, the mirror has to do the same thing you're doing with the other arm so this is what I did. As you can see, all of them are moving in the same direction – one goes to the other corner, all of them go to the corner, and at the end, they look like they explode and go back again."

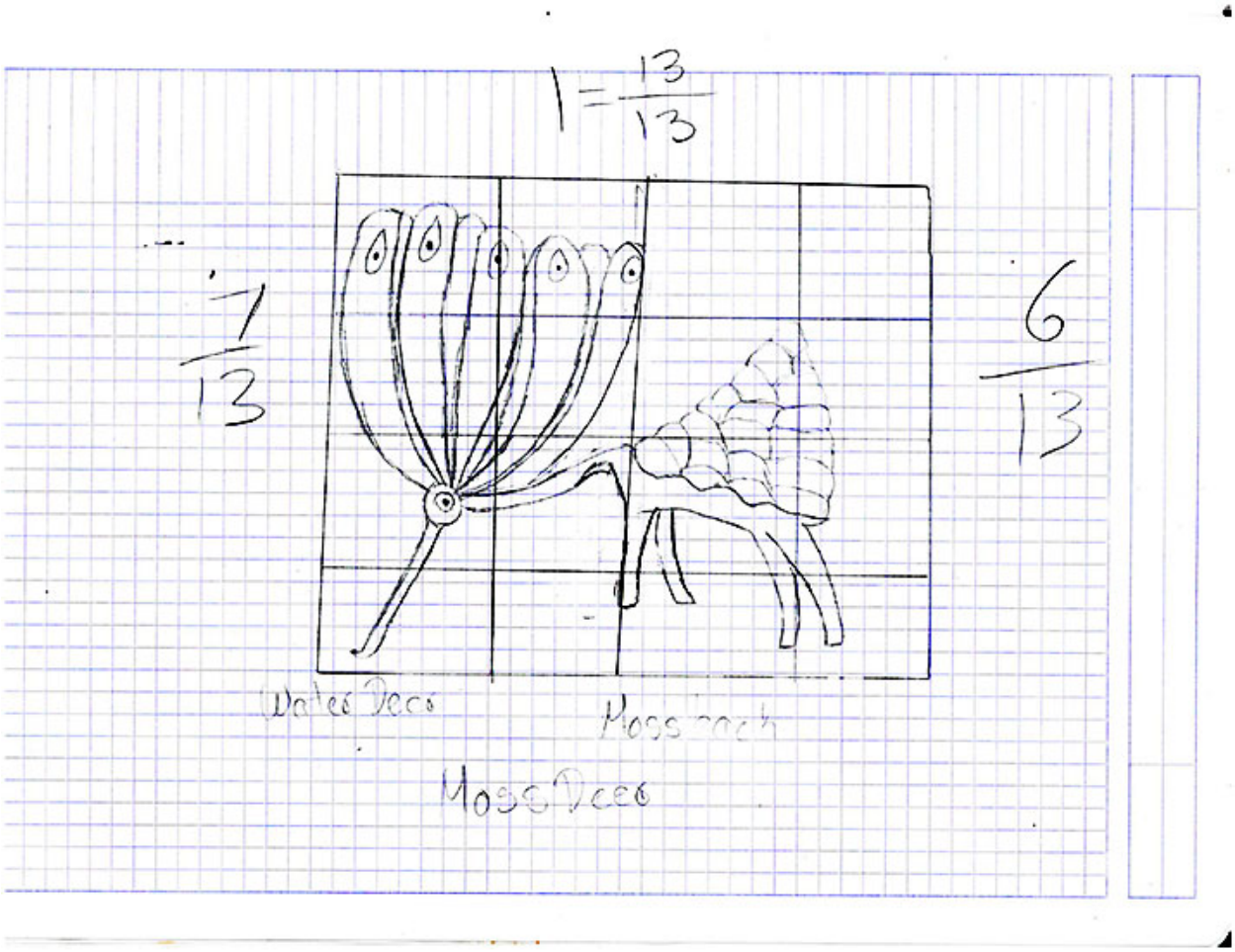


Example 2: Alfredo created this complex abstract two figure animation- as shown with translations turned on in the Choreo Graph app. Alfredo used coordinate pairs to decide how to make one figure symmetrical to another for each move in the animation.



Example 3: Alfredo's four-figure symmetrical animation, using translations to guide his design. Completed with figures crossing lines of symmetry while remaining perfectly symmetrical to the other three.

This artifact was created the day after he had created the double-figure symmetrical dance after Alfredo had been challenged to create translation designs in Choreo Graph. He combined the practices and math concepts he had learned in the symmetry unit, and the new information of translation using a coordinate plane and coordinate pairs, into a complex illustration of symmetry. When describing this project, Alfredo precisely described the coordinate pairs each figure traveled to that made the movements symmetrical, pointing out that when each pair was "the same, but one is negative," (e.g: (2, 10) and (-2, -10), the movement would be symmetrical.



Example 4: Alfredo's journal sketch of two animals combined and the fractional parts each took up to make a new whole. Creating grid lines on the graph paper was a way that made counting the squares and figuring out the fractions more efficient.

During the [crazy animal mashup]() activity, he first drew a precise sketch of his creature, then recreated that sketch in the Fraction Mash. Instructors challenged him first to describe the digital creation in fractions, eventually having him describe his graph paper sketch plan (Example 4) of the combined animal in fractions as well. He performed this by creating a new grid size that would make counting easier on top of the sketch.

Example 5: An example of Alfredo's animal species, "seanake." He used Fraction Mash to merge a snake and seal together for his final project. His playful combination of words to form new ones shows his growing comfort with the English language.

For his final project, Alfredo created a zoo of new Fraction Mash animal species, playing with the English language by giving each of them combined names such as "Seanake" for a seal and a snake (Example 5). He then imported all the animals into Choreo Graph and animated visitors looking at all the animals in the zoo. He was delighted to share his artifact (Example 6), describing how he created the animals in Fraction Mash. He laughed along with the rest of the audience as he read each and explained the syntax rules for how he came up with each combined animal name.

Example 6: Alfredo used Choreo Graph to animate visitors looking at all the animals in the zoo.