Digital Design for English Language Learners: Javier 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.

Javier's family is from Ecuador, and though he was born in the United States, he spent a few years in Ecuador before returning to the United States. He spends a lot of time at the library since both his parents work. Javier was just entering middle school and was nervous for the coming year to be attending a new school with new people.

Persistence through challenges.

Coming into the workshop, Javier was confident in speaking up and often dominated conversation in the classroom. In the pre-assessment, he had no trouble deciphering numerators and denominators of given fractions, correctly answering each question. Before this workshop, Javier saw himself as good at math and rated it "80-20" for enjoying it to disliking it.

During the workshop, Javier was always excited to present and show his work to the class and was always ready to discuss the math theories he had developed while working with the Noticing Tools™:

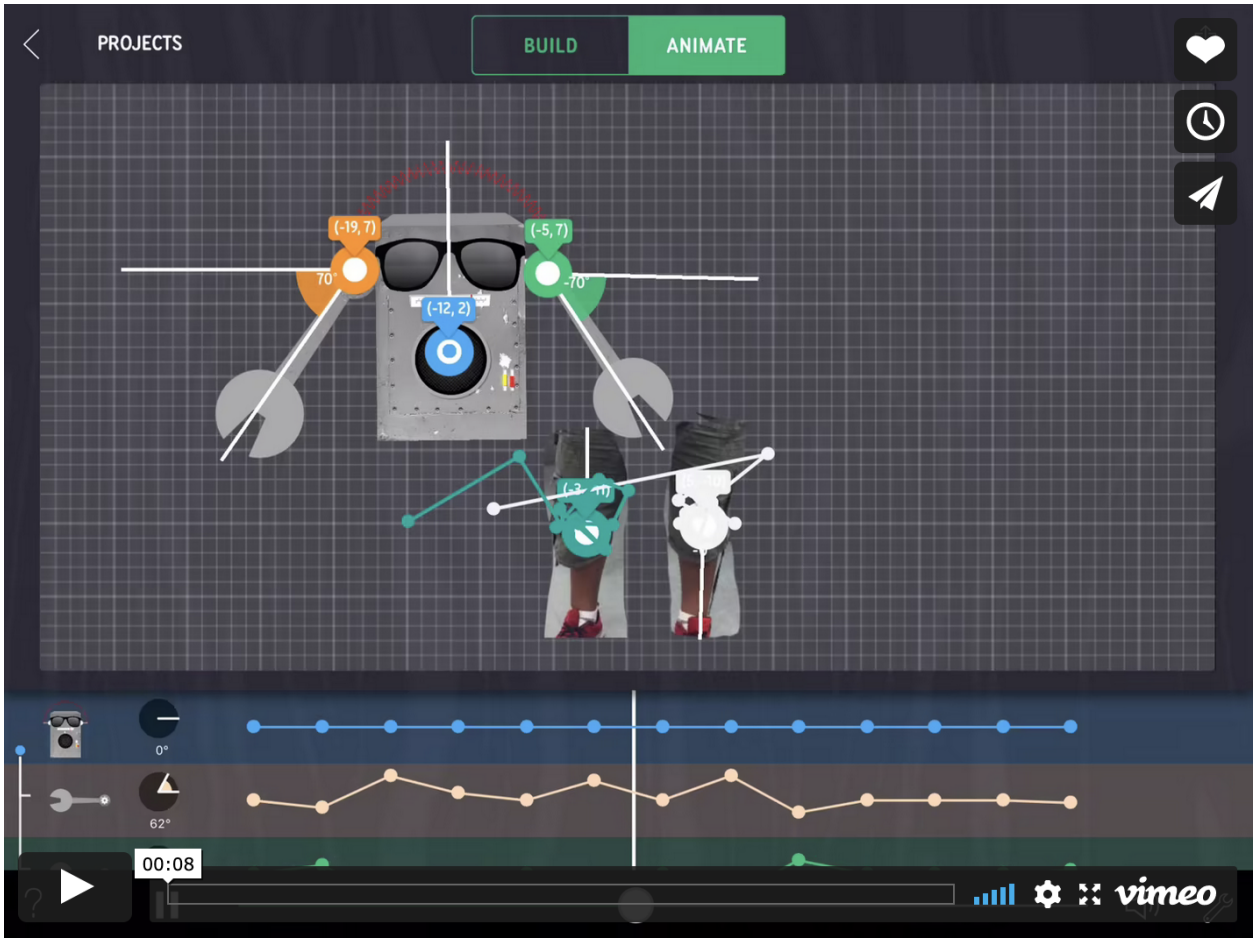
> *"I actually learned that right now, if you look right here, depending on the spaces between the two points of the angles, from one point to another, depending on the little space between, that'll define what speed it will go to. If, like for example, if I go to 55 … if it has a really little space in between, it's pretty slow. But, for example, if I go from 180 to -90, it'll actually move pretty fast because it's a really big space between the two points."*

Much of his thinking was done out loud, and he was constantly working to understand and discuss the math concepts in class with the instructors. During a presentation of the angles he had found and categorized in the Angle Hunt activity, Javier explained why he thought a particular angle was obtuse rather than acute. He gestured from the image to the drawn

protractor, describing how the way that the angle opened up would place it on the “obtuse” side of the protractor, rather than the “acute” side. As soon as the instructors saw his misconception, they were able to discuss an important aspect about angle classifications that had been glossed over before: The direction the angle is pointing and opening do not define its type, the size does.

According to Javier, his greatest takeaway from this workshop was coping with the challenges and struggles of a project without giving up. When working through the number line with the instructors, Javier regularly avoided the use of odd-numbered denominators in his fractions because he could not figure out what the half-point would be for an odd denominator, making the placement of a fraction on the line challenging. The instructor did not allow him to shy away from this challenge, instead, providing him with a way to find the half of an odd number, then encouraging him to not only practice it on his own but also teach a fellow student how to use the method as well. In another project, Javier neared fatigue in trying to match angles on a figure for his symmetrical dance:

> *Javier: “It took me so much to get the perfect place!”*
>
> *Ximena: “Most great things come out of a struggle.”*
>
> *Javier: “That’s true, I actually made the body move but then I remembered that’s not symmetrical.”*

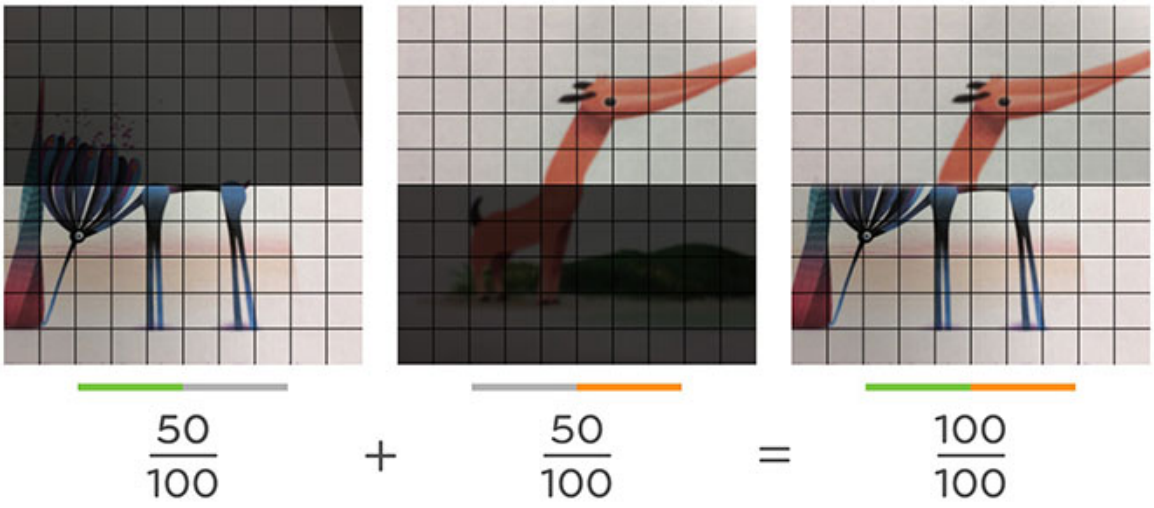


Example 1: Javier's figure animation on Choreo Graph for the mood dance activity. While trying to achieve symmetry between parts, he struggled to match the movements of the limbs of his figure and to connect them to the body.

Example 2: After struggling to connect a figure's limbs, Javier created a single-figure dance, pushing himself to match the limbs and finally achieving success in the Choreo Graph app.

After persevering through the struggle of matching angles and keeping his figures' limbs connected (Example 1), Javier went forward to create not only a single-figure symmetry dance (Example 2) but also a double-figure symmetry dance (Example 3). Throughout the workshop, Javier struggled with struggle, and on occasion, the thought of an additional challenge coming his way was too much for him.

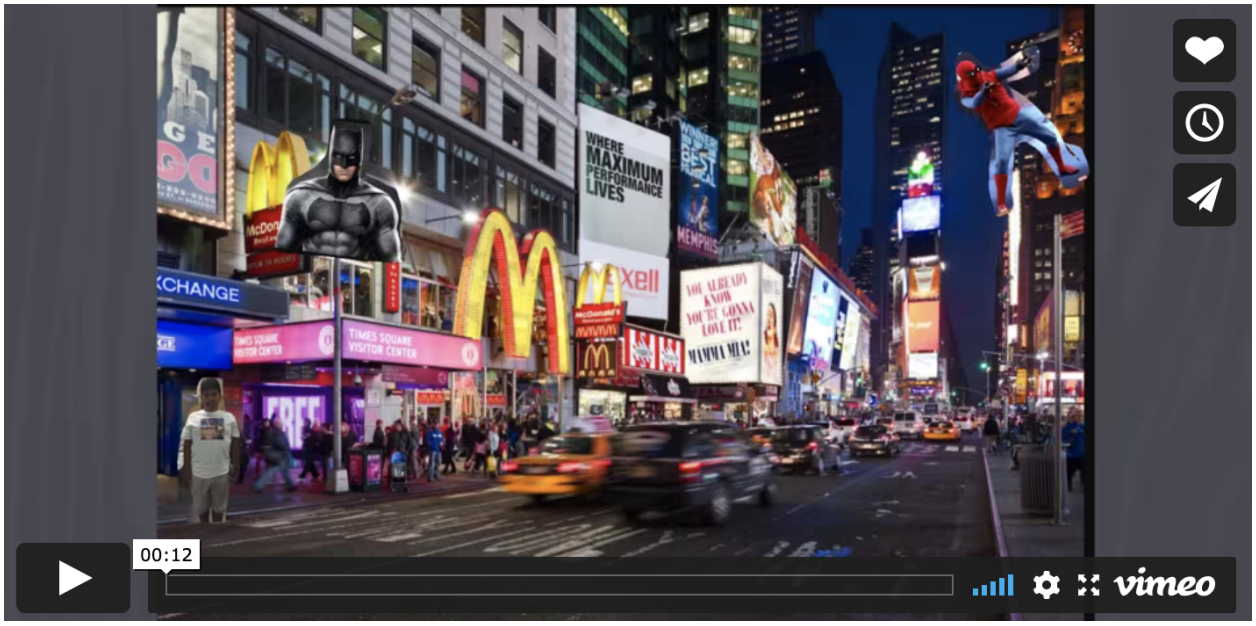
Example 3: Encouraged by his earlier success, Javier persisted by creating double-figure symmetry dance in Choreo Graph.



Example 4: Javier created a new creature in Fraction Mash, with a 50/50 combination of two images of creatures. He had difficulty redefining the new whole of his mash-up, which required additional breaking down of the problem.

After first completing his animal mashup in Fraction Mash with a simple 50/50 combination of images (Example 4), Javier intentionally avoided any further levels of challenge. Xiomara and Heidi instead appealed to his desire to show his understanding of concepts by asking him to try redefining the whole of his mashup, since the level he stopped at was “way too easy for someone like [him]”.

For his final project, Javier created a three-part presentation of a superhero battle (Example 5), extended from what was originally intended to be a one-scene chaotic brawl. Heidi guided Javier through this additional challenge of creating three intentionally designed scenes with three narratives, working through the struggle he felt when faced with another challenge late in the week. The narrative motivated him to move forward with the more complex idea, as did the idea of presenting it to a room of parents and staff that had not yet seen his comprehension of math content.



Example 5: Javier's final project consisted of a three-part presentation of a superhero battle created in Choreo Graph.

In the post-assessment, Javier remained well versed in the workings of fractions and their parts. He enjoyed and understood math more after this workshop, and understood the necessity of struggle a bit more as well:

> *"Now I feel like it's kind of easy, but like that it also takes some challenges to make it easier. And I think it's pretty fun, actually, like way funner than before. I used to*

think math was really boring, but now I really think that math has its fun ways as well."