



## Digital Design for English Language Learners: Rayyis and Nikhil 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.*

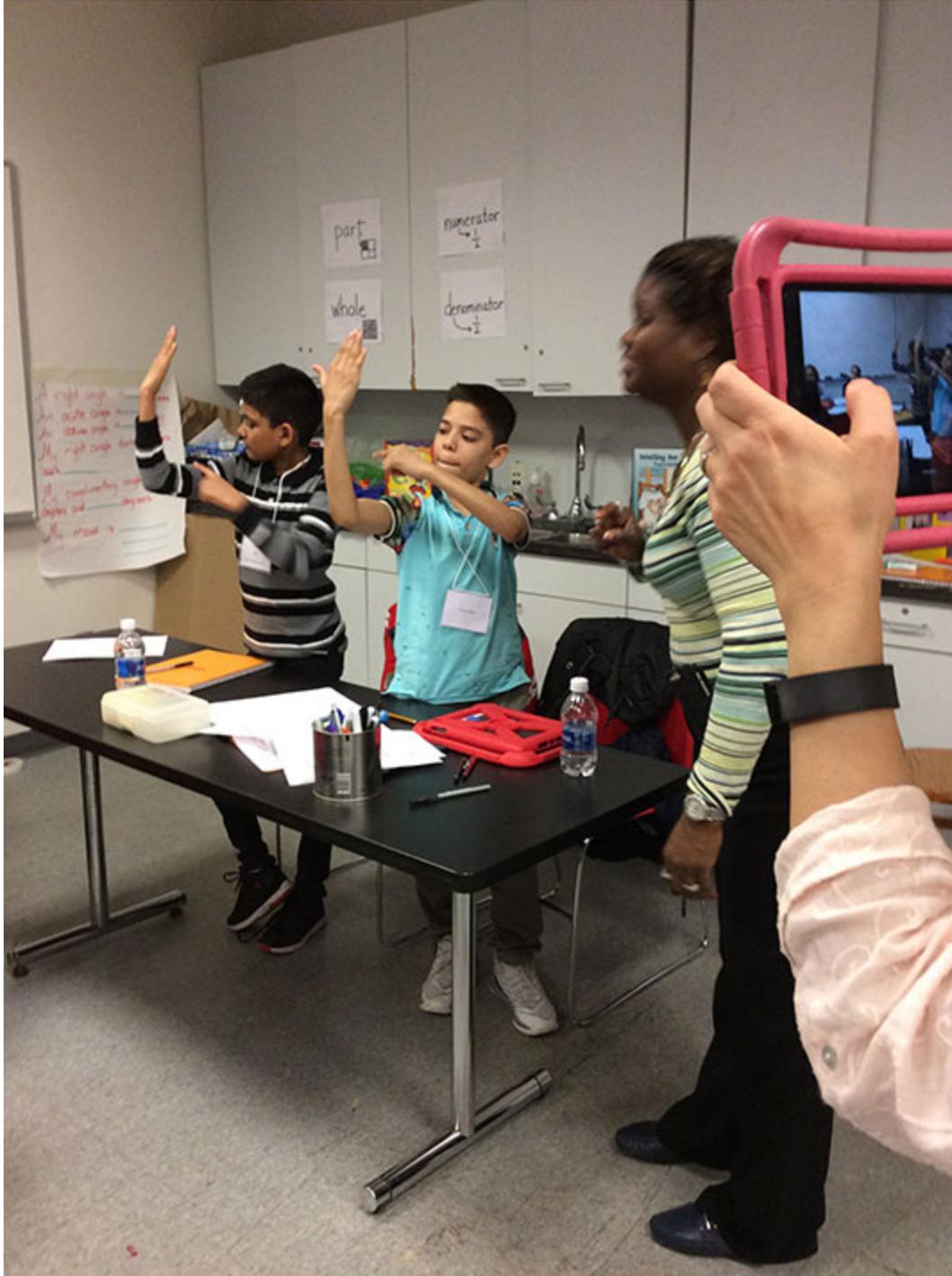
*Rayyis and Nikhil were unique in these workshops, as they were the only two English Language Learners who did not speak Spanish as their first language. While Nikhil was from Nepal and Rayyis was from Bangladesh, both had been in the United States for only five months and were encouraged to help each other navigate a class where no one else spoke their languages.*

### Paired learning as a path to rich math discourse.



*Example 1: Nikhil (left) and Rayyis (right) work collaboratively on an iPad in the workshop. Rayyis largely controlled the iPad, but Nikhil provided ideas for what their project should be.*

Rayyis spoke Urdu, with slightly more command of English than Nikhil. Nikhil spoke Bengali, a dialect of Punjabi that could be understood by Rayyis even if it differed slightly, and had less command of English than Rayyis. Despite still learning English, Nikhil was more verbal during the design process than Rayyis and pushed him to create more ambitious work. The two paired up on a single iPad that Rayyis primarily controlled, despite the fact that each one had their own iPad to work on (Example 1).



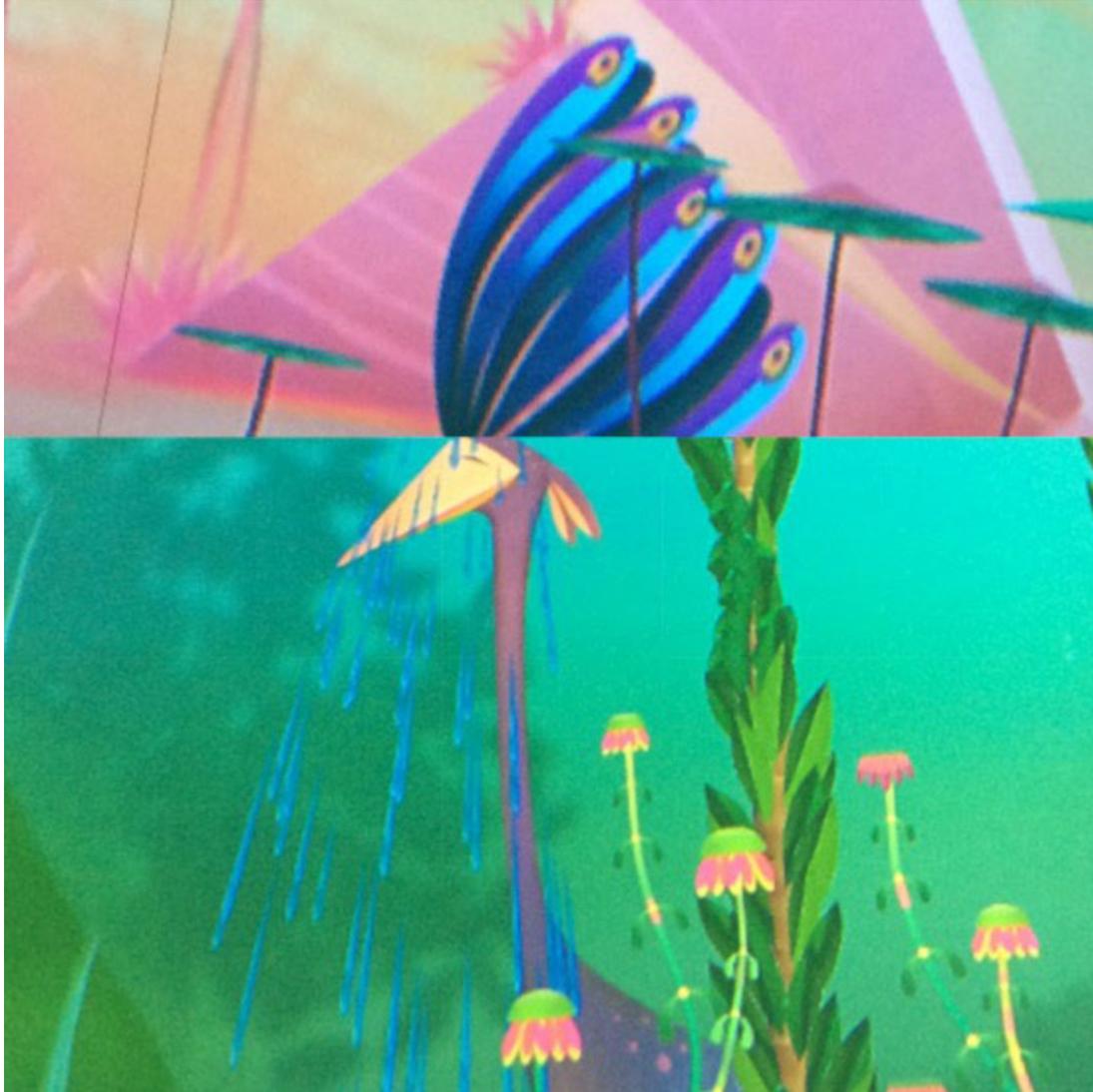
*Example 2: Nikhil (left) and Rayyis (right) act out right angles with their arms, pointing at where the angle is formed to the instructor. They physically acted out angles often, especially when figuring out their animations.*

Our instructors were challenged by these students, and our TESOL-trained instructor stepped up to help these students through physically acting out concepts (Example 2) and using physical math tools like a large number line on the floor of the workshop to address concepts such as

finding the half of an odd number. Instructors would lead Rayyis and Nikhil through their calculations to find half, walking along the number line to show where the halfway point would lay. Rayyis and Nikhil embraced the physicality of the instruction, referring back to the physical descriptions later in the workshop. The two also relied heavily on the charts and written posters that were on the walls, finding English math terms for the concepts they explored in the workshop.

From the beginning of the class, Rayyis engaged in class discussions and debates bilingually. He became a ringleader for the pair, presenting the work that he and Nikhil had put together in front of the class, and translating for Nikhil when they presented their work individually. He was better able to follow along with what the workshop was doing and often told Nikhil what to do during the workshop. Nikhil followed Rayyis' lead but did not do so unquestioningly. When Rayyis was frustrated with a project or question, Nikhil would push back to persevere or correct his math when it was incorrect. The two engaged in spirited debates about interpretations of the math in their projects or in their notebooks, resulting in greater understanding for both of them.

Nikhil had many ideas of his own throughout the workshop, but due to his limited use of English, he could not directly communicate them to the instructors or fellow students. Instead, he brought his ideas into the products that he and Rayyis produced together and would make clear during presentations that they were ideas that he had contributed.



*Example 3: Nikhil and Rayyis' combined animal. Nikhil spoke adamantly in Bengali that the feathers should be on top of the taller animal's head, while Rayyis translated in English.*

While designing their combined animal (Example 3) in the workshop, the pair worked together on Rayyis' iPad to create a combined creature. In his home language, Nikhil described his ideas of how to combine the animals with Rayyis, who usually replied in English as they worked. Through their bilingual discussions in their collaborative process, facilitators and instructors were invited into the discussion. Facilitators guided them through the process, as Nikhil made his ideas clear for what should happen and Rayyis executed them or pushed back in favor of his own ideas. At the end of the process, Nikhil said that they had created exactly what he had said they should make. When it came time to discuss the fractional makeup of their combined creature, Nikhil chimed in to answer the instructor's questions with the English that he knew to describe their math thinking:

*Instructor: "OK, so which animal has more? Is greater?"*

Rayyis: "The 15 out of 25."

Instructor: "The 15 out of 25 is more. Is it more than one half?"

Rayyis: "More than one, yes. Yes, because ..."

Nikhil: "One half is 12 point 5."

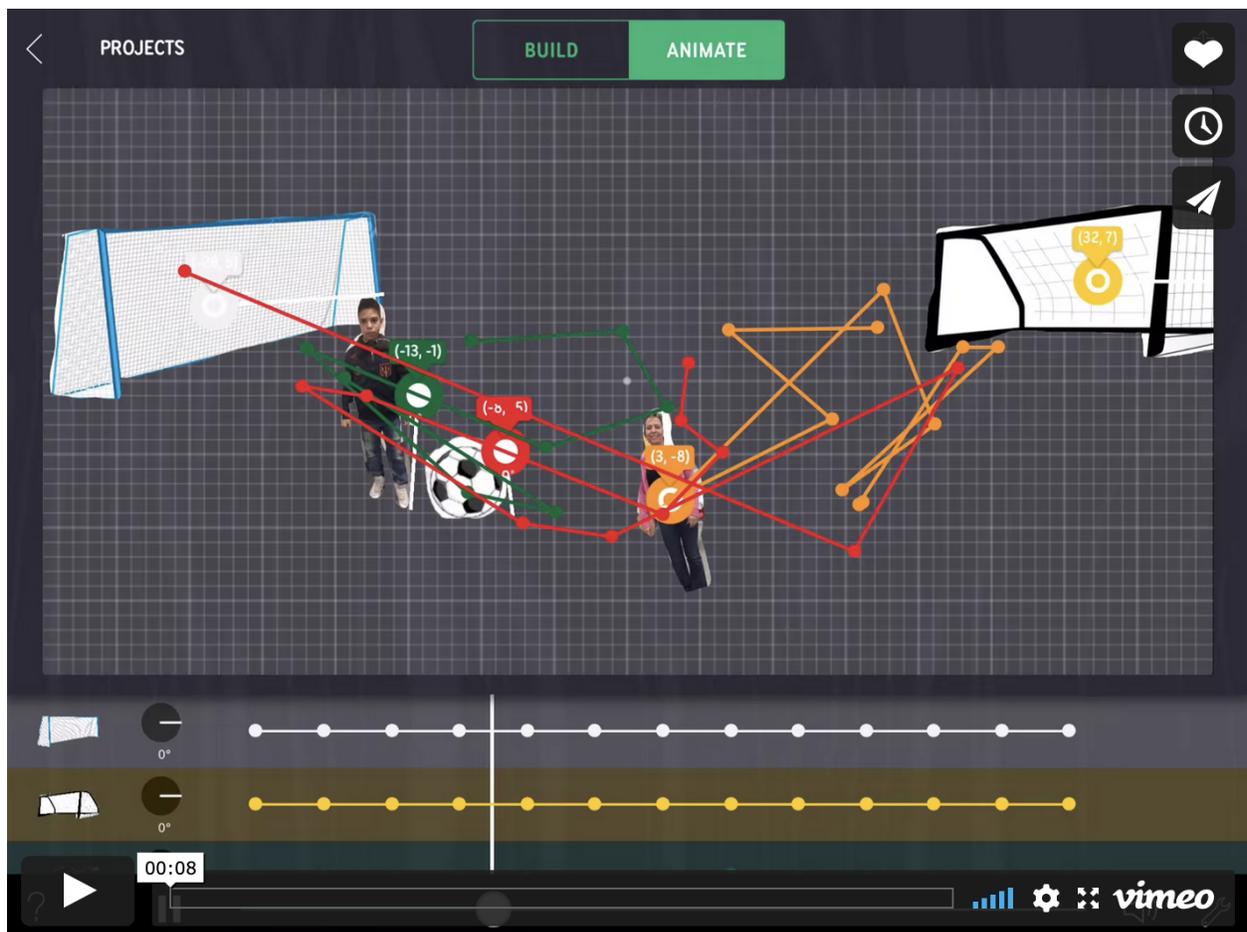
Instructor: "Yes, good, that's right, and ..."

Nikhil: "And ..."

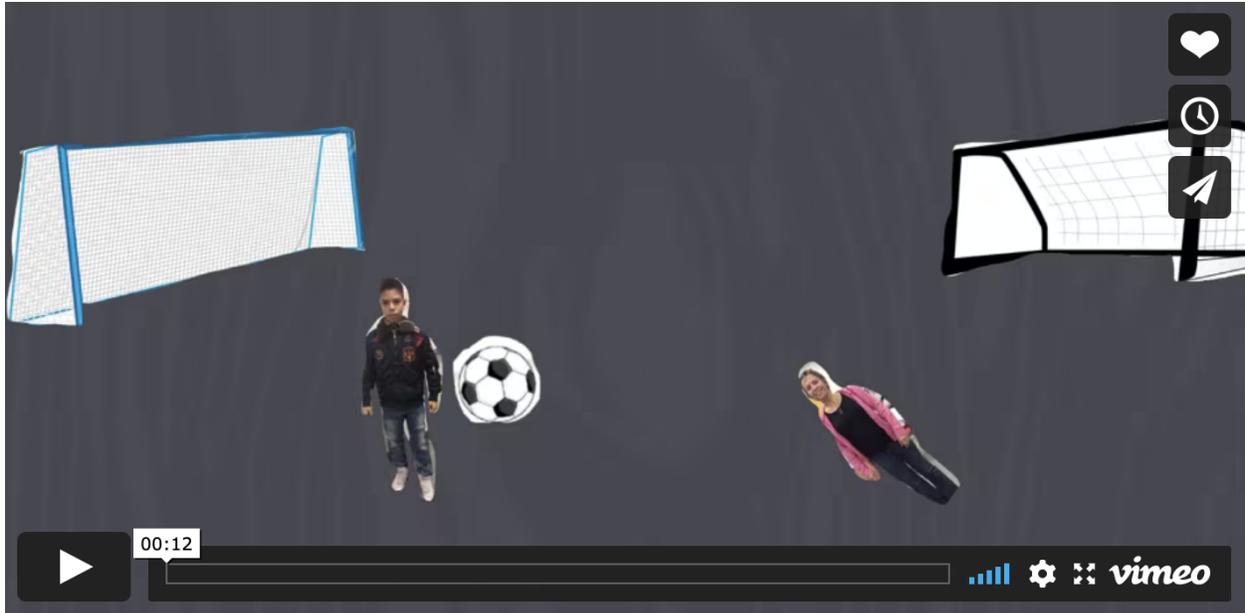
Rayyis: "And 15 is ..."

Nikhil: "Bigger."

Rayyis: "Bigger."



Example 4: Rayyis' final project with translation lines and coordinate grid visible. Rayyis used the translation tools as a guide to figure out how to make a "score."



*Example 5: Rayyis' final project as he showed it at the Family Celebration, without translation lines and coordinate grid visible.*

While Nikhil did not remain in the workshop to create a final project, Rayyis stayed and created a complex animation (Example 4) in [Choreo Graph](#) of an instructor and himself playing soccer (Example 5). After he gave his presentation in English at the Family Celebration, Rayyis' dad expressed his pride in his son's progress:

*"Do you realize he is only in the country six months? I can't believe that he was able to be up in the front and do this."*