PIPER

Engaging all types of learners in collaborative STEM experiences with PBL

How students in one high-need district got completely absorbed in STEM, language, problem solving, and collaboration.

Reedley, California is home to **Kings Canyon Unified School District**, a district where **80% of students qualify for free or reduced lunch and 30% are English-language learners.** Like most school districts, digital fluency and STEAM education are top-of-mind and the district was looking for solutions that would work not only in a typical learning environment, but also for ELL students.

As a result, Joseph Valero, English Language Development & Migrant Workers Director for Kings Canyon, organized a summer program for the district's highest-need students in grades 4-8.

Valero's goal was a simple, but ambitious one:
Get students who would normally be behind, ahead in computer science... all while minimizing the lift on teachers and staff.

And for that, he looked to Piper.

Kings Canyon had previously piloted the Piper Computer Kits during a Saturday Enrichment program and Valero was excited about rolling it out on a larger scale.

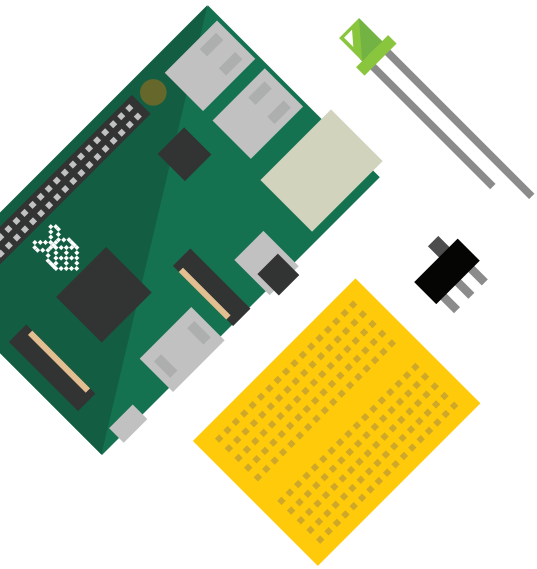
Kings Canyon purchased Piper Computer Kits district-wide for their Summer Enrichment program. Piper Computer Kits teach students to assemble, wire, and code working computers. (for more information and kit specs, click here)

The first step was introducing Piper to the teaching staff through a professional development workshop run by the Piper School Success team. Many of the Kings Canyon faculty had never taught electronics, computer science, or coding before. In just a half-day, the staff become comfortable (and excited) with not only the Piper Kits, but teaching STEM curriculum to all types of learners.

"It was really exciting when we finished putting the Piper together and it turned on," said KCUSD teacher, Gwenn Southerland. "Then we got to do some of the coding where we were giving it commands. I don't have a background in teaching circuits or anything like that. There is a series of red, yellow, and green lights... like a stop light. It was really cool for me because then I started to understand, oh my gosh this is what is taking place in the city. Someone's coding a computer to get these lights to come on."

The teachers' enthusiasm rolled over into the classroom, as the students were immediately absorbed in the unique lessons.

> *The kids loved it. Absolutely loved it. They told their friends that they need to come to summer school. Really. We had more kids show up either the second or third or fourth day wanting to be part of our program because of Piper.*
> *- Gwenn Southerland*



The engagement coupled with Piper's student-centered process meant the teaching staff were able to step back and allow each of the groups to problem solve on their own.

"I was able to just turn the kids loose," said teacher Felicia Loera. "We went over some basics in the beginning -- what's an input, what's an output-- stuff like that, but while they were building the kids picked it up easily."

The hands-on nature of the Piper kits and its inquiry-based curriculum, developed in collaboration with Piper educators, creates an experiential learning environment where kids naturally learn problem solving and collaboration.

"What I really like about the Piper as an educator is it forced me to be hands off," said Southerland. "I didn't have the answers for everything. I couldn't tell you what to do. A lot of our kids are used to being given the answers and just dowing things by rote. And so it was really wonderful for me to be forced to take a step back and say, 'Well I don't know. What do you think? What do you want to try?... Well, try that.' If that didn't work, 'Now what are you going to do? What makes sense? Go back to the blueprints.'"

Piper Kits were assembled in group of 2 or 3 students to encourage collaboration.

"I picked boy-girl pairs," said Loera. "It forced them to work together. They really built a relationship with their partner. Someone they probably wouldn't otherwise talk to, they talked through the problems. And they would watch the other teams and when they saw someone finish, they'd go over and ask, 'how did you do that?'... It really built a team community in the classroom."

> *We want to encourage students to work together like you do in business, like you do in your regular job. I would put two or three students together on one Piper and they had to work together. And then it was really neat for them to realize that they have different strengths. - Gwenn Southerland*

And, students in the program self-reported a **24% increase in their ability to collaborate** towards a common goal and help others along the way.

The collaborative nature of the projects also allowed different learning styles and aptitudes to shine through that may not come to the surface in other settings. Especially for those students with language or reading difficulties.

"Another thing I really, really liked about the directions for students was it was in a blueprint form... like you would see in real life. And there was very little text to actually read. It was all visual and problem solving. So that made it accessible for all the students regardless of their language ability. And regardless of their reading comprehension," said Southerland.

"I had one young man who, you know, gets in trouble, even though he's a really good kid. He was just so focused and didn't even look at the blueprints. He took one look at it and just started putting things together and problem solving. He had his Piper built and turned on before anyone else. It allowed him to really shine."

Overall, Kings Canyon students self-reported that they became **28% more digitally fluent** and have a greater understanding of how everyday devices work following using Piper.

Other key findings of the Kings Canyon Outcome report (complete report can be found here) showed:

1. Students showed greater levels of mastery in computer science through metacognition

2. Students displayed more comfort in the process of problem-solving and accepted that cognitive dissonance leads to greater learning and better outcomes

3. Student grit & perseverance increased after using Piper and students developed a better growth mindset towards problem solving

4. After Piper, students displayed greater leadership qualities when working with a group on computer science challenges

Valero appreciated the results and positive reactions of the teachers so much that he presented the data and the experience to their school board.

Piper will be continue to be used in Saturday Enrichment classrooms and beyond in Kings Canyon Unified Schools.