

EXPANDING POSSIBILITIES:

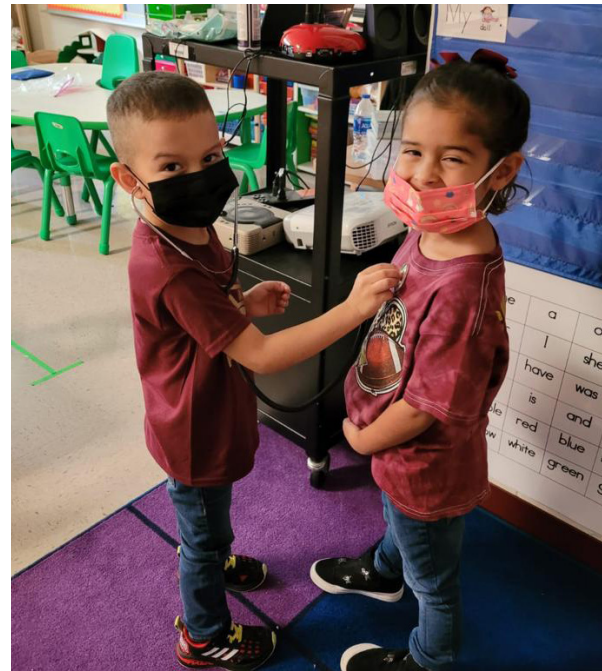
**Student Voice Driving
STEM Growth**



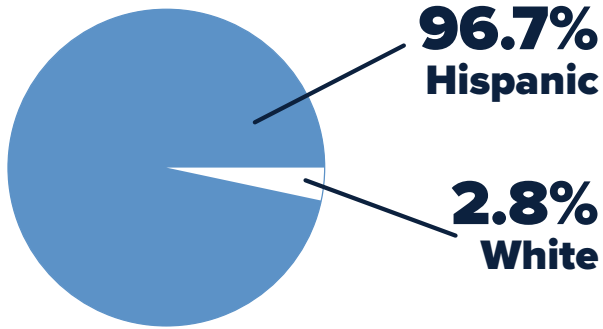
Early STEM Exposure: Long-term STEM Success

Earlier this school year, Los Fresnos High School Project Lead The Way (PLTW) engineering teacher, Javier Martinez, stepped in front of a 4th grade class to talk about his students' work with **robots and coding**—and got a surprise. “One kid said, ‘Oh you’re using loops...where you get things to repeat,’” Martinez recalled. “And I said, **‘Yes, that robot is using loops,’ and I kind of got goosebumps because this is elementary, and they know about loops.**”

When Los Fresnos Consolidated Independent School District set out to **create a PLTW pipeline** extending from preschool through high school, this is exactly the type of connection they were hoping to build. Holly Maldonado, the district’s Science Strategist for elementary grades, also reflected on the change in elementary students’ understanding of PLTW and their reactions to learning about PLTW courses at Los Fresnos High School. “Over the last few years...[the high school PLTW teacher] said that there’s just a **totally different feel,**” Maldonado reports, “The minute he says PLTW or Project Lead The Way, they’re like,

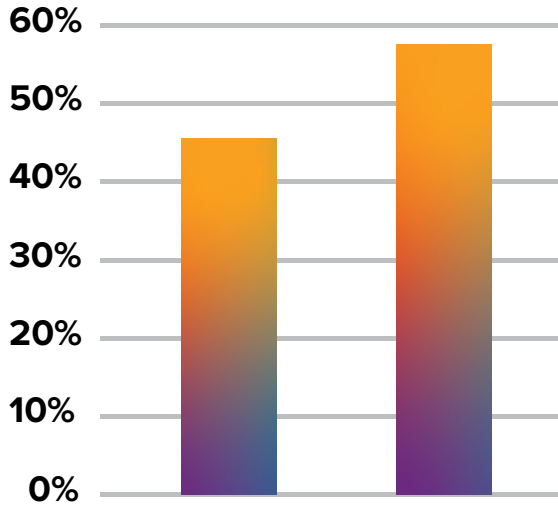


Los Fresnos CISD Student Demographics



- **48.5% Female**
- **80.4% Eligible for free or reduced-price meals**
- **20.1% English Language Learners**
- **13.4% Receive special education services**

Figure 1: **Los Fresnos PLTW expansion**



2016-2017

46%

- **4,986 PLTW students**
- **PLTW Launch:** 1 module per grade in Kindergarten through 5th grade
- **PLTW Gateway:** 4 units across grades 7 & 8
- **High school programs:** 1 course each in the PLTW Engineering and PLTW Computer Science

2021-2022

57%

- **5,939 PLTW students**
- **PLTW Launch:** At least 2 modules per grade in PreK through 5th grade
- **PLTW Gateway:** 8 units across grades 6 - 8
- **High school programs:** 9 courses across PLTW Biomedical Science, PLTW Engineering and PLTW Computer Science

‘Oh, sir, let me tell you about what we did in our class!’ **There’s just a greater excitement.”**

For Los Fresnos, introducing students to PLTW early isn’t just about **building connections** with middle and high school and **generating enthusiasm** for science, technology, engineering, and math (STEM), it’s also about **preparing students for life** after high school. “And hoping that in the end,” says Maldonado, **“we’re getting more kids out there ready to go, interested in so many job availabilities that are waiting for them.”**



“I would’ve not become the person I am right now.”

Los Fresnos’ PLTW journey began in the 2016-17 school year, when the district started PLTW Launch in Kindergarten through 5th grades, PLTW Gateway in middle school, and the PLTW Computer Science and PLTW Engineering pathways in high school. Seeing the **success of its initial investment**, Los Fresnos



Problem Solving



Critical and
Creative Thinking



Collaboration



Communication



Ethical Reasoning
and Mindset

expanded its PLTW offerings over the subsequent five years by **adding PLTW Launch modules** in elementary school, PLTW Gateway units in middle school, and the PLTW Biomedical Science pathway in high school (see figure 1).

Los Fresnos' PreK-12 approach to STEM opportunities is a commitment to their students that is supported by research. Studies indicate that early exposure to STEM is associated with **positive attitudes about math and science**, increased interest in STEM later in life, and improved academic performance in later grades, through high school (Maltese & Tai, 2010; McClure, et al., 2017). As one Los Fresnos middle school student reflected, "If PLTW was never a thing. If it never existed...**I would've not become the person I am right now.** I wouldn't have learned robotics. I would've not liked coding. I would've not discovered something I really love."



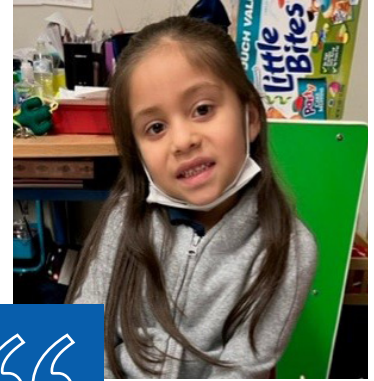
You need to catch them very early. Very, very early. Because either they find something else – which is fine – or we lose them.”

*- Javier Martinez, PLTW
Engineering Teacher*

In the elementary grades, **PLTW has sparked students' interest in science** outside of the regular school day. "Everybody wants to be part of the coding team and everybody wants to be part of robotics," says Karen Flores, a teacher at Los Fresnos Elementary School, adding that **"Before, it was our running clubs were packed, now it's coding and robotics."**

School-based experiences may be particularly influential in maintaining interest in STEM (Maltese & Tai, 2010; Maltese, et al., 2014). Indeed, potentially losing students

after getting them excited about STEM in elementary is what spurred Los Fresnos to expand its PLTW Gateway program in 2021-22. Maldonado recalls conversations with the district's Executive Director for Academics, Valarie Londrie, about getting students **"amped up**



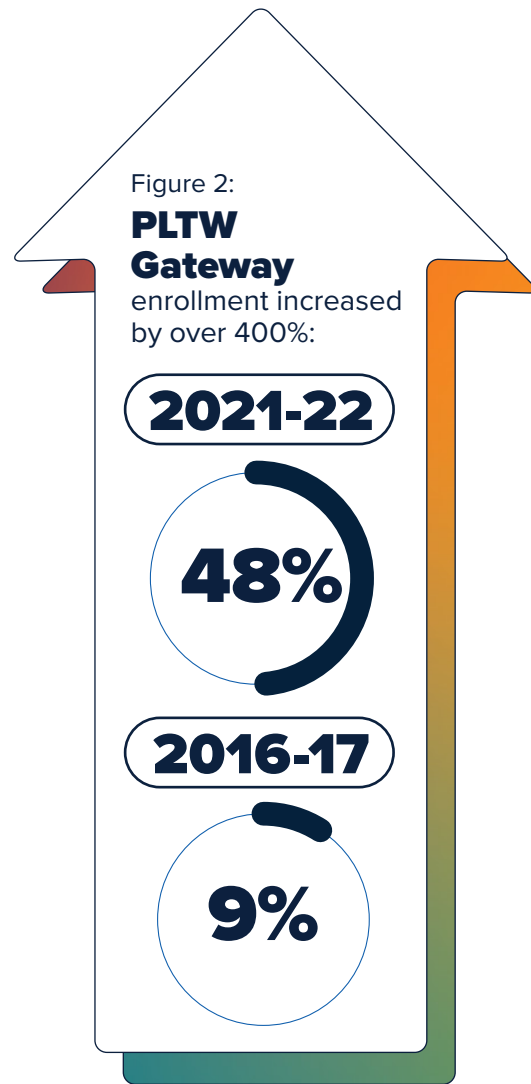
Giving them more options is obviously great. It sparks interest in different fields, especially in the STEM fields."

- PLTW Gateway teacher



and ready to go” in elementary, only to have them unable to continue PLTW in middle school because there wasn’t enough time in their schedule. Students also **expressed frustration** with having to **choose between PLTW and other electives** in middle school. As one high school PLTW student recalled, “I definitely had to choose and, well, I chose band... but it was really hard.” A 7th grader echoed this experience: “It was a pretty hard choice just ‘cause when we did it in elementary it was a really fun thing. So, letting go of that is hard.”

In response, Los Fresnos **expanded the number of PLTW Gateway** units including Design and Modeling, Automation and Robotics, and Flight and Space units, and added the Medical Detectives unit to allow students more opportunities to fit PLTW in their schedule. The district also created space for a second elective in 6th grade by combining two courses into a single reading and writing course. As Londrie describes, Los Fresnos expanded PLTW Gateway directly in response to **“student expectations and demand.”** One 6th grade student **expressed appreciation** for the changes: “I think it





really benefited us a lot...I'm really glad that the school decided to change the schedule so they could fit in that time for their students to be able to do this class."

Students have taken advantage of these **new opportunities**. In 2016-17, 224 7th and 8th grade students were enrolled in PLTW Gateway. After expanding PLTW, **1,175 students were enrolled** in grades 6 through 8. That increased the share of middle school students taking PLTW from just 9 percent to nearly half – 48% - of students (figure 2). By continuing PLTW in middle school, students can **build on the skills they developed** in their PLTW Launch lessons. As one PLTW middle school teacher commented, PLTW Launch is a “preview” to what she teaches, especially

the **collaboration** and group work required. PLTW Gateway students described PLTW Launch as “**building up to where we are now**”, noting both the PLTW Launch tools they use in their PLTW Gateway classes, such as levers, pulleys, and wedges, and the **problem solving** and design skills they use.

At the high school level, Martinez is starting to see the **rewards of early exposure** to PLTW: “Now I have students in my classroom that went to the middle school, so they have all of that [the **design process, brainstorming and coding**]. It’s like ‘wow’. It’s so seamless. It’s much easier. It’s smoother...And later on, I may have the elementary students who have gone through all this.”

**“They’ve got background knowledge now.
They’ve got a point of connection.**

- Holly Maldonado, district elementary Science Strategist



“We offer it to every student in every classroom in every campus.”

In addition to **meeting student demand**, access was an important consideration for the district when expanding PLTW. “We offer it to every student in every classroom in every campus,” says Maldonado, “trying to get as many of those kids realizing that they are successful in that area [STEM] and then continuing it on is huge.”

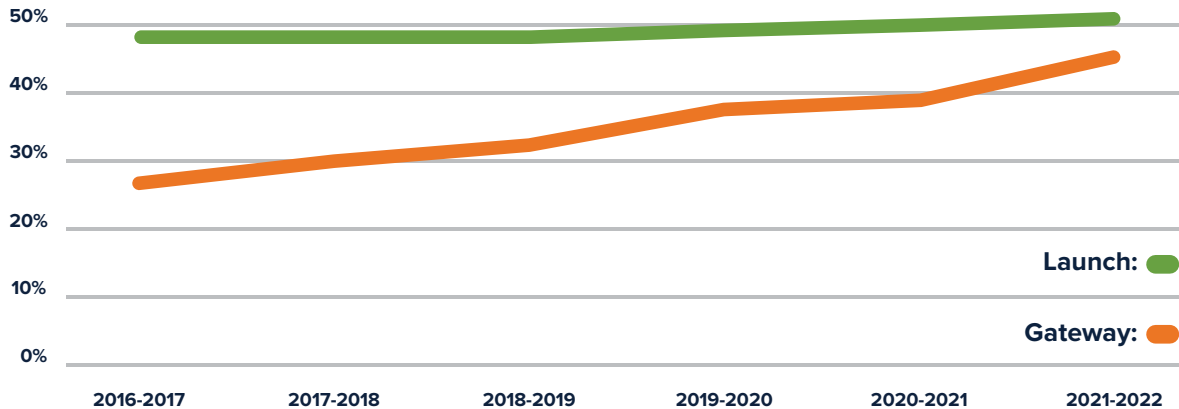
Given the **underrepresentation of women and people of color** in STEM careers, late elementary and middle school may be an especially **critical time to engage** all students in STEM classes and activities. Studies have found that students develop their science identity--whether they see themselves as a ‘science person’--during the late elementary and middle school years (Archer, et al., 2010; Tai, et al., 2006), and that **early exposure to STEM may reduce racial, gender, and economic gaps** in science knowledge and interest (Morgan, et al., 2016; Christensen & Knezek, 2017). One PLTW student experienced this firsthand with her 7th grade PLTW class: “I remember walking into the classroom – I was the only girl there. I was really

worried at first, but then **I found out that it was something that I was really good at.**” Her early success with PLTW sparked an interest in programming. “In 7th grade when we had started to learn how to code – **I coded an entire thing by myself,**” she recalled, “I felt really accomplished because it was my first PLTW class I had taken, and that really made me more interested in taking more of these classes.”

But for current 7th graders in Los Fresnos, it’s unlikely there’s just one girl in a PLTW class. The expansion of PLTW in elementary and middle school appears to be creating **opportunities for students of all genders** to participate equally. Because all elementary students participate in PLTW Launch, the percent of PLTW Launch students who are female has been roughly 50% since the program began. However, when the middle school PLTW Gateway program began in 2016-17, just one in four students was female. As more students were exposed to PLTW Launch in elementary school and as access to PLTW Gateway expanded in middle school, the share of



Figure 3: % of PLTW students who are girls



female students in PLTW Gateway grew—and in 2021-22, 46 percent of PLTW Gateway students were girls (figure 3).

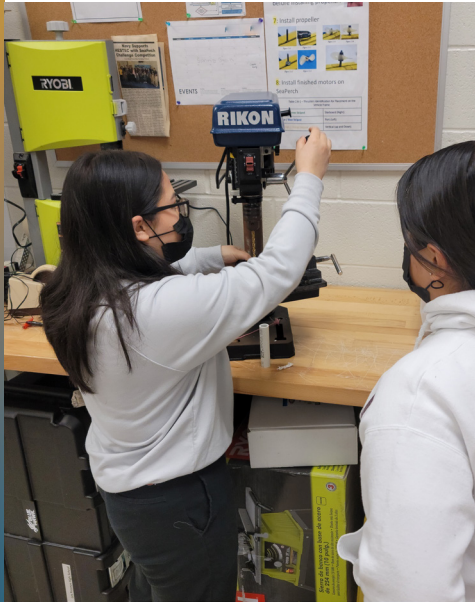
PLTW—with its **collaborative approach** and materials available in Spanish and English for both the PLTW Launch and PLTW Gateway programs—has also **helped English learners develop** their science identity and form new relationships with classmates. Middle school teachers noted that they use the Spanish version of PLTW materials,

including translations of students' journals and the Spanish version of the myPLTW site, to **help Spanish speaking students engage with the lessons** and content. Teachers also noted that the PLTW group work helps these students develop their speaking and listening skills with support from their peers.

Karen Flores, who **teaches bilingual students** in her preschool classroom, explained that she uses the Spanish language materials to introduce English learners to the vocabulary, instructions, and topic for a PLTW Launch lesson. Then, when students join the PLTW Launch lesson, they are better positioned

to follow the lesson and **apply their knowledge.**

For example, she had one student who could understand English well, but struggled with speaking the language. Flores reviewed the vocabulary and content for a PLTW lesson with the student in Spanish to prepare him for the class. The next day, he was able to show his PLTW group how to do the project. “[His classmates] let him take over and he did the whole thing,” recalls Flores. **“It was awesome. It was just awesome that the kids were like ‘wow’.** And after that...[his classmates] started





Not only when teachers can see more in their students but also when peers are able to see the potential and the capabilities within other students, those are the moments of success that we love seeing Project Lead The Way offer to us.”

- Holly Maldonado, district elementary Science Strategist

seeing him different. They started integrating him into the group.” Flores also noted that she has seen her students’ **vocabulary expand** with the program along with their reading skills because students are motivated to read the instructions and read along with the lesson videos.

Moving forward, Los Fresnos plans to **build on their success**, assessing how things are going, and making adjustments as needed. “You’ve got to jump in and you’ve got to go,” Maldonado counsels, “Once you do that and you see it firsthand with the students, it’s one of the most rewarding experiences that there is.”

At least one PLTW high school student would likely agree. Back in that elementary school classroom earlier this school year, one high school student was surprised by how well elementary students understood the work of the **high school engineering**



club. “If you ask [the elementary students] what code was, they know what code is,” he recalled, “A little kid told me, he said that **‘because of you, I want to study computer science now’**. That was completely great for me.”

“

Once you experience it, there’s no going back.”

- Holly Maldonado, district elementary Science Strategist

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