

**A Day in the Life of Carlos:  
An Eleventh-Grade Student's Experience with STEM Education  
at Southwest New Tech High School, an Inclusive STEM High School**

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**Author Note**

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The objective of the Opportunity Structures for Preparation and Innovation (OSPrI) research program is to examine the opportunity structures at exemplar inclusive STEM High Schools (ISHSs) created to engage, inspire, and prepare students for STEM fields. In contrast to highly selective STEM-focused schools that target students who are already identified as gifted and talented in STEM, ISHSs aim to expand workforce development, prepare STEM professionals, and develop new sources of STEM talent, particularly among underrepresented minority students. In addition, the ISHSs explored in this study have college preparation as a primary goal.

The OSPrI research team identified eight exemplar ISHSs across the United States to explore the questions, *Is there a core set of critical components designed and implemented in well-established, promising ISHSs? Do other components emerge?* The research was conducted in two phases. In Phase 1, the goal was to characterize the schools from the perspectives of a variety of informants within and outside the ISHSs. The case studies for all eight schools are available to read on the OSPrI website (<https://ospri.research.gwu.edu/>).

In Phase 2 of the OSPrI study, the goal was to capture students' perspectives of ISHSs as well as STEM programs in comprehensive high schools. One school of focus was Southwest New Tech High School (a pseudonym, now referred to as SWTech) in a southwestern state in the U.S. We conducted the Phase 1 site visit in May 2012. The resulting case study illuminated how its educational program contributed to this award-winning school's remarkable successes (AUTHOR et al., 2013). SWTech showed evidence of all 10 critical components listed in Table 1. Especially prominent, however, was its instructional program, which was built entirely on project-based learning and the philosophy created by the New Tech High instructional model (New Tech Network, 2015). Four other critical components (see Table 1) were also apparent: the quality of SWTech's extensive STEM-focused, student-centered, cross-disciplinary curriculum; a well-developed technology infrastructure that supported ambitious instruction; a well-qualified teaching staff with strong and varied STEM backgrounds; and a well-developed network of supports for students from underrepresented groups such as students first in their families to attend college. Emergent themes revealed the students' strong sense of a school family and a positive school climate nurtured by the school administration and teachers. SWTech's personalized education provided students with social capital and developed 21st century skills to prime students for further success after graduation.

Student outcomes showed SWTech to be a highly successful STEM school that appeared to reach each student and prepare them for college.

In November 2014 we returned to SWTech for the second phase of the study. The purpose was to capture how two students, one female 10th-grader and one male 11th-grader, experienced their school days. The research question was, *From the points-of-view of students underrepresented in STEM fields, what are the educational experiences and opportunity structures provided by their school?* Two pairs of researchers shadowed each student for 2 school days. We followed the students from the moment they arrived at school to when they left for home, observing them in classes and during informal activities. The classroom observations were guided by an observation instrument that focused on the class-level activities as a whole while another instrument was focused entirely on the target student. Using semi-structured protocols, we also interviewed the students and their parents, as well as the principal, guidance counselor, advisors, and teachers. We recorded common themes in the classroom observation notes and transcribed interviews, noting once again the presence of the 10 critical components in Table 1. We also found a new set of themes that emerged from the students' points of view of the school. After each case study was written, we provided drafts to the principal and participating students to check for accuracy, and to approve the case. This case study of Carlos (a pseudonym) is the result of this site visit and interpretation of findings.

**Table 1*****Ten Critical Components of Inclusive STEM-Focused High Schools***

<b>Critical Component</b>	<b>Practices Observed</b>
<b>1. STEM-focused curriculum</b>	<ul style="list-style-type: none"> <li>• Strong courses in all four STEM content areas</li> <li>• Engineering and technology offered or intentionally integrated into STEM subjects and non-STEM subjects</li> <li>• More STEM requirements than school district or state</li> </ul>
<b>2. Reform instructional strategies &amp; project-based learning</b>	<ul style="list-style-type: none"> <li>• Active learning; project-based learning or inquiry in STEM classes</li> <li>• Incorporation of 21<sup>st</sup> Century Skills into goals and products of instructional practices</li> <li>• Performance-based assessment practices</li> <li>• Research opportunities</li> </ul>
<b>3. Integrated, innovative technology use</b>	<ul style="list-style-type: none"> <li>• Technology an explicit part of school design and implementation</li> <li>• Technology used to connect students with information systems, models, databases, teachers, mentors, and social networks</li> <li>• Technology used for student production</li> </ul>
<b>4. Blended formal/informal extended learning</b>	<ul style="list-style-type: none"> <li>• STEM activities extend beyond the boundaries of a typical school day, week, or year (e.g., afterschool clubs, mentorships, internships; apprenticeships and summer programs)</li> </ul>
<b>5. Real-world STEM partnerships</b>	<ul style="list-style-type: none"> <li>• Students connected to business, industry, and the world of work via mentorships, internships, or projects applied to STEM learning</li> </ul>
<b>6. Early college-level coursework</b>	<ul style="list-style-type: none"> <li>• Flexible school schedule designed to provide opportunities for students to take classes at institutions of higher education or online; college credits accrued</li> </ul>
<b>7. Well-prepared STEM teaching staff</b>	<ul style="list-style-type: none"> <li>• Teachers are qualified and have advanced STEM content knowledge and/or practical experience in STEM careers</li> <li>• Teachers are collaborative and buy into school mission</li> </ul>
<b>8. Inclusive STEM mission</b>	<ul style="list-style-type: none"> <li>• The overarching, inclusive, STEM-focused mission of the school manifests itself in school practices</li> <li>• Active recruiting of students from underrepresented groups</li> </ul>
<b>9. Administrative structure</b>	<ul style="list-style-type: none"> <li>• Varies (school within a school, charter school, magnet school, etc.) and most likely affected by the school's provenance</li> <li>• Networked; able to garner community support</li> <li>• Leadership is mission-centered, nimble, innovative</li> <li>• Flattened hierarchy and shared leadership with staff</li> </ul>
<b>10. Supports for underrepresented students</b>	<ul style="list-style-type: none"> <li>• Systems of advisories, tutoring, and data and communication used to create a personalized education for every student</li> <li>• Extensive college and career counseling</li> </ul>

*Note.* Adapted from “Inclusive STEM high school design: 10 critical components,” by E. E. Burton, T. Behrend, S. J. Lynch, and B. Means, 2014, *Theory into Practice*, 53, p. 1-8.

### **OSPrI Day in the Life**

Southwest New Tech High School<sup>1</sup> (SWTech), a public secondary school (grades 9–12), sits on the outskirts of a major city in a southwestern state. The downtown area of the school district consists of a couple of blocks of down-at-the-heels early 20th century storefronts and small businesses. While it may seem out on the edge in some ways, Southwest New Tech is the center of 350 high school students' daily lives.

SWTech opened its doors to students in 2007, resulting from a confluence of opportunities and incentives. While the large comprehensive high school in the district was struggling to meet state assessment standards and failing to graduate a large proportion of students, funding opportunities to open a new school came from the Bill & Melinda Gates Foundation, as well as the state-level STEM High School initiative which included a roadmap for the schools and technical assistance from the state. In turn, the school district for SWTech provided funds to renovate a former middle school to house the new SWTech high school. So began this STEM-focused school with a look and feel strikingly different from typical high schools.

SWTech is one of about 160 schools in the New Technology Network. Using the New Tech project-based learning approach, “students collaborate on meaningful projects that require critical thinking, creativity, and communication in order for them to answer challenging questions or solve complex problems” (New Tech Network, 2015). Teachers provide authentic and challenging projects that students work on for several weeks. Over the project, teachers provide an entry document that introduces a real-world problem, optional workshops, laboratory experiences, technology-based resources for learning, and individual tutoring—mostly without direct instruction or lectures. This approach to teaching and learning is designed to create an atmosphere of learning that is student-driven and engaging and that meets the needs of students with a wide variety of academic abilities. There is no tracking at SWTech.

Those interested in attending the school are accepted through a lottery open to all students in the district. As a result, the student population is diverse, though it has more white students and fewer economically disadvantaged students than the district or the local comprehensive high school (Table 2). Socially, however, students reported a very inclusive atmosphere (AUTHOR et al., 2013) in which they get along well, without cliques, and learn to work productively with a range of students in their class projects.

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<sup>1</sup> All of the names used in this case study are pseudonyms.

**Table 2*****Demographic Information on Southwest New Tech High School and School District (2012–13)***

	<b>Southwest New Tech High</b>	<b>School District</b>
	Percent	
African American	21.5	23.5
Hispanic	47.6	61.7
White	25.6	10.2
Economically disadvantaged	51.5	79.6
English learner	1.8	31.0

**Source:** AUTHOR et al.(2013).

The course of study at SWTech keeps students very busy over their 4 years. Graduation requirements include 5 years of science, 5 years of mathematics, 2 years of engineering, and 2 years of technology elective credits. This outpaces the high school graduation requirements set by the state, and SWTech students typically take several of these courses for college credit.

The result of this design and culture is a school that shows strong results and has received many accolades. While students enter SWTech with achievement scores similar to those who attend the district's nearby comprehensive high school, substantially higher percentages of SWTech students pass the state standards in all subjects (AUTHOR et al., 2013). SWTech has a 100% graduation rate, and every graduate gains admission into a 2- or 4-year college. The school has been used to show what is possible in STEM education and has influenced policy makers and from all over the U.S. and beyond. SWTech has won numerous awards and recognitions.

## Meeting Carlos

On Monday, November 3, 2014, the fall sky darkened over the course of the day. The wind picked up and rain threatened. It was the first day of classes after Halloween. About half the Southwest New Tech High School students were in short sleeves, the other half were in hoodies and sweaters. Carlos<sup>2</sup> arrived at school as he did each day by school bus, dressed that day in a plain black T-shirt and grey skinny jeans, toting a backpack with the colors and logo of a nearby university. His neat short hair had a few curls at the top, which he played with unconsciously when deeply focused in schoolwork. His dark brown skin showed over his high-top sneakers, where his jeans were rolled at the cuff.

Carlos had arrived in the United States from Mexico 4 years earlier with his mother and three siblings, joining their father who had moved 10 years prior. He was now in 11th grade, having spent 1 year in middle school before starting at Southwest New Tech. His mother said they are a very traditional family and that “It has been difficult to change our habits to those of this country, and we are trying to adapt.”<sup>3</sup> She added that,

It has not been easy, but it is not so difficult, we are on a path. The idea of being in this country is to change the mind-set, change tradition, break traditions, because Mexico has a tradition of marriage at a very early age and leaving school.

Carlos is the oldest of the four children. His mother described him as a very hard worker and respectful. She said he is responsible, helping care for his younger siblings, does not drink or smoke, and is a good son. “He’s my superkid.” The adults around Carlos at Southwest New Tech also described him as hard working and disciplined. His advisor said,

He’s a person that, you know, he’ll take care of what he needs to take care of. ... He’s one of those that, “OK, well, I understand that maybe I need to do some makeup work” or” I need to make sure that I can make this project a little bit better”... before he will go grab the [basket]balls like some of the other [students].

His advisor described Carlos’ growth over the last 3 years: “As a freshman, I didn’t see him do that [choose work over play] as he will do now. ... His growth over that short period of time has been amazing.”

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<sup>2</sup> All of the names used in this case study are pseudonyms.

<sup>3</sup> The interview with Carlos’ mother was conducted in Spanish. The quotes used in this narrative were translated from Spanish to English on December 10, 2014.

In class, Carlos was quiet and serious. He was generally always the first student in the room to focus on the task and the one who maintained focus to the end of an activity or the end of the class period. One of his teachers described him as very thoughtful, good at independent work, and not afraid to ask questions. This teacher added that Carlos earned good grades and was quite conscientious, always interested in knowing how to do better.

Carlos described his classes as challenging but added that “There’s always a way to find out the solution.” He said, “My freshman year, I really thought [my classes] were easy ’cause the teachers, since we were new, they were helping us and giving us more and more, um, uh, views to do stuff, and that really helped me. I thought they were kind of easy.” Carlos described an increase in the rigor of his courses in 11th grade and explained teachers now ask more of students. “They treat us with a college aspect, so we are getting ready for college.” He said that “there are some really difficult parts” in his STEM classes, typically a big challenge in each class project.

To address these challenges, he used a process he learned in his first weeks at Southwest New Tech. “The first trimester is the learning and the basics, and then going through [grades] 9 and 10 you sort of get an idea of how the teacher wants you to work and how to behave.” He said,

First, you talk to your group and, like, if they know, they will tell you. If they don’t, your second thing will be go to the [online ECCO] briefcase and find if we have workshops or we have talked about it [in class]. If we don’t, then we will go to the teacher and ask for a workshop or ask them just the question and have them explain it to you.

If he needed extra help, Carlos said he would ask teachers “if they’re staying after school or request an extra day or workshop that will help us more. If not just ask them personally, like come during lunch or anything.”

Regarding his teachers, Carlos offered,

I think they challenge every single one of us to give our best ’cause they know we can do it, and I think that’s helpful ’cause sometimes we might have, like, a really, really big struggle with a paper but they know we can do it. We just have to try and work harder.”

Carlos told us, “We use technology every day; it’s part of the culture here. I think it’s really good for us to have that privilege to have so much technology.” He used desktop computers in the school classrooms, he had his own iPhone and laptop, and also used an iPad provided by the school. Carlos’ family paid only insurance on the device each year. What was most helpful to Carlos was the online school portal (ECCO) where he could look into the “briefcase” of each class he was taking. He said the briefcase...



has everything we've been through or we are going to be doing. And if you're, like, almost done with your project and you want to look at the very first thing, you go to your briefcase, you look at it and learn and have the refreshing of the project.

That way he was able to review previous class assignments and materials provided by the teacher, such as workshop notes and supporting articles or videos. He reviewed "assignments and workshops we have, extra stuff like research they gave us, like articles or videos." Carlos also checked his grades online; his parents could but did not.

He cited the use of technology as an important resource in improving his English.

I think it really helped me 'cause now that I see the regular high school where you get papers and do that and you don't have, like, enough technology to look at, I think it would be more difficult. 'Cause I came here, like, the technology helped me a lot with translating things, and since we have more interaction with the teachers that help me, too, a lot with the explaining.

Having teachers to ask and the ability to review class materials online, he always had opportunities to review class content and find answers to his questions.

Although Carlos was very quiet, he had many friends in school. These friends included boys and girls from a mix of racial and ethnic backgrounds. In each class, he had at least one friend to sit with. Carlos reported that "Since it's a small school, we know everyone." He continued, "It's part of the culture that we respect and we get along with each other." Carlos added that because he had been completing group projects in each of his classes for the last 3 years, he worked with everyone in his 11<sup>th</sup> grade class and many students in other grades at the school as well.

Even though Carlos was a determined student, he said, "I really don't like reading that much. ... I'm not a reading person." Given a choice, he spent his free time playing sports. He typically spent his lunch hour playing soccer or wall ball and had tried out and won a spot on the local comprehensive high school baseball team (Southwest New Tech has no sports program).

After high school, Carlos plans to major in agricultural engineering. He learned about this field through career exploration activities during his advisory class, in which students "go online and we look up certain majors and we look at schools—I mean universities—and what the requirements and stuff." Although he had not yet determined which college he would like to attend, he was considering schools within the state.

### **How Carlos Came to SWTech**

Carlos was not interested in engineering or technology before he arrived at Southwest New Tech High School. Instead, both he and his family became interested in the school after receiving a letter in the mail sent to all middle school students. “And I came to the tour they would give us before school.” His parents were supportive: “My mom, she was telling me to go here. She went online and she looked and said, ‘It’s a really nice school.’”

Having been at Southwest New Tech for 3 years, he would not go back to a more traditional high school. He said of his friends, who attended the nearby comprehensive high school,

They tell me how that high school runs and everything. I’m, like, I see how, um, New Tech helps us more and in different ways. I wouldn’t go to a regular high school. ... I believe at regular high schools you don’t have the teachers as much helping you or keeping you on track or something.

He also valued learning through projects.

I am more, like, a visual person, so I like to see presentations and how like, like entry documents [introducing class projects] we sometimes we have a film. And we come up with a film, and we are watching it and you get the ideas in your brain and, yeah, know you’re pumped to finish or start the projects.

His mother was also pleased with the choice of Southwest New Tech for Carlos. Her daughter attended the nearby comprehensive school, but Carlos’ mother said of Southwest New Tech that “I see that they [the teachers] say to him that he has good potential, potential. They speak to him, they’re attentive. This is a school with drive. They pay attention to their students.”

### **Carlos’ Day at Southwest New Tech High School**

#### **Period 1, Engineering Design/Physics: Projectiles and Cannons**

Carlos’ first period of the day was a combined course of Engineering Design and Physics. Carlos was working with two other students, Melissa and Gerry.

The class was midway through a project in which groups were designing and building projectile devices, such as trebuchets and cannons. On Monday (day 1 of our visit), Carlos and his project group participated in a classroom lesson on projectile motion. Carlos and his group sat at the back corner of the classroom. All three were in front of computers, along the row of computers lining the back wall of the classroom. The day’s session was organized around a Google Docs worksheet (accessed by students online) and an online cannon simulator, both of which students reached through the ECCO briefcase. The two co-teachers presented to the students the task for the day, which was

to identify independent variables (e.g., height, angle), dependent variables (e.g., range, accuracy), and how to use the variables to form and test a hypothesis. As the two teachers walked the class through the activity, they asked closed-ended questions (“What do we call horizontal distance?”), to which Carlos regularly raised his hand or just answered along with the rest of the class (“range”). During this instruction, the teachers walked the class through writing a hypothesis, using the simulator to test their hypothesis, recording their data on the worksheet, and then drawing a conclusion based on their data. Student groups were then set loose to repeat this process several more times on their own as the teachers circulated around the room. Carlos’ group set off on the project, mostly working in quiet companionship. They occasionally consulted with one another, and Carlos took the lead filling in the online worksheet. As the end of the period was announced, Carlos’ group members confirmed that they would meet again in the afternoon to complete all the required hypothesis testing that was due by 6:00 p.m.

The lesson flow observation revealed that in this class 100% of class time was spent on task. Regarding the class structure, 21% of class time was teacher centered, 58% was small group centered, and 21% was a mix of small group work and teacher centered instruction (as students worked in groups with teachers checking in with each group). No time was spent on individual seatwork. The lesson flow data does not necessarily mean that every student used time in this way, but describes the class structure as a whole.

On Tuesday (day 2 of our visit) and with a longer class period available, the class moved to a large barnlike lab space for a working session. Walking around the corner and into the building space used by the robotics team, Carlos’ group began work on their construction design that they had developed over the last 2 weeks. After creating a set of plans for their cannon and sourcing plywood, PVC pipe, and the requisite bolts and hardware, Carlos, Melissa, and Gerry returned to where they had left off the last week. During the day’s session, the team used hacksaws, jigsaws, clamps, drills, and other tools to create the parts that would form their cannon. With detailed, hand drawn designs out on the worktable providing a constant reference, the team again worked quietly and consistently through the period. As they had the day before, they occasionally conferred in quiet voices, with Carlos generally in the lead.

At one point, Carlos measured a piece of wood for where it needed to be cut. He walked the four steps over to the chop saw and lined it up with where to cut. He and Melissa conferred when they could not get the saw to turn on, and Carlos walked around the table to check that the saw was plugged in. Carlos quickly found one of the teachers providing support and asked for help with the saw. This was their second day in the lab, and the team had not yet used this tool. The teacher guided them through the use of the saw. As Carlos picked up and walked away with the correct-length piece, the teacher stopped him. “Wait, come back.” Carlos stepped back, and the teacher showed him how to lock the saw arm safely away and how to turn off the power and unplug the saw. Thirty minutes

later, Melissa cut another piece of wood using the chop saw. Carlos helped her place it correctly and watched her carefully. Melissa then walked away with the needed piece of wood, while Carlos quickly and quietly locked the saw arm, turned off the power, and unplugged the tool.

During the period, Carlos used the drill, saws, and other tools while providing his teammates with opportunities to use them as well. At each turn, there were occasional quick comments shared among the team, but just as often Carlos just took the next step on his own. As he was preparing the center to drill a hole in, he walked over to the tool shelves, got a clamp, and walked back to his table to clamp down the wood and drill the hole as his group members waited. Carlos' group continued its focused and quiet work throughout the period, getting to the point of loosely placing their cannon components together and checking on their fit. In this class, lesson flow showed that 88% of class time was spent on task, with a few minutes used to walk the class over from the classroom to the lab space. Once at the lab, no time was teacher-centered or spent on individual seatwork, rather, 100% was small group centered.

### **Circle Time: Connecting with Community**

After the first-period class, Carlos proceeded to the gym with the rest of the student body for Circle Time. Circle Time occurs every Monday for 15 minutes, with all students and teachers gathering to share announcements, give encouragement, and celebrate achievements. It is also a time when students who have broken the school's rules are given a chance to apologize and ask for acceptance back into the community. When Carlos arrived at the gym, he found some friends and immediately sat on the floor with them. A teacher approached the microphone in the middle of the gym and greeted the students by yelling, "Good morning, Southwest New Tech High!" He then introduced two U.S. Army recruiting officers, who spoke briefly about themselves, why they each had decided to join the Army, and invited the Southwest New Tech students to visit the Army STEM vehicle in the school parking lot<sup>4</sup>. \* A teacher then congratulated the school counselor for completing her doctorate degree, spurring a warm round of applause. A student went to the microphone and reminded the school of the upcoming Sadie Hawkins Dance. Lastly, another student went to the microphone to promote a student club and remind students that the trimester finals were approaching. When students went to the microphone, the other students cheered and supported them.

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<sup>4</sup> This vehicle was the size of a small moving van, painted in pixelated camouflage, and used TV screens and touch-screen computers to immerse visitors in a futuristic scenario of civil unrest. The STEM vehicle was intended to publicize STEM careers and demonstrate how civilian scientists and engineers, along with military forces, can play important roles in national security. Carlos chose not to attend this activity.

**Lunch: Time Out for Wall Ball**

Carlos and his friends, along with the rest of the Southwest New Tech High School student body, spilled out of the gym and headed to the cafeteria, where lunch tables were arranged in circles. After sitting down at a lunch table for a few minutes, Carlos and his friends headed outside and sat on the ground, spending about 10 minutes playing on their iPads and talking. In this outdoor quad, one of the boys produced a tennis ball from a backpack and the group spent the bulk of their lunch period playing wall ball. A group of 8–12 kids (including one girl) used a wall and the tennis ball to create a raucous and physical game of catching, throwing, and leaping. Many students joined and left the game throughout the lunchtime, while teachers and other students passed by, watching and enjoying the spectacle. Carlos was at the center of the game, catching and throwing the ball more than any other player. At the end of the lunch period, Carlos headed straight to class, not eating any lunch.

**Period 2, Geometry/Introduction to Engineering Design: Skateboard Park Design Project**

On Monday (day 1 of our visit), Carlos sat quietly, facing the front of the room and waited as students gathered for the Geometry/Introduction to Engineering Design class. He looked a bit spent after the energetic play during the lunch period. Other students at this time were lively, talking with friends and talking with the teachers. The class was in the middle of a project to design a skate park containing specific types of angles. That day's lesson supported a component of the required design, which asked students to provide proofs for the geometric constructs contained in their skate park design. The class got started as one of the two instructors went over a few homework problems from the prior week on supplementary angles. As she solicited answers, Carlos was among two or three students raising their hands to offer answers to the first few questions. The teacher called on him the first time, but passed him over the other times "to hear from someone else." As the teacher asked questions for everyone, such as "Do we all agree?" Carlos continued to answer aloud. After this whole-class review, the remaining 30 minutes were given as work time for students.

Given the option of working on his sketches, reviewing Kahn Academy videos, or participating in a mini-workshop with the teacher, Carlos chose to spend 15 minutes in the workshop. He took his notebook to the front table with five other students, where the teacher walked them step by step through the process of writing both table and paragraph proofs. At each step, the students wrote in their notebooks until the proof was completed. All the students in the workshop were quiet and following along, filling in their notebooks. When the teacher asked a question, Carlos typically answered in a soft voice.

The workshop wrapped up, and the teacher had more students for another workshop. Carlos went back to his original seat and spent the rest of the class working in his notebook. His iPad was set out in front, his notebook closest to him, his head lowered, and he played with the curls in his hair as he continued to build more geometry proofs for his skate park design.

In this class, 100% of the time was spent on task. Regarding class structure, 10% of the class time was teacher-centered, and 90% was left to student choice of working in small groups, working individually, or participating in teacher-centered direct instruction.

On Tuesday (day 2 of our visit), the class session was again devoted to the skate park assignment, with students designing and constructing scale models of their skate parks with Play-Doh<sup>®</sup>. These models were expected to incorporate geometric proofs and attend to the design constraints. The teacher moved around the room checking in with each group. As he checked with Carlos' group, he confirmed that they needed to prepare PowerPoint slides for their final presentation. Carlos then moved to the computer and began work on the presentation. His group moved over with him, and his two group members, Glenn and Henry, reviewed the rubric while Carlos worked on the slides. Glenn decided to begin sketching skate park obstacles on graph paper while Carlos and Henry continued to work on the slides. Later, all three moved back to an open table to sketch skate park obstacles on graph paper and begin construction using Play-Doh for a few minutes. The rest of the period continued with Glenn and Henry working on the skate park model and Carlos working at the computer on the presentation using both his notes and consulting with Henry on the proofs. When the teacher signaled that there were only 8 minutes of class remaining, Carlos' group had constructed obstacles with several of the constraints listed. With only a few minutes of class time remaining, the teacher stopped the class to explain details of the report required as part of this project. This prompted the three boys to discuss how they would divide the uncompleted work. Carlos wanted to finish the six-page report, and the three boys agreed to stay after school the next day to finish building the 3-D skate park.

### **Period 3, Advanced Graphic Design: Planet with a Population of One**

After escorting a friend to her classroom during the passing period, Carlos arrived to his Advanced Graphic Design class a couple of minutes late (although he was not the only late student, and it raised no issue). That day, this class was starting a new project creating "little planet" panoramic photos, visuals created by resizing and re-proportioning pictures using Photoshop<sup>®</sup>. The first step was for the students to go outside, each with a partner and a digital camera, to take photographs of themselves. Carlos and his friend headed outside near the school garden and spent 15 minutes taking pictures with standard poses, along with plays on perspective (appearing to hold up the water tower miles away)

and mugging for group shots. Returning to the classroom, students were instructed to load the pictures onto the classroom computers. The teacher had prerecorded a tutorial of the steps involved in creating the little planets; it was in a file accessible to the students on a global drive available to the whole school. Carlos started the tutorial file and listened using headphones. Although there was ongoing conversation among students in the room, Carlos worked quietly on the task without distraction. At one point, his friend asked him a question, and the two conferred. Then both waved and asked the teacher to come over to help, which she did after assisting several other students first. As Carlos' friend waited for help with her question, Carlos continued with his own little planet project. Carlos was the first to create a round planet, and others in the class followed along a few minutes afterward. He was still working, focused, making edits and changes. As Carlos fiddled with his image, it became twisted and turned, the grass turned bright green, and the sky became a deep violet blue. At the end of the period, the teacher called out to students to save their work because they would finish it the next day. Carlos was packed and out the door as the other students were still closing down their computers.

All of the time in this class was spent on task, as noted in the lesson flow. Regarding class structure, 15% of class time was teacher-centered, 31% was small group work, and 46% was spent on individual seatwork.

#### **Period 4, English/U.S. History: Taking Part in a Trial**

The English/U.S. History students were reading *Inherit the Wind*, last leaving off at page 92. The class on this day was noisy, with students talking, laughing, and generally excited. Carlos was in the midst of this energy, sitting at a table with friends, but could not be heard over the general din. After calling the class to order, the teacher asked for volunteers to read aloud the roles in the story. Carlos raised his hand once for a small part with few lines, but only half-heartedly. Another student was quickly chosen for the role. The teacher quickly selected among the volunteers. Once the reading began, Carlos was quiet but clearly engaged, smiling, laughing, and appreciating the performances of other students in class. In the final 20 minutes of class, the students were asked to form groups of three or four. Without effort, Carlos and the three other students at his table agreed to work together. The task was to answer in writing (on paper) two analytic questions about the story, "What will Cates' [the defendant] fate be? Guilty or not guilty?" and "What does this mean for the community?" Carlos immediately had pen in hand, and others were saying things that Carlos wrote down. As others drifted off the task or just listened, Carlos and another boy had an extended conversation about the questions. As the final minutes ticked down and the paper was due, the group resumed its discussion, with Carlos listening, contributing, and writing the group response. At the end

of the period, the students tumbled out with the same amount of energy and noise that they had brought in an hour earlier.

The lesson flow showed that 83% of the time was spent on task. In addition, 75% was primarily teacher-centered, 25% was small group centered, and no was spent on individual seatwork.

### **Period 5, Orchestra: Trip Preparations**

Carlos headed over to the cafeteria for orchestra, his last class of the day. After stopping at the instrument storage room across the breezeway to pick up his violin, Carlos entered the cafeteria with about 15 other students. The students took the instruments out of their cases, arranged their chairs in a semicircle at one end of the very large room, and put their music stands, music, instrument cases, and themselves into position. Carlos was the first student seated, and he waited with his violin, bow, and music in place. He tuned his violin using an app on his school-issued iPad. The teacher addressed the group, talking about the trip the orchestra would be taking in 2 days to the campus of a nearby university. On this trip, they were to participate in a campus tour and meet with music professors and students. The teacher spent 25 minutes conferring with students about the trip individually, collecting money from those who wanted to order lunch and checking with students about parent permission forms and emergency contact forms. Carlos had chosen not to participate in the trip because he had a project in Advanced Graphic Design and he felt he could not miss the class. While this planning was occurring, Carlos and the other students tuned their instruments, talked quietly, and generally relaxed. Carlos stayed in his seat, talking occasionally with the boy next to him, and playing an occasional run of notes. When the teacher pulled the group together, Carlos played his part from his seat in the back row. The group made it through about two lines of music. When rehearsal was over, Carlos stowed his violin away in the storage room and headed for his bus to go home.

In this class, 41% of the time was spent on task; all of this task time was teacher-directed in whole group.

### **Discussion and Interpretation**

After seeing Southwest New Tech High School through the eyes of Carlos, his school and his school experience could be described in several ways. Learning the content needed to prepare for and succeed in college was certainly a priority, but other aspects of Southwest New Tech included the community environment and the focus they provide for future success. Carlos, along with other students at staff at Southwest New Tech, work daily to address but were not solely focused on immediate goals such as homework



worksheets, course exams, or even achievement test scores. Instead, the goal shared in this community, one Carlos also embraced for himself, was the development of skills, personal capacities, and a trajectory toward reaching each young person's potential.

### **What and How Did Carlos Learn?**

Over the 2 days of our visit we saw Carlos challenged by rigorous coursework, as well as many types of learning experiences. His course load included engineering, physics and geometry, along with graphic design, English, U.S. history, and orchestra. Beyond covering content, his courses asked him to engage with concepts and ideas, including testing hypotheses through simulation, using advanced computer skills, and exploring classic American literature. His work in the machine shop provided hands-on learning as his team constructed a cannon, working to measure, construct and continually test their design. He had opportunities to participate in expressive arts through orchestra and graphic design. And he did this in collaboration with peers more frequently than receiving direct instruction or completing individual seatwork.

The pedagogical practices used at Southwest New Tech presented these very different course subjects to students using a project-based learning design and, often, in courses that integrated two disciplines. Each project consistently challenged Carlos to participate in knowledge construction, problem solving, and communication. Carlos reported that each project challenged him in some way, but it was clear in our observations and conversations that he has learned to consult teachers in and outside of class time, and to use his computer to access information (since the school does not use textbooks) and to review online materials posted by his teachers to support his learning.

### **What Does it Feel Like to be at the School?**

Although he participated in his engineering, physics, and mathematics courses more vocally than his other courses, Carlos was consistently attentive, focused and productive in each of his classes. The adults around him agreed that he prioritized his schoolwork and took it seriously. As one example we saw during our visit, he had chosen to skip a college campus visit in order to participate in an important presentation scheduled in another class on the same day. School was a setting where Carlos played wall ball, soccer and basketball with his friends, and he had a friend (or several) in each class. Yet it was not a place for goofing off – he took ownership of his learning, and seemed to particularly enjoy the opportunity to work in the hands-on setting of the engineering lab.

Carlos was quiet and never attracted attention to himself, yet his low-key style was not an impediment in an environment populated with several hundred teenagers. He appeared relaxed at school, among friends. It appeared – and Carlos agreed – that students get

along well and there are no cliques or bullying. Because the school is small, Carlos has been in a project group with most everyone in his grade, and with many who are in the 12<sup>th</sup>, 10<sup>th</sup> and 9<sup>th</sup> grades as well. Teachers told us that he often provided leadership and direction to his project groups, managing to help the group focus on the task and track their progress, without directly telling others what to do or creating resentment.

And school seemed a safe place for asking questions. Carlos reported to us that he felt supported by the school staff. He spoke one-on-one with three of his five teachers over our two-day observation, and said that he regularly sought out help from them in completing a project or clarifying a question. The projects teachers designed at Southwest New Tech provide plenty of opportunity for students to organize their time and self-regulate, providing opportunities to strengthen personal agency.

### **Where Will This School Take Him?**

Although he had arrived to high school with no previous interest in STEM and limited English, in 11th grade Carlos was studying rigorous STEM subjects, earning good grades, and preparing for an engineering major in college. His family placed a high value on education, and has chosen to break with the tradition of leaving school at a young age. Instead, they encourage their children's preparation to advance in the United States through college and professional careers.

Southwest New Tech has a strong track record, with a near 100% graduation rate and college admission rate, in a community where about half the students are the first generation in their families to attend college. By attending Southwest New Tech, Carlos too has been provided the means to qualify for college, the habits of mind needed to persist and succeed through challenges, and the support of adults that care about his success. Now Carlos shares in the goal of a college degree in engineering and, with the help of those around him, working hard to reach his potential.

### References

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