A Day in the Life of Olivia: A Junior's Experience of STEM Education at Central High School

Ann House
SRI International

Inez N. Moore
The George Washington University

Michael R. Ford
The George Washington University

Michael J. Cox
The George Washington University

Sharon J. Lynch
The George Washington University

Author Note

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Correspondence should be addressed to Ann House, SRI International, Center for Technology in Learning, 333 Ravenswood Avenue, Menlo Park, CA 94025. Email: ann.house@sri.com.

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"A Day in the Life" of Olivia[1]: A Junior's Experience of STEM Education at Central High School

The objective of the Opportunity Structures for Preparation and Innovation (OSPrI) research program is to examine the opportunity structures created for students in both inclusive STEM High Schools (ISHSs) and comprehensive high schools with STEM programs that engage, inspire, and prepare them 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 and comprehensive high schools do not have strict admission requirements. This inclusivity may serve students in underrepresented groups by providing opportunity structures that they might not ordinarily encounter, as it helps to develop new sources of STEM talent, expand workforce participation, and prepare new STEM professionals.

One of the goals of the OSPrI study was to capture students' perspectives of STEM learning opportunities in both ISHSs and comprehensive high schools. In April 2015, our research team visited one such comprehensive high school, Central High School, a large secondary school in the Midwestern region of the United States. The purpose was to capture how two African American students, one male 10th-grader and one female 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 researchers shadowed each student for 2 consecutive 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. Two instruments guided the classroom observations. One researcher focused on the class-level activities as a whole, and a second focused on the target student. Using semi-structured protocols, we also interviewed the students and their parents, as well as the administrators, guidance counselors, and teachers. We recorded common themes in the classroom observation notes and transcribed interviews, noting the presence of the 10 critical components in Table 1 (Peters Burton, Lynch, Behrend, & Means, 2014). We also identified 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 approve the case. This case study of Tae describes a typical school day in his life.

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

Critical Component	Practices Observed
1. STEM-focused curriculum	• Strong courses in all four STEM content areas • Engineering and technology offered or intentionally integrated into STEM subjects and non-STEM subjects • More STEM requirements than school district or state
2. Reform	• Active learning; project-based learning or inquiry in STEM

[1] All of the names used in this case study are pseudonyms.

	instructional strategies & project-based learning	classes • Incorporation of 21st Century Skills into goals and products of instructional practices • Performance-based assessment practices • Research opportunities
3.	**Integrated, innovative technology use**	• Technology an explicit part of school design and implementation • Technology used to connect students with information systems, models, databases, teachers, mentors, and social networks • Technology used for student production
4.	**Blended formal/informal extended learning**	• STEM activities extend beyond the boundaries of a typical school day, week, or year (e.g., afterschool clubs, mentorships, internships; apprenticeships and summer programs)
5.	**Real-world STEM partnerships**	• Students connected to business, industry, and the world of work via mentorships, internships, or projects applied to STEM learning
6.	**Early college-level coursework**	• Flexible school schedule designed to provide opportunities for students to take classes at institutions of higher education or online; college credits accrued
7.	**Well-prepared STEM teaching staff**	• Teachers are qualified and have advanced STEM content knowledge and/or practical experience in STEM careers • Teachers are collaborative and buy into school mission
8.	**Inclusive STEM mission**	• The overarching, inclusive, STEM-focused mission of the school manifests itself in school practices • Active recruiting of students from underrepresented groups
9.	**Administrative structure**	• Varies (school within a school, charter school, magnet school, etc.) and most likely affected by the school's provenance • Networked; able to garner community support • Leadership is mission-centered, nimble, innovative • Flattened hierarchy and shared leadership with staff
10.	**Supports for underrepresented students**	• Systems of advisories, tutoring, and data and communication used to create a personalized education for every student • Extensive college and career counseling

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.

"**Day In the Life" of Olivia: A Junior's Experience of STEM Education at Central High School**

Central High School (CHS) is a public secondary school (grades 9-12) in the Midwestern region of the United States. The school is located in the suburbs outside a major city. The school is situated in a town of roughly 7 square miles and has a population of approximately 33,000 residents. The median household income is $71,201, and 2.5% of families live below the poverty line. Central High School's student body is 66% non-Hispanic white, 21% non-Hispanic black, 3% Hispanic, and 10% other races.

CHS was founded in 1928. The campus is comprised of the main campus buildings and Clark Hall, a project-based learning building. Clark hall houses a variety of collaborative learning spaces, community college classrooms, and a YMCA. Across the street on the main campus, the original Lincoln high school building from 1928 still serves students as the primary location for many humanities classes. Adjacent to this building is the Hamilton building, housing the majority of STEM classes, in addition to some of the school's more innovative initiatives, including the DECA program, information technology class, and a speech class. Finally, the Jefferson building is home to the "Freshman Experience", a program run by the assistant principal to acclimate freshmen students to high school life.

Athletics are an integral part of the school's identity, with approximately 800-1,000 of the school's 2,400 students participating in a sport. CHS teams have had a long history of success that extends back several decades, including dozens of district and conference championships, and several junior Olympians. However, opportunities abound for students to get involved in after-school activities outside of athletics. The school has over thirty-six clubs including clubs for astronomy and rocketry, programming, and underwater robotics.

The abundance and diversity of activities available at CHS is a reflection of the principal's vision to help kids succeed in all aspects of life after graduation. CHS already has a career center with marketing and IT programs, a digital online academy, a dual enrollment program for students to earn college credit, and a DECA program, where students can gain business experience by initiating marketing campaigns for local businesses. Additionally, for the 2015-2016 school year, the principal plans to open the school's Fabrication Lab, a program with business classes and internship opportunities with local companies for students with engineering or technical skills.

CHS students have a strong record of college preparation. The school offers a wide variety of AP courses, and the students who take advantage of these offerings tend to perform very well; 75% of the 439 AP tests taken by CHS students in 2014 received a score of 3 or higher. Moreover, 76% of students took the ACT—the admissions test of choice for most CHS students.

Meeting Olivia

It was still cloudy, chilly and windy in early April. Olivia punctually met us before the first period of the day, and provided friendly conversation as we navigated the hallways congested with students. At 6'6" tall, she intentionally slowed her walking pace to allow us to follow, but her height made it easy spot her in the crowd. As we spent time shadowing Olivia at Central High School and talked with her mother and other adults at her school, we got to know a bit about her family life, her life as a student and the opportunities at Central High School. We also learned some of her

thoughts about her STEM education experiences at CHS and how they fit with her view of her future after high school.

Family context

Olivia's family moved to the suburbs from a nearby city 3 years ago, expressly so their children could attend Central High School. Her mother said, "We had visited a bunch of schools [around the area] and we all liked [Central High School]." Her mother continued, "I was real upset with the school they had left," so she shopped for a new school "like I shop for a car or a new good pair of shoes." This included online research to examine school websites and report cards, as well as whole family visits to "4 or 5 schools in 2 or 3 districts." As a family, they agreed that Central High School offered both the academic and athletic programs that would help the family of very tall and sports-minded children win college scholarships and succeed in higher education.

Olivia and her brother both started at the school as freshmen, and are now juniors. She also has an older sister who has graduated from college, an older brother who is a senior at Central High School, and a younger brother in middle school who would soon attend the high school.

Every person in the family is extraordinarily tall and athletic. Olivia's father was a college athlete, her mother played high school basketball, her sister attended college on a volleyball scholarship, and her older brother was trying out for college basketball recruiters on one of the days we visited. Her mother said she tells her children, "You've been given these bodies. This is your job, to take care of this to go to the next step. Because I don't have a house to mortgage for you, our credit stinks, and we probably won't be able to get much financial aid or scholarships for you. This is what it is. You have this gift. Take it and roll with it." Fortunately, Olivia loves basketball, and plays center for Central High School as well as in year-round Amateur Athletic Union (AAU) leagues.

The family expectations for Olivia and her siblings are explicit and consistent. Her mother described a laser focus on providing the children with greater opportunities than she had. She said she tells them, "'I want you to be better than we are.' I know where I failed and that's why I'm so tough on them. I don't want them working somewhere because they have to. I want them working somewhere because they want to." High grades, college preparation, and college athletic scholarships are clear expectations and the path to being able to do the work they want to do.

Olivia as a student

Adjusting to Central High School from her middle school took some effort. Olivia said, "I'd been getting really good grades in my old school," and expected to "come in here and get the good grades that I needed to get. My first grading period, I was kind of startled because I got 3.0 and I usually get higher than that." She said she learned at this school "they have you do more stuff instead of just sitting there like my old

school did." She also found that she was encountering material that was new to her. "Some of the stuff that the teachers were teaching here, I didn't know anything about it, I'm like, 'What is this? I've never learned this before.'"

Once she saw her grades were slipping, she started to ask for help. "I wanted to be able to be that student that knows everything, and I was like I don't want to ask anyone for help, I just want to do it on my own." Yet this drop in her grades prompted her to "start asking teachers for help and I started going to the P.A.S.S. Room[2] and turning in assignments on time and making up the assignments that I didn't turn in." Her grades went back up, and have stayed up since.

Now a junior, Olivia still prefers to figure out problems on her own, but she has kept up her study habits – visiting the P.A.S.S. room when needed, and asking teachers for help. Olivia maintains strong grades, along with basketball practices and games year round. This early experience taught Olivia to be attentive, "because your grade can slip at any time. Sometimes teachers don't tell you when they're going to collect something. They'll just say, 'Do this and then I'll collect it whenever.' So, you just got to get the stuff done when you can get it done and be prepared to turn it in. Like, if you don't turn it in, that's going to be like a crucial part of your grade. You've got to get stuff done when it's due."

Olivia's mother pays close attention to her children's grades. She said, "I check their grades on Homework Access (an on-line program). Olivia knows she can go to the PASS Room and she's got great relationships with her teachers." She added, "that's one of the things I like about here, is there's so much help, there's no reason for you to fail here."

Olivia has not taken any college courses at CHS, and does not plan to do so next year. She knows that she has the opportunity to take "a double credit class[3]," though she isn't interested. "I'm just going to wait until college to take college classes. I think I'm on the right track now. I think I'll be ready for college when the time comes. My mom, she's like, 'Take what you know you can handle. Take what you need to take to graduate.' So, that's where we're kind of at right now."

Technology

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[2] The P.A.S.S. (Positive Academic Support Solution) room is open to students every period of the day, as well as one morning a week and two afternoons each week. The PASS room is staffed with qualified teachers to assist students with homework, finishing missed tests or quizzes, and explaining concepts. Usually, one teacher from each major academic area (Math, Science, Social Studies, and English) is present. Computers are also available in this room to aid students in completing their work.

[3] College Credit Plus allows high school students to earn high school credit and transcripted college credit which transfers to all public colleges and universities in the state.

Students at CHS are allowed to bring their own technology devices to school. Along with her iPhone, Olivia brings her ASUS laptop computer (a gift from her grandmother) most every day. She says, “it's easier and quicker to get out than to go all the way up to the laptop cart and get one from the school. I use it to get online and look stuff up. Like, if I don't understand something, I look it up online or something. Or like on our town hall [project currently happening in her Environmental Studies class], I'm actually looking stuff up for tidal energy on my laptop right now.” In English class, Olivia once used her computer for an assignment on Edgar Allan Poe. “We had to make our own stories … I researched about gothic tales and stuff to get my story together.” The class projects that require online research, however, occur only occasionally. During our two day visit, we saw her use her iPhone for both social (texting friends, playing games) and academic purposes (taking photos of class lecture slides), but not using her computer.

CHS teachers and administrators use a variety of online websites to manage grades, assignments and portfolios. The students must learn to use them all. In addition to the portal her mother uses to see her children’s grades, Olivia said different teachers used different sites including Schoolology (a learning management system), Turnitin.com (an originality check and platform for peer and teacher feedback), and Kahoot! (an online test review site).

Olivia enjoys working with technology, and her interest in solving things on her own shows through. She says, “I like working with computers. I like to fix things. Like if the computer's messed up or if there's a software program not working or the Internet is off or something like that, I like to try to fix it.” Her mother agreed, saying Olivia is “the one we call when we need her to hook the TV up or the cable” or “help her dad read his e-mail on his cell phone." Her mother says, “she's the computer girl we call for everything.” At CHS, Olivia took a technology class earlier in the year, and plans to take at least one more technology class next year. While Olivia seemed excited to take another technology class, she did not express any intent to take any computer science courses, or any of the science sequences traditionally considered college science preparation, such as chemistry and physics, which are offered at CHS.

- **Social setting**

Populated with 2,400 teenagers, CHS seemed to have a remarkably relaxed social environment. Olivia has a small number of close friends she sees everyday in a hallway nook during passing periods, and before and after school. She is also friendly with many students at school. As one teacher said, “whenever I see her in the hallway, she's never by herself, she's usually walking with a friend, talking as she goes.”

Starting at the school as a freshman, she first became friends with several students in the club that sponsors the multicultural festival (described below). Through these friendships and by playing on the basketball team, she has in her three years built a community of friends within the very large school student body. As we saw in the

multicultural festival and lunch periods described below, as well as in classes and hallway, the school environment seems low key and comfortable, and Olivia agreed that the school is generally open and accepting of everyone. Olivia's mother said that the middle school in their old district had one or two fights a day, but at this school her children tell her there are fights only "every now and then."

The school principal said, "We tell people we're the most diverse district…with the most diverse offerings for our kids, and the most diverse opportunities. So we may have many different cultures, as you saw in the gymnasium [at the Multicultural Festival], but then we try to have the most diverse course offerings…because we believe that's what our community expects."

- **Plans for the future**

Olivia's STEM classes this semester are Algebra II and Environmental Science. She reports that she isn't very interested in her Environmental Science class, but she really enjoys mathematics. She says, "I have really good grades in math. I usually get A's all the time. I like to do equations. I don't know why. It's just better than science. I have a cool teacher. She's cool. She's like one of my favorite teachers." Beyond having a cool teacher, Olivia enjoyed other math classes at CHS, and also told us she enjoyed math in middle school.

As college approaches, this interest is now starting shape her plans for the future. Her mother recalled for us that "the other night, we were laying on the bed and she says, "Mom, I think I might like math." And I said, "Really?" I said, "Doing what?" I said, "Teaching?" She says, "No. I don't know if I want to teach but," she says, "I think I'd like to do something with math and computers or something," so we just started talking about a different variety of things she could do -- accounting, computer science, all kinds of stuff."

Her mother sees technology in the future for Olivia. "I just see her doing something with computers, with technology. I really do." Olivia's mother explains that this future she sees for Olivia stems from the family sacrifice of moving out of the city and re-locating to the more expensive suburbs,

> *I think if I had not moved her, would she be prepared? No. I think now, being here, she's prepared. … I watch the work that she does when she comes home, the work that she brings home, the assignments she has to turn in, and a lot of it being online. She never had that opportunity where she came from before, learning how to submit papers online and in a timely manner and just all kinds of stuff.*

While none of her family members work in STEM-related careers, Olivia's mother sees her "very determined" daughter on the road to working somewhere she wants to work.

Olivia's day at GLHS

Period 1, Psychology: Perception Quiz

First period Psychology class begins at 7:36. Students file into the room for class on time, filling the rows of desks facing the large white board at the front of the room. Olivia sits in the row closest to the outside window. The teacher starts out with a question and answer session reviewing the content on human sensation that will be covered on the day's quiz. "What would happen if our absolute threshold for hearing were lowered?" A handful of the 22 students quietly offer answers. "What are the skin senses?" Pain, pressure, cold and warmth are answered in response. Through this back and forth session, Olivia sits erect, coat in lap, watching closely. Her pink iPhone sits face down on her desk, and her backpack is on the floor next to her chair. She joins in to answer every third or fourth review question. Olivia's friend seated next to her doesn't participate at all, but studies his handwritten notes.

After about 15 minutes of review, the teacher passes out the quiz. As soon as the quiz form arrives to her desk, Olivia gets started on the quiz containing 25 multiple choice and 2 extended response questions. The teacher continues to explain to the class that, because the PARCC test can have multiple correct answers, he has put multiple correct answers in the quiz's multiple-choice questions. After this final explanation, by 8 am the class is completely quiet, focusing on the quiz. The teacher types for a few minutes on the computer at his desk in the back of the room, but spends most of the quiz time moving about the room, strolling down the aisles of desks, and responding to raised hands with clarifications. Five minutes into the quiz, Olivia asks a quick, quiet question of the teacher, and he gives a confirming reply that she understood the question correctly. After 20 minutes, some students are starting to hand in their papers, though Olivia is still working, with her head bent down over her paper. At 8:23, the bell rings, and Olivia pops ups, hands over her paper to the teacher, grabs her backpack, and is heading out the door talking with friends in one smooth motion.

The lesson flow observation for Day 1 of Psychology revealed that 90% of class time was spent on task. Thirty-four percent of class time was teacher centered and 66% was individual-centered. While the lesson flow data do not necessarily mean that every student used time in this way, it does describe the class session structure as a whole.

On Day 2 of our observation, few students are on time, and those that wander in report traffic issues related to the rainy weather that morning. Announcements blare from the class loudspeaker, requesting some students report for PARCC testing. Class starts 10 minutes late, with the teacher handing out quizzes to students who indicated the day before that they needed more time. Those that did not need more time quietly waited for 10 minutes. Olivia plays Candy Crush on her iPhone.

After the quizzes are collected, the teacher starts a lecture introducing principles of Gestalt perception that lasts the rest of the period. As he starts to talk through the

content he displays on PowerPoint slides, Olivia has her head down on her desk, and continues to play on her iPhone. She admits to us that she was up late last night, and is feeling very tired this morning. Over the next 45 minutes, the teacher talks through an outline provided on his PowerPoint slides, providing examples and involving students in questions and demonstrations. As he describes each principle, he provides an example that students may encounter, such as noticing how objects that are close seem to move when closing one eye and then the other eye, but objects further away do not.

First period came very early today, and Olivia alternates between sitting up and answering along with the class to the teacher's questions, resting her chin in her hand, and looking forward with her head on her desk. She manages to open (silently and under her desktop) and eat a bag of Cheetos. She also occasionally picks up her iPhone, and tells us later that she took photos of every one of the teacher's slides, and will write the content down later. In this, she is not alone - only two boys in the back row are taking notes on paper. Three questions requiring student responses were asked during the lecture.

A few minutes before the end of the period, the teacher comes to a logical stopping point in his presentation. After he wraps up, the students wait quietly, gathering their belongings, before hurtling out the door when the bell rings. Since Olivia's next class is a quick trip four doors down on the same hallway, she doesn't need to rush during the 6 minute passing period.

Regarding the instruction on Day 2, the lesson flow observation revealed 78% of class time was spent on task. Eighty-nine percent of class time was teacher centered, and 11% was used for individual seatwork.

Period 2, Community Law: A Few Good Men

Upon entering the classroom for Community Law, Aerosmith is blaring. Students drift in and find their usual seats, which are arranged in three sets of rows, each set of rows faces the middle from the right, left and back sides of the room. Students mingle and chat with each other, but are in their seats when class starts.

On Day 1, the teacher starts class by bringing up an outline PowerPoint slide on the overhead projector. They are currently discussing the investigation phase of the criminal justice process. He is dynamic in his speaking, moving around, and gesturing with energy. Olivia (and the rest of the class) all pull out a set of printed notes made by the teacher, which had been distributed the week before. The notes have blanks, where students are expected to fill in key words and concepts as they follow the class lecture. Olivia is attentive, sitting upright with her pen, notes handout, and iPhone out on her desk. She checked her phone quickly before class started and a few times during class, but most of the time it rests face down on the desk. After 15 minutes of lecture, the teacher starts a movie, A Few Good Men. The teacher stops the film every 5 minutes or so to explain or point out a connection to

criminal investigation. Olivia manages to open a single serving cereal pack under her desk in silence, nibbling on dry Trix during the film. The class is very quiet during the film, though it appears one or two students have fallen asleep. At a transition point in the film's story, the teacher hits stop. Students stretch and rise, and wait quietly for the 3 minutes until the bell rings.

On Day 2, the same sequence occurs – with loud rock playing during passing period, students chattering and settling into seats, and the teacher presenting content-dense PowerPoint slides along with lecture for about 20 minutes. During this lecture, Olivia pulls out her laptop computer. She spends nearly 10 minutes turning it on and trying to connect to the school wireless, without luck. Finally she closes the computer and jots a few items on the class notes pages. The teacher then plays more of the film, A Few Good Men. Like yesterday, the teacher pauses the video every few minutes to draw a connection to the class content or to clarify the story – Did they do this on their own? Was there criminal intent? Which defense would this fall under? Students watch quietly, many with their heads down on their desks. Olivia alternates between sitting up, focused on the film, and laying her head down on her desk. At 9:14 the teacher stops the video, and reminds the class to turn in their case worksheets tomorrow. He instructs them to wait for the bell at 9:16 and they can leave.

On both days of Community Law, 90% of class time was spent on task. In addition, 90% of class time was teacher centered and 10% was individual-centered.

Period 3, Introduction to the Visual Arts: Painting

Heading down the stairs, Olivia has a long walk to her third period class. On the way, she stops to have a quick conversation with a few friends and her brother, who also attends CHS. They check in with each other in an alcove set across from an exterior door, a spot where they usually relax before school starts and for a few minutes between classes.

In art class, students are in the middle of a painting project. Using a photograph or illustration of their choosing, the assignment asks students to place a grid on the illustration, expand that grid, and create an original painting of the same image but larger in scale. Students work at tall tables, and casually gather their brushes, paint palettes, and paintings in progress. The class is focused on work, but also students are social, walking around, talking with those at their table as they work. The art teacher is also walking around talking with students, giving advice and answering questions. He turns on some ambient music on the class speaker system. The class is generally quiet, focused, yet social and relaxed.

Olivia is the most talkative among the students in class, but does not seem engaged in the assignment. She tells us that she picked an image to paint that she felt would be easy to complete. Although the teacher gives her advice on adding shadows, using darker values, and strategies to better copy her selected photograph, she does

not seem interested. She declares her painting to be finished even though it will be days before others in the class are finished. She tells us that the class is fine, but she just isn't interested, and she preferred other assignments using drawing rather than painting. She is excited to take a class next term where they create art using computers.

Using the lesson flow observation, both days in art class were 85% on task and was 100% individual-centered. The 15% of class time not spent on task were the 9 minutes scheduled each morning in all 3rd period classes for closed-circuit television announcements. These announcements are written and presented by CHS students taking Introduction to Television Broadcasting.

Period 4, Study Hall: Multicultural Festival

Olivia's study hall period is held in a large modern room with plenty of windows and light. The teacher supervising study hall had a sign out sheet, which Olivia used both days during our visit. On Day 1, we used the time to talk about our "Day In the Life" visit and get to know Olivia better. On Day 2, Olivia signed out because she wanted to attend the school's multicultural festival. The festival went on all day, so that students could attend during lunch or other free period. The event was held in one of the school's three gymnasiums. As we entered the room, it was crowded with students and buzzing with loud noise. In the center of the gym, students wearing dress from their home countries performed dances, to a large and receptive audience. Around the perimeter were tables featuring different nations using tri-fold posters, food samples, cultural items and flags. Each table was hosted by one or more students, and included countries from Europe, Asia, Africa, and the Americas. Olivia worked her way through the crowd, talking with friends and eager to enjoy a plate of food. The dance performances lasted throughout the period, concluding with several line dances in which everyone was encouraged to participate. At the invitation and encouragement to dance, 50-60 people join in, including several teachers though Olivia did not dance.

Period 5, Algebra II: Reference Angles and Radians

Period 5 starts at 11:20am, and Olivia makes her way down another crowded hallway in time for Algebra class. By this time in the day, she has navigated between the far corners of the nearly city block-sized school building. In the classroom, desks are placed into 4 seats table groups, although the class is usually arranged in rows facing the front white board. Graphing calculators are available just inside the classroom door for quick access and deposit, and students freely take them as needed. Algebra II textbooks are stacked in the corner, looking unused.
Algebra class starts with a review of work from the day before on reference angles and radians. Olivia pulls out her problem pages, as well as her iPhone, pencil and pen. Students request to the teacher which problems they would like to see her explain on the board, and she works through each problem and prompting students throughout, what do we do here? What do we write for this? What do we subtract

here? The teacher works through 6 problems on the board before telling the class that they will be practicing these concepts today, in preparation for a quiz on Thursday.

The teacher passes out a new set of problems, and students get to work. Students are seated in groups of four, and while a few students choose to work on their own, Olivia joins in with her tablemates to complete the problems. Several times the room gets a bit loud with conversation, and Olivia deftly combines working, talking with others, and a few texts on her iPhone. The teacher and the classroom aide circulate around the room, answering questions and checking on progress. Olivia regularly asks the teacher over for clarification or confirmation of her progress through a problem, more often than most of the other students in class. As other students and groups in the class are finishing the day's problem set, Olivia is still heads down and focused. Even as others are putting away their things in the final minutes, Olivia is checking her work, and having a final quick conversation with the teacher about a sticky problem. As her Algebra teacher later said, "she's usually one of my more engaged kids and she asks a lot of questions. She's usually all about getting her stuff done." With three minutes remaining, the students including Olivia pack up, return their calculators, and wait quietly for the bell to ring.

The lesson flow observation revealed this period to be 100% on task. Twenty percent of class time was teacher centered and 80% was small group-centered.

Day 2 in Algebra class also begins with a review of work from the day before, with students asking the teacher to work through specific problems on the board. As this activity wraps up, the teacher transitions to introduce new content. She and the classroom aide hand out a new set of pages, and the teacher lists out the content and concepts needed for the next steps: Pythagorean theorem, sine, cosine and tangent. Olivia is distracted, putting the plate of food she brought out of the Multicultural fair into a plastic bag, but gets back on track quickly, taking down a few notes. The whole class is watching and listening, responding to the teachers' prompts: How do I simplify a radical? What do we do next? After 20 minutes of explaining the new problems, the teacher and classroom aide hand out worksheets for the day. Olivia immediately gets to work on the new problems, as does most of the class. Olivia calls the teacher over right away for a quick question. While some students work in groups like they did the day before, other students, including Olivia, choose to work on the problems on their own.

In math class, Olivia asked questions of the teacher frequently. She told us later, "when I call her over, I kind of like do it but I'm not asking her for help. I'm kind of making sure. I'll pick a question, I'll just go through it with her to make sure it's correct, because I wanted to make sure I had it." She said, "That's the one class I'm actually interested in, like I'd get everything correct on that and keep asking questions because I want to learn more about that."

Over the next 15 minutes, Olivia asks the teacher or the aide 6 quick questions, and finishes up her worksheet. Half of the class is still working, and Olivia picks up her phone and sends a few texts for the remaining 8 minutes of class. At 12:08, everyone gathers their things, puts away their calculators, and heads out the door.

The lesson flow data of Day 2 of instruction for the class as a whole revealed this period to be 100% on task. Forty percent of the period was teacher centered and 60% was small-group centered (though Olivia chose to work on her own).

Period 6, Open Lunch: Nachos, Pizza, Burritos

The school has three periods for lunch (periods 4, 5 and 6), and the cafeteria is still filled with students and long rows of tables with chairs from 5th period lunch. Each day there are three entrees from which to choose, and each is served from one of three windows at the far wall of the room. The choices on Day 1 were nachos, pizza or burritos. Long lines quickly form at each window. The noise level rises quickly as well, with everyone talking, but the room retains a relaxed atmosphere – there is no shouting or roughhousing, and most everyone cleans up after themselves. A campus police officer is there, along with two other school staff, greeting students as they enter and exit.

Since Algebra class was just across the hall, Olivia gets there in time to set aside a few seats for herself and her friends. The 48 minute period provides just enough time for her to stand in line at one of the three entrée windows, eat her lunch (Olivia chose the nachos), and walk outside and across two intersections to get to her next class in another building.

Period 7, Environmental Science (B days): Exploring Watersheds

Olivia's seventh period classes are held in Clark Hall, the newest addition to the Central High School. Clark Hall is a separate building located approximately one block away from the main campus, and was opened in 2011 to feature state-of-the-art classrooms and lab spaces. Olivia's afternoon schedule features rotating courses of double periods in Clark hall, designated by the school as "A" and "B" days. During a two-week period, Olivia has five A days and five B days which this semester are Environmental Science and English 11.

After lunch, Olivia walks across the street from the main campus toward Clark Hall. Other students are also on the way to Clark Hall, or coming back from grabbing lunch at the various surrounding fast food spots and restaurants. The first floor of Clark has commercial space; but currently a local credit union is the only occupant.

Upon entry to the building, students head upstairs to the second and third floor of the building. Markedly different from the older main campus, wide bright corridors open to classrooms and open conference rooms filled with modern, movable furniture (desks, chairs, and stools) and white boards. Olivia says that she loves

Clark Hall; having a class in Clark is a privilege for juniors and seniors, and it makes her feel like a college student.

At 1:15, Olivia walks into the Environmental Science class. It is arranged similar to a college-level lab room, lined with high lab tables and stools that allow students to stand as they work. Along the walls are stacks of unused textbooks and a locked cabinet filled with laptops. The teacher starts off with a few short announcements and then proceeds to the lesson continued from the previous session on watersheds. Using a power-point presentation displayed on the white board, the teacher describes the features of a watershed. He then asks students to work in small groups to develop a definition of a watershed, and after they devise definitions, he leads the class in a discussion of their definitions and the accepted definition. The teacher then shows an episode from the BBC's Planet Earth series on fresh water.

Following the video, the teacher begins instructions for a quick activity on watersheds. Using water dyed blue with food coloring, a pipette, and plastic terrain models, students in small groups and conduct a series of tests to simulate watershed formation. Using the blue-dyed water as precipitation and the plastic terrain models as areas of "land," students were able to see how rain water separates into rivers, lakes, and basins. During this lab assignment, students also completed a worksheet on their findings.

Environmental Science is not Olivia's favorite course; she would appreciate more hands-on learning. She explained, "[In] Environmental Science, we rarely do labs and experiments… but [today] was actually a good day because we had to do lab and I like to do hands-on stuff."

The class period was 90% on task. Seventy percent of class time was teacher centered (including time spent on the extended video) and 30% was small group centered.

Period 7, English 11 (A days)

On "A" days, Olivia has English 11 in the Period 7 time slot in Clark Hall. On day 2 of our visit, then, Olivia headed to her English classroom. The teacher begins the period by reading a chapter aloud from *The Fallout*, a Young Adult science fiction novel. Some seem to listen intently, others are wearing earbuds, but everyone is quiet as the teacher reads aloud. When the teacher arrives at the end of the chapter at a suspenseful turn in the story, everyone including the teacher agrees that they would like to hear more. The teacher reads another chapter.

The goal of today's lesson is to examine the characteristics of realism. The task for the session will be to analyze characters in a Bret Harte short story, *The Outcasts of Poker Flat*. First, the teacher provides a short lecture on the time period in which the story is set – the 1849 gold rush in California. She provides an overview of relevant concepts such as manifest destiny, resettlement of native peoples, the gold rush,

boomtowns, and hyperinflation. As the teacher presents her PowerPoint supported lecture, Olivia is watching, attentive, with her pen in hand. The final slide the teacher presents is a painting of winter snow scene in the Sierra Nevada mountains, where the story is set. She explains that its purpose is to "to get a picture in your mind of where this story takes place." The handout she has distributed contains a character list from the story. She explains that the students will be asked to select a character and in writing "describe the person, why are they there, what happens to them at the end," and whether at the end of the story the student feels that character is "weak or strong." The teacher also shares a rubric articulating the required components of the assignment and the point value of each component.

After a quick break (it has been a hour since class started), the class reassembles and the teacher reads the Bret Harte short story aloud. She stops during the reading, providing key pieces of information and clarifies outdated language that the students may not understand. Once again, the class is very quiet and look to be reading along with the printed pages as she reads the story for the group. Students have just a few minutes to plan their work for this assignment; they will have time in class next time to work on their papers.

Finally, just as the period comes to a close, the teacher offers some last-minute advice about how to approach their new essay assignment, saying "sloppy work is lazy and disrespectful" and encouraging them to "put your best foot forward."

English 11 was 77% on task. Seventy-seven percent of class time was teacher centered (including the teacher reading aloud) and 23%was individual-centered.

Summary and Conclusion

This case study of Olivia revealed her typical day of high school at Central High School. We saw her at school from when she first arrived off the bus, to the end of the school day and heading home. This visit provided insights both in the resources and opportunities presented at the school, as well as the classes in which she spent most of her time.

What and How did Olivia Learn?

Olivia described the first day we observed with her as quite typical. She felt pleased that she did well on her Psychology quiz, she likes when her Criminal Law teacher shows movies "to visually show us about what we learned," and she was happy to have a hands-on lab activity in Environmental Science. She said, "I think the day itself was actually a pretty good day."

When asked what she learned, she went back to her favorite subject, mathematics. "I learned how to do new math stuff yesterday. The angles and the radicals. I don't know how to explain it. I just know how to do it. That's like my thing. I can't explain it to people. I just know like, this is what you do. You do this, you do this,

you do this. I'm like, 'Yeah, I solved that.'" Her teacher agreed, saying "she does very well in [math]. She seems to just get things really fast." Olivia didn't mention any content or skills learned in her other classes.

Throughout the two days, Olivia's attention and energy levels seemed to range from active and engaged, to laying with her head on her desk, to stopping her painting project before completion. She relished solving equations in Algebra II class, but otherwise compliantly participated in structured activities, listened to lectures, or watched movies.

How Did it Feel to be a Student at Central High School?

Olivia was having a busy week, including preparing to travel for the weekend to a basketball tournament. Yet beyond being tired from staying up late, she was confident about her work in her classes and she enjoyed the multicultural fair, an annual event to which she was greatly looking forward.

Olivia seemed happy and socially engaged throughout the day, talking with classmates during class, and sharing hellos as she made her way through the crowded hallways. Olivia was respectful and polite with her teachers, and they as a group were understanding of issues like traffic problems, but also focused on the content for the day's lessons. Neither Olivia nor any other students had any trouble with teachers or hassles with other students. Her level of responsibility seemed to connect most clearly to her understanding that teachers can ask for work at any time and she must be ready, as well has her role as a student athlete, which requires additional commitments to balance. As the athletic director explained, student athletes like Olivia are in season all year long, between the school season and AAU teams. "It's a 12 month commitment for them including summers. There's just no dead period for them and they use as much time and coaching that they want to get out of it. Olivia is one that is here every day after school, putting in time in the weight room, putting in time in the gym."

Where Will This School Take Her?

In many ways, CHS is a high functioning, conventional high school, with class periods less than 1 hour (46 minutes), a large student body, and a broad set of class subjects (from Honors Mandarin to Music History to Robotics Science). CHS is also a local sports powerhouse. The principal shared that, in addition to the girls basketball team reaching the regional tournament this year, "our baseball team right now is ranked, our softball team is ranked, our girls' track team is probably going to win the state championship" and also just "won the indoor state championship." One third of the students at CHS are in athletic programs, so to support the many students interested in college athletics it works to ensure their athletes take the core courses required by the NCAA. The athletic director said, "our ultimate goal for them, if they have aspiration and ability to go on to the next level is to walk out of

these doors and be eligible to play academically, eligible to play their first year" in college or university.

Little emphasis seemed to be placed on supporting Olivia's interests in mathematics and technology. She was not often provided opportunities for project-based learning, not provided opportunities to build real world connections to industries or professions, nor did she report being encouraged to take on challenging courses in STEM disciplines aligned to her interests such as Computer Science. Rather, CHS is focused on helping Olivia (and their other student athletes) prepare for the goal of being prepared both academically and athletically for NCAA-level athletics. This goal is consistent with that of Olivia and her family, and the reason it was chosen by Olivia and her family. It is now up to Olivia to make the most of this opportunity.