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Granite Secondary School:

A Case Study of an Inclusive STEM-focused High School

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The structure of the case study of Granite Secondary School (a pseudonym) will begin with a description of the context of the school, followed by a summary of admissions procedures and curriculum structure. To further describe the school, a summary of outcomes such as graduation rates and state test scores will be presented. Following a description of the school, the research questions from the OSPri study will be addressed by describing the most prominent and unique Critical Components found at GSS.

The Granite School District serves approximately 5,530 high school students. The student demographics for the district are 41% White, 35% African American, and 17% Hispanic, with 66% classified as economically disadvantaged. GSS serves a diverse body of 325 students with demographics that closely mirror the population of the City: 47% of the student body is white, 31% African American, 7% Hispanic, and 15% are of two or more races with 57% considered economically disadvantaged. Instruction at the school features student-centered learning, an integrated math curriculum, a virtual high school, 15 hours of college credit, and an internship to be completed before graduation. The school has strong partnerships with a local community college, a local university, a school support network, and a museum. GSS was founded in 2007 with a core group that included the principal, four teachers, one counselor, and 74 ninth graders. The school has added a grade a year and now serves about 400 students in grades 9-12. Starting in fall of 2012 GSS expanded to include the sixth grade and will add the seventh and eighth grades over the next two years, making it a grade 6 through 12 school.

Admissions and Coursework

The admissions process at GSS is intentionally designed to be inclusive. Applications are made available on the GSS website in January. Teachers visit all of the County middle schools to present information about the school and distribute recruitment materials. The application process requires students to submit recommendation forms, a discipline profile, and an attendance profile. The GSS admissions committee then reviews the materials and contacts the students for an interview. The application is meant to be informative, and every student applicant is interviewed. The interview process is designed to determine whether or not the applicant is interested in attending GSS and committed to completing the level of work that GSS requires of its students. After the interview process is completed, students still in the pool are then selected by lottery.

In 2007, GSS's first year, there were 74 applications, and all were admitted. There were approximately 100 applications in the second year and in 2011 GSS had approximately 200 applications, resulting in half of the applicants being admitted by the lottery. The increase in applicants indicates that the community is well-aware of GSS and considers the opportunities provided by the school beneficial.

The following represents the course of study for all students at GSS:

- **Science:** Earth and Environmental Science, Biology, Chemistry, Physics. After completing those courses, students have a choice of college level science classes through the partnership at the local college.
- **Math:** Integrated I, Integrated II (which is the starting point for those with Algebra I credit in eighth grade), Integrated III, Advanced Functions and/or Pre-Cal or math at

college, Intro to Derivatives and AP Calculus (1st Semester offering course) or Math at college. GSS states on their website that math is not taught in isolated arenas; instead it is integrated across all four years in order to give students “a true sense of how mathematics shapes our world.”

- **Engineering:** Engineering the Future (an elective designed by the museum partner), Applications of Science (integrated science, technology, and engineering), Drafting I, II, and III. Students are also given opportunities to advance in Engineering through the local community college and take Hydraulics, Auto CAD I and II, Computer Aided Manufacturing
- **Technology:** Technology Lab (other technology objectives are integrated into the science, mathematics, and engineering courses)

Courses are taught over a single year are taught in one semester-long, intense courses to create cohesive contact among the students and between the students and the teacher. For example, chemistry courses meet for 90 minutes each day and conclude in one semester. The intense, shortened courses are intended to be parallel to the local community college’s schedule so that students may seamlessly take courses on GSS’s campus as well as taking a course or two at the local community college. The rigor of the other disciplines of science is difficult to determine because Biology is the only tested science subject. In the two semesters prior to the site visit, the teachers explained that their students had a 93% and 95% pass rate (see Figure 1 below). The teachers report that they focus on quality rather than quantity; they didn’t actually teach all that was assessed on the state test. However, the students still did well, and they attribute this success to the students’ ability to solve problems, not just memorize material. There is no information available on the rigor of other science courses.

GSS has a distance-learning program where students can take additional coursework offered at the local community college. The facilities for this program include two distance learning labs at school. Alternatively students can take these classes online at home. Students can choose to remain at GSS for a 5th year and earn an Associates of Arts or an Associates of Science from the local community college and the state will pay for their books and courses. Because of the partnership with the community college, there is a great deal of flexibility in the levels of classes that students can take. A mathematics teacher explained that “*some students need 5 online courses to get them ready for calculus, whereas other students only take 2 courses here at GSS before they are ready.*”

All students at GSS take honors courses, and all of the teachers strive for a Project-Based Learning approach when possible. The instructional model is intended to allow for more inquiry-based teaching and student-centered learning. The teachers focus on relevant issues from which course work aligned with the state’s learning standards are derived. The purpose of connecting relevant issues to their curricular structure is to engage students. This instructional model is adopted purposefully with the expectation that teachers collaborate in cross-curricular lessons and build relationships that support student learning. The principal describes the design as follows:

“We don’t want a school where the teachers are just necessarily the givers of information. We want the students being inquisitive and questioning and discussing and that is what I tell folks when I am hiring them- is it’s easy to create a lesson plan where you are the center of attention, but then I want you to create a lesson plan where the students are doing the work. You are not the center of attention. You are more of a

coach on the sideline, and you can assist them, but you are not doing it for them or just spoon feeding them information to memorize.”

“I try to practice a civil instructional environment here. I think that's where we've got to hang our hat more than anything, because I can't count on funding at the college. I can't count on legislators always making that decision. I've got to strategically, I need to hang my hat on a climate and a culture of teachers and letting kids, it's not worksheet driven, it's not testing driven. It's an environment where the kids can come and enjoy school and not be bored all day long.”

Student Performance Outcomes

Algebra I, English I, and Biology end of course (EOC) exams are all measures that indicate that GSS students perform at a very high level as seen in Figure 1. Student performance on the EOCs is reported in achievement levels ranging from I to IV. Level III is defined as “Students performing at this level consistently demonstrate mastery of this subject matter and skills and are well prepared for the next grade level or for a more advanced level in this subject area”, and Level IV is defined as “Students performing at this level consistently perform in a superior manner clearly beyond that required to be proficient in this grade level or subject matter and are very well prepared for the next grade level or for a more advanced level in the subject area.” Students are considered to be at or above grade level if they receive a score of Achievement Level III or IV on the EOC tests.

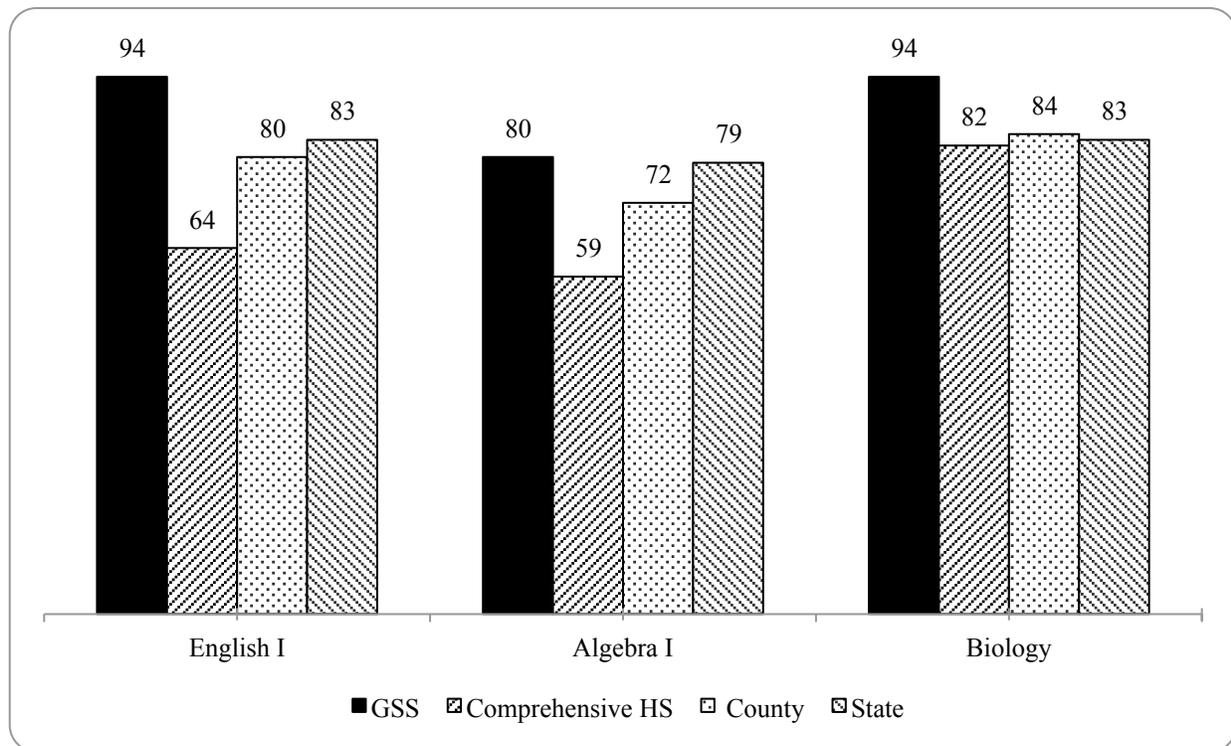


Figure 1
 2011-2012 End-of-Course Test Results for GSS, nearby Comprehensive High School, County, and State (Percent at or above grade level, for all grades tested)

Generally, across all three subjects, GSS outperforms the comprehensive high school, county, and state in each demographic subgroup, most notably with their economically disadvantaged students, Black students, and female students.

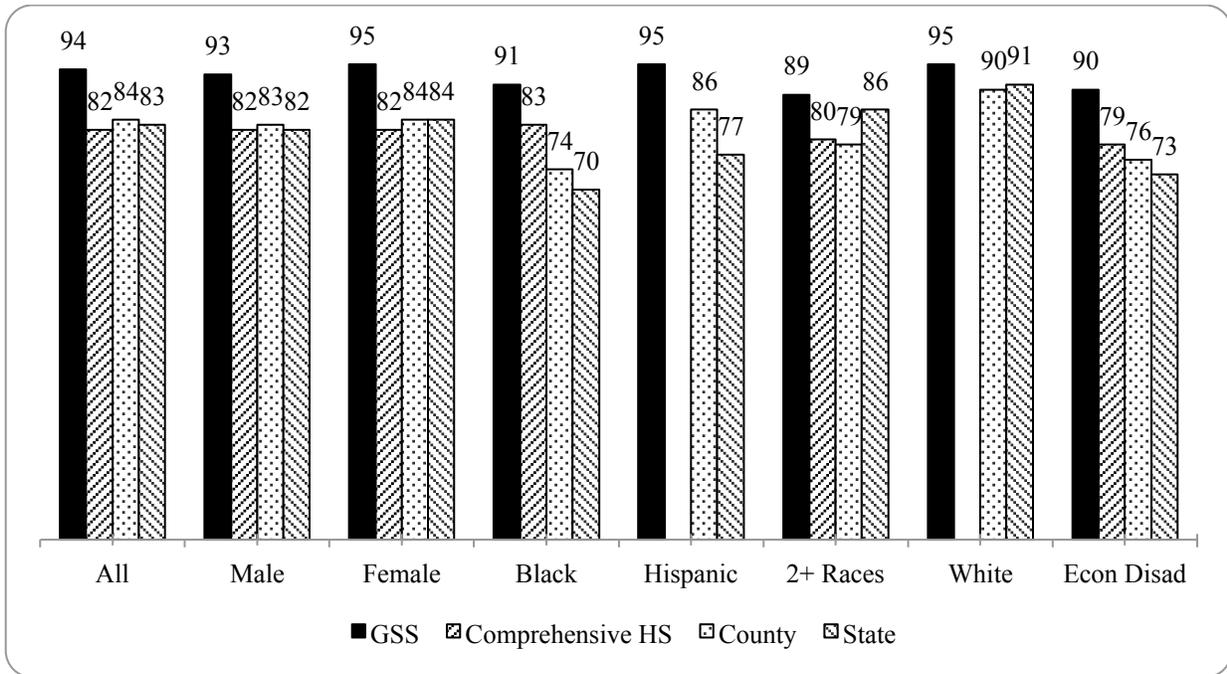


Figure 2
 2011-2012 Biology End-of-Course Test Results for GSS, nearby Comprehensive High School, County, and State (Percent at or above grade level, for all grades tested, disaggregated by gender, ethnicity, and economic condition)

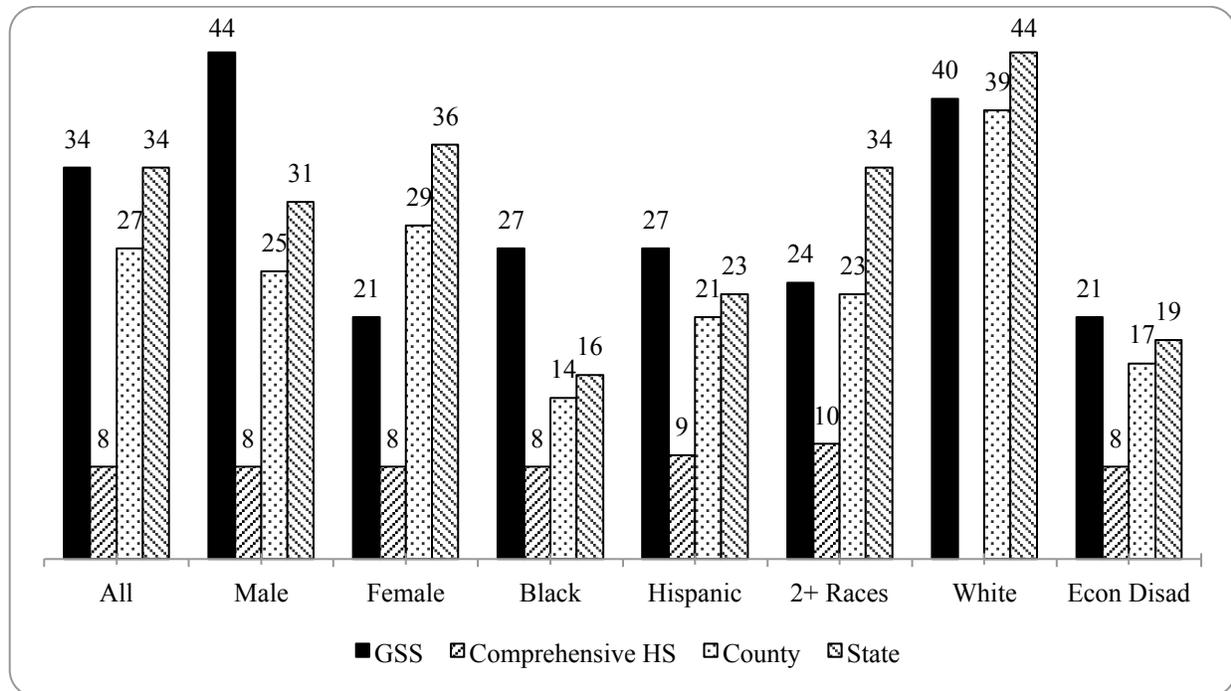


Figure 3
 2011-2012 End-of-Course Test Results for GSS, Comprehensive High School, County, and State (Percent at Level IV “superior achievement,” for all grades and subjects tested, disaggregated by gender, ethnicity, and economic condition)

Overall, GSS graduates a higher percentage of its students than all three comparables, most notably for their economically disadvantaged students, of which they graduate over 95%. GSS also graduates over 95% of their Hispanic and Black students, compared to rates in the mid-70s for the nearby comprehensive school, County, and state.

Table 5
 2011-2012 Cohort graduation rates for GSS, Comprehensive High School, County, and State

	GSS	Comprehensive High School	County	State
All Students (%)	94.7	68.5	80.1	80.4
American Indian (%)	n/a	n/a	85.7	73.7
Asian (%)	n/a	n/a	81.8	87.5
Hispanic (%)	> 95	n/a	76.5	73.0
Black (%)	> 95	70.3	76.0	74.7
White (%)	90.6	20.0	84.0	84.7
Two or More Races (%)	92.9	n/a	81.9	80.6
Pacific Islander (%)	n/a	n/a	n/a	n/a
Economically Disadvantaged (%)	> 95	78.6	77.7	74.7

Families in this rural community seem to be of modest financial means, and GSS does not appear to be an affluent school in any way. However, parents said that they were attracted to

the school because of its small size, smaller class sizes, as well as its STEM focus. Students at GSS are asked to do more and perform at an honors level no matter who they are. This leads parents and students to remark on improvements in student time management and focus. When asked about the inclusive nature of the school, an 11th grader in a focus group provided some insights:

The school culture is very diverse. There are no bullies; everyone is different...In other schools people follow the cool crowd. Here we're all unique. Here you don't pick on people; we're supportive of other students. We're really close, almost like a family. We even have a doorbell. We're all weird in our own ways, we really connect. Always hugs and smiles. The staff wants us to be friends, and to feel safe at school and wants us to fit in (with lots of groups). No drama, don't bring it in. We need to work with others when at a job, and need to get used to working with others. Here we do a lot of group work and they pair you up with people; that are how we come to be friends. Here you can be friends with people in other grades – that doesn't happen at other schools.

District Testing Exemptions

GSS has special exceptions from the District to not give the 9-week benchmarks. The principal states, “*District has 9-week benchmarks, but we don't do that. We were trying to do something different. Everything to me should be a benchmark. I shouldn't have to take a day of instruction to give a multiple-choice test to see where they're at. Exit tickets give that data. You need to use that... That's why the joy of school is gone. I want to keep the joy in. I don't have a problem with assessments if they were more performance based. My kids can do. They are articulate and can talk to you. That is not the measuring stick though. It is a multiple-choice test, that in the long run, the students aren't held accountable. The teachers are. There are too many issues. I don't believe in a system I'm giving to someone else how they do is a mark on me, because I know. I wish they'd just trust professionals again.*” The flexibility of the District to excuse GSS from testing requirements has created a learning environment that embraces reform-based teaching and demonstrates a sensitivity of the District to the innovative educational system provided by GSS.

Early College Experiences: CC6

A partnership with Bison Community College (a pseudonym) expands the curricular offerings students get in their high school career. Generally, students take the introductory level courses in mathematics, science and engineering at GSS, and then if recommended by the principal, they are free to take any of the advanced offerings at Bison Community College. This opportunity creates an environment where the majority of the students who attend in person on the GSS campus consist mainly of freshmen and sophomores, and the upperclassmen are often off-campus attending courses at Bison Community College or taking online courses at home in the morning before they come back for their coursework at GSS. There is a thumbprint reader at the front door where students sign in and sign out. Most of the juniors and seniors at GSS only come to campus for one period a day, and they take courses online or at the community college for the remainder of the day, which results in very personalized experiences for students. The pass rate for all GSS students taking college courses (freshmen to seniors) was 94.5%. The college would like to expand its offerings at GSS. Mechanical engineering is the focus of the engineering courses, and the department at the college would like to offer all types of engineering courses to GSS students, such as industrial systems technology, electronics

engineering, sustainability technology, and operations management. However, there are space and logistics issues to be addressed. The intention is to build hybrid courses for the GSS students so that they get the experience of an online course coupled with a face-to-face experience. GSS deals with the lack of space and resources by partnering with Bison Community College to tap into their course offerings as an extension of GSS. As noted earlier, such curriculum planning is personalized. The principal described the goal: *“I want them to finish two years of college if they can before the end. That is our goal for every one of them. Some don’t do it. Some get 15 hours of college work, and I would be happy with that. It’s whatever they can do is where I want to push them.”* GSS students first take engineering classes taught by a core group of BCC engineering teachers at the high school, and students can then take additional engineering courses through BCC. During the academic year of the school visit for this study, BCC was teaching two courses at the high school each semester: Autocad Drafting and Computer Aided Manufacturing. About 10% of GSS students pursue a five-year associate’s in engineering and a significant number of others take the courses offered at the high school taught by Bison Community College engineering teachers for dual credit. In addition to engineering, some students take lab-based science classes at Bison Community College.

Extending Resources and Personalizing Instruction: CC1 and CC6

The Critical Components of STEM-Focused Curriculum and Early College-level Coursework were a prominent feature at GSS. The structure of the curriculum and the partnership with the local community college was designed to provide additional resources not found at GSS and to offer a more personalized curriculum through early college experiences. Incoming students are varied in what they have learned and are able to do. They come from middle schools from throughout the large rural district, and many are children whose parents are in the military and who have lived all over the world and attended many schools. GSS works to personalize the program for them and meet them where they are as they enter the school. Later on, as students advance, there are increasing opportunities to use the resources of the community. The curriculum specialist explains:

It’s built into everything we do, very personalized. Every kid that goes here is not going to college. However, we try to give options and opportunities. If they want to take college classes, they have to prove themselves, and once they do, we try to do all we can do to push them in that direction...They start taking college classes as early as freshmen, and some of our juniors and seniors, we don’t even see. They clock in and out...So this is a lot of freedom.

The students appreciate this flexibility and one pointed out that he thought that it was possible because the school is so small. Apparently it is harder to find and take opportunities in larger school bureaucracies. The rural area that GSS is located in does not offer as many opportunities in STEM as more populous areas, so GSS takes all the resources available and funnels them to the students, using the community college, university, and online learning, as well as 4H, tutoring opportunities, and small collaborations with local activists and educators.

The nurturing environment is generated by the school’s small size and the close relationships of the students, teachers and the principal. Parents also indicated that the small class size contributed to their and their children’s choice of GSS, as well as their success in the coursework. Ninth graders described incidents of caring attention from their teachers and peers, while eleventh graders talked about knowing all the freshmen. Students reported that they feel free to seek help from any teacher, not just a specific teacher of a course they are taking. This is

facilitated by the small size of the school and positive relationships among all members of the school community.

College courses are a priority in the personalization of classes. Students who are taking college courses first obtain the college schedule, then GSS scheduling fits the high school classes around the college courses. If the high school level courses don't fit, then students have the opportunity to take the courses online. GSS students generally begin college coursework before their senior year, with some as early as 9th grade. The GSS administration allows student to enroll in courses at the community college depending on student performance. The principal personally approves the students who apply to take college courses, and he states, *"Students have to prove they're ready here before we allow them to go over there and take those courses. We look at their report cards and I sign everyone's report card and I put a little note on them 'good job' or 'you need to improve this grade' and so I see what they're doing and we give the ones we feel are ready a release form."* GSS monitors students' grades on college coursework and "pulls them back" into high school courses and supervised online coursework as described by a school administrator: *"Some students aren't ready for the community college scene, so we have to keep them here on our campus to take electives."* These students are then given the opportunity to "prove themselves" in the following semester at the high school level.

After GSS students complete Integrated Mathematics I/II/III, they have the option to take a College mathematics course to satisfy their fourth mathematics requirement. AP Calculus is also an option offered at the high school with the possibility of getting college credit depending on their exam score and the college policy for award of college credit. Some students take all the mathematics courses offered by GSS, and also take additional mathematics courses at BCC. According to a GSS administrator, most GSS students satisfy their graduation mathematics requirements by the second semester of their sophomore year, because students can take a full mathematics course each semester. Because of the variety of classes offered at Bison Community College and the flexibility of GSS scheduling, students coursework becomes personalized and builds skills that are directly marketable outside of high school (for example, the CAD courses).

GSS has limited resources and space to offer a variety of different courses. GSS gains flexibility in their course offerings and deals with limited resources by strategically partnering with Bison Community College. Giving students opportunities to take college courses is a priority for GSS, as evidenced by the graduation requirement of GSS students to take 15 credits in. This opens up a variety of different subjects that would not be taught at a traditional school and increases the rigor of the courses. Taking college courses early with effective support also sets up students to have high self-efficacy in their ability to pass college coursework. Students who see themselves as successfully taking college courses are more willing to continue their work in a 4-year college setting.

Dealing with Technology Limitations: CC3

The GSS School District has developed a comprehensive technology plan that outlines the role technology is expected to play in student learning. The vision statement declares, *"In [the local] County Public Schools, all students and staff will experience continuous academic and personal growth through the effective use of current and emerging technologies, thereby preparing them for life in the 21st Century."* The plan goes on to argue for every class in the county to be a "technology-based environment." Technology is implemented with two primary goals. The first is to make sure County students are able to use technologies to prepare themselves for future work. The second goal for technology use is effective and creative uses of

technology will help its schools meet the needs of a wide variety of students. Thus, the County's design for technology use is to supplement traditional educational methods while preparing students to use technology after they graduate from high school.

On the whole, technology use at GSS can be characterized as resourceful, though not especially innovative or integrated. Teachers, students, and administration are creative in finding ways to accomplish their goals despite limited technology resources, but most people feel they could be more effective if these resources were more developed. In a statement that captures this dynamic, the principal states, *"Everything's out of warranty, so I'm the technology repair guy. My limited knowledge, I'll take it apart, fix the keyboard, put new keys on them. We just make do."* Challenges with old and outdated technology create many problems for teachers, who must be resourceful to solve them. One teacher notes in survey, *"Our computers are limited and the ones we have do not always work. When I do get to use them, I have to devise class with two separate lessons, objective, and products to allow the other half to work in partners to do the above."* An advanced drafting class experienced challenges with installing the drivers they needed to complete a lesson. Students independently contacted technical support to resolve the issue and when technical support was not able to help them, and the students were also resourceful in figuring out the source of the problem and fixing it, later teaching other students how to fix it. Thus, resourcefulness and overcoming challenges is a primary feature of the way technology is used to support teaching and learning. The physical laboratory facilities at GSS were also limited, and similar to the computer technology, teachers at GSS still found ways to make learning student-centered. At a district level, the use of the technology is a struggle due to the rural context. However, GSS is extremely resourceful given limited means to technology. All members of the GSS community, teachers, administrators and students alike, work together to share their expertise to create the most effective learning environment possible. Most importantly, according to the teachers the lack of technological resources does not hamper the educational experiences at GSS.

Required Extracurricular Grade-Level Projects: CC4

Students are required to complete a grade-level project for every year that they attend GSS. Grade-level projects are primarily conducted outside of school time. These grade-level projects are meant to be expanded upon across all four years of attendance at GSS. The projects offer students an opportunity to engage with real world organizations and investigate issues about which students are passionate. Each grade-level project is meant to teach the students a different set of skills, and enable students to view issues at many different levels of thought. Students use the four projects to determine what they may or may not want to study in their higher education pursuits. The grade level projects also help contribute towards GSS's culture, and emphasize community service to the students.

The freshman-year project is focused on scholarly research. This project allows students to research a subject matter of interest to them and then requires them to apply it to one of the core curriculum courses. This project is designed to give students necessary researching and writing skills that they can apply to courses they take in the future.

The sophomore-year project is focused on providing the students with an opportunity to engage in community service activities. Students are required to volunteer for 20 hours of community service during the school months. Most students volunteer at either a program in which students tutor other students at GSS, neighboring Comprehensive High School, or other high schools in nearby counties or at a nearby community garden (where students learn about

gardening techniques and food sustainability issues). Additional volunteer opportunities exist based on student resourcefulness. Students have also presented their work to nearby community leaders in the past as a way to open the school to its neighbors. At the end of the sophomore-year project, GSS students write a paper on social issues which help them to reflect on their community service experiences.

The junior-year project expands upon the sophomore year project and asks students to take their community service experience and begin to think globally. Juniors are required to volunteer for 40 hours of community service during the school months. Most students choose to continue volunteering with the organization that they volunteered at during their sophomore year, however they are also free to pick a new organization in which they are interested. At the end of the junior-year project, students are required to complete a research paper on the global issues they discovered in community service. This paper is designed for students to apply the skills they learned in their first-year project and integrate their reflections from their sophomore-year projects.

Finally, the senior-year project is focused on cultivating GSS students' career interests and providing them with real-world work experience. The stated goals of the senior project include: "Develop good work habits," "Experience personal growth," "Strengthen communication skills," and "Gain an awareness of the community's vast resources and the world of work." Seniors are expected to intern at a nearby organization for 60 hours during the school months. GSS students have interned at technology companies, medical offices, hospitals, and nearby schools. Seniors are expected to find the internships themselves; however they can receive some assistance from their guidance counselors or other adults. The senior-year project culminates in a paper in which the students research a potential career and include details about their own experiences.

Summary

Granite Secondary School can be characterized as a rural inclusive STEM school that provides a quality, personalized education by capitalizing on the few resources available. The most prominent Critical Components found at GSS were CC1 (STEM-focused Curriculum), CC3 (Technology Use), CC4 (Blended Formal/Informal learning Experiences) and CC6 (Early College-level Coursework). GSS deliberately structures early coursework through a partnership with Bison Community College in order to deal with limitations common to rural school districts. Similarly, GSS is limited in terms of technology, but continues to find ways to extend social capital to extend their technological resources. GSS coalesces school work, community service, research, and career options through their blended formal/informal grade-level projects.

GSS overcomes barriers placed by having a small physical facility and teachers who are teaching at capacity by matching their schedule to the local community college. In doing so, GSS is able to extend their course offerings to those of the community college, and in turn, upgrading the rigor of their high school classes for smooth student transition to college. Since the college has a larger capacity for variety of classes (e.g., arts, humanities, and drafting) and vertical articulation of classes (offering advanced semesters of biology, chemistry, earth science, mathematics, engineering and physics), students can use their junior and senior years at GSS to take courses coursework beyond the limits of traditional high schools and individualize their educational experiences. GSS supports students as they transition to college coursework. The freshman and sophomore courses are taught with students at the center and encourage a great deal of student responsibility for learning, using inquiry and problem-based learning as much as

the resources allow. Additionally, GSS builds in required extracurricular research projects that help students see the relevance of their in class learning and build 21st Century skills. Taking courses at the college level when still in high school not only increases the rigor, variety, and individualization of the instruction, it also builds student self-efficacy towards successful completion of college coursework. Granite Secondary School is supported externally by the district to provide individualized instruction through the exemption of certain high-stakes test given by the state. The students test scores on end of course exams which are still required by the district (Biology, Algebra I, and English) are higher than surrounding schools, the district as a whole, and the state. Faced with limited budgetary, technological, and logistical resources, Granite Secondary School administrators, teachers, and students work collectively to overcome these barriers and provide high quality education by finding ways to blur the lines of traditional secondary schools.

References

Reference sources are withheld until permission is given to reveal the identity of the school (under review).