

**Sierra College Community College District  
CTE Community Collaborative Grant  
Final Report for 09-140-271 and 09-141-271  
February 1, 2010 – March 31, 2012**

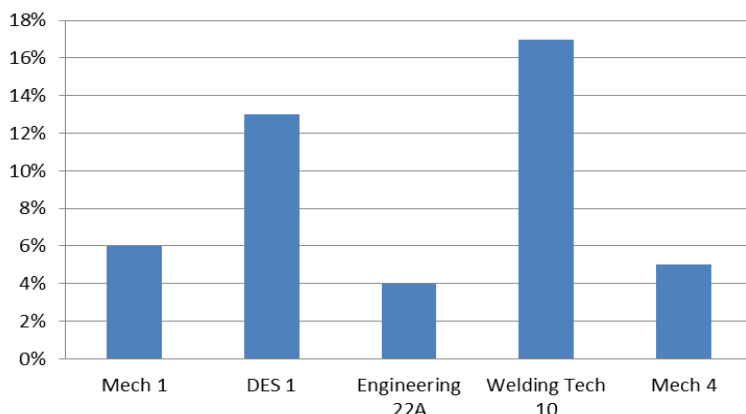
**A) Using data reported on a periodic basis, describe the outcomes resulting from the project.**

The goals of the Sierra STEM project are to: 1) create a pipeline of engaged and highly prepared students entering Sierra College's degree and certificate programs in Mechatronics, Engineering, Energy Technology, Welding, and Drafting & Engineering Support and, 2) build seamless pathways bridging secondary and postsecondary education in high wage, high demand occupations in engineering & design and manufacturing & product development sectors. Activities are organized around four primary objectives: a) provide career exploration for middle and high school students, b) strengthen CTE programs, c) provide professional development, and d) facilitate externship opportunities for teachers and faculty.

Through activities conducted under these goals, the project exposed *21,000 middle school and high school students* to career choices; engaged over *1,000 high school students* in new and updated engineering & design and manufacturing & product development courses; facilitated *4 teacher and faculty externships* with business and industry; conducted *11 professional development workshops* for more than *290 teachers and faculty*, and provided access to *10 professional development opportunities* for *14 teachers and faculty*.

A fall 2011 survey of 188 Sierra College students taking CTE entry-level courses in Engineering, Mechatronics, Drafting & Engineering Support and Welding degree and certificate programs showed the pipeline's early impact.

Percent of fall semester 2011 students enrolled in selected Sierra College CTE courses who previously completed a Sierra STEM supported high school course



Of high school students that took a Sierra STEM-supported course within the last three years, graduated, and then enrolled in one of five Sierra College CTE courses, the greatest impact on enrollment was seen in Drafting & Engineering Support (13%) and Welding (17%).

- B) **Describe the extent to which the project contributed to meeting the needs identified in the application.**

### **Career Exploration**

**Over 1,000 middle school students and 20,000 high school students used career exploration software to explore occupations.** The project supplied Career Cruising software licenses to 11 high schools in Placer and Nevada County (Bear River, Chana, Colfax, Del Oro, Foresthill, John Muir Charter, Nevada Union, North Tahoe, Oakmont, and Placer High Schools) and 3 middle schools (Chicago Park Elementary School, Bowman Charter and Union Hill).

**700 high school CTE students participated in Sierra College's Career Exploration Day.** On October 8, 2010, students from 7 high schools in Placer and Nevada County participated in classroom tours and faculty presentations for all CTE programs on the Sierra College Campus.

**185 middle school students participated in a career fair that featured 14 regional employers, Sierra College CTE programs, 49er ROP, and the Nevada Union Partnership Academy.** On April 13, 2010, middle school students from Union Hill and Chicago Park Elementary interacted with employers, and completed hands-on activities including making an LED flashlight. Parallax Inc. ([www.parallax.com](http://www.parallax.com)) donated 2 instructional robotic kits to a science and math teacher. Students were surveyed after the event and 81% reported that they learned about high school elective classes involving hands-on projects as a result of attending the Career Fair. 56% reported that they learned more about careers involving math and science, and "that there are high school classes I can take to pursue my dream job."

**More than 4,100 high school and middle school students received a notebook featuring Sierra College CTE programs and their related highly paid careers.** The notebook was produced through a partnership with Sierra College for Applied Competitive Technologies (CACT).

### **Strengthening CTE Programs**

The project continued to strengthen CTE programs in engineering & design and manufacturing & product development career pathways at 7 high schools in Placer and Nevada County (Placer, Colfax, Oakmont, Rocklin, Del Oro, Lincoln, and Nevada Union). **Over 1,000 students participated in strengthened programs of study.** Detailed descriptions of the high school programs are included below. Promotional posters and press releases are included in Appendix A.

An evaluation of the project showed that middle and high school CTE programs in Placer and Nevada County have strengthened their capacity in preparing students for entry into postsecondary and career pathways in engineering & design and manufacturing & product development sectors. The evaluation was conducted by an independent researcher in April 2011, to assess strategies employed to date, obtain suggestions to

improve, and provide guidance for prioritizing future efforts. 11 teachers representing 7 high schools and 5 school districts provided input via an on-line discussion board. The full report is included in Appendix A.

A curriculum database was established at Sierrachoolworks.com.

<http://sierraschoolworks.com/section/curriculum/overview/>

Teachers can access and add lessons that are hands-on, introduce STEM careers, integrate mathematics concepts into hands-on projects or develop skills that are used in industry. The database makes it possible to link lessons to California State Education Standards as well as careers related to the lesson subject area.

### **Del Oro High School: Welding Technology & Tech Essentials**

The Welding and Fabrication laboratory was improved with updated equipment, and curriculum was revised to align with industry standards. 25 students participated in the updated course. 4 students received certification for E7018 3G Vertical Up position, up to the maximum of ¾” plate. The Sierra College Welding Department Chair conducted the weld tests and issued certifications.



*From teacher Mike Pahl: “Thanks again for the hard work you guys do on the STEM Grant. My students love the new welders. Here are some comments from my Advanced Ag Welding Class.”*

*I really enjoy the new welders. They are a lot easier to use than the old ones that we had. My beads look way better! - Ryan Clesi*

*The welders produce some clean, smooth beads. They are way better than the prehistoric civil war welders that we had. - Jake Paynter*

*Thank you for the ability to get the new welders. They are great. The Maxstar 200 is amazing. - Nate Bracco*

*Thank you very much for the new welders. They work very well. My welds have improved since the last welders that we had. - Kyle Campbell*

*I like the new Maxstar welders. Stick welding is a breeze. It makes a really workable puddle, vertical ups are flawless. They are nice welders. - John McManus*

*Thank you for the new welders. My welding skills have improved a lot. - Matthew Schmit*

*These welders are the peanut butter on my jelly! Thank you so much for all you do. - Cody Hill*

*These welders are SWEET!! They are very consistent and have greatly improved my welds. Thanks. - Brad Keifer*

A new program of study called Tech Essentials was developed to expose all students (and especially all girls) to CTE programs of study and STEM careers. The Tech Essentials laboratory was updated to include Computer Aided Drafting (CAD), Mechatronics and manufacturing. In the pilot class, 253 9<sup>th</sup> grade students participated in a hands-on project simulating manufacturing processes. Students built the Tech-Explorer catapult project ([www.tech-explorer.com](http://www.tech-explorer.com)) by working in teams and using a lathe, mill, a drill press, a hydraulic press and multiple hand tools.



### **Rocklin High School: Engineering Support Technology**

The Engineering Support Technology Laboratory was improved with updated equipment and curriculum was revised to align with Sierra College Drafting and Engineering Support (DES) curriculum. 230 students learned new skills through hands-on project based lessons where students used CAD software to design products and CNC machines to prototype and manufacture projects.

The program was granted a 1-year license of Algor (a \$5,000 value) as an add-on to their Autodesk software license. This program enhances the experience for intermediate and advanced level students, allowing them to design in Inventor and create virtual simulations (just like in industry) before they create a product and test it. The software helps to complete the theme of rapid prototyping, a critical component that is common in the engineering world. Specific applications include creating flow line analysis of the

CO2 cars that students draw and mill; working with science Olympiad to create bridge models, conducting virtual tests (static and dynamic loadings), building and breaking the bridges, and collecting data through a load cell. These culminating activities take students through the design and development cycle used in industry settings.

6 students from the program participated in Skills USA and competed in Sacramento on February 7, 2011. The Sierra College Center for Applied Competitive Technologies (CACT) provided high powered laptops for the team to use. All 6 students earned gold medals in drafting.



Bryce Adams, Trevyn Adams, Brandon Yates, Griffin Brunner, Dennis Oliferuk, and Nathan Dove all took the highest honors awarded for their drafting categories.

The program also partnered with CACT to create a “Joe Kosmo Award for Excellence” trophy for NASA’s inaugural Lunabotics competition ([nasa.gov/lunabotics](http://nasa.gov/lunabotics)), held at the Kennedy Space Center in Florida. Students designed the trophy in CAD software and the Sierra College 3D printer produced the final product. The trophy was presented to the Montana State University team by the director of the Kennedy Space Center at a culminating awards ceremony.



## Colfax High School: Design Tech

60 students participated in the Design Tech Program which integrated design, manufacturing, computer applications, and communications delivered by 3 CTE teachers. Students designed and prototyped a race car body; used vacuum forming technology to manufacture the car shell, a CNC plasma cutter to fabricate the undercarriage, soldering tools to make the electronic control system; and developed promotional posters, graphics, videos, and portfolios. The culminating event included a competition where student entries were judged and cars were raced.

The project also inspired additional innovative teacher and student work including;

- A new math intervention and prevention game called “Fraction Contraption” ([www.fractioncontraption.com](http://www.fractioncontraption.com)). A video demonstrating the game was submitted to a STEMposium competition (<http://stemposium.org/videos>) and was selected as one of 40 semi-finalists statewide. On March 12, 2011, teacher, Jonathan Schwartz presented his entry at Microsoft Corporation in Mountain View, CA. While not selected as a finalist, the video was featured at the STEMposium event on April 1, 2011 at the California Academy of Sciences in San Francisco.
- A new series of classes called Tech Essentials, which were piloted in fall 2011.
- A student-built 3D printer (<http://www.youtube.com/watch?v=MRbUsIwB-5E>)
- A new module in creative problem solving in partnership with Sierra College CACT and DT Engineering Associates. The module, posted on the project website ([sierraschoolworks.com](http://sierraschoolworks.com)), teaches students how to “brainstorm” as part of the product design/ development process.



## Nevada Union High School: Innovative Design Engineering Applications (IDEA) and Tech-Explorer Catapult

30 students participated in a pilot of Nevada Union High School’s Innovative Design Engineering Applications (IDEA) program which included an applied physics teacher, a drafting teacher, and a shop/lab teacher. A vertical axis windmill project was designed and developed where students prototyped and tested blade designs and mechanical parts. Students used additive manufacturing technology (FDM) and a shop-built generator to test models in a wind-tunnel. Successful prototypes were fabricated from more durable

materials in the IDEA lab. Students also learned basic shop skills, including welding and foundry work.

The program recruited 5 volunteer mentors to assist students in fabrication techniques. Mentors included a retired airline mechanic, a Matsen Ship lines captain and model hobbyist, a machinist (CNC, injection molding), the shop supervisor & machinist from a UC Davis lab where graduate student projects are constructed, and an international buyer for Macys and historian. Community interest groups involved in the project included “The Wing Is the Thing” (TWIT), a group of engineers interested in avionics and wing design; and the Experimental Aircraft Association, which donates incomplete kit airplanes to school programs.

Teachers visited Electronic Carbide, Black Bart Welding, and Sierra Metal Fab to share program information and gather feedback on applicable industry based skills to integrate into curricula.

122 students built the Tech-Explorer catapult project ([www.tech-explorer.com](http://www.tech-explorer.com)), a simulated manufacturing experience. Students worked in teams and used a lathe, mill, a drill press, a hydraulic press and multiple hand tools.

### **Placer High School: Advanced Mechatronics and Welding Technology**

54 students participated in Placer High School’s Advanced Mechatronics course. A new project was developed where students built, wired, programmed, and problem skills to build a color sensor. <http://www.youtube.com/watch?v=Hwfocxo8zq>. Another project included designing and building a robot with an ultrasonic range finder.



The program was featured in the Auburn Journal on February 13, 2011: “Auburn’s Placer is High Tech.” <http://www.auburnjournal.com/detail171385.html>

46 students participated in an updated Welding Technology course, which included CNC metal cutting and fabrication.

### **John Muir Charter School: Outreach and Career Exploration**

40 students working towards their GED received information on Sierra College CTE programs and their related careers. Outreach was conducted in partnership with the Sierra College Center for Applied Competitive Technologies (CACT) and the California Conservation Corps.

### **Lincoln High School: iDesign**

25 students participated in Lincoln High School's iDesign Program learning CAD/CAM technologies. Students used SolidWorks and Mastercam software and completed basic machining operations on manual and CNC mills.

Based on best practices from this program, the Western Placer USD decided to take the program to scale by implementing Project Lead The Way (PLTW). New lab space was identified and renovation plans were developed. A \$150,000 grant from Lowe's was obtained to reconstruct shop space and the district committed to training 2 faculty members.

### **Oakmont High School: Design Tech International Baccalaureate**

25 students participated in Oakmont High School's inaugural Design Tech International Baccalaureate program, learning design, manufacturing, marketing, and material properties concepts and applications. The Sierra College Center for Applied Competitive Technologies (CACT) provided a 3D printer (additive manufacturing) to use as part of the learning experience. At the end of the term, 100% passed the IB performance test.



The project partnered with Sierra College in a National Science Foundation (NSF) project to integrate mathematics into project based learning. 143 students built the Tech-Explorer catapult project ([www.tech-explorer.com](http://www.tech-explorer.com)) by working in teams and using a lathe, mill, a drill press, a hydraulic press and multiple hand tools. A short video on applied mathematics was submitted to the STEMposium competition in spring 2011 (<http://www.youtube.com/user/STEMposium?feature=mhum#p/a/f/2/0WJEY07vG68>).

### **Externships**

**Four teachers and faculty participated in business and industry externships (61 hours).**

On June 15 and 16, 2010, Steve Dicus, Design Tech International Baccalaureate instructor at Oakmont High School, participated in a two day externship with Pasco Scientific. He toured several departments and documented his experience through a video which was shared with students and teachers.



On August 2, 2010, Tara Kringel, Fashion Design teacher at Roseville High School, participated in a 4 hour externship with Ezeeye Imaging. She was exposed to industry practices in graphic design which she incorporated into curriculum and lab experiences for students.

From November 16 to December 22, 2010, Phil Pattengale, Engineering Professor at Sierra College, participated in a 9 day, 33 hour externship at Renesas Electronics America, Inc. in Roseville. Renesas engineers engaged Mr. Pattengale in working on an electron microscope, which also applied to instructional applications taught at Sierra College. Following the externship, Renesas hired Mr. Pattengale as an external consultant to apply his expertise to other manufacturing technologies.

On July 19, 2011, Dan Frank, Engineering Support Technology teacher at Rocklin High School, participated in a one day (8 hour) externship at RCD Engineering. The company designs and manufactures dragster and race car parts sold to companies like NASCAR. The teacher commented that the experience “allowed him the opportunity to get back into industry and see how design and engineering principles work in a manufacturing environment; and what basic math skills are needed by entry level employees.”

### **Professional Development**

**The project developed and conducted 11 professional training events attended by more than 290 teachers, counselors, and faculty members.** These included:

- On June 7, 2010, teachers and faculty learned the basics of using and applying Mastercam software. 8 teachers from Nevada Union, Oakmont, Placer, Rocklin, Del Oro, and Colfax High School and Sierra College participated in the training.



- On September 22, 2010, 11 teachers and administrators from Placer Unified High School District participated in a 2 hour workshop, “Fraction Contraption.” Teachers ranked the workshop as excellent and said that they could use the game to practice fractions daily in their classroom, teach probability, and continue to review basic math concepts such as integers and number sense.

- On January 8, 2011, 11 instructors and 13 students participated in a 4-hour workshop: “Fraction Contraption, Advanced Math through a Sound Foundation.” The training focused on building a hands-on project where students could apply math skills.
- On March 11, 2011, the project co-sponsored a Math Articulation Conference on “Are High School Students Ready for College?” The conference was attended by 84 teachers and counselors from 34 high schools and 7 middle schools, PCOE , CalPass, and Sierra College.
- On March 18-19, 2011, two workshops were held at the annual CITEA conference in Fresno. 12 CTE teachers learned how to construct the game using CNC machines, a laser cutter, and power tools, and how to use the game as a mathematics intervention tool. The workshop was co-sponsored by the Paton Group. Participants rated the workshop as excellent and said that the most valuable component of the course was; “students will be able to understand fractions because of the game” and “walking away with an actual product/model of the game.”
- On April 15, 2011, the project organized and moderated a STEM faculty panel for 70 high school counselors at Sierra College’s Counselor Symposium. The panel included three Sierra College CTE faculty members and the Mathematics Department Chair. Panelists provided counselors with information on educational and occupational pathways in Mechatronics, Drafting & Engineering Support, and Energy Technology.
- On June 6, 2011 a workshop on Mastercam software was conducted for 14 high school and Sierra College teachers and faculty. In the full day workshop, participants learned how to set up computer code in Mastercam, which they used to manufacture dominoes and stacking blocks on CNC milling machines.



Participants were guided through the Mastercam interface including opening, merging, and importing drawings, understanding WCS and cutting planes, mill type and stock setup, tool path operations (drill, pocket, contour, importing and editing images files, contour for engraving), back plot and verify, G1-code generation, and fundamentals of G and M code. Content included handouts and lesson plans. A lesson plan on teaching the Mastercam software was posted on the project website ([www.sierraschoolworks.com](http://www.sierraschoolworks.com)). “Networking with other instructors, sharing project ideas and gaining an increased understanding of the software was valuable; it was a good combination of instruction and practice,” reported participants.

- On August 10, 2011, a teacher workshop for 21 participants from 4 elementary and middle schools and 4 high schools was conducted at Colfax High School. Participants learned how to teach basic math skills using the Fraction Contraption game

([www.fractioncontraption.com](http://www.fractioncontraption.com)) as a teaching tool, and agreed to participate in a pilot program in which they would: 1) use the game in their classroom to teach basic math skills that were grade level appropriate, 2) expose students to how math is applied in everyday life, 3) administer pre- and post-tests to capture performance data, 4) share data results and their experiences, and 5) share grade-appropriate curriculum developed in relation to the project.



- On September 19, 2011 a workshop for 25 high school counselors and 5 teachers was held at the Placer High School District's Technical Center. The workshop was facilitated by Michael Brown, English teacher, and Rose Murphy, Humanities Academy Counselor, from Nevada Union High School. The training provided participants with a variety of resources to share with their students, including general career and college research, and CTE and STEM careers curriculum and lesson plans. Other presenters included Gregg Ramseth, Director of Technology, Placer Union High School District, and Alistair Turner, Program Manager for International and Outreach at Sierra College. 95% of participants rated the workshop as excellent or good, and indicated that they gained valuable, "resources and handouts," "websites," and "lesson on the Sierra College CTE programs." They appreciated "the passion of the presenter – keeps us engaged and reminded of why we are in the field," and "hearing how Career Cruising is being used at other schools."
- On October 20, 2011 a workshop was conducted for 13 teachers from 4 high schools and 5 elementary and middle schools at Colfax High School. A new game was introduced called "Fence the Yard" to teach students geospatial reasoning. Teachers also received DVDs of the Future Channel movies and curriculum to show how math is applied in exciting careers in Science, Technology, Engineering and Math.
- On November 11, 2011, the project held a workshop and lab tour for 6 teachers and 2 Sierra College faculty members at Oakmont High School's Design Tech program. The participants learned introductory SolidWorks skills, and used a 3D printer, laser cutter, and CNC router to make projects that could be replicated in other CTE classes.



**The project also provided professional development training to CTE teachers and faculty at a variety of regional and statewide workshops and conferences including:**

- On November 12 and 13, 2010, 2 instructors from Nevada Union and Roseville Joint Union High School Districts attended a CDTC Workshop at Oakridge High School. The workshop featured hands-on projects for Mechanical and Architectural Design, manufacturing and rapid prototyping.
- On August 11-15, 2010, a Sierra College Energy Technology faculty member attended the PG&E Power Pathways faculty forum in San Francisco. New curriculum was shared at the event and new connections with established community college programs were strengthened.
- On November 30 to December 2, 2010, the Engineering Support Technology teacher at Rocklin High School attended AutoDesk University training. In partnership with Sierra College's Perkins Program 2 Sierra College drafting instructors attended as well. The instructor commented; "WOW, there is a whole other world! I can't wait to get back and start incorporating much of this!"
- On March 23, 2011, Colfax High School teacher, Jonathan Schwartz exhibited in a regional STEM Expo hosted by William Jessup University. The expo was attended more than 150 students and parents.
- Teachers from Oakmont, Colfax, and Rocklin High Schools participated in several professional development workshops including; GoEngineer & SolidWorks Race To Production Technology Event on June 9, 2011 at the California Automobile Museum; a Google SketchUp workshop on May 24, 2011 at Placer Union High School District Office delivered by Sierra College faculty member, Ed Mojica; and at a Sierra College Engineering Support Technology teacher workshop on May 21, 2011 delivered by Sierra College Department Chair, Alison Salome.
- On June 27-29, 2011, teachers and faculty from Rocklin High School and Sierra College were selected and attended the Strategic Linking of Academic and Technical Education (SLATE) Contextualized Learning Council (CLC) convening in Irvine, CA. The SLATE initiative is a new project of the Institute for Evidence Based Change (IEBC) funded by the James Irvine Foundation. This group is working to establish cross-discipline connections between curricula while adding real world context.
- In July 2011, Oakmont High School teacher and President of California Drafting Technology Consortium (CDTC), Steve Dicus, attended the MTTA/CDTC Summer Conference at Cal Poly San Luis Obsipo, CA.
- In August 2011, Rocklin High School Engineering Support Technology teacher, Dan Frank, attended Mastercam teacher training at the summer institute in Gigg Harbor, WA. New knowledge and skills were integrated into the program's CAD/CAM curriculum.
- In fall, 2011 Michael Kane, Associate Dean of Sciences & Mathematics completed a 7 week 35 hour course "Understanding Gender Equity Issues in STEM Education" and developed a resource Wiki on the subject <https://castemequity.wikispaces.com>

- On October 18, 2011, Jim Nieto, Principal of Bear River High School attended the Green Curriculum Institute in Pasadena, CA. The California Education and Environmental Initiative developed 85 units of K-12<sup>th</sup> grade curriculum that meet Science and History-Social Science academic standards. <http://www.calepa.ca.gov/Education/EEI/> This information was shared with Bear River teachers and outreach efforts began with community/business/educational partners to leverage local resources and strengthen educational programs.

**C) Summarize the activities of the project that enhanced the mission of the program.**

The Sierra STEM project was designed to inspire and engage Placer and Nevada County middle school, high school and community college students in manufacturing & product development, engineering & design career pathways, and prepare a highly skilled future workforce for occupations in emerging industries. Manufacturing and product development sectors in California and the nation are undergoing transformational changes, requiring advanced skill sets in digital technologies, mathematics, designing for manufacturability, sustainability, and cross-discipline collaboration. The project:

- Worked collaboratively with CTE teachers and faculty to update curriculum and modernize laboratories
- Expanded linkages and program alignment from high school CTE programs to Sierra College CTE degree and certificate programs in Mechatronics, Engineering, Engineering Support Technology and Energy Technology
- Institutionalized career exploration activities in STEM (Science, Technology, Engineering, Math) and other occupations in middle and high schools
- Developed a regional CTE learning community where teachers and faculty developed and delivered workshops to their peers, shared curriculum and other resources, and provided mentoring, and
- Strengthened business and industry engagement in secondary CTE programs through teacher externships, site visits, guest speakers, and student tours.

Furthermore, a goal of the project was to create self-sustaining programs that would remain responsive to education and labor market needs. As teachers developed, piloted and refined new curriculum, new models emerged including:

- Lincoln High School's transformation of the iDesign program into **Project Lead The Way**. Western Placer USD secured a \$150,000 grant from Lowe's to modernize laboratory space that included previously purchased Computer Numerically Controlled (CNC) equipment and CAD lab, and invested additional funds to train two teachers, furnish the classroom, and purchase new instructional materials.
- Oakmont High School's transformation of a Robotics class into a **Design Tech International Baccalaureate** program. Roseville Jt. Union HSD invested in teacher training and instructional supplies, and used previously purchased equipment (e.g. a CNC router) to enhance the project-based curriculum. The Sierra College Center for

- Applied Competitive Technologies (CACT) lent a 3D printer for students to create prototypes from CAD-designed projects.
- Placer Union HSD's transformation of a two-decade old Tech Core class into **Tech Essentials**, designed to reach all 9<sup>th</sup> grade students. CTE Professional Learning Communities at each high school worked collaboratively to develop curriculum and student learning outcomes. Labs were updated to incorporate new technologies and simulated manufacturing processes, and an intervention and prevention model for teaching the "Seven Essentials of Math" (measurement, fractions, ratios/proportions, probability, decimals, percents, and geometric reasoning) was created (fractioncontraption.com). Additionally, Colfax High School's woodshop program transformed into **Project Lead The Way**, and Placer High School expanded its **Mechatronics** program.
  - Chicago Park Elementary was designated as a Charter School and won funds to build a **new technology center**. The Sierra College CACT donated a Tech-Explorer laboratory and professional development training so that middle school students could use automated and hand tools in a simulated manufacturing environment to build a catapult, which was placed in the new tech center last year. Curriculum was developed to support career exploration lessons, and a pilot group of teachers participated in a math prevention/ intervention learning community using the Fraction Contraption game (fractioncontraption.com).

**D) Provide a recommendation of ways to strengthen the collaboration between community colleges, high schools and ROCPs to expand career-technical education programs and related opportunities for students. Were the partners involved in this project successful in their efforts to expand collaborations? What were the strengths and weaknesses of the partnerships?**

Recommendation: Build strategies for sustainability in project planning and implementation.

This was achieved through the following activities:

The Sierra College Center for Applied Competitive Technologies (CACT) has a vested interest in preparing a future workforce that is highly skilled and educated, and stocking the pipeline of students that continue their education in STEM (Science, Technology, Engineering, and Math) related career pathways. The CACT will continue to help direct the project and act as a conduit for advisory members, business donations, and technical consultation.

Efforts to bring high school CTE teachers and Sierra College faculty together to cross-collaborate have resulted in equipment donations, shared curriculum, participation in training events, and technical assistance for program planning and lab setup. Additionally, high school CTE teachers were invited and regularly participate on Sierra College advisory committees for Mechatronics, Drafting & Engineering Support, and Engineering programs. The project will continue to support communication and collaboration between CTE teachers and faculty, and conduct outreach to middle school teachers to encourage academic preparation for CTE courses at the high school level.

High school CTE programs committed Perkins funds to support their programs, resulting in new equipment and instructional supplies. 49er ROP is a project participant and is committed to supporting career and technical programs at the secondary level.

Stronger connections were developed with Sierra College's Perkins initiative and 49er ROP. Collaboration leveraged funds to provide professional development for faculty and teachers, share curriculum, and obtain new resources. The College's Tech Prep (Transitions) program continued to assist teachers and faculty in developing articulation agreements.

Recommendation: On a statewide level, improve opportunities for sharing best practice models and other resources.

Project staff and participating teachers and faculty attended and spoke at presentations and events, both regionally and statewide, providing exposure to best practices from other CTE Community Collaboratives and secondary CTE programs. Expanded networking and information sharing would help best practice models go to scale and potentially achieve greater impact; and reduce the costs of research and program development.

In addition to sharing best practice models via presentations and professional development events, the project website was updated to share curriculum, success stories, and other resources with teachers, faculty and counselors statewide. A project newsletter was developed and mailed to business and industry partners, middle and secondary administrators in Placer and Nevada County, and Sierra College CTE faculty.

#### Strengths and Weaknesses

Strengthened partnerships resulted in new resources for high school and college CTE programs, updated curriculum aligning secondary and postsecondary programs, and new connections to business and industry partners. Weaknesses included limitations in industry partner time and funding as compared to the on-going and increasing need by CTE programs to receive industry-level professional development training and industry-current lab equipment.

- E) Within your final report, provide an assessment of the capacity of community colleges, high schools and ROCPs to engage in and support effective, integrated programs of career and technical preparation. What aspects of the project were easily achieved? What were the difficulties that arose?**

The project's strengthened programs of study comprise a strong pipeline of students graduating and continuing their postsecondary education at Sierra College. Sierra STEM-supported schools are effective providers of programs that are inspiring and engaging a future workforce in manufacturing and product development, engineering and design careers. This strong base of support includes Boards of Trustees and their Superintendents, teachers, counselors, students and parents.

Sierra College CTE programs are also strongly supported by employers and the community. Over half of Sierra College students have taken at least one CTE course.

Linkages from feeder high schools to CTE programs at the college are important and logical – particularly for high profile programs such as Mechatronics and Energy Technology. Through Tech Prep and Career Connections, Sierra College has an interest in supporting student enrichment and articulation, and provides technical assistance to bring high school and college teachers together to renew and develop agreements.

Aspects of the program that were easily achieved were administrative support from principals and superintendents, and business/industry support from regional employers. Difficulties that arose were structural – coordinating limited resources to assist with development of curriculum and course sequencing, and finding adequate laboratory space. Other challenges included piloting new curriculum while teaching full time.