

IV. Application Narrative

(A) Project Summary

- 1. PCC will add long-term capacity* to deliver accelerated STEM credit by increasing the quality of and access to dual credit engineering options by modeling a pathway for high school teachers to be certified to teach Engineering 100. Through expanding outreach and activities that build interest in STEM more underrepresented students will earn STEM college credits.
- 2. Overarching goals* are to certify dual credit teachers in Engineering 100 to increase the number of underrepresented students completing a STEM dual credit course, while escalating their self-identity as successful STEM students.
- 3. Impacts/changes from implementation* is a model for an Engineering 100-level dual credit certification that will dramatically increase the number of certified teachers, heighten student engagement in STEM studies and careers, and strengthen efforts of Regional STEM Centers to increase dual credit courses through model dissemination to schools and colleges.
- 4. Key Partners* – High schools, South Metro Salem STEM Partnership (SMSSP), Portland Metro STEM Partnership (PMSP) and Oregon Museum of Science and Industry (OMSI).

(B) Project Rationale

1. Community overview. Portland Community College (PCC) enrolls more than 94,000 students annually. Students reflect regional diversity with 32% representing ethnic minorities: 47% are male, 53% are female and 47% percent are low-income based on the number of PCC students receiving Pell Grants. The PCC service district includes 13 school districts, many with a high ratio of underrepresented students, such as Hillsboro where 44.5% are eligible for free/reduced lunch, Forest Grove at 58%, Gaston at 43.7%, and Veronica at 48.9% (Database, 2013-2014). PCC will target outreach at schools with a high percentage of poverty and of ethnic minorities.

2. *STEAM/CTE related needs and challenges.* Few high schools provide engineering dual credit, in part because of the 1) perception of the high cost of delivery, 2) perception and actual difficulty in certification through existing instructor qualification pathways and 3) lack of awareness of support (professional development stipends, faculty mentoring, and loaner equipment). Historically underserved populations have disparate participation and completion rates in STEM studies due to low college-level science/math skills, lack of role models, limited belief in their abilities in math and science, and apprehension about a college environment (Mason). According to a 2011 U.S. Department of Education report, Black and Hispanic students represented just 7.5 and 7 percent of all STEM degrees. In Oregon only 29.9 percent of STEM degrees were awarded to women and only 30 percent to racial minorities (Mason).

3. *STEM career opportunities* in Portland Metro are in manufacturing including specialized information technology and very high-tech manufacturing (semiconductor/electronic components and mechatronics), product design and food packaging (ECONorthwest, 2012).

4. *Project learning experiences/supports* designed to stimulate and sustain interest in STEM studies include: 1) Students attending PCC events and meeting faculty, and experiential summer camps; 2) tuition-free college credits; and, 6) development of STEM college/career plans.

5. *Ensuring State content standards are addressed.* PCC Dual Credit office certifies the course meet standards. Engineering 100, a gateway course encouraging students to follow their interest toward a science, math, engineering, or design degree, will also incorporate Next Generation Science Standards (NGSS) for Engineering Design which details key scientific ideas/practices that all students should learn by the time they graduate from high school (Council, 2012).

(C) Project Plan: 1. *Summary specific objectives / outcomes* – The following are specific objectives and their corresponding outcomes: 1) Increase professional development for high school dual credit teachers / At least ten teachers will be trained (4Change underserved outreach,

NGGS, OMSI e-Textiles projects based on Girls RISENet, Engineering 100); 2) Increase long-term capacity to deliver accelerated college credit in STEAM/CTE / Ten teachers from five schools will be certified – an increase from 1 to 11 with a resulting increase in earned college credits; 3) Increase efforts of regional STEM centers to increase dual credit courses by providing a model STEM gateway course / Model developed/disseminated; 4) Increase historically underrepresented high school student's interest, excitement, preparation and retention in STEAM/CTE college studies through focused summer camps / At least 55 students will attend the camps and at least thirty additional students will enroll in PCC Fall Term 2015.

*2. Evidence-based approaches. **Summer Camps*** are based on active learning principles that state 1) engineering summer studies help students acclimate to a college environment and gain confidence (MIT, 2014) and 2) by incorporating lab experiences students build math, science and engineering skills (Olin College of Engineering Program Objectives, Pedagogy and Curriculum, 2014). Studies report that **dual credit** prepares students for college level studies. A 2008 Oregon University System Office study noted this (Jacobs, 2010) as well as the Community College Research Center at Columbia University (Community College Research Center, 2012) which found that dual enrollment of disadvantaged, first generation students was linked to numerous positive college outcomes including increased enrollment, persistence and increased GPA.

3) Activities to recruit, encourage, engage, and provide opportunities to underserved and underrepresented students and/or educators. Since one of the stumbling blocks to increasing the number of high school teachers qualified to teach Engineering 100 has been the lack of a 100-level specific qualification option, PCC Engineering Faculty and Dual Credit Office will support a pathway that allows teachers who only lack a few required competencies to develop them prior to applying for certification. This pathway will be introduced to high school teachers through targeted outreach and marketing by PCC Advisors and Engineering Faculty to high schools with

high numbers of low-income ethnic minority students to find teachers interested in pursuing Engineering 100 dual certification. Onsite workshops will explain the training options available and interested teachers will be invited to join the project. Ten teachers from five schools will be guided through the Engineering 100 course by PCC Engineering Faculty and conduct a gap analysis to help contextualize course activities to the needs of their home school (minority and female student interest, employer needs). PCC Faculty will revitalize/contextualize course with content through activities in design, applied math, and alignment with NGSS core engineering practices. It will be piloted at PCC before being used in the schools. PCC Engineering Faculty will create supplemental materials: minilab projects that support building block concepts in STEM and mini-capstone project options that integrate STEAM/CTE and build on existing 3D fabrication and e-textiles labs. High school teachers and PCC Engineering Faculty will attend training in 1) National Science Foundation's *4Change Diversity Outreach* (increase outreach and effectiveness of professional engineering societies in reaching girls), 2) NGSS engineering practices through PMSP, and 3) OMSI e-Textiles projects. PCC Engineering Faculty, PCC Hermanas and Diversity Council leaders, and the +STEAM club will contact Regional STEM Centers, equity partners such as Adelante Chicas, PSU Louis Stokes Alliance for Minority Populations (LSAMP), and PSU-PCC Bridges to Baccalaureate to assist with direct outreach to high schools students at target schools to facilitate enrollment in Engineering 100. Once the Engineering 100 courses are scheduled, students and teachers will participate in a PCC Sylvania kick-off event to visit the Maker Space and will meet PCC faculty; they will also have a celebratory course completion event at PCC. PCC will support project success several ways. PCC +STEAM club will assemble Fab Lab Maker's Carts (equipment needed to teach the course), five to deliver to schools and one for the PCC course. These will later be loaned to the PMSP Equipment Lab Library. PCC Engineering faculty and employers will make presentations

in the high school classrooms and PCC Advisors will assist with college planning. PCC summer camps will acclimate students to the campus and faculty, encourage enrollment in Engineering 100, and create interest in college studies. The Tech Robotics and E-Textiles camps-will enroll female minority students. The Build-a-Bot camp will enroll Engineering 100 students planning to attend PCC. **Please see Appendix C Action Plan.**

4. Planned project activities meet the stated objectives. Activities were expressly created to directly address objectives and are coordinated to increase access, develop excitement, create opportunities in the community, and encourage underrepresented students to expand their belief in themselves and their ability to pursue studies and careers that will support a rich adult life.

5. Implementation Timeline: Spring 2014 – 1) PCC Engineering Faculty/staff grant orientation; 2) High school teachers identified to become dual credit certified; 3) Faculty creates mini-labs and mini-capstone projects that utilizes Maker Cart; 4) Outreach to increase diversity in summer camp; 5) Develop training for Engineering 100 teachers. Summer – Fall 2014 – 1) Tech Robotics and E-Textiles Camps; 2) PMSP STEM Teacher Academy NGSS Class for teachers promoted; 3) Engineering100 training for teachers; 4) Faculty and Project Director revise/contextualize Engineering100 activities; 5) *4Change, Hands-on-Minds-on and e-Textiles* training for faculty and teachers, 5) Dual-Credit instructor approval. Fall 2014 - 1) Schedule winter Engineering100 course; 3) Build Maker Carts, schedule speakers, and host PCC visits; 4) Deliver Fall 2014 pilot of revised Engineering 100 at PCC. Winter 2015 – 1) Deliver Engineering100 at high schools and PCC; 2) SMSSP and PMSP promote dual credit enrollment in STEM 100 math, digital design, and engineering technology. Spring 2015 – Recruit for summer Build-a-Bot camp. Summer 2015 – 1) Build-a-Bot Camp for students completing Engineering 100; 2) Close out grant/ final reports.

(D) Evaluation Plan. PCC will assess effectiveness by looking at summative measures, as well as formative evaluations. The **summative measures** will be comprised of specific outcomes

linked to program objectives: 1) Increase professional development for dual credit teachers; 2) Increase long-term capacity to deliver accelerated STEM college credit; 3) Increase efforts of STEM Center partners to increase dual credit courses through the model gateway course, Engineering 100; 4) Increase underrepresented student's excitement, preparation and retention in STEAM/CTE college studies through Engineering 100 and focused summer camps. **Formative measures** will provide the project team and instructors feedback regarding the progress and success of various tasks. A formative evaluation assessing the process will be conducted three times. Relevant key staff and instructors will indicate on a form the extent to which they believe the program tasks that took place since the previous formative evaluation were successful, and to offer input as to suggested changes. Examples of tasks may include: teacher training, schools offer courses, instruction of students in Engineering 100 (including attendance and students' attitude toward and knowledge of STEM studies and careers), summer camps, efforts recruiting teachers (including achieving minority/woman representation), curriculum revision, partner involvement. For each task, key staff /instructors will indicate extent to which tasks were successful from 1(=not successful at all) to 5 (=very successful). If the staff/instructor indicated a value of 1 through 3, they would be asked to comment on the process and provide feedback. These forms would be collected by the project coordinator.

(E) Sustainability Plan Leverage/support/reallocate resources. The Dual Credit Office will oversee certified courses, Maker Carts will be available through PMSP, and partners will continue activities. The model for an Engineering 100-level dual credit certification will still be used. Activities will be continued through regular programming. The PCC Foundation will seek funding to continue summer camps. Community partners will continue expanded outreach to underrepresented groups. The Regional STEM Centers will disseminate the model, professional development opportunities and dual credit options to partner schools.

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