Project Summary

The Foundation for Family Science & Engineering (FFSE), an Oregon-based, non-profit organization, will partner with Central School District (CSD) and Western Oregon University (WOU) on an initiative to increase access for students and families to quality STEM learning experiences by implementing innovative, evidence-based engineering education programs designed for elementary age students in both formal and informal learning environments. Effective engineering education naturally highlights the interconnectedness of science, technology, engineering and mathematics (STEM) subjects while emphasizing the development and practice of essential career skills, such as problem-solving, critical thinking, communication, and teamwork. The *Engineering a Pathway to STEM* initiative will build the capacity and confidence of elementary classroom teachers and out-of-school time educators to facilitate STEM focused classroom curriculum, projects both during and afterschool, and community-based family events, as well as provide the tools and resources for successful and sustainable implementation. This initiative will serve as a catalyst for CSD and the communities of Independence and Monmouth to build excitement, support and momentum around the importance and urgency of improving STEM education for all students. And it will position CSD to significantly enhance and expand their engagement with existing resources and relationships with local partners, such as Western Oregon University.

Project Rational

Central School District serves students and families from two diverse small cities and adjacent rural areas. 60% of CSD's students are economically disadvantaged and 30% are English Language Learners. 43% of students in grades K-5 are Hispanic/Latino. Monmouth has a population of 9,476 with 10% Hispanic/Latino while Independence has a population of 8,764 with about 30% Hispanic/Latino and 22% speaking only Spanish. Poverty and low educational

attainment have impacted overall student achievement for many years and a significant achievement gap persists between White and Hispanic/Latino students. The District Report Card, issued annually by the Oregon Department of Education, clearly shows the challenges Central students face. In 2013, 45% of 5th graders did not meet the state science standards and 46.6% of 3-5 graders did not meet state math standards. Also, the achievement gap in science between White and Hispanic/Latino elementary students averages about 30 points (Appendix G).

The region surrounding CSD presents a rich variety of STEM resources and career opportunities, including business and industry that focus on technology, aerospace, agriculture, resource management and manufacturing, as well as STEM based education programs at area universities and colleges. CSD will work with FFSE to identify strategies that will create a stronger connection with these opportunities and help teachers, students and families to benefit from the rich STEM resources in their region. Western Oregon University is located in Monmouth and is a long-standing education partner for CSD. WOU is eager to strengthen and expand their role in supporting STEM education for students in CSD, as well as assist CSD to fully engage with the South Metro-Salem STEM Partnership, a regional collaboration to improve STEM education. A critical element of the programs being implemented in *Engineering a Pathway to STEM* is exposure to and exploration of engineering careers as participants engage in problem-based activities set in real-world contexts. This is achieved through direct career connections in the program materials, the use of locally relevant and meaningful examples, as well as through the incorporation of diverse students, faculty, and professional STEM career role models as volunteers that interact directly with CSD teachers, students and parents.

Research shows that 8th grade students who express interest in STEM are up to three times more likely to pursue STEM degrees and careers than students who do not express such

interest (Science, 2006). To gain this interest, children must be exposed to positive experiences with science and engineering very early on, be confident in pursuing their interests, and their parents must be able to encourage and support this interest. Research also shows a significant improvement in a child's self-confidence and academic success when parents are more actively engaged in their learning (Henderson and Mapp, 2002). Family involvement is even more important in rural communities where there is less exposure to and awareness of STEM related fields. Introducing parents, along with their children, to STEM careers at an early age will build a foundation for further exploration and learning and help to close the "opportunity gap" that often exists for students from low socioeconomic backgrounds or from minority populations that are traditionally underrepresented in STEM fields.

One of the major challenges related to STEM learning faced by elementary students in CSD is that they do not receive a consistent or sufficient amount of instruction in science and little or no instruction in engineering. CSD is committed to improving STEM education for its students and incorporated STEM as a major component of its successful 21st Century Community Learning Center grant that has breathed new life into CSD's afterschool programs this year. *Engineering a Pathway to STEM* will build on this investment by improving the ability of both afterschool educators and elementary teachers to deliver effective STEM instruction through a focus on engineering. As a result, CSD elementary classrooms will better address the Oregon Science Content Standards which include Engineering Design as a core standard at every grade level K-5, as well as addressing the requirements of the Next Generation Science Standards (NGSS) that call for an even greater inclusion of engineering at the elementary level. The EiE classroom curriculum works in concert with existing math, science, and literacy curricula and provides a culturally relevant and meaningful way for students to learn and practice

the skills associated with science and engineering. EiE units are closely aligned to both the Oregon Science Content Standards and the NGSS (Appendix H and I). Engineering Adventures (developed by the same team behind EiE) and Family Engineering (an Oregon-based program developed with support from the National Science Foundation) meet these same criteria for afterschool settings and parent and community engagement.

Project Plan

To meet the needs of teachers, students and families in CSD, *Engineering a Pathway to STEM* will implement three nationally recognized, evidence-based engineering education programs specifically designed to reach all students, but especially those that are traditionally underrepresented and underserved in STEM fields – Engineering is Elementary (EiE) in the classroom, Engineering Adventures in afterschool programs, and Family Engineering for community-based family events. Research has shown that these innovative programs successfully engage elementary-age children in quality engineering experiences and are effective with multicultural audiences (Cunningham & Lachapelle, 2012) (Helms, Mitchell, et al., 2012).

Engineering a Pathway to STEM will make significant impact on the teachers, students, and parents in CSD by meeting the following objectives. (Please see full Project Plan in Appendix A and Project Timeline in Appendix B):

1) Use innovative and exciting engineering education programs to increase student and family participation in, and access to, quality STEM learning and exposure to STEM career opportunities. Engineering is a natural vehicle for students to learn about and practice all of the STEM subjects. Studies show that students who experienced the EiE curriculum showed greater gains in science learning than students who used traditional science curricula (Lachapelle, Cunningham, Jocz, Kay, et al., 2011). Through this Oregon Department of

Education funded effort, CSD teachers and out-of-school educators will receive robust professional development in STEM subjects, CSD elementary students will spend more time participating in STEM learning experiences during both school and afterschool hours, and STEM professionals and university students will help parents become more engaged in and supportive of their children's exploration of STEM subjects and career aspirations. Through professional evaluation and reporting, this initiative will also advance STEM education statewide.

2) Provide culturally responsive STEM education experiences that are accessible and meaningful for <u>all</u> learners. *Engineering a Pathway to STEM* will assist CSD in addressing their existing achievement gap and honoring the OEIB Equity Lens by introducing programs proven to be accessible and inviting to multicultural audiences. Also, encouraging and supporting both family and community involvement in forging a pathway to improved STEM education for their children will help to surround students of all backgrounds with a community culture and home environment that understands and values STEM learning and career pursuits.

3) **Build a foundation for rich, sustainable STEM education by cultivating, and increasing participation in local and regional efforts for improving STEM education**. CSD will work with FFSE to better understand the interests, needs and expectations of their community with regards to STEM education and assist with identifying appropriate strategies and goals to advance long-range planning sustainability for STEM education in their region. CSD will strengthen and expand their collaborations with local partners such as WOU as well as pursue and maintain an on-going engagement with the South Metro-Salem STEM Partnership. Throughout the project, FFSE will provide planning assistance, project coordination, professional development and coaching with an emphasis on building local capacity and implementing sustainable practices for enhancing STEM education overall.

Evaluation Plan

David Heil and Associates, Inc. (DHA) has agreed to serve as an external evaluator of the project and will prepare a detailed evaluation plan to include front-end, formative, and summative evaluation. Kelly Riedinger, Ph.D., Director of Research and Evaluation for DHA, will conduct the external evaluation, paying particular attention to the development and implementation of the *Engineering a Pathway to STEM* project and predicted outcomes. DHA will use a utilization-focused approach to ensure that the evaluation design meets project needs and that findings are informing continuous program development and improvement. A mixed methods approach will be used in all three of the evaluation phases and data collection will include both quantitative and qualitative data. Data collection will include: surveys of classroom teachers and afterschool educators, students, parents, and community STEM stakeholders; focus groups with educators; and interviews with project leaders. The evaluator will present evaluation findings through two written reports to inform project leadership, stakeholders, funders, and external audiences and to foster broader implementation of similar programs and practices across the state.

Sustainability Plan

Engineering a Pathway to STEM will ignite interest in and excitement for STEM learning in CSD schools and communities, as well as build a strong foundation for CSD to continue progress towards creating a rich, STEM education for their students. In doing so, it will also model innovative materials and practices, as well as capture lessons learned, that can be shared more broadly to impact other schools, universities, and communities across the state of Oregon. The professional development, resources, and increased regional partnerships and collaborations that CSD will gain through this initiative, will continue to impact teacher practice, student learning, and family engagement in STEM for many years.