

(A) Vision and Purpose

The seven easternmost counties of Oregon are included in the Greater Oregon STEM Collaborative (GO STEM). The area is rich in resources but due to geographic isolation and poverty, students here suffer gaps in opportunities to experience STEM and are underserved and underrepresented among peers who pursue STEM careers. Resources and economic stability suffer further due to the dearth of local talent to fill STEM-related positions.

The long-term vision and purpose of GO STEM are to serve Baker, Grant, Harney, Malheur, Umatilla, Union, and Wallowa counties with a sustainable partnership that bring together the resources of education, business, and organizations in support of STEM learning environments and career opportunities. GO STEM will plan and implement its vision and purpose by facilitating common understandings that assist communities with STEM needs. GO STEM will provide a framework that ensures positive learning environments for diverse learners. GO STEM has three core purposes aligned with statewide STEM network principles.

1. To serve underrepresented and underserved teacher-learner populations (PK-20) with STEM programs that close the achievement gap evidenced by demographic and academic achievement data in math and science (Appendices D & E, 2010)
2. To contribute to 40-40-20 in the eastern region of the state with compelling educational programming for educators and students in STEM and STEM-related areas.
3. To build a coalition of education, business, and community partners dedicated to supporting and addressing STEM and becoming proficient in STEM concepts necessary to make personal and societal decisions.

The need for STEM professional development, outreach and resources has become more apparent as communication with potential STEM Hub partners has occurred. The five lead stakeholders, the 12 additional partners and the increasing number of potential partners signify the desire for increased opportunities in STEM education in eastern Oregon.

Small communities do not have large business/industrial presence. Rural schools experience geographic isolation, STEM careers are underrepresented and there is an "out-migration" of young people and professionals from these communities. EOU has a long history of building beneficial and sustainable partnerships in rural eastern Oregon. The long-term educational, cultural, and economic sustainability of this area depends upon continued assessment of regional needs and delivery of educational programs in accessible, affordable, and flexible formats that develop the knowledge base necessary to meet evolving STEM needs.

A logic model developed for GO STEM frames inputs and activities to expected outcomes and impacts based on anticipated needs and challenges in the region (Appendix B). Phase I will involve a needs assessment to ensure planned activities align to need, standards, and effective models for instruction supported by evidence-based research; provide experiential learning for students; provide professional development and pre-service learning opportunities for teachers and university students; partner with business and industry to provide service and project-based learning opportunities; provide informal educational opportunities; develop lending libraries of materials distributed in key locations around the region; and develop a web repository to serve as a hub for information exchange in STEM and STEM-related fields.

Expected impacts from GO STEM include:

- Increased number of students engaging in K-12 STEM experiences and increased number of educators participating in STEM professional development.
- Increased capacity of underserved and underrepresented students prepared to enter post-secondary STEM programs and the STEM workforce in eastern Oregon.
- A sustainable framework of partnerships that supports communities of interest around STEM-related innovation, problem-solving, stewardship of resources and exchange of knowledge that improves local workforce conditions and drives investment, growth, and opportunity.

(B) History and Content

Current STEM collaborations include a University School Partnership (USP) grant and a Math Science Partnership (MSP) grant and administration of The Eastern Promise. EOU and Wallowa ESD are partners on a MSP STEM grant, EO STEM. The three year project involves teachers from Union, Malheur and Wallowa counties and is the third MSP grant received by the partnership between Wallowa ESD and EOU.

EOU is collaborating with five school districts on a USP grant focused on embedding engineering into the curriculum in grades three through eight. This is the fifth USP grant EOU has received and implemented. The projects have focused on Science Inquiry, Engineering Design, Oregon Science Standards and Next Generation Science Standards (NGSS).

Over 175 teachers have been served by the MSP and USP projects which have reached students throughout eastern Oregon. Additionally events for students have been conducted by EOU in collaboration with numerous partners including SMILE, Northeast Oregon Area Health Education Center (NEOAHEC), and Umatilla School District. Girls in Science, Lego Robotics, Saturday Science and Family Science Nights are annual events hosted or provided by EOU.

Local resources have been leveraged to enhance all of the STEM projects. Engineers from Anderson Perry Engineering have been involved in teacher professional development opportunities and in local classrooms. Presentations at teacher workshops have been made by professionals from organizations and businesses such as Blue Mountain Solar, Wallowa Resources, OSU Ag Experiment Station and EOU. Students from EOU's Colleges of Education and Science have participated in SMILE, Girls in Science, Family Math and Science, Lego Robotics, Saturday Science and after school STEM events. These students are a valuable resource often not recognized or utilized. Space for workshops and presentations has been provided by OSU Ag Experiment Station, EOU, and school districts. The Confederated Tribes of

the Umatilla Indian Reservation (CTUIR) is providing space for a Saturday Science event planned for March. EOU faculty, students and the Rural & Native American Programs Coordinator for EOU will lead the event in conjunction with CTUIR.

Resources and attributes which support STEM learning and provide sustainability are extensive in the GO STEM area. EOU is widely recognized as being a first-rate provider of professional development opportunities. EOU includes STEM education in its pre-service elementary and secondary education programs and is routinely involved in providing Science and Math experiences for students of all ages. EOU has a lending library of science equipment and materials that will be available on loan to teachers and students within the Hub area. Wallowa ESD and the other rural ESDs involved in the project have excellent reputations for supporting schools and providing outreach, networking and educational services. Health organizations and natural resource agencies partnering on GO STEM will provide relevant, real-world applications and content.

GO STEM has secured a broad range of stakeholders including rural and micropolitan schools, many of which serve minority students; ESDs serving eight counties; Vernier Software and Technology; NEOAHEC; CTUIR and after school programs like SMILE and Umatilla School District STEM programs. Additional partners include Blue Mountain Community College, Key Technologies, Wallowa Resources and regional school districts. Supplementary contacts have been made with other stakeholders who have voiced an earnest interest in joining GO STEM including Oregon Cattlemen's Association, Friends of Ladd Marsh, Blue Mountain Conservatory and Grande Ronde Model Watershed. Conference calls, Google Hangouts, video conferencing and face to face meetings will be used to engage current and potential partners during Phase 1.

The Eastern Promise is a collaborative effort between EOU, the InterMountain ESD (IMESD), Blue Mountain and Treasure Valley community colleges, and school districts in eastern Oregon. The program creates opportunities for high school students to participate in college-level courses and earn college credits. The goal is to increase the number of eastern Oregon students who are prepared for and attend college which follows the Governor's "40-40-20" plan. EOU is the lead organization for Eastern Promise which includes a three-week Summer Institute for high school students. The 2014 Summer Session will include STEM offerings with hands-on, lab and research oriented lessons so students experience immersion into STEM fields.

The EO STEM MSP project currently serves teachers in three counties in eastern Oregon. GO STEM will work intimately with EO STEM to plan professional development opportunities, share resources and recruit teachers. MSP projects in Oregon have an existing statewide network of communication and support which will be utilized by GO STEM

Through partnership with the Frontier ESDs and Willowa School District, GO STEM will coordinate with CTE regional programs in construction, agriculture and engineering design. These programs provide rich learning contexts. GO STEM will provide teachers in these programs opportunities to engage in professional development to strengthen the academic content and STEM integration.

(C) Partnership Plan Development

A broad community of stakeholders has been contacted and engaged in GO STEM. Schools, businesses, student focused organizations and ESDs throughout eastern Oregon are committed to the project. Through the statewide MSP network collaboration with Lane County's "Content in Context" project and potential STEM CORE Co-op Regional STEM Hub has already begun.

During Phase 1 a *Leadership Team* will be created to guide and focus the direction and implementation of the GO STEM Partnership Plan. The board will consist of 4 members from the lead organizations and 3 members from the other partners. Two at-large community members will join the board as needed. A *Needs Assessment* will be administered to collect data to best determine how STEM education can effectively be promoted throughout eastern Oregon and to ensure planned activities are aligned to need. Letters of support and commitment from community partners will be secured. An evaluation plan will be developed with the help of an outside evaluator who has worked on previous MSP projects in eastern Oregon. A sustainability plan will be outlined by the Leadership Team and will include specific information on how to overcome challenges, sustain the Hub and maintain communication and engagement with partners.

Timeline

Phase 1 of the project will take 3 months to complete. The Partnership Plan will be developed and ready to implement by May 15, 2014.

- February - hire staff and assemble the governing board.
- March - governing board will meet to begin fleshing out Phase 2, the Needs Assessment is developed and administered, information about the project is disseminated; meetings with partners are scheduled; evaluation and sustainability plans are created.
- April - governing board meets; materials are purchased, professional development and after school programs are planned and scheduled.
- May - after school and community programs are delivered.

This timeline allows the project to move forward with summer events for educators, students and community members.

Several elements from Phase 2 have been undertaken. Partnerships and community assets have been capitalized on and the demographics of the geographic region to be served have been compiled. A logic model to frame inputs and activities with expected outcomes and impacts based on anticipated needs and challenges in the region, has been completed (Appendix B).

(D) Programmatic Strategies

GO STEM will use evidence-based practices to promote STEM learning and achieve the goals of the project. Educator professional development, integration between in-school and out-of-school time, problem-based learning, leveraging interactions with STEM professionals, 21st Century skills, habits of mind development, and parent and community events are being planned (Appendix C).

Program Strategy 1: Evidence-based Practices for Learners: The work of engineers, and the math, science and technology integrated into engineering, is not studied in most K-12 schools. Research on STEM learning and teaching has provided insights into effective STEM education. In general, effective STEM instruction builds on students' interests, prior experiences, and on what they know, while providing opportunities to engage in the practices of science. Students deepen their understanding of core ideas in STEM fields while exploring concepts that are shared across disciplines. Engaging in scientific investigations and engineering design projects related to core concepts in STEM provide opportunity for students to explore questions about their world and gain experience in how scientists and engineers investigate problems and develop solutions (NRC, 2011). Effective STEM education must be based on a coherent set of standards and connected curriculum. Successful STEM curricula are aligned across disciplines K-12 and focus on "the most important topics in each discipline, are rigorous, and are articulated as a sequence of topics and performances" (NRC, 2013). Recent research

recommends that students should be introduced to STEM as soon as they enter elementary school. Children's ability to develop interests in STEM, and identify themselves as scientists or engineers happens much earlier than previously believed. Other recommendations include elevating science to the same importance as reading and math in elementary curriculum, with the same devotion to instructional time and resources (NRC, 2011).

Evidence-based Practices for Professional Development: Effective teaching is key to STEM education. Teachers need content knowledge and pedagogical expertise to be successful, but research suggests that secondary and elementary math and science teachers are not prepared to meet the demands (NRC, 2011). To be effective, professional development should focus on developing teachers' content knowledge (NRC, 2011). Snow-Renner & Lauer (2005) studied research that focused on student achievement and standards-based teacher professional development. They found that when the professional development focused on particular curricula the student learning outcomes were greater than when the professional development focused solely on pedagogy. Active learning and modeling of effective and relevant pedagogy are important to the extent that the learning methods used in the professional development mirror the pedagogy the teachers are expected to use with their students (National Staff Development Council, 2001). Professional development employing active learning for teachers utilizing the same methods they are expected to use with students, lead to greater change in teaching behaviors (Jeanpierre, Oberhauser & Freeman, 2005).

Program Strategy 2: Alignment to Standards and 21st Century Skills: The most important factor in student achievement is teacher quality. Growth in teacher knowledge along with changes in classroom practice result in student learning gains (McCutchen et al., 2002). Common characteristics of effective professional development include alignment with school

goals and standards, collaborative opportunities with colleagues, active learning opportunities, job-embedded development with feedback and follow up professional development, and focus on core content (Archibald, Cogshall, Croft, & Goe, 2011; Garet, Porter, Desimone, Birman, & Yoon, 2001; Penuel, Fishman, Yamaguchi, & Gallagher, 2007).

GO STEM professional development workshops will implement lessons focused on the Common Core (CCSS) and the Next Generation Science Standards (NGSS). Pedagogical strategies aligned with the standards (CCSS, NGSS) will be modeled with an emphasis on application of strategies for classroom implementation. Follow up professional development and feedback from faculty and other STEM partners will be provided so that support is built into the professional development process. This will encourage classroom implementation through collegial relationships and continuous support. In addition to working with school partners on needs-based professional development in the Common Core for Math, the project will also address the Standards for Literacy in Science and Technical Subjects.

GO STEM will utilize numerous methodologies to meet the needs of all learners. Explorations, literature pieces and assessment possibilities will be selected to include visual, audio and active engagements. Strategies which engage all learners will be modeled and discussed including language acquisition and content area reading strategies. Teachers and students from historically underserved areas will be recruited to participate in GO STEM learning opportunities. Partners who serve underrepresented areas will be key to assuring students and teachers in their areas have access to STEM opportunities. SMILE, CTUIR, Umatilla after school programs and school districts with high numbers of minority students are currently all partners in the project. Outreach events such as Family STEM nights, student activities for the Ladd Marsh Bird Festival and Saturday Science will provide access and

promote interest for all students. Events will be targeted for areas with underrepresented students.

Program Strategy 3: Equity: According to the 2010 Census, most counties in the eastern region of the state have increasing populations of school-age children heading into the traditional college age bracket, and these populations are generally increasing faster in rural regions than elsewhere. Recent growth is represented by a significant Native American population in Umatilla county and burgeoning Hispanic populations in both Umatilla (24.7%) and Malheur (32.5%) counties. The number of persons 25+ in age with Bachelor's degrees has not increased proportionally in Umatilla (15.6%) and Malheur (14.2%) counties. Consequently, the 40-40-20 goal for attainment of a Bachelor's degree in this area continues to lag behind the state average (29%). Counties with the highest Hispanic and Native American populations send less than 30% of their students to the OUS system after high school. The challenges are exacerbated in Baker (20%), Harney (20.5%), and Malheur (22.6%) counties where the percentage of persons subsisting below the poverty level exceeds the state average (14.8%) (Appendix D).

According to research by National Alliance for Partnerships in Equity (NAPE, 2013) factors that discourage women and under-represented minority students from pursuing STEM careers includes lack of educational opportunity, career information, family characteristic and expectations, self efficacy, and societal stereotypes. Important elements in increasing equity in STEM include well prepared teachers in all classrooms, student and teacher opportunities to engage in STEM curriculum, experiences exploring STEM careers, and seeing themselves as being able to achieve a STEM career (NRC, 2013).

GO STEM will be purposeful in providing access, promoting interest, and increasing attainment for underserved and underrepresented students. The Leadership Team will include

representation from underserved groups. Professional development will be based on evidence-based practices that engage all learners and are known to be effective in closing the achievement gap. Active learning strategies and hands-on engagements will be used to connect content to students' lives or "real work" experiences. Different learning approaches, such as audio, visual, or multimedia, will be used to encourage interactive learning experiences. Multiple literacy formats including technology, text, and video will provide opportunities for engagement for diverse learners. Key community and outreach events, such as Family STEM nights and Saturday Science, will be conducted in areas with underrepresented students. Other community events such as Ladd Marsh Bird Festival will provide access and promote interest for all students

(E) Application Process

Face to face meetings, conference calls, individual calls and email were used to develop this proposal. Communication with members from the lead organizations was frequent and continual. Faculty and administration from EOU, Wallowa ESD superintendent, the NEOAHEC director, staff from Vernier, school superintendents from Joseph, Wallowa and Umatilla and the Director of Education from Confederated Tribes of the Umatilla Indian Reservation were intimately involved throughout the process. Input was also sought from SMILE, 4-H, Cayuse Technologies, Key Technologies, Oregon Cattlemen's Association, US Forest Service, Blue Mountain Community College, University of Oregon and additional school districts and ESDs.