

The Portland Metro STEM Partnership (PMSP) is applying for a Phase II grant to become an Oregon Regional Science, Technology, Engineering and Mathematics (STEM) Hub. During the funding period of the grant, we will facilitate the use of the Oregon and Multnomah County equity lenses to help educators build and/or maintain culturally responsive STEM programming. We will help forge new partnerships with STEM professionals and providers of expanded learning opportunities (ELO) to increase student access to college preparation and STEM workforce development programming. Finally, we will further advance our capacity to measure the productivity and impact of STEM partnership programming.

A. Mission and Vision: Key stakeholder groups from K-12 school districts, higher education, business and community-based STEM program providers formed the PMSP to address critical issues involving Oregon’s leaky STEM education pipeline, changing STEM workforce requirements, and the need to increase equitable access to STEM degree programs and careers (Appendix A). Our community recognized that transforming STEM learning in Oregon was a systemic challenge that could only be achieved through a partnership effort. The development process resulted in the establishment of a functioning collective impact partnership with a shared vision, a business plan, a framework for shared outcomes and common measures of success, and the establishment of the Intel STEM Center to serve as the PMSP backbone organization.

The mission of the PMSP is to provide development, networking, and assessment services that enable STEM educators to leverage assets to create learning environments in which ALL students acquire the identities of successful STEM learners, and sustainably transform learning environments to achieve Oregon’s 40-40-20 education goal in the STEM disciplines.

B. Community Demographics and Needs Analysis: The PMSP serves the Portland metro area with school district partners from Beaverton, Hillsboro, Portland and Forest Grove (Appendix

B). This grant application also includes a plan to disseminate programming to a wider region (including East Multnomah County) to serve high-needs student populations through two strategic investment areas, educator professional development and linking in-school STEM with expanded learning opportunities (ELO) (Table 1).

Table 1: Community Demographics

Service Area	Students Enrolled	Students Eligible for Free/Reduced Lunch	Students Under-represented
PMSP Partner Districts	111,674	41.6%	46.7%
Additional Dissemination Region with Hub Grant	166,560	52.9%	41.5%

In addition to serving students from high needs demographics, our partnering districts have well-documented needs to improve student achievement in math and science (Table 2).

Table 2: PMSP School District OAKS Data

District	% of students that do not meet in Mathematics			% of students that do not meet in Science		
	Grades 3-5	Grade 8	Grade 11	Grade 5	Grade 8	Grade 11
Beaverton	26.4	27.5	23.9	24.5	19.9	31.5
Forest Grove	45.1	46.7	16.2	61.5	52.7	38.9
Hillsboro	39.7	43.5	28.6	31.1	38.4	38.7
Portland	29.9	36.0	29.4	27.1	35.6	43.5

C. Goals and Outcomes: During the 16 months of funding, the PMSP will advance its mission through three initiatives: 1) STEM Educator Professional Development, 2) Linking In-school and Out-of-School STEM Programming and 3) Transforming STEM Learning Environments in Schools. Our partners have identified these initiatives as the highest priority opportunities to leverage resources and supporting programming that address critical needs of our region’s underserved students and STEM educators. The performance of the partnership’s initiatives will be monitored and managed using productivity and impact indicators that are consistent with the PMSP Shared Outcomes and Common Measures framework. These indicators are contained in Section E: Evaluation Plan of this grant application.

Professional Development Program Outcome 1: Build a cohort of highly proficient professional development instructors and teacher leaders to support educators in creating and maintaining effective STEM learning environments. The PMSP Teachers Academy will focus its professional development (PD) instructor training on culturally relevant instruction and personalized student learning. The PMSP will partner with Portland Public Schools, Multnomah County and Girls, Inc. to deliver customized training that is framed by the ODE Superintendent’s Equity Lens and employs the Multnomah County Equity and Empowerment Lens leading towards more equitable policies, programs, and instruction for instructors, teachers, and STEM Center staff. Effective instructor and teacher leader training will also include instruction in use of personalized learning technologies as an effective instructional tool to transform teaching and learning in the area of assessment instruction. Instructors will receive training on the integration of the use of device-mediated learning and assessment, and the use of Open Education Resources and adaptive curriculum for formative assessment and differentiation.

Professional Development Program Outcome 2: Pilot and assess a program to promote personalized professional growth for STEM educators. The PMSP will scale up a reflective PD program that was piloted in a previously funded ODE grant entitled *Connect2Math-Connect2Science*. Cohorts of teacher participants from PMSP summer workshops and district trainings will receive support in using the partnership’s Teacher Instructional Practices (TIP) rubric and data generated from classroom artifacts and teacher reflections. TIP training will also be provided to district teacher leaders and PD follow-up course instructors to ensure broad dissemination of these data-driven practices. Classroom teachers from the seven PMSP STEM transformation schools will receive priority consideration for participation.

Professional Development Program Outcome 3: Create an on-line and hybrid delivery capacity to support a variety of formats for disseminating/delivering effective STEM professional development. A partnership with the Office of Innovation at PSU, Portland Community College and school district technology and online learning specialists will support the delivery of innovative hybrid, online, synchronous, and asynchronous courses. Within the funding period of this grant, ten courses will be offered that include substantial or complete online delivery components. They will include a three-course Next Generation Science Standards (NGSS)-focused science sequence for elementary educators, grade-level CCSS Mathematical Practices courses, Moving Science into the Next Generation, and Patterns Physics.

Collaboratory Program Outcome 1: Create expanded learning opportunity (ELO) partnerships between schools, after school providers, and community STEM education providers to increase program alignment, student access, and the development of successful STEM learning identities in underrepresented students. The Collaboratory will directly support the coordination, modification/development, and implementation of programming that aligns to content standards and PMSP Common Outcomes to cohesively connects students' in-school and out-of-school learning experiences. The PMSP will facilitate the implementation and analysis of assessments that will guide ELO partnership and program improvement. ELO partnership models and curriculum will be thoroughly documented to facilitate expansion and replication. The Collaboratory will also work with STEM business and higher education partners to recruit and prepare volunteers to support in-school and ELO instruction.

Collaboratory Program Outcome 2: Increase the support for out-of-school STEM education by advancing programming that brings alignment to the Next Generation Science Standards, Common Core Math Standards, and PMSP Common Outcomes/Assessments. The

Collaboratory will scale up development workshops and support for out-of-school providers to build better understanding of the K-12 STEM standards, identify current alignments within their programming, identify opportunities for growth, and make modifications to foster stronger alignment to standards. Additional workshops will focus on the use of PMSP Common Outcomes and Assessment Measures and the research-based factors that impact student college and career readiness in STEM.

Collaboratory Program Outcome 3: Develop a support system to expand the reach and impact of existing and emerging STEM mentoring programs. The Collaboratory will scale up its partnership with Oregon Mentors to develop training and support systems to expand the reach and impact of STEM mentoring programs. The Director of the STEM Center Collaboratory will leverage existing grants and partnerships to achieve this outcome. Appendix J provides more detail about this program outcome.

Learning Environments Program Outcome 1: Increase capacity to support STEM transformation schools and assist aspiring STEM lab schools. The PMSP will expand its capacity to support K-12 STEM transformation schools and the implementation of their STEM investment plans. This support includes networking and fundraising assistance for the networked improvement communities (NIC), targeted professional development, and use of Common Measures to drive school improvement. This initiative will also enhance the capacity of PMSP to support aspiring STEM schools (e.g. ODE STEM Lab School Grant Program) with organizational materials and protocols, and professional development and networking opportunities with higher education, STEM professionals, and community partners.

Infrastructure Outcome 1: Increase the leadership capacity of the Intel STEM Center program offices (Partnership Development, STEM Teachers Academy, Research and

Assessment and the Collaboratory). The office directors are lead designers, developers and coordinators for the PMSP initiatives and their associated programs as outlined above (also www.pdxstem.org). The directors work with regional partners including direct collaboration with district Teachers on Special Assignment (TOSA) who have half-time assignments in the Intel STEM Center. The Directors manage the partnership's STEM assets, preserve alignment to partner priorities including the ODE Equity Lens, manage partner relations including the STEM Transformation/Lab schools, advance the implementation of the PMSP Shared Outcomes and Common Measures framework, and maximize the performance of partnership-funded programming.

Infrastructure Outcome 2: Establish an operations structure for the Intel STEM Center. An office specialist will be hired to be responsible for enrollment management in PMSP programs, accounts paid and received, maintenance of office equipment, supplies and the partnership's communication system, management of the equipment lending library, staging partnership meetings and events (e.g., STEMposium), and maintaining the PMSP website.

A sampling of progress we have made to date in these initiative areas includes: two years of STEM Teachers Academy programming serving over 600 teachers, planning and development work in seven STEM transformation schools, establishment of the STEM Center's Vernier lending equipment library, formation of a STEM out-of-school professional development program, and co-leading the development of a STEM mentor training series with Oregon Mentors. See Appendix H for additional progress (<http://tinyurl.com/PMSP2013Newsletter>).

D. Strategies: As a partnership that is focused on college and career readiness, the PMSP is particularly invested in engaging and supporting underrepresented students and students from family cultures that do not include histories of STEM success. We believe the often cited STEM

achievement gap is a consequence of an opportunity gap that limits access of underrepresented student populations to formative STEM learning opportunities that are available to affluent and connected student populations. To bridge the opportunity gap the PMSP will: 1) Work with in-school and out-of-school educators to build culturally responsive learning environments that engage ALL students in aspirational STEM learning, 2) Increase minority student access to expanded learning opportunities (ELO) to help build the knowledge, skills and attitudes of successful STEM learners and 3) Provide underrepresented minority students with opportunities to meet successful STEM students and career professionals from similar family cultures who can serve as mentors and role models.

This approach to bridging the opportunity gap supports the overarching goal that *every* student acquires the academic identity and motivational resilience of a successful STEM learner, and develops the higher order thinking skills and ability to apply conceptual knowledge necessary to pursue STEM college and career pathways.

Partnership Strategy 1: STEM Educator Professional Development. The STEM Teachers Academy provides high quality, research-based and data-driven educator PD programming, and coursework that are reflective of the STEM needs and priorities of partnering school districts. STEM Teachers Academy programming is aligned with the CCSS in Mathematics and NGSS. We must increase the number of effective PD instructors and the number of educators participating in PD experiences in order to both deliver high quality PD and measure its impact. STEM Hub grant funds will support the implementation of best practices for culturally relevant instruction, the effective use of instructional technology, and to create a scalable delivery platform to support on-line assisted educator PD.

Partnership Strategy 2: Linking In-School and Out-of-School STEM Programming. The

Collaboratory provides leadership and supports partners in creating programming that links in-school and out-of school STEM resources. This initiative seeks to build functional relationships between STEM businesses, academia, and community and school-based STEM programs.

Partnership Strategy 3: Transforming STEM Learning Environments in Schools. The PMSP supports the transformation of STEM learning environments in K-12 schools. This currently includes a whole-school model in seven schools from four districts (<http://pdxstem.org/stem-schools/>) that serve 3500 students (50% underrepresented minority students and 54% free or reduced lunch). The 4-year program of planning, capacity building, implementation and refinement engages community assets to support the transformation process. This work is a laboratory for developing and testing strategies for STEM transformation in a variety of school environments and will inform the future work of other schools in our partnering districts and throughout the state. During the budget period of this grant the work in these schools will advance from the capacity building to the implementation phase.

Intel STEM Center Infrastructure. The Intel STEM Center is the backbone and operations base of the PMSP. Located in office space donated by the Beaverton School District, the STEM Center houses program offices and the equipment lending library. Investment in the STEM Center human infrastructure will enable the partnership to increase our service and dissemination capacity to new and existing regional and statewide collaborators.

E. Evaluation Plan: Over the past three years the PMSP has conceptualized a STEM Common Measurement System that includes a logic model for all partnership activities, a comprehensive outcomes framework, and measurement tools (both existing and under development) that map to each partnership outcome. The PMSP logic model (Figure 1) serves as an overarching theory of change for all partnership initiatives and is used to guide program design; for detailed logic

models for each initiative’s program outcomes see Appendix J. All linkages in Figure 1 indicate that past research has demonstrated a relationship between variables in the STEM Common Measurement System and student achievement. This work will appear in a peer-reviewed journal article in *Studies in Educational Evaluation* by Saxton et al. (also see: <http://pdxstem.org/intel-stem-center/office-of-research-and-assessment/>).

Figure 1: PMSP Logic Model (See Appendix I & J for more details)

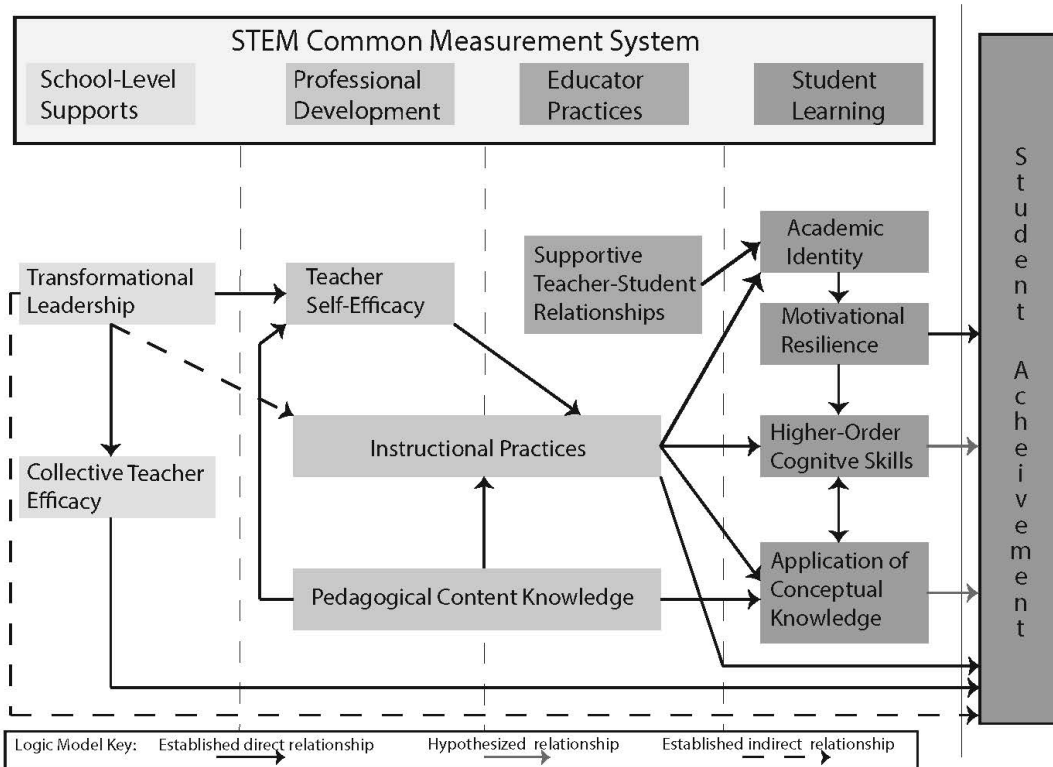


Table 3: Evaluation Questions

Professional Development (PD) Program Outcome 1	How does cultural relevance (or personalized learning) training impact the a. Implementation of culturally relevant professional development in PD courses? b. Changes in teacher efficacy beliefs regarding for culturally-relevant instruction?
PD Program Outcome 2	How does the professional growth program influence the change of teacher’s instructional practices over time?
Collaboratory Program Outcome 1	How does the creation of new expanded learning opportunity partnerships impact: a. Both teacher and community educator instructional practices? b. Students’ Academic Identity and Motivational Resilience?
Learning Environments Program Outcome 1	How does the partnership’s support, assets, professional development and resources impact: a. Teacher practice outcomes as appropriate to each school’s goals? b. Student outcomes as appropriate to each school’s goals?

The PMSP will evaluate the effectiveness of each initiative’s outcomes by setting both productivity and impact indicators (Table 4). Productivity indicators are numbers or percentages of targeted populations served. Impact indicators are specific outcomes that map directly onto the PMSP STEM Common Measurement System.

Table 4: Evaluation Plan – monitoring progress towards productivity targets and measuring impact.

Program Initiative 1: STEM Educator Professional Development (PD)	
<i>PD Program Outcome 1: Highly proficient professional development instructors and teacher leaders</i>	
<u>Productivity Indicator (Target):</u> % of PD instructors and teacher leaders trained (100); % of Summer 2014 courses including of culturally relevant pedagogy (50%; ~12 courses) % of PD instructor teams receive training (20%; ~5 courses); % of Summer 2014 courses including personalized learning (20%; ~5 courses)	<u>Impact Indicator:</u> Teacher Self-Efficacy Survey (emphasis on sub-scale that measures Efficacy for Culturally Relevant Pedagogy)* Teacher surveys about personalized learning*; Subset pilot of student survey of instructional practices (metacognitive assessment & relevance)*
<i>PD Program Outcome 2: Personalized professional growth (PPG) PD</i>	
<u>Productivity Indicator (Target):</u> # of district leaders/PD instructors trained (60); # of PPG PD cohorts (10 total; 5 summer follow-up; 5 teacher leaders); # of PPG participants (100)	<u>Impact Indicator:</u> Teacher Instructional Practices Rubric scores (time series data) and teacher reflections about what they plan to change as a result of PD
<i>PD Program Outcome 3: Create on-line delivery capacity for STEM professional development</i>	
<u>Productivity Indicator (Target):</u> # of courses with hybrid/online component (10)	<u>Impact Indicator:</u> N/A
Program Initiative 2: Linking In-School and Out-of-School STEM Programming	
<i>Collaboratory Program Outcome 1: New expanded learning opportunity (ELO) partnerships</i>	
<u>Productivity Indicator (Target):</u> Number of partnerships (5) Number of students served (1000; at least 50% on free and reduced lunch)	<u>Impact Indicator:</u> Student - Affective student survey *; pilot Application of Conceptual Knowledge; Educator - student survey of instructional practices (centeredness & relevance)*; PD – embedded reflections related to instructional practices
<i>Collaboratory Program Outcome 2: Support for out-of-school STEM education</i>	
<u>Productivity Indicator (Target):</u> # of participating Community STEM Education providers (10 CM; 30 NGSS); # of students served by participating Community STEM Education providers (25,000)	<u>Impact Indicator:</u> N/A
Program Initiative 3: Transforming STEM Learning Environments in Schools	
<i>Learning Environments Program Outcome 1: Increase capacity to support STEM transformation schools and assist aspiring STEM lab schools.</i>	
<u>Productivity Indicator:</u> # of grants submitted (2 per school); Frequency of meetings at school (monthly), # of community partnerships with schools (2); # of programs co-developed with community partners (8 programs; 600 students served), # of teachers served by PD (75%; ~74); # of teachers engaged in PD to support use of reflective data to improve instruction (50%; 50 teacher); # students served at all schools (3500)	<u>Impact Indicator:</u> Student - Affective student survey*; pilot Application of Conceptual Knowledge or Higher-Order Thinking Skills as appropriate to outcomes specified in school STEM Investment Plans Teacher - Measurement of teacher outcomes as identified in school STEM Investment Plans

*Indicates measurement tool will be used to collect data in a pre/post format.

All measurement tools are described in the Saxton et al. article including a rationale for their selection and existing reliability and validity evidence. Measurement tools marked as ‘pilot’ are under development by the PMSP Office of Research and Assessment. During the funding period, all the initiative’s outcomes have the impact goal of increasing the percentage of participants (students or teachers) that score at optimal threshold levels on corresponding measurement scales (i.e. students answering only 4’s “fairly true” and 5’s “totally true” on a 5-point scale are in the optimal threshold for Academic Identity and Motivational Resilience).

F. Partnership Community Assets: The founding partners of the PMSP include Oregon’s largest university (PSU), only health research university (OHSU), largest STEM employer (Intel) and three of Oregon’s four largest school districts (PPS, BSD and HSD). PMSP initiatives are being planned and executed with leadership staff from K-12, higher education, local business and community organizations. Appendix A contains a table of PMSP partnering organizations that actively participate in either cost sharing, program delivery and/or serve on the PMSP Board of Advisors. Table 5 has a sampling of the resources that PMSP partners contribute. See also Appendix H, PMSP Newsletter. (<http://tinyurl/PMSP2013Newsletter>).

Table 5: Sample of PMSP Community Resources

Partnering Organization	Community Resource	Leverage
Self Enhancement Inc.	Equity programming	STEM transformation schools
Vernier Software & Technology	Professional development and VS&T equipment	STEM Center Resource Library
Outdoor School	Environmental education programming	Impact assessment development
Intel	STEM professionals	Science fair judges, STEM mentors
Oregon Mentors	Best practices in mentoring	Mentor training, educator professional development
Worksystems Inc.	BizConnect and Career Information Systems	Career pathways development
Oregon Department of Transportation	ODOT Engineers and projects	OTREC grant and in-school student projects
American Chemical Society	ACS Portland Section membership	Mentor development
Technology Association of Oregon	TAO membership volunteers	Out-of-school Innovation Academies

G. Governance and Backbone: The PMSP operates as a collective impact partnership with over 40 collaborating organizations (See Appendix C for a sample of PMSP partners' letters of commitment and support). The backbone of the partnership are the four program offices of the Intel STEM Center: Partnership Development, STEM Teachers Academy, Collaboratory and Research and Assessment. The PMSP executive director and directors for each program office administer the work of the STEM Center.

The PMSP has an Advisory Board that includes representation of major PMSP stakeholder organizations (Appendix F). The Board meets quarterly to review PMSP affairs and the execution of its business plan. The PMSP also convenes quarterly all-partners meetings to review and plan partnership initiatives. Organizations declare themselves to be PMSP partners through a memorandum of understanding (Appendix D) that is negotiated with the Executive Director.

The PMSP operates through two fiscal mechanisms. The STEM Teachers Academy and the Office of Research and Assessment are financed through matching funds, program income, grants and gifts to PSU and the PSU Foundation. The PSU Center for Science Education administers the curriculum of the STEM Teachers Academy. Impact NW is the fiscal sponsor for grants and gifts for the Office of Partnership Development and the STEM Collaboratory (see fiscal sponsorship agreement in Appendix G).

The business plan for the PMSP was developed through a grant from PSU and by partner consent over a period of two years (Appendix E). The process included monthly partners meetings and two annual STEMposiums that were hosted by Intel. The STEMposiums provided a forum for regional STEM stakeholders to review, comment and contribute to the formation of this plan. The PMSP STEM Common Measurement System includes student, teacher and professional development performance indicators that are used to measure the impact of PMSP

activities (Appendix I). The PMSP Executive Director meets weekly with the STEM Center Directors. The PMSP Advisory Board conducts an annual review of partnership performance.

H. Sustainability Plan: The collective impact model calls for: a common agenda, a shared measurement system, mutually reinforcing activities, continuous communication and a backbone support organization. The PMSP STEM Common Measurement System helps keep partners focused and engaged. The work of the PMSP arises out of the STEM education challenges and opportunities that have been identified by its partners. The PMSP partners and the STEM Center Directors are collectively responsible for maintaining alignment of PMSP programming and directing its assets to address the needs of students.

PMSP partners have agreed to a cost sharing strategy in which investments in the STEM Center backbone are leveraged with grants and philanthropic gifts to support PMSP initiatives. Teachers Academy courses that carry PSU credit generate tuition revenue that enables the PSU Center for Science Education to fund instructor costs and the cost sharing of school district teachers on special assignment (TOSA), who develop and instruct courses, and provide links to K-12 districts, classroom teachers and the Collaboratory's out-of-school providers.

I. Participation in Statewide STEM Hub Network: Partners from the PMSP have served on the Joint Interim Taskforce for STEM Access and Success (HB4056) and are currently serving on the Oregon STEM Council (HB2636). PMSP has 7 partners serving on the ODE NGSS Science Content Panel. Directors from the PMSP are assisting in the development of emerging STEM hubs in east Multnomah County and South Portland-Salem. Since 2011, the annual PMSP STEMposium has served as a forum for STEM stakeholders to gather from across the state to plan for the development of a statewide STEM hub network. In April 2014, the PMSP will partner with the ODE to co-host the 4th Annual STEMposium.