Project Narrative

Re-imagining Career and College Readiness:

STEM, Rigor, and Equity in a Comprehensive High School

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Competitive Preference Priority 6: Innovations that Support College Access and Success

Bellevue School District (BSD) offers strong supports for college success. District curricula are aligned with state and national standards, and BSD ranks in the top 1% nationally for student participation in Advanced Placement (AP) or International Baccalaureate (IB) courses (Bellevue School District, 2010). Additionally, BSD's College Corps program provides trained volunteers to help with college applications and access information about scholarships and financial aid. BSD students also use the Discover Career Planning Program, available through ACT (http://www.act.org/discover/), to identify options for postsecondary schooling and careers. The innovation proposed here redefines the relationship between high school and the business community by connecting students with local professionals in STEM fields to provide real-world validation for students' college and career questions. Counselors will also ensure that all students fill out and submit at least one college application before graduation.

Competitive Preference Priority 7: Innovations to Address the Unique Learning Needs of Students with Disabilities and Limited English Proficient Students

All beginning Limited English Proficient students (LEPS) in BSD are served by Sammamish High School (SHS), the site where grant activities will begin. Additionally, approximately 15% of students at SHS qualify for special education services, nearly twice the average for all comprehensive high schools in the district. LEPS and students with disabilities (SWDs) face unique challenges because of gaps in their schooling histories and sometimes inadequate preparation for high school. These challenges have resulted in lower levels of advanced course taking and AP exam pass rates than the student body as a whole (only 13% of SWDs and 30% of LEPS took at least one AP exam in 2009, compared with 72% of general education students). The proposed innovation provides increased instructional time for LEPS and SWDs with a focus

on mathematics, which is a frequent barrier to high school and college readiness. It also provides one-to-one mentoring from local professionals for information about college access and opportunities for job shadowing and internships. These interventions will increase student achievement and high school graduation rates for LEPS and SWDs (see criterion A, outcomes).

Absolute priority 3: Innovations that complement the implementation of high quality standards and high quality assessments.

A. Need for the project and quality of the project design

Context. Bellevue School District serves students in Bellevue, Washington, a suburban area ten miles east of Seattle. Fifth largest city in the state, Bellevue's population of approximately 120,000 enjoys a thriving downtown, with a rich retail shopping area that is home to international technology, engineering, and financial corporations. The city also has a rapidly growing immigrant population: in 2008, over 33 percent of residents had been born outside the United States. Bellevue School District serves approximately 17,000 students in 32 schools, including four comprehensive high schools, and contains tremendous linguistic, ethnic, and socioeconomic diversity. The ethnic composition of the district is 50.5% White, 28% Asian or Pacific Islander, 10% multi-ethnic, 8.2% Hispanic, 2.9% African American, and 0.4% Native American. Across the district's comprehensive high schools, the percentage of students qualifying for free or reduced price lunch varies from 9-34%.

Over the past 15 years, BSD has adopted a program of high standards and rigorous curriculum. Schools teach a shared, districtwide curriculum that is aligned with state and national standards. All students are encouraged to take advanced level courses: approximately 61% of BSD students receive credit on at least one Advanced Placement (AP) exam before graduation,

compared to 15% of students nationwide.[1] All high school juniors in the district also take the Preliminary SAT/National Merit Scholarship Qualifying Test (PSAT/NMSQT), a comprehensive, standardized assessment that measures skills and aptitudes important to success in college. This test provides an opportunity for students to begin addressing areas of specific need as they prepare for life beyond high school.

Need for the project. Numerous recent publications highlight the need for increased emphasis in K-12 education on 21st century skills and preparation for science, technology, engineering, and math (STEM) careers (e.g., National Research Council, 2010; Partnership for 21st Century Skills, 2010; Katehi, Pearson & Feder, 2009; Wagner, 2008; Committee on Prospering in the Global Economy of the 21st Century, 2007). James McInerney of the Boeing Company describes a looming "skills shortage" as many STEM professionals retire over the next 10 years, and college and university missions reflect the needs of a changing world (e.g., California State University Polytechnic-Pomona [www.csupomona.edu/mission.php], Olin College [www.olin.edu/about_olin/overview.asp]). Women, ethnic minorities, and other underrepresented groups continue to face barriers in STEM fields, areas that are increasingly important to competition in a global economy (Committee on Maximizing the Potential of Women in Academic Science and Engineering, 2007; Committee on Prospering in the Global Economy of the 21st Century, 2007; Anderson, 2006; The Education for Innovation Initiative, 2005).

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[1] The College Board's Advanced Placement Program® (AP®) enables students to pursue college-level studies while still in high school. Each AP teacher's syllabus is evaluated and approved by college faculty, and AP exams are developed and scored primarily by college professors and a select number of AP teachers.

Traditional curricula have not been successful at helping students develop needed skills (e.g., critical thinking, adaptability, and effective communication) for today's rapidly changing job market. Skills in mathematics, especially, have become a tremendously influential gatekeeper for success in college and technical careers, as indicated by continuing patterns of remedial math course taking in college (e.g., Washington State Board for Community and Technical Colleges, 2009). The high percentage of students enrolling in remedial college courses (approximately half of students at Washington's two-year colleges) indicates that high schools are not giving students the skills they need for postsecondary success.

BSD has successfully implemented high quality standards and assessments throughout its schools. However, gaps still exist in graduates' college readiness, especially in the areas of math and science. Across the district, math and science scores on the state test (Washington Assessment of Student Learning - WASL) in 2008-09 were 20-30 percentage points lower than scores in reading and writing. And despite the broad availability of AP courses, disparities in participation and performance continue to surface. Across the district in 2009, pass rates on AP exams for African American and Hispanic students were 28 and 20 percentage points, respectively, lower than pass rates for White students (College Board, 2009). At Sammamish High School (SHS), a high-needs comprehensive high school in the district, 76.6% of all seniors had received credit for at least one AP course before graduation, compared to only 63% of Hispanic seniors, 38% of LEP seniors, and 35% of seniors with disabilities. Through a two-year process of self-study, staff, students, and parents at SHS have become convinced that a shift in curriculum and assessment is needed to increase graduates' readiness to compete in a global workforce. Our proposed project will complement the existing high quality standards and assessments to increase achievement for all students.

Project design. Our exceptional innovation is the development and implementation of a scalable, sustainable, 21st century skills based program, which represents a fundamental shift in a comprehensive high school learning experience. Based on a coherent, problem-based curriculum, we will help our students develop the skills to successfully compete in the 21st century job market.

Our project will begin at one district high school, Sammamish High School (SHS), with the common district curriculum facilitating scalability to other schools. SHS serves approximately 1000 students, with an anticipated increase to 1200 students by the end of the five-year grant period. 34% of students qualify for free or reduced-price lunch, double the average for students at the other three comprehensive high schools.

Our proposal has three key elements: first, the design and enactment of problem-based curricula in both AP and non-AP courses, using problem-based learning (PBL) as a framework to support student growth in key cognitive strategies and academic behavior. Second, we will implement a series of specific supports for struggling students, focusing on increased mathematics literacy. Third, we will work with our partners to provide professional development (PD) that will help teachers to implement new problem-based curricula and evaluate their effectiveness. Though individual aspects of our proposal have been carried out elsewhere, the combination we propose of rigor and equity in a comprehensive high school is exceedingly rare.

A foundation of our proposal is raising the level of rigor in the curriculum, especially for non-AP courses, through problem-based learning. Each PBL unit will require students to collaborate in small groups to solve complex, “ill-defined” problems (Greenwald, 2000). Students will research and revise their ideas over time, with the teacher acting as a facilitator through the learning process. For example, students in a chemistry class might submit a proposal

for reducing greenhouse gas emissions in their county. Biology students might play the role of a watchdog group evaluating a new approach to cancer treatment (Greenwald, 2000). Professionals from related fields will provide real-world validation of content knowledge and participate in evaluating student work.

Problem-based curricula represent a shift from traditional classroom dynamics, and allow students to develop skills in metacognition, self-directed learning, creativity, and communication (Katehi, Pearson & Feder, 2010; Wagner, 2008; Hmelo-Silver, 2004). Changes in course design will be phased in over the five years of the grant, with one year of planning/piloting and one year of implementation for each new course (see Appendix H). Teachers involved in curriculum design will have one extra planning period daily to devote to this work.

A robust framework for assessment is critical to all aspects of the project. Formative, interim (end of unit), and summative (end of course) assessments, embedded coherently in the PBL framework, will be used to identify student needs, measure student growth, and evaluate program effectiveness. Assessment content will be aligned to common goals for career and college readiness in the 21st century, as defined by the College Board Standards for College Success, the National Research Council (2010), the Board on Science Education (2010), and the Common Core State Standards (National Governors' Association, 2010). Assessments will be developed collaboratively by school and district staff, UW research partners, and the project leader, and validated by UW and College Board partners.

We will implement specific supports for underserved students. 240 students identified by teachers and counselors (60 from each incoming grade, 9-12) will participate in an intensive "Starting Strong" program, held for two weeks each summer. Students will be identified through PSAT/NMSQT and ReadiStep scores (see below), as well as through other assessments and staff

observations. Starting Strong will offer 50 additional hours of instruction in core academic subjects, emphasizing math. During the school year, students will also meet weekly with volunteer mentors (local professionals in STEM disciplines) who will provide access to information about college readiness and success, as well as job shadowing and internship/externship opportunities.

Expanded administration of the PSAT/NMSQT to all 9th-11th grade students will improve early diagnosis and remediation of academic weaknesses. College Board staff will train teachers to analyze PSAT/NMSQT score data and use them formatively, targeting instruction towards student strengths and weaknesses. Principals at the two middle schools that feed into SHS have also agreed to annually administer ReadiStep, a validated assessment developed by the College Board, to eighth grade students. ReadiStep scores will provide additional formative assessment information for high school staff about incoming ninth graders.

Customized professional development (PD) will support teachers in designing and implementing problem-based curricula. Researchers from the University of Washington Institute for Science and Math Education (ISME) will gather classroom data on changes in teachers' practice with respect to components of problem-based instruction. They will also use surveys, observations, and interviews to conduct focused studies of ten youth throughout their high school careers. To develop a quantitative sense of the power of particular practices, ISME researchers will compile all data into a single coded database to locate "salient events" that are repeatedly referenced by students as informative and supportive of their engagement with STEM learning. Video and narrative cases created from these data will form a basis for creating context-valid, relevant PD. Customized College Board-sponsored seminars, led by experts in the field, will

offer the best tools and techniques for helping students acquire the skills needed to excel in the AP® classroom, with special emphasis on the development of critical thinking skills.

We anticipate the following outcomes at SHS over five years: (1) a 20% increase in AP exam pass rates, especially in STEM content areas (Biology, Chemistry, Statistics, Calculus AB/BC, Physics, Environmental Science); (2) a 20% increase in SWDs and LEPS enrolling in AP STEM classes; (3) 75% of all students, 50% of SWDs, and 60% of LEPS successfully completing pre-calculus with a B or better (current percentages are 48%, 18%, and 10%); (4) 100% of all students reaching standard on the state math test; (5) 10% annual improvement on the state science test for all students, and 15% annual improvement for SWDs and LEPS; (6) 90% on-time graduation rate for SWDs (100% extended graduation rate), and 75% on-time graduation for LEPS (90% extended).

B. Strength of research, significance of effect, magnitude of effect

Demonstration of research-based findings or reasonable hypotheses that support the proposed project; demonstration that the proposed project will likely have a positive impact on improving student achievement or student growth, closing achievement gaps, decreasing dropout rates, increasing high school graduation rates, or increasing college enrollment and completion rates. Our innovation aligns with widely disseminated frameworks for college readiness and success. First, the key elements of our project fit within Conley's (2010) four dimensions of college and career readiness: key cognitive strategies, key content knowledge, academic behaviors, and contextual skills and awareness ("college knowledge"). Our proposal to implement rigorous, problem-based curriculum focused on 21st century skills, specific supports for high-need students, and mentoring relationships with local professionals will promote students' development in all four of these dimensions. Our innovation also aligns with the recent focus on

rigorous and *relevant* curriculum and positive personal *relationships* (International Center for Leadership in Education, 2008). The significance of these three elements in adolescent education was confirmed by a recent federal consensus report (National Research Council, 2003).[2]

The individual elements of our proposal are supported by extensive research. Problem-based learning (PBL), first implemented in medical schools over 30 years ago, has been shown to increase student learning in a variety of settings. According to Hmelo-Silver (2004), "quasi-experimental studies in medical schools tend to support the hypothesis that PBL students are able to construct knowledge…in problem-solving contexts" (p. 250), and showed that PBL students were able to diagnose cases more accurately than students taught with a traditional curriculum. Schwartz and Bransford's (1998, cited in Hmelo-Silver, 2004) controlled experiment with undergraduate psychology students demonstrated that problem-solving activities not only helped students learn specific skills in the moment, but also better prepared them for exposure to future content.

Many K-12 students need specific scaffolding for problem-based instruction. Hmelo, Holton and Kolodner (2000), Palincsar and Herrenkohl (1999), and White and Frederiksen (1998) describe effective scaffolds for metacognition and collaboration that could be adapted to the PBL context. For example, White and Frederiksen's controlled comparison study showed that instruction in reflective self-assessment increased students' scores on Teamwork, Design, and Reasoning, all at the $p = 0.02$ level or smaller. Effect sizes were greatest for lower-achieving students (Cohen's $d = 1.03$, 0.79, and 0.77 respectively, compared to 0.34, 0.22, and 0.16 for higher-achieving students), showing that lower-achieving students gained most from their

[2] One school in BSD, Newport High School, is implementing this focus on rigor, relevance, and relationships as part of the Successful Practices Network (http://www.leadered.com/spn.html).

treatment. The overall research on PBL with K-12 students, however, is limited. Our findings will add valuable information to this relatively small literature base.

Our proposal also expands the use of high-quality assessments (AP, PSAT/NMSQT) that have been shown to positively impact college readiness and success. Mattern, Shaw & Xiong's (2009) nationwide study of 71,000-93,000 students (number of students varied by analysis) revealed a positive relationship between AP exam performance and college success. Using a controlled, paired contrast design, the authors found that higher performance on the English Language, Biology, Calculus AB, and US History exams corresponded to higher first year college GPA (Cohen's d ranging from 0.13-0.21, depending on exam) and higher second-year college retention rates (Cohen's d = 0.24-0.42), even after controlling for prior academic achievement. Hargrove, Godin & Dodd's (2008) quasi-experimental study of public high school graduates in Texas found that African-American and Hispanic students who took AP courses and exams had higher college GPAs than other African-American and Hispanic students from the same SAT® range and the same socioeconomic background. Ewing, Camara, & Millsap (2006) showed through a study of over one million students that PSAT/NMSQT scores are positively correlated with AP exam scores ($r > 0.50$ for 20 of 29 AP exams), lending validation to the College Board's process of using PSAT/NMSQT scores to identify students who might need extra support for AP success (AP Potential).

One-to-one youth mentoring programs have also produced positive outcomes, with modest but significant effect sizes (Rhodes, 2008; Rhodes & DuBois, 2008; DuBois, Holloway, Valentine & Cooper, 2002). Research suggests that best practices (e.g., establishment of meaningful relationships over time, a degree of structure in mentored activities, and mentors' focus on youth interests and preferences) increase the benefits of mentoring programs (d = 0.22

[random], 0.20 [fixed], compared to d = 0.07 [random], 0.04 [fixed]).

Extent to which the proposed project has been attempted previously, albeit on a limited scale, with promising results that suggest more formal and systematic study is warranted. Problem-based learning is already in place in some SHS courses, with promising results. For example, students in the advanced accounting course create a viable business plan, with mentoring and evaluation by state business professionals. This experience has increased student understanding of how school learning relates to solving problems. Many companies in the Bellevue community have encouraged and made it possible for mentors to participate.

The year-long AP US Government and Politics course was also redesigned using PBL principles (see selection criterion C). The new course is organized around five "project cycles," each constituting an authentic task (e.g., students act as members of a United Nations task force to advise a nation emerging from long-standing dictatorship about the various forms and features of constitutional democracy). In each cycle, students work together to interpret texts, create and revise solutions, and reflect on their growing understanding of the course's essential question ("What is the proper role of government in a democracy?"). Researchers used a non-randomized intervention design with statistically matched intervention and control groups to study the outcomes of this course for 314 AP students in BSD. Students at one high-achieving and one moderately-achieving high school participated in the redesigned curriculum, and were compared to a matched sample of students in a third high-achieving school who received the traditional AP curriculum. Results showed that students receiving PBL instruction performed as well or better on the AP examination than their peers ($p < 0.05$; 75.7% pass rate for PBL students at the high-achieving school, compared to 51.1% in the traditional course), and significantly outperformed students in the traditional course on a performance assessment measuring conceptual

understanding (p = 0.001; Mosborg, et al., 2010).

C. Experience of the eligible applicant

Past performance of the applicant in implementing projects of the size and scope proposed. BSD has received a number of recent grants and engaged in partnerships with public and private educational organizations. In 2006, BSD received a $1.9 million grant over the space of three years from the Bill and Melinda Gates Foundation. Two main goals of this grant were to (a) construct an on–line curriculum framework and enhance learning continuity across grade levels and (b) enable teachers to improve instructional rigor through a shared knowledge of the curriculum, collective classroom practices and teaching methodologies. The grant award was used to develop BSD's "Curriculum Web" into a learning resource for teachers, students, and parents. Grant monies were also used to support outside partnerships to support curriculum design and modification. For example, BSD partnered with the LIFE (Learning in Informal and Formal Environments) research center at the University of Washington to redesign fifth grade science curricula for increased engagement and conceptual learning. At the high school level, chemistry teachers adopted a previously available electronic curriculum (Lawrence Hall of Science) and published a modified, web-based version so that students, parents, teachers, and external partners could collaborate around improving lessons and developing related assessments. Special education and ELL teachers partnered with the BSD curriculum development groups to create sharable accommodations – and in some cases team-taught the chemistry course in order to better develop support materials.

From 2008-2010, BSD also partnered with the George Lucas Educational Foundation, University of Washington researchers, and the non-profit Bellevue Schools Foundation ($229,100), to redesign Advanced Placement course curriculum in US Government and Politics

(see selection criterion B). BSD recently received funding from the Bill and Melinda Gates Foundation to continue this work with the AP Environmental Science course.

Since 2005, middle school science teachers in BSD have worked with Seattle Pacific University, Facet Innovations, and the Institute for Systems Biology on three National Science Foundation-funded DRK-12 grants (total grant funding to date: $4.1 million). The grant models include teacher teams adapting the curriculum for delivery through BSD's online curriculum web, partnering with special education teachers to embed accommodations, and then participating in PD around the curriculum, instructional strategies, and student expectations.

BSD has also received recognition in national publications. Conley's *Creating College Readiness* (2009) highlighted SHS specifically for its success in preparing students for college. SHS was one of only 15 comprehensive high schools around the country selected for inclusion in this report, and the only high school in Washington State. Conley's profile emphasizes three factors in SHS's success - its "college preparatory curriculum and culture, comprehensive support services, and integrated counseling guidance program" (p. 91). This i3 development grant will help SHS to refine the structure already in place to better serve all students.

<u>Evidence that the LEA has significantly closed achievement gaps between groups of students (section 1111(b)(2) of ESEA), or significantly increased student achievement for all students described</u>. Data from state tests (Washington Assessment of Student Learning - WASL) show that BSD has made significant progress in closing achievement gaps for AYP subgroups over the past six years. For example, the achievement gap for students with disabilities on the 10th grade reading examination has gone from 55 percentage points in 2003-04 to only 21 in 2008-09. On the writing examination, students with disabilities scored 43 percentage points behind their typically developing peers in 2003-04, but were only 8 points behind in 2008-09

(OSPI, 2009; see figure 1 below). Achievement gaps have also narrowed for students of Hispanic descent in reading, and for students of African-American and Hispanic descent in writing (Figure 2). Results at SHS follow this same pattern.

Figure 1. 10th grade reading and writing trends in state test scores by special education, BSD.

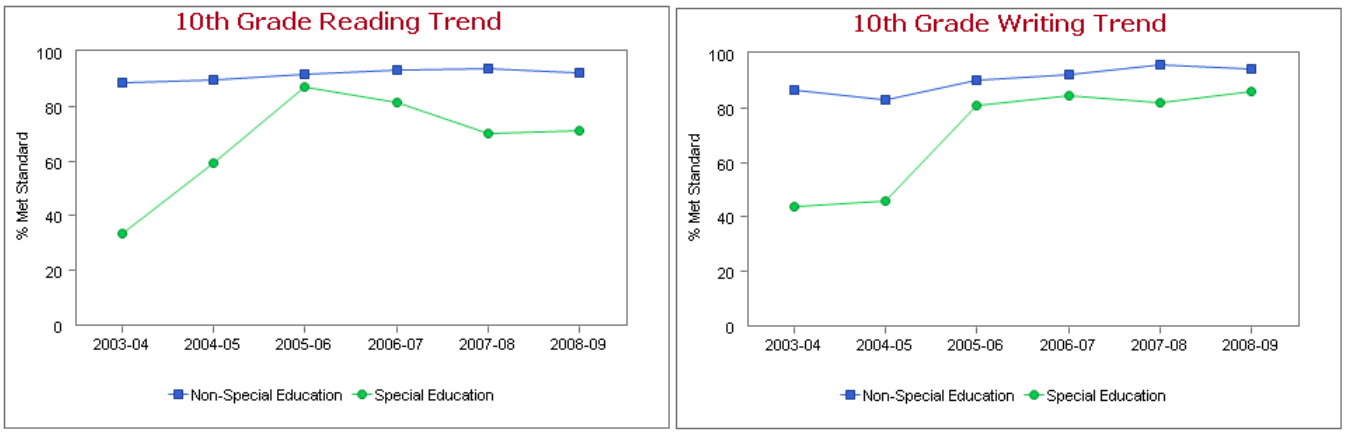
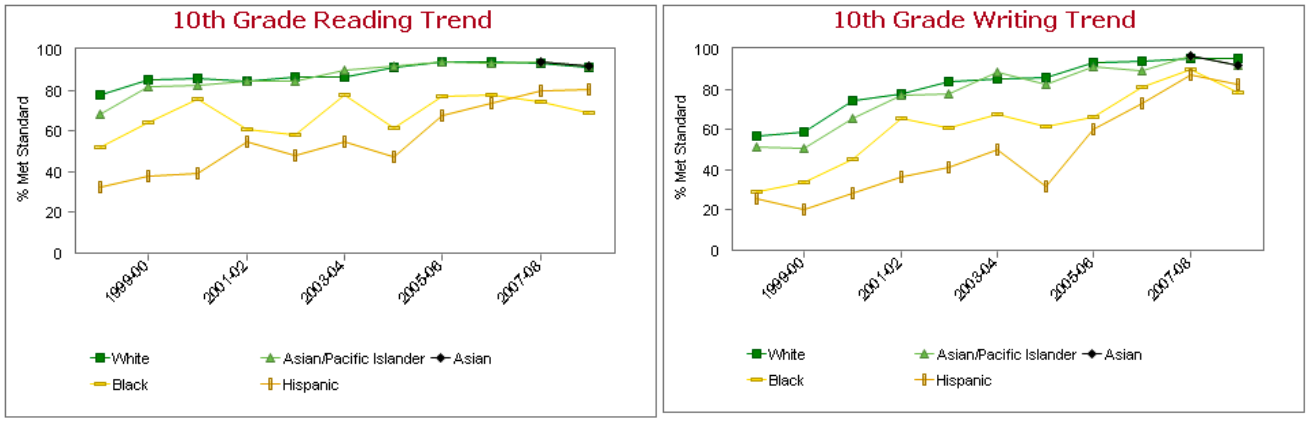


Figure 2. 10th grade reading and writing trends in state test scores by ethnicity, BSD.



On the tenth grade math and science tests, however, test score gaps remain across the district and at an individual school level. Districtwide, students with disabilities scored 52 and 47 percentage points behind their peers in math and science, respectively, in 2008-09. At SHS, these gaps were 36 and 32 points for math and science. Disparities also remain for low-income

students and students of African-American and Hispanic descent. As noted in Selection Criterion A, these remaining gaps are a strong reason for the project's focus on STEM disciplines.

Evidence that the LEA has made significant improvements in graduation rates or increased recruitment and placement of high-quality teachers and principals. On-time graduation rates in BSD have remained high (86-90%) since 2004. Districtwide, 97% of classes are taught by NCLB highly qualified teachers, including 100% of classes in high poverty schools. BSD also had the highest number of new National Board Certified Teachers (NBCTs) in Washington State for 2009. NBCTs "[meet] rigorous standards through intensive study, expert evaluation, self-assessment and peer review" (National Board for Professional Teaching Standards, 2010); according to a recent federally commissioned study, board-certified teachers were more effective in improving student achievement than non-certified teachers (Hakel, Koenig & Elliott, 2008). From 2004-2009, the percentage of BSD teachers receiving board certification on their first attempt jumped from 61% to 83%, compared to a constant national average of 40%. Due to district financial support, release time, and mentoring from other NBCTs, 27% of BSD teachers have achieved National Board certification, compared with only 5.3% of teachers statewide. NBCTs are distributed equitably across district schools.

D. Quality of project evaluation

Because the proposed project is being submitted under the Development Grant category, the set of research-based strategies that are proposed promise to meet the desired outcomes but are in need of further testing and refinement. The goals of the project are to build on four specific strategies (problem-based learning, 'Starting Strong' summer program, mentoring, and high-quality PD) that have been implemented successfully in limited ways in this district. Further, the goal is to develop processes and materials that will enable an entire high school to systematically

implement this program, which can be scaled up to all high schools in the district and beyond. Thus, the evaluation will focus on four aspects of the project: (1) providing systematic feedback to project staff and participants to support the immediate and ongoing improvement of courses, events, and PD offerings; (2) documenting the various processes, procedures, pitfalls, and strategies that lead to successful PBL integration into an array of different courses so that others can use this information to adapt and integrate PBL into their unique contexts; (3) measuring changes in student outcomes throughout the project to begin to provide an evidence base about the effectiveness of the program; and (4) determining the cost per participant (students and teachers) for a program of this type. In general, the evaluation is aimed at readying the program for validation and scale-up. $385,620 (10% of the project cost before evaluation and indirects) will be allocated to fund the evaluation.

Formative Evaluation. Specific approaches will be utilized to help team members implement problem-based learning, the Starting Strong program, mentorships, and teacher PD offerings with fidelity, yet adapted to the particular content areas and contexts of this project. At the beginning of the project the evaluator will meet individually with key team members and conduct at least two evaluation meetings in order to ensure a consensus about the non-negotiable features of PBL, Starting Strong, mentoring, and PD that are inviolate for this project. These factors will be documented to assist others in the validation and scale up of this project's core strategies. The design process will be documented through participant interviews, observation, student data, and evaluator participation in key design meetings. Results from these data will be regularly fed back into the system during leadership meetings to monitor development and to address any design drift that is occurring.

If it is discovered in the course of curriculum development that core design principles are not being implemented with fidelity, the evaluator will reconvene key members of the design team to recast, if necessary, the core principles. The formative evaluation cycle will be intense during the first two years to ensure that the key design principles are both correct and being implemented with fidelity. By year three the curriculum development process will be well documented and the evaluator will assist in the development of a handbook and supporting materials to assist others in the design and implementation process. A checklist of key design features will also be developed for use in years three through five. The evaluator will continue to monitor, collect feedback, and provide information for the iterative design process.

As teachers implement the newly revised PBL courses and Starting Strong program, the evaluator will visit classes at critical time periods to observe the courses in action. Student focus groups will capture students' experience, and the teacher will reflect on what is working and offer potential design solutions to problems. Lessons learned will inform course development in other content areas.

An important part of the PBL course revision is the identification and/or adaptation of assessments that measure changes in student learning and growth. As each course is developed assessments will be at the forefront of the development process so that content-specific knowledge and higher-level thinking can be reliably and feasibly measured. Students will take pre and post versions of these assessments at the start and end of each course. This will allow for student performance changes to be documented for each year of the project, and in many cases a comparison made between typical and PBL version courses. Grades and other performance data for each student will be accessible through the district data system.

Professional development offerings will be evaluated. Single day workshops will be evaluated with an end-of-workshop form for feedback on the conduct of the workshop and on items learned, new questions, and suggestions for improvements. For multi-day workshops, short content and attitude instruments (pre/post) will be administered to capture changes. In addition, all teachers and administrators that participate in at least one workshop will be asked to complete an end-of-year survey so that we can identify change at three points in time. Participants will be randomly contacted during the year to provide feedback about the PD component.

Using the project timeline, the evaluator will help the project team to create a set of benchmarks for each activity and then collect data and report on the attainment of these benchmarks to help the project with course corrections, as necessary. In addition, student performance on embedded assessments in each course will be analyzed and shared with team members to see how well each student group, especially LEPS and SWDs, is performing and whether or not achievement gaps are closing.

As courses are implemented, a running total of the number of students served in each PBL course or Starting Strong will be established to compute the yearly cost of the project per student. Similarly, cost per teacher will be computed for the PD offerings and curriculum development/implementation processes. In sum, the formative evaluation will provide information with respect to the extent to which the program is being implemented with fidelity, timely feedback for corrections and improvements, evidence of the promise of the program for improving student outcomes, and data and performance feedback that allow for periodic assessment of progress toward achieving intended outcomes.

Summative Evaluation. The summative evaluation will compile all documentation, lessons learned, and student performance data and generate a meta-analysis of the five-year project. In addition, a random sample of students both in high school and those that have graduated will be contacted to determine the impact of their PBL courses on current and future career and academic plans. Students and parents will be asked to give permission to be contacted at these times. In particular the summative evaluation will be designed to provide evidence that the implemented program has promise for improving student outcomes, information about the key elements and approach of the project so as to facilitate further development, replication, or testing in other settings, and the overall cost per student for elements that were proven promising at improving educational outcomes for students.

E. Strategy and capacity to further develop and bring to scale

Number of students to be reached & applicant's/partner's capacity to reach that number of students during project period. The proposed project will reach approximately 2200 students at SHS over the five-year grant (1000 students in year 1 and 300 new students added in each of years 2 through 5), as well as 4500 students at BSD's other three comprehensive high schools during grant years 4-5. Resources requested in this proposal have been aligned to project costs. Shared district curriculum will facilitate the spread of PBL units within BSD.

Applicant's capacity (personnel, finances, management capacity) to further develop and scale the practice, or work with partners to ensure that can be done based on findings of the proposed project. A scale-up team will begin preparing for project dissemination in years 3-5 of the grant. Team members will prepare informational and training materials for on-site PD and ongoing consultation. The full-time project leader will aid in this effort. Our partnerships with the UW ISME, College Board, and the UW College of Education will add capacity to scale the practice

to other regional or national high schools, and our advisory board of local educational and industrial leaders will help to secure resources and leverage professional connections to assist in scaling.

Feasibility of proposed project to be replicated in a variety of settings & student populations. The project will result in a number of deliverables that will facilitate project replication. PBL curriculum frameworks will be made available to schools at zero or minimal cost. The project handbook created in cooperation with the external evaluator (criterion D) will identify non-negotiable design principles of the intervention, while allowing for local contextual adaptation. Video and narrative representations produced by UW researchers will become a means of propagating key ideas and practices. Aided by our advisory board and existing district partnerships, we will also seek additional public and/or private funding to allow key team members to support project implementation in new settings.

Estimate of project cost, and cost per student for applicant or others to reach 100,000, 250,000, and 500,000 students. Total project cost: $4,324,717.00

Total cost per student per year (based on projected enrollment): $912 for years 1-3; $555 for years 4-5 (PBL curricula begin to be enacted at all district high schools). Project cost per student for 100,000, 250,000 and 500,000 students: $252 (extended instructional time, PD, salary costs for PBL planning, and College Board assessments and training, based on costs incurred by this LEA for a school of approximately 1000 students and 60 staff members). Because the key design elements involve teacher salaries and per-student assessment fees, we do not anticipate significant reductions in per-student costs for scaling above 100,000 students.

Mechanisms to be used for disseminating information about the project to support development and replication. Information about the project will be disseminated through a variety of peer-

reviewed journals (e.g., Journal of Research in Science Teaching, Science Education, and the International Journal of Science and Mathematics Education) and school and district publications (e.g., newsletters of the Bellevue Schools Foundation and UW College of Education). The community outreach director and scale-up team will also plan site visits and weeklong institutes for interested schools.

F. Sustainability

Demonstration that the applicant has the resources and the support from stakeholders (e.g., state educational agencies, teachers' unions) to operate the project beyond the length of the Development grant. BSD's many community and industrial partners will facilitate the continuation of mentoring programs and provision of real-world STEM expertise in the classroom. The Bellevue Schools Foundation, a non-profit organization whose mission is to promote and help fund the best possible learning opportunities for all students in the Bellevue School District, also continues to be a strong supporting partner (see letter, Appendix D). The Bellevue Education Association's vice president has been instrumental to the project design, and the union's executive board voted unanimously to support this project (see letter, Appendix D). The potential and planning for the incorporation of project purposes, activities, or benefits into the ongoing work of the eligible applicant and any other partners at the end of the Development grant. Problem-based curriculum and assessments developed during this project will be available to district high schools for their continuing use. The intensive Starting Strong summer program will continue to operate, funded by a combination of state (Learning Assistance Program - LAP) and private funding. Our partnership with the College Board will also allow for the continued administration of the PSAT/NMSQT to all 9th-11th grade students and access to score data

training. PD for implementing problem-based curricula will be incorporated into new staff orientations and refresher workshops at the school and district level.

To allow for ongoing effective use of assessments, activities will follow recommendations of the Department of Education (USDOE, 2010) as follows. *Data systems* - the current district data system supports the use of assessments by linking interim (end of unit) and summative (end of course) assessment data to individual students, as well as all other collected student data. *Leadership for educational improvement and use of data* - team leaders will model the use of data to improve instruction and identify student needs in staff and leadership team meetings. *Tools for generating actionable data* - common interim assessments will be administered at the end of each major unit and common summative assessments will be administered at the end of each course. *Social structures and time set aside for analyzing and interpreting data* - regular meetings will be held on contracted early student-release days, between interim assessments. Data from common interim and summative assessments, linked to each student, will be analyzed in disaggregated and aggregated groups. Formative assessment data will be collected and shared as needed when evaluating claims made during interpretation of interim and summative assessments. *PD and technical support for data interpretation* - the project leader and district staff will provide PD and technical assistance to teams of teachers to assist in scoring, analyzing, and responding to assessment responses. *Tools for acting on data* - the curricular structure of PBL activities allows flexible instructional responses to results from formative assessments. The time and supports provided to teachers allow more significant collaborative changes to curriculum, which will be documented in the common curriculum.

G. Quality of Management Plan and Personnel

Adequacy of the management plan in achieving project objectives on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks. Table 1 displays activities and milestones over the five-year term of the grant. Elaborated action plans for PBL course design and project scaling can be found in Appendix H.

Table 1. Timeline: Re-imagining Career and College Readiness: STEM, Rigor and Equity in a Comprehensive High School

Activity	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Key personnel hires: project leader & community outreach director	By Nov. 1				
Grant implementation team meetings	1-2x/mo., Sep-June; external evaluators participate as desired		1/mo., Sep-June; external evaluators participate as desired		
PBL course planning, piloting, implementation, & evaluation	Sept-June, annually - see Appendix H for detailed timelines				
Assessment development - PBL courses	By Aug 30: Develop criteria for standards & alignment and pre-post course assessments	Gather baseline data	Ongoing assessment refinement and administration; data collected via existing district infrastructure		
Expanded administration of College Board assessments	PSAT: Oct				
	ReadiStep: May				

Starting Strong	Apr-Jun: plan curriculum & recruit students from SHS and feeder middle schools Aug: 2-week program; 50 hours of instruction in core subjects, focusing on math				
External evaluation (see project narrative, criterion D for detailed plan)	By June 1: Individual mtgs with key team members	By June 1: Develop checklist of key design features; intensive formative eval.	Continue formative eval.; develop handbook for scaling	Ongoing data collection: PD evaluations, focus groups, classroom observations	By Sep. 1: Summative evaluation data collected
Advisory Board	By Nov 2010: Hold first annual meeting. Years 1-3: annual board meeting; individual consultations as needed Roles/responsibilities: (a) overall program guidance for STEM college readiness & career preparedness; (b) help in finding mentors for student & classroom pairing			Annual board meeting; individual consultations as needed Board roles/responsibilities shift to ensuring sustainability and scalability past the term of the grant (mentor relationships, fundraising)	
Mentors: recruitment & orientation	March	May	May	May	May

Professional Development	By Oct 30: compile 5-year schedule of PD offerings	PD from grant team leaders, College Board, and UW partners as specified in the schedule. Topics include PBL course design and implementation and use of assessment data to differentiate instruction.			
Scaling effort - see Appendix H for elaborated timeline			Establish team; develop materials	In-district expansion of PBL model	Out of district expansion: PD & materials

Qualifications, including relevant training and experience, of the project director and key personnel, especially in managing projects of the proposed size and scope.

Personnel	**Relevant Training/Experience**	**Project Responsibilities**
Dr. Amalia Cudeiro, BSD Superintendent	▪ Co-founder and partner, Targeted Leadership Consulting ▪ Asst. Superintendent, Boston Public Schools	▪ Oversee grant activities, including project dissemination within the district ▪ Liaison with other districts for scaling
Dr. Andrew Shouse	▪ Assistant director, UW ISME ▪ Directs portfolio of externally funded research	▪ Lead research into student and teacher learning

	(NSF, Merck Institute) ▪ Director, two NRC consensus volumes on science education	▪ Direct development of narrative and video cases for use in PD
Dr. Randy Knuth	▪ Evaluator for 12 federally-funded projects since 1999 (Dept. of Ed., NSF, NIH, HHS, NASA)	▪ Lead project evaluation (see this document, criterion D)
Daniel J. Gallagher	▪ BSD K-12 Science curriculum specialist ▪ Co-PI, two NSF DRK-12 proposals ($2.4 million over 3 years and $3.5 million over 5 years)	▪ Facilitate alignment of science curriculum and assessments with established standards ▪ Liaison with curriculum developers for all content areas ▪ Support analysis of assessment data
Thomas C. Duenwald	▪ SHS Principal; 11 years as an administrator in BSD ▪ Member school, UW-Ackerley Partner Network ▪ District representative on UW Professional Education Advisory Board, Teacher Ed. Program	▪ School-based leader of grant implementation team ▪ Liaison between district, project leader, and grant partners
Kim Herzog	▪ Vice President, BEA	▪ Teacher leader on grant implementation

	▪ 18 years as Biology/AP Biology teacher in BSD	team
Advisory board members (5-7 total; see letters from J. Bransford, D. Conley, L. Hood, Appendix D)	▪ Leaders in 21st century education and/or industry ▪ Ability to tap sustainable sources for youth mentoring	▪ Meet annually to consult on curriculum implementation and grant sustainability
Project leader (full-time, to be hired)	▪ Master's or doctoral degree in education ▪ A curricular instructional leader well versed with various stakeholder issues and track record of implementing change	▪ Monitor timelines and budgets ▪ Facilitate curriculum development and use of assessment data ▪ Oversee grant administration and reports

Bibliography (see Appendix H)