DATE: 1-9-13

TITLE II - 2013-2014 COMPETITIVE GRANT PROPOSAL COVER PAGE

Title of Proposed Program: Hyalite partnership evaluation and summer STEM camp

Name of Institution: Montana State University-Bozeman

Project Director: Nick Lux (Co-PI: Brock LaMeres)

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Partners: Bozeman Public School District
Brock LaMeres, MSU College of Engineering
Beyond the Chalk Consulting Firm

Annual Budget Request $ 63,179.24

The primary intent of this proposal is to provide a teacher-quality endeavor that simultaneously supports the professional development of practicing in-service teachers and preservice teachers. Major goals of the project include providing resources needed to strengthen the already-existing unique partnership between Montana State University and the Bozeman School District, facilitate professional development activities to ensure that teachers, highly-qualified paraprofessionals, and preservice teachers are trained in the skills needed to use technology to enhance student learning in STEM. To support this work, we are seeking funding to provide necessary support for the following elements: 1) Technology needed to enhance the side-by-side professional development between inservice and preservice teachers; 2) The design and implementation of a planning retreat to better understand and more widely distribute the site-based laboratory classroom model for teacher training and professional development; 3) The delivery of a summer STEM camp where participating inservice teachers and preservice teachers learn side-by-side with participating Bozeman youth about STEM learning.

ASSURANCE OF USE OF FUNDS

Assurance that funds made available under TITLE II – IMPROVING TEACHER QUALITY to supplement and not supplant non-federal funds in accordance with Section 8. The persons submitting this proposal agree to use funds received from this proposal only to supplement and not supplant non-federal funds, in accordance with Section 8.41.

(Signature of Project Director) (Date)
Needs/Goals

The Hyalite Partnership Evaluation and Summer STEM Camp program is a professional development teacher quality endeavor intended to simultaneously support practicing in-service teachers and preservice teachers. More specifically, the proposal addresses all four aspects of the “Rigorous Core” strategic concern as outlined by OCHE. Funding will be used to provide infrastructure and capacity-building efforts needed to grow a new component of the partnership between the Bozeman School District and the Montana State University Department of Education. This partnership and capacity-building focus will facilitate professional development activities to ensure that teachers, highly-qualified paraprofessionals, and preservice teachers are trained on the skills needed to use technology to enhance student learning in STEM.

The MSU Department of Education recently partnered with Hyalite Elementary School to offer an innovative teacher education course that is site-based, and taught entirely within the newly created Hyalite/MSU Collaborative Teaching Classroom. This learning space, located at Hyalite Elementary School, serves as the hub for the Hyalite/MSU partnership in teacher education. The primary intent of this new effort is to support symbiosis, where all involved gain something from participation. Benefactors of this design include Hyalite teachers, Hyalite K-5 students, and MSU preservice teachers. The participating cooperating teachers gain digital learning professional development and the help and assistance of eager education students excited to begin honing their skills as teachers through these early field experiences. Participating Hyalite students benefit from the opportunity to engage in often innovative and exciting technology-based activities delivered by the preservice teachers. And the preservice teachers are provided opportunities to gain invaluable experience by working with expert practicing teachers. The plans outlined in this proposal build upon the momentum created by this partnership in an effort to provide high-quality technology-focused and STEM-related professional development to participating teachers, to advance preservice teacher education, and ultimately to improve student learning.

Hyalite Elementary School is a high-need LEA, with over 45% students served being from families with incomes below the poverty line as defined by the US Census Bureau, and the Bozeman Public School District (BSD) as a whole has a 27.2% rate of participation in the Free and Reduced Lunch program. And out of all elementary teachers in the District, there are presently no K-5 classroom teachers with a math or science endorsement. In addition, despite nominally appropriate formal certifications among BSD teachers, none have endorsements specific to STEM content; there is a strong need for expanding STEM competencies among elementary and middle school teachers in the Bozeman Public School District.

Program Partnering

The foundation for this proposal lies in a joint venture between MSU and the Bozeman Public School District. Collaborative partners include the MSU College of Education, Health, and Human Development (EHHD) and the MSU College of Engineering (COE), and the Bozeman School District. Letters of commitment have been provided from all partners to describe how the proposed activities outlined in this proposal align with the program’s goals.

For this project, MSU EHHD will provide program oversight and administration, and lead the design and implementation for the planning retreat and summer STEM camp. Further, EHHD faculty members will facilitate the planning retreat and provide contributions during the analysis of the site-based teacher education model as to how the model could be improved upon and more effectively deliver professional development for inservice and preservice teachers. Conversations will also focus on how the model might be expanded to cover more content areas, and how it might be more widely distributed to other sites within the Bozeman School District. And lastly, EHHD faculty will participate in the summer STEM camp, with a focus on how the STEM content and instruction could be integrated into their teacher preparation curricula.

The Bozeman School District will serve a number of roles in the project. First, BSD teachers will participate in the planning retreat in Spring 2014, at which they will contribute reflections on the site-based teacher education model, and how that model might be improved to provide more substantive professional development for both participating practicing teachers and MSU preservice teachers. In regard to the summer STEM camp, BSD teachers, paraprofessionals, and students will be the primary participants.

Beyond the Chalk, an independent teacher professional development firm, will provide to the project expertise in technology integration and STEM learning through the design and delivery of a three-day robotics summer workshop. This summer camp will provide a venue for students and teachers to learn together. Goals of this camp will be to provide professional development to practicing BSD teachers and MSU preservice teachers, while simultaneously providing 4th and 5th grade students STEM-based instruction through the exploration of robotics.

MSU College of Engineering collaborator Dr. LaMeres will provide insight at the planning retreat in a capacity that will serve to make the summer camp a successful professional development experience for BSD
teachers and MSU preservice teachers. He has considerable experience in STEM education, including professional development for teachers in the realm of STEM education, and will contribute his expertise at the retreat as the group plans the summer STEM camp. Further, Dr. LaMeres has an authentic and real-life background working in STEM and robotics, and he will use this background to provide real-world relevancy of the STEM learning for participants. This real-world experience in STEM fields and designing and delivering STEM instruction will serve critical importance in planning the summer camp. And finally, as a professor in the College of Engineering, Dr. LaMeres is educating next generation STEM teachers in his engineering courses. Therefore, providing him access and insight at the K-12 level serves as an important touchstone for what he does in regard to the design and delivery of STEM instruction.

Program Content

This proposal addresses the “Rigorous Core” strategic concern as outlined by OCHE, with the primary end goal being to equip teachers with the necessary knowledge of how to use computers and other technology to enhance student learning. This will happen by growing an established partnership and capacity-building efforts focused on providing sustained, high-quality professional development activities for both inservice and preservice teachers in STEM. Two bodies of research were used as the foundation for this proposal: Technology as a mechanism for supporting STEM learning, and the importance of field experiences in teacher training.

Research Basis - Technology and STEM: First, a large set of research on technology and STEM suggests that digital learning tool hold potential to significantly advance students’ learning in the STEM content areas (Bell & Trundle, 2008; Finkelstein et al., 2005; Fisch, Lesh, Motoki, Crespo, and Melfi, 2010; Kebritchi, Hirumi, and Bai, 2010; Klisch, Miller, Beier, and Wang, 2012; McKagan et al., 2008; Miller, Chang, Wang, Beier, and Klisch, 2011). In these cases, technology provides learner support for the collection and analysis of data, generation of models to test hypotheses, and engage with simulations that provide insight into invisible processes that support students’ construction of complex scientific understandings. Further, research has found that technology can be leveraged to significantly improve students’ learning in science, especially when accompanied and supported by high-quality professional development (Gerard, Varma, Corliss, and Linn, 2011).

There are many ways that technology can be integrated to support this kind of learning in STEM areas. Ketelhut, Nelson, Clarke, and Dede (2010) found that students who participated in virtual environment-based science inquiry curricula “show a stronger understanding of science inquiry than all other students” (p. 67). Neiss and Gillow-Wiles (2013) report findings that indicate teachers note that technology affords certain time-saving aspects, like immediate feedback for learners, that increase teachers’ ability to incorporate more inquiry into the classroom. Other research indicates that technology can support the learning process by extending student-teacher conversations, and provide tools for students to collect data and test models (Sharples, Taylor, and Vavoula, 2007). Obara (2010) found that solving math problems in a virtual learning environment allowed learners to come up with different strategies to address problems, and advanced their ability to solve future problems more easily and more accurately. Learning in a virtual environment has also been found to be beneficial for low-achieving students. Moyer-Packenham and Suh (2012) report a significant gain in math achievement for those low-achieving students that participated in learning environment that included a virtual manipulative treatment. More specifically, the integration of computer simulations and conceptual models in scientific inquiry has demonstrated value in developing robust student understandings even in areas replete with misconceptions (Pallant & Tinker, 2004). Interactive simulations provide learners with opportunities to engage in experimental practices, connect to prior knowledge, and use new technological innovations (Fan & Geelan, 2013). Other research indicates simulations and virtual labs, that can be delivered via tablets, have potential to expand students’ cognitive capacities, allowing them to experiment with more complex data, form hypotheses, and test those hypotheses in real time (Jenkins, 2009). Combined, these findings suggest that technology can effectively provide learners, and teachers, opportunities to more effectively engage in STEM content and provide considerable support the teaching and learning process within that domain.

Research Basis – Teacher Training: Research also indicates that field experiences are one mechanism that can provide preservice teachers the critical opportunities to wrestle with and think about how students learn, and contend with the issues surrounding technology integration (Darling-Hammond, Hammerness, Grossman, Rust, & Shulman, 2005). Teachers must also experience the positive effects technology has on teaching and learning. New teachers entering the profession need opportunities to develop positive beliefs about “the use of technology in a wide variety of ways” (p. 309). These kinds of experiences can readily evolve out of co-teaching scenarios where preservice teachers are paired with expert in-service teachers. Further, the advantages of a field-based approach to preparation for technology-integration include affording occasions where preservice teachers are able to not only design, but also deliver, technology-based instruction in a hands-on environment (Hay, 2006). Given this approach, preservice
teachers can design these technology-based activities in tandem with cooperating teachers, providing those in-service educators with exposure to new learning innovations, and providing support the teachers need to successfully integrate these innovations into their classroom practice. Zeichner (2010) reiterated the importance of this approach, and points out that early field experiences serve as a place for preservice teacher learning that is much more than just application of theory or skills.

Participating BSD teachers will be recruited through BSD administration-generated district-wide advertising, and selected using a simple application process in which they provide details as to how they plan to continue to grow the practicing teacher/preservice teacher relationships outlined in the proposal, and how they intend to integrate the STEM instruction learned during the summer camp into their own teaching during the 2014-2014 academic year. Again, the project as outlined in this proposal has an organic origin, with the project building upon an already-existing strong partnership between the LEA and IHE. Stakeholders in the partnership recognize the value of site-based teacher education as a model of professional development for both practicing and preservice teachers. However, resource constraints and planning time have limited a more widespread deployment of the successful model beyond the current design. Funding for this proposal will be used for four primary purposes:

1. Purchase needed technology to successfully build the partnership and professional development opportunities
2. Fund a planning retreat at which participants would collaborate and plan how to sustain and grow the partnership, as well as for the planning of a summer STEM camp for rising 4th and 5th grade students
3. Fund the summer STEM camp, with a focus on engineering curriculum with interdisciplinary connections
4. Support a follow-up graduate seminar for participating teachers to continue their development as they strive to implement their summer camp learning.

Needed Technology: Due to resource constraints, the technology needed to support the MSU/Hyalite collaborative classroom is often limited in availability. Although Hyalite does have several mobile computing carts, they are shared among all teachers in the building. As a result, planning for the use of the devices becomes challenging. What is needed to fully support this project is a mobile device cart dedicated entirely to the Hyalite/MSU Collaborative Teaching Classroom. Therefore, this proposal includes provisions to purchase 25 iPad Minis and supporting software. These devices will remain in the collaborative teaching space, and always be available to support inservice teacher professional development as well as collaborative partnerships with MSU preservice teachers.

Planning Retreat: The primary goal of the 2-day planning retreat is to provide a venue in which the participating Hyalite teachers, MSU preservice teachers, MSU faculty, BSD instructional coaches, and district administration can discuss the reciprocal nature of the partnership. Day one of the discussion will address how MSU preservice teachers can provide BSD teacher professional development regarding uses of technology to improve learning for BSD students. Efforts will focus on how to improve the design and delivery of innovative, technology-rich lessons in a co-teaching fashion that pairs BSD teachers and MSU preservice teachers. Retreat discussions will address how the MSU preservice teachers can work more closely with the Hyalite teachers on designing and implementing standards-based instruction. The retreat will also explore how to provide more focused professional development. Participants will discuss how to plan and implement standards-based high quality, intensive, and classroom-focused STEM activities that have a positive and lasting impact on instruction in the classroom both at Hyalite and beyond.

Day two of the retreat will focus on disseminating the site-based classroom design to other BSD schools, and on planning the summer STEM camp. This process will include a discussion with participants on how to successfully expand the pilot to other BSD schools, and what benefits might be gained district-wide for this expansion. The conversation will also cover the planning of implementation of the summer robotics camp at which inservice and preservice teacher participants will design technology-supported standards-based STEM instruction. Participants at this retreat will include MSU College of Engineering and College of Education Health and Human Development faculty and Education preservice teachers, and BSD teachers, administrators and curriculum specialists.

More specifically, the retreat will focus on responding to the following questions:
A. How might the site-based program be improved to provide on-going professional development for Hyalite and BSD teachers and improved training for preservice teachers?
B. How might the site-based model be expanded to other schools within BSD?
C. How should MSU and BSD design and deliver a summer STEM camp for 4th and 5th grade students?
**Summer STEM Camp:** In partnership with the Bozeman School District and Greater Gallatin United Way kidsLINK program, the summer STEM camp will provide STEM-focused professional development for BSD educators and MSU preservice teachers, as well as exposure to innovative STEM education for participating youth. The summer STEM camp will be delivered as a one-week component of the Bozeman School District and Greater Gallatin United Way kidsLINK four-week summer camp program. The camp will utilize the collaborative model developed in the Hyalite experiment of engaging inservice and preservice teachers in co-learning of instructional technologies, and will add an element of these teachers learning alongside the participating children.

The primary intent of the camp will be to provide a venue for side-by-side learning among BSD students, teachers, paraprofessionals, MSU preservice teachers, MSU faculty. Fourth and fifth grade students attending the summer-long kidsLINK camp would spend the last week of that camp (August 11-15) attending the STEM camp. Specific goals of the summer camp will include side-by-side learning/professional development for all participants consisting of:

- Days 1-3: Deliver Lego Mindstorms Robotics Curriculum professional development opportunities for participating BSD educators and MSU preservice teachers, and STEM-focused learning opportunities for participating BSD students
- Days 4 and 5: Opportunities to build digital literacy skills, including using multimedia to communicate scientific knowledge and understandings, for participating BSD educators and MSU preservice teachers, and STEM-focused learning opportunities for participating BSD students
- Increase STEM literacy participating BSD students

The camp will consist of two trainers who have been working with schools, teachers, and students developing authentic, problem based programming opportunities. These trainers will not only lead students through the beginning steps of programming using various apps and materials, such as Lego NXT robotics, but also demonstrate to practicing and preservice teachers how programming fits into STEM programs and helps target Common Core State Standards across many content areas.

As follow-up support, teachers and paraprofessionals who participate in the grant will also be given the opportunity to take a 2-credit graduate level course titled “Using Technology to Support STEM Learning”. This course will provide practicing teachers support in further integrating the STEM concepts learned during the STEM camp into their own teaching during the Fall of 2014. It would also serve as a collaboration point, where participating teachers and paraprofessionals can share lesson/unit plans, including data relevant to lesson improvement. During the course, teachers will be provided ongoing exposure to strategies they can use to extend and refine the STEM activities they learned during the summer camp professional development. Teachers will refine those activities, implement them in their classroom, collect data on the effectiveness of those lessons, and analyze that data in instructional improvement efforts. Participating teachers will then share their STEM instructional activities, including findings from lesson analysis, in an effort to build a library of STEM exemplar lessons that can then be distributed district-wide and beyond.

**Project Timeline**

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<thead>
<tr>
<th>Date</th>
<th>Activity</th>
<th>Participants</th>
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<tbody>
<tr>
<td>February, 2014</td>
<td>Purchase needed technology for Hyalite/MSU Collaborative Classroom</td>
<td>• MSU Faculty and Hyalite Teachers and Administration</td>
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<tr>
<td>April, 2014</td>
<td>Planning Retreat</td>
<td>• Hyalite teachers</td>
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<td>• MSU preservice teachers</td>
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<td>• MSU education faculty</td>
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<td>• MSU engineering faculty</td>
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<td>• BSD instructional coaches</td>
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<td>• BSD administrators</td>
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<td>• Instructional Technology Specialists</td>
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<td>August, 2014</td>
<td>Summer STEM Camp with focus on engineering and interdisciplinary connections</td>
<td>• BSD K-8 teachers</td>
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<td>• BSD paraprofessionals</td>
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<td>• MSU faculty</td>
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<td>• MSU Preservice teachers</td>
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<td>• 4th and 5th grade BSD students</td>
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<td></td>
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<td>• Instructional Technology Specialists</td>
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Capacity to Achieve Goals and Sustain Program

This proposal is building upon an already-established, yet growing partnership. Current participants recognize the incredible value of the partnership, and have indicated across the board that this site-based model to provide professional development experiences for both practicing teachers and MSU preservice teachers is one that they would like to see grow.

Hence, our proposal is sustainable in at least three ways:

- The purchase of the technology will facilitate the preservice/inservice teacher collaboration at Hyalite school every semester.
- A model will be tested for a STEM summer camp that can be continued in future years, at a minimum as part of the kidsLINK program and preferably with additional funding to expand on the model. With the New Generation Science Standards (NGSS) on the horizon, teachers will gain knowledge and experience in STEM instructional delivery needed to address those standards.
- Teachers (inservice and preservice) who learn the engineering and instructional technology content for inclusion in their classroom lessons will continue to implement this instructional content with their students.

The partners who will be capable of continuing successful aspects of the program are Professor Nick Lux (continuing to teach pre-service teachers in collaboration with Hyalite and other elementary BSD schools); preservice teachers who will learn new content and teaching strategies; inservice teachers will develop and implement new lesson plans and consolidate their learning through a graduate follow-up course; and BSD which will continue its elementary grades summer camp and use camp fees and additional grants to continue to train teachers and engage students with STEM content.

MSU faculty and collaborators will also devise and implement a plan for dissemination of the model to a wider audience, using an existing website, the BSD newsletter, and conference presentations.

Evaluation Plan

Measurable outcomes for the planning retreat to be held in April 2014:

- Focused conversations on how the site-based teacher education approach can provide on-going professional development for Hyalite and other BSD teachers and MSU preservice teachers.
- Analysis of data currently being collected about the site-based teacher education professional development model in place at Hyalite Elementary school in the Fall of 2013 and Spring 2014.
- Completion of a findings report from this data analysis that include recommendations as to how the site-based program might be improved to provide on-going professional development for BSD and MSU preservice teachers.
- Development of a plan on how the site-based teacher education approach can be deployed beyond Hyalite Elementary School within the BSD school district, as well as statewide.

Measurable outcomes for the summer STEM camp to be held in August 2014:

- Evaluation of student and teacher learning outcomes from the camp (and lesson development by the teachers)
- Development of a strategic plan to continue implementation of a summer STEM camp that could provide annual professional development opportunities to support BSD teachers in the design and implementation of technology-supported standards-based STEM instruction with special emphasis on engineering integration.
- Evaluation of the average Math and Science CRT scores for the participating students, comparing their collective 2014 scores with their collective 2015 scores.
### Evaluation Overview and Timeline

<table>
<thead>
<tr>
<th>Objective</th>
<th>Assessment Strategy</th>
<th>Timeline</th>
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<tr>
<td>Focused conversations on how the site-based teacher education approach can provide on-going professional development for Hyalite and BSD teachers and MSU preservice teachers.</td>
<td>Participant focus group</td>
<td>April 2014</td>
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<td>Analysis of data currently being collected about the site-based teacher education professional development model in place at Hyalite Elementary school in the Fall of 2013 and Spring 2014.</td>
<td>Follow-up survey</td>
<td>April 2014</td>
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<td>Completion of a findings report from this data analysis that include recommendations as to how the site-based program might be improved to provide on-going professional development for Hyalite and BSD teachers.</td>
<td>Expert review</td>
<td>April 2014</td>
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<td>April 2014</td>
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<tr>
<td>Development of a strategic plan to implement a summer STEM camp that will provide professional development opportunities to support BSD teachers in the design and implementation of technology-supported standards-based STEM instruction.</td>
<td>Expert review</td>
<td>April 2014</td>
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<td>Implementation of summer STEM camp</td>
<td>Pre/Post Survey to measure participant perceptions of the summer camp and of their own competency for delivering the curriculum throughout the school year</td>
<td>August 2014</td>
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<td>Documentation of new teacher-developed lessons for subsequent classroom use</td>
<td>August 2014</td>
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<td>Pre/Post testing of participating student knowledge</td>
<td>August 2014</td>
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<tr>
<td>2-credit graduate level course “Using Technology to Support STEM Learning”</td>
<td>Pre/Post Survey to measure participant perceptions</td>
<td>Fall 2014</td>
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<td>Assessment of participating students progress overall with math and science curricula</td>
<td>Comparison of the group’s 2014 average CRT scores with their 2015 scores</td>
<td>Spring 2015</td>
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### Attachments

- a) Budget
- b) Budget Justification
- c) Program Report (Forms B and C)
- d) Résumés for each person involved in program oversight and services
- e) Letters of commitment from all partners
References


