Montana Math Teachers’ Circle

University of Montana

Ke Wu, Ph.D.
David Erickson, Ph.D.
Matt Roscoe, Ph.D.
Fred Peck, Ph.D.

Proposed Grant Period: January 1, 2016 - December 31, 2016

Proposal submitted to Improving Teacher Quality State Grants, Title II program,
Office of the Commissioner of Higher Education
### FORM 1: COVER PAGE

1. **Project title (maximum eight words):** Montana Math Teachers’ Circle

2. **Institution of higher ed. (or nonprofit organization):**
   
   Academic department: Department of Mathematical Sciences  
   Address: 32 Campus Drive, Math Building, University of Montana  
   City: Missoula  
   State: MT  
   Zip: 59812

3. **Project Director(s): (please list principal project director first)**
   
<table>
<thead>
<tr>
<th>Name</th>
<th>Telephone (work)</th>
<th>E-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ke Wu</td>
<td>406.243.4818</td>
<td><a href="mailto:ke.wu@mso.umt.edu">ke.wu@mso.umt.edu</a></td>
</tr>
<tr>
<td>David Erickson</td>
<td>406.243.5318</td>
<td><a href="mailto:david.erickson@umontana.edu">david.erickson@umontana.edu</a></td>
</tr>
<tr>
<td>Matt Roscoe</td>
<td>406.243.6689</td>
<td><a href="mailto:matt.roscoe@umontana.edu">matt.roscoe@umontana.edu</a></td>
</tr>
<tr>
<td>Frederick Peck</td>
<td>406.243.4053</td>
<td><a href="mailto:frederick.peck@umontana.edu">frederick.peck@umontana.edu</a></td>
</tr>
</tbody>
</table>

4. **Mailing address of principal project director (if different from above):**

5. **Core content area(s): Mathematics**
   
   Grade level(s): 5-12  
   Other:  
   Number of participants: 100 teachers

6. **Does this proposal constitute a continuation or expansion of a previously funded project?**  
   - [ ] Yes  
   - [X] No  
   
   If yes, please give the year of the original grant(s):

7. **List names of all collaborating school districts:**
   - Billings Public Schools  
   - Polson School District  
   - Missoula County Public Schools  
   - Great Falls Public Schools  
   - Helena East Valley Middle School  
   - MT GEAR UP schools

8. **Proposed funding:**
   
   | A. Title II-A Grant | $108,792.72 |
   | B. Institution of higher ed. or nonprofit org. (AIM) | $7,003 |
   | C. Collaborating school districts | $0 |
   | D. Other | $0 |
   | TOTAL | **$115,795.72** |

9. **Fiscal or grant administrator responsible for grant:**
   
   Name: Shawn Whitworth  
   Title: Sponsored Programs Specialist  
   Telephone: (406)243-4959  
   E-mail: shawn.whitworth@umontana.edu

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**Project Director**  

**Chief Academic Officer**
FORM 2: PARTNERSHIP ELIGIBILITY

Project Title: Montana Math Teachers’ Circle

Project Director: Ke Wu

Required Members (please list as indicated):

(1) A private or state institution of higher education (IHE) and the division of the institution that prepares teachers and principals

- Dr. David Erickson, Professor, Department of Curriculum and Instruction, College of Education and Human Sciences, University of Montana

(2) A school of arts and sciences

- Dr. Ke Wu, Associate Professor, Department of Mathematical Sciences, College of Humanities and Sciences, University of Montana
- Dr. Matt Roscoe, Assistant Professors, Department of Mathematical Sciences, College of Humanities and Sciences, University of Montana
- Fred Peck, Assistant Professors, Department of Mathematical Sciences, College of Humanities and Sciences, University of Montana

(3) A high-need Local Education Agency (LEA)

- Billings Public Schools
- Polson School District
- Missoula County Public Schools
- Great Falls Public Schools
- Helena East Valley Middle School
- Identified high-need LEA as described by OPI for each location:
  - Missoula and surrounding area: Victor High School
  - Billings and surrounding area: Ashland Public School
  - Polson and surrounding area: Arlee Elementary School
  - Great Falls and surrounding area: Browning High School
  - Helena and surrounding area: Butte High School
- MT GEAR UP schools
  - Arlee Middle/High Schools
  - Box Elder Middle/High Schools
  - Browning Middle/High Schools
  - Eureka Middle School/Lincoln County High School
  - Hardin Middle/High Schools
  - Harlem Middle/High Schools
  - Heart Butte Middle/High Schools
  - Lame Deer Middle/High Schools
  - Libby Middle/High School
  - Lincoln Middle/High School
  - Lodge Grass Middle/High School
  - Pryor Middle School/Plenty Coups High school
  - Rocky Boy Middle/High School
  - St. Ignatius Middle/High Schools
  - St. Regis Middle/High Schools
  - Thompson Falls Middle/High Schools
  - Troy Middle/High Schools
  - Wolf Point Middle/High Schools

Additional Members (if applicable):
(This list may include another LEA, a public charter school, an elementary school or secondary school, an educational service agency, a non-profit educational organization, another IHE, etc.).

Partner: Higher Institute of Education in Montana
University of Great Falls
Salish Kootenai College
Helena College
Rocky Mountain College

Partner: State, Federal, and National agencies
- Montana Council of Teachers of Mathematics (MCTM)
- Montana Office of Public Instruction (OPI)
- Montana GEAR UP
- American Institute of Mathematics (AIM)
Montana Math Teachers’ Circle seeks to invigorate mathematics teaching by engaging teachers in problem solving activities and creating a collaborative and supportive professional learning community (PLC) of university and K-12 teachers of mathematics. It is a three-year program, although only the first year of funding is included in this proposal that will support (1) biannual math teacher’s circle gatherings at five locations: Billings, Missoula, Polson, Great Falls, and Helena; (2) a 3-day training workshop for leading team at each location on “How to run a math teachers’ circle”; (3) a 3-day inquiry-and-discovery-learning workshop in the summer; and (4) the establishment of a continuous, technology-assisted, virtual PLC. Funding will support the professional development of 100 teachers in a blended of face-to-face and virtual professional learning opportunities during the school year and summer months.
1. Have any of the project directors for this proposal had previous grants through the Montana Office of the Commissioner of Higher Education?

☐ Yes  ☐ No

If yes, please give the following information:

- The name of the project director/s and the year of the grant/s:
  - David Erickson, 2005 - 2010

- For each grant, the amount of the original award and the total amount expended; For each grant, the number of participants projected and the number who participated; If yes, provide a brief description of the results of the evaluation of each grant. Evidence of improvement in classroom instruction or student achievement would be most significant.

<table>
<thead>
<tr>
<th>Grant Name</th>
<th>Year</th>
<th>Amount Funded</th>
<th>Approximate number of participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before It’s Too Late! I</td>
<td>2005</td>
<td>$48,850</td>
<td>75, Regionally throughout state, but short duration</td>
</tr>
<tr>
<td>Before It’s Too Late! II</td>
<td>2006</td>
<td>$61,000</td>
<td>75, Regionally throughout state, but short duration</td>
</tr>
<tr>
<td>Before It’s Too Late! III</td>
<td>2007</td>
<td>$74,382</td>
<td>45, Shifted to 5-day residential workshops at MLC</td>
</tr>
<tr>
<td>Before It’s Too Late! IV</td>
<td>2008</td>
<td>$120,000</td>
<td>70, Continued more impactful 5-day workshops (two) at MLC</td>
</tr>
<tr>
<td>Before It’s Too Late! V</td>
<td>2009</td>
<td>$60,365</td>
<td>35, One 5-day workshop</td>
</tr>
<tr>
<td>Before It’s Too Late! VI</td>
<td>2010</td>
<td>$56,115</td>
<td>30, One 5-day workshop</td>
</tr>
</tbody>
</table>

2. For each project director, please list any other grants or other significant obligations (summer school teaching, consultancies, book contracts, etc.) during the period of proposed grant activity. Please describe how the project director’s time will be allocated between the Title II-A project and these other obligations.

Project Principle of Investigator (PI), Dr. Ke Wu: Wu will not teach in summer 2016. She currently has three NSF grants (one as PI, one as Co-PI, and one as external evaluator), but she only has a total of 0.5 month summer salary committed to these three projects. She also has a couple of small grants which does not require any of her FTE. This leaves her more than enough summer time for this Title II grant work.

Project Co-PI, Dr. David Erickson: Erickson teaches only one class in summers for 7 weeks, thus, plenty of summer time for grant work. He currently has a NSF Noyce LABT grant that takes about 12 days each summer, leaving a month for this Title II grant.

Project Co-PI, Dr. Matt Roscoe: Roscoe is the Co-PI for a DOE-MSP for 2015-2016. He has obligations associated with the grant in the summer of 2016 that will occupy 1/2 of his available summer work schedule. He is also teaching one on-line course in the summer of 2016. These obligations will not conflict with his proposed commitments to the Montana Math Teachers’ Circle effort as they do not conflict with the proposed timeline of activities in the summer of 2016.

Project Co-PI, Dr. Fred Peck: Peck is a new tenure-track faculty member at UM, thus he does not have other grants. He is going to teach one course in the summer of 2016, but this will not conflict with his commitment to the proposed project work.
3. If the applicant is an institution of higher education, does it have a school or department of education?

[ ] Yes
[ ] No

If yes, describe the joint efforts that were involved in preparing this proposal and planning project activities between the school or department of education and a core academic area department at the institution. (Please identify participants by name and title at the institution.)

The preparation of this proposal involved faculty members from both the Department of Mathematical Sciences (Drs. Ke Wu, Matt Roscoe, and Frederick Peck) at College of Humanities and Sciences and the Department of Curriculum and Instruction (Dr. David Erickson) at the Phyllis J. Washington College of Education and Human Sciences at UM-Missoula.

We had several meetings to discuss and collaborate on the overall ideas of the proposed project, various components of the project and each of us took parts of the writing proposal responsibilities and as well as communicating with various partners. It is truly a collective effort among the PI team and all our partners to shape and finalize this proposal.

4. Does the applicant institution of higher education or nonprofit organization have a pre-existing agreement with one or more local school districts for providing professional development for teachers or teams of teachers (and appropriate school personnel) of that district?

[ ] Yes
[ ] No

If yes, in the space below give the name of each such local school district and provide documentation of the agreement(s) (with signatures) in Appendix B of the proposal. If no, in the space below give the name of one or more local school districts that have provided a letter of agreement indicating official support of proposed project activities and provide the letter(s) (with signatures) in Appendix B of the proposal.

- Matt Bishop and Carrie LaPierre, math teachers from Polson School District; Scott Wilson and Bill Appleton, school administrators from Polson School District
- Beth Walsh and Kathy Dummer, math teachers from East Valley Middle School; Dan Rispens, Principle of East Valley Middle School
- Jennifer Hudson, math teacher; Lisa Wood, Math Department Chair, Dennis Holmes, Principle, Tyleh Blood, Assistant Principle from Billings Senior High School
- Nick Grener, math teacher from Hellgate High School; Lisa Hendrix, Principle of Hellgate High School
- Chris Olszewski, Director of Curriculum & Instruction from the Great Falls Public School District; Margaret Kotthoff, math teacher from Great Falls High School
- Zach Hawkins, program director, and Suzin Kratina, senior project manager, from MT GEAR UP program

Identified high-need LEA as described by OPI for each location:
- Missoula and surrounding area: Victor High School, Rona Monta (math teacher)
- Billings and surrounding area: Ashland Public School, Jennifer Dyas (math teacher)
- Polson and surrounding area: Arlee Elementary School, Sibley Ligas (2nd grade teacher)
- Great Falls and surrounding area: Browning High School, Travis Miller (math teacher)
- Helena and surrounding area: Butte High School, Ashley Johnson (math teacher)

5. Describe the participation of teachers and/or administrators of the local school district(s) named in question four in preparing this proposal and planning proposed project activities. LEAs must consult with private school officials during the design, development, and implementation of the professional development program to ensure equitable participation. Title IX, Section 9501 of ESEA requires that Title II, Part A services for professional development that are provided to private school teachers and other educational personnel be equitable in comparison to those provided to public school teachers. (Please identify participants by name and title within the school system.)

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1. For school administrators and teachers in Missoula, Billings, and their surrounding areas, we have worked closely with them in the past three years on Math Teachers' Circle events. This was why we could successfully recruit large number of teacher participants (12-20 teachers at each location) when we run the circle activity. When we brought up the idea of continuing the teacher circle at these locations, we received immediate support and commitment for participation.

2. Schools at other locations (Helena, Polson, and Great Falls) were reached by the faculty members from one institution at each location to be involved with the development of the project. Their feedback and suggestions then were communicated with the PI team at UM. The names of faculty members and their affiliations are:
   a. Amy Kong and Kim Haughee, math faculty from Helena College
   b. Polly Dupuis and Matt Seeley, math faculty from Salish Kootenai College
   c. Dr. David Thomas, Meredith Berthelson, and Khim Raj Shrestha, math faculty from University of Great Falls

6. Describe any other involvements with K-12 schools any project director has had in the last five years (e.g., supervising student teachers, teaching on-site courses, judging nominations, etc.).

Wu's involvement with other K-12 Schools include:
- Math Teacher Circles with K-12 school teachers in Missoula and Billings since 2013
- Math Circles with middle school and high school students in Hamilton, Columbia Falls, and Bonner since 2013
- Math Day event each fall at UM since 2013: About 250 middle school and high school students come to the Math Day
- Annual road trip to visit the middle schools and high schools on or near all seven reservations, 2011 - now

Erickson's involvement with other K-12 Schools include:
- MTE-Partnership with MCPS and Arlee; research on the two-intern one-cooperating teacher model for the culminating student teaching semester.
- Supervision of two student teachers in Spring 2015 at CS Porter Middle School
- Observation of one student teacher in Delta Junction, Alaska in Spring 2014.
- Noyce Scholars teaching in Arlee, Harlowton, Highwood, MCPS, Ronan, Stevensville, and Superior

Roscoe's involvement with other K-12 Schools include:
- Bridge to Algebra Program, Big Sky High School, Missoula, MT Summer 2015
- Project EAST Volunteer, Lewis and Clark Elementary School, Missoula, MT Fall 2015
- Developing Standards-Based Assessments, Missoula County Public Schools Assessment Institute, The University of Montana, June 23, 2015
- Developing Standards-Based Assessments, Hellgate High School, September 28, 2015
- Bivariate Data Analysis, STREAM 8th Grade Launch Workshop, Bozeman, MT, February 24-25, 2015
- Using GeoGebra in High School Mathematics Classes, Butte High School, September 19, 2013
- Number and Operation in the Common Core, STREAM Launch Workshop, Bozeman, MT, February 1-2, 2013.
- Mathcounts Coach, Washington Middle School, Missoula, MT 2012-2013

Peck's involvement with other K-12 Schools include:
- Montana Math Teachers’ Circle in Missoula and Billings, since 2015
- Montana Math Day since 2015
- Montana High School Math Circle since 2015
- SLD Intervention Workshops: Accessing grade-level content. Cherry Creek Public Schools, Cherry Creek CO, 2014-2015
- Understanding structure to aid in mathematical problem-solving. Colorado Council for Learning Disabilities. 2015
- Algebraic reasoning for students with SLD. Colorado Department of Education. 2015
PROPOSAL PROJECTIONS AND PROGRAM REPORT: TEACHERS

Please complete first column in proposal; then complete other columns in year-end report.

<table>
<thead>
<tr>
<th>Provide the number of participants in the program by each of the following categories:</th>
<th>Number Projected in Proposal</th>
<th>Actual Number of Participants</th>
<th>Sub-category</th>
<th>Sub-category</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of K-12 districts served:</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of high-need districts served:</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of schools served:</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of K-12 teachers served by school level:</td>
<td>5</td>
<td>Out of field or uncertified:</td>
<td>Without major in subject taught</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>50</td>
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<td></td>
</tr>
<tr>
<td>High school</td>
<td>45</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of administrators served:</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle school</td>
<td>2</td>
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<tr>
<td>High school</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paraprofessionals</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Number of K-12 Staff</td>
<td>0</td>
<td></td>
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<tr>
<td>Number of pre-service teacher candidates served:</td>
<td>15</td>
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<td>Number of higher ed faculty involved:</td>
<td>14</td>
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<tr>
<td>Other (such as adjuncts):</td>
<td>0</td>
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<tr>
<td>Total from Higher Ed:</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Intensity of Professional Development</th>
<th>Projected in Proposal</th>
<th>Actual Number</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Hours</td>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Number of Events</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Number of Participants Per Event</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Identification of Local Need

It has been almost 20 years since the Third International Mathematics and Science Study (TIMSS, 1997) demonstrated that American students’ understanding of mathematics, when compared to their international counterparts, decelerates across the middle school years of instruction leading to a performance gap that widens in high school and beyond. TIMSS analysis of the mathematics curriculum in the US characterized it as unfocused; lacking coherence, demand and rigor. A cascade of curricular proposals followed the TIMSS report. NCTM’s Principles and Standards (2000), the National Mathematics Advisory Panel (2008) and the Common Core State Standards (2010) made strong recommendations for changes in the teaching of mathematics; presenting a clear picture of not only what is taught (mathematical content) but also how students are to learn (mathematical practice). The identification of the importance of mathematical practices such as problem solving, constructing viable arguments, modeling with mathematics, and making use of structure (CCSS, 2010) are hope for the improvement of mathematical learning for students in Montana. Recent studies, however, reveal a decline in student performance in mathematics. These results identify a need to support Montana teachers during this critical period of educational reform with opportunities to experience mathematics as both content and practice so as to provide a model of teaching mathematics as both content and practice that aligns with the current vision of the Montana Common Core Standards for Mathematical Practice and Content. The Montana Math Teachers’ Circle is such an opportunity.

The Montana Math Teachers’ Circle will address the following identified local needs:

*Montana Math Teachers’ Circles will develop teacher knowledge of mathematical content and practice, leading to increased student achievement.* The need for the development of teacher knowledge of mathematical content and mathematical practice is well-documented on a national level, especially in elementary and middle school (i.e. Ma, 2010; Hill, Rowan & Ball, 2005; TEDS 2010). Evidence that this need also exists in Montana can is found in recent NAEP score data that show a large difference in mathematical achievement among 8th grade students associated with the mathematical education of the classroom teacher. As shown in Table 1, 8th grade students’ mathematical achievement is strongly associated with teacher’s content-specific education. 8th grade students in classrooms with highly qualified teachers in Montana scored nearly 5 standard errors higher than their counterparts in classrooms with less qualified teachers.
Table 1. National Assessment of Educational Progress (NAEP) 2013 8th Grade Results by Teacher’s Education

<table>
<thead>
<tr>
<th>Year</th>
<th>Jurisdiction</th>
<th>Math Education Major</th>
<th>No Math Education Major</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean Scaled Score</td>
<td>Standard Error</td>
</tr>
<tr>
<td>2013</td>
<td>National Public</td>
<td>288</td>
<td>(0.6)</td>
</tr>
<tr>
<td>2013</td>
<td>Montana</td>
<td>294</td>
<td>(1.4)</td>
</tr>
</tbody>
</table>

Further evidence of the need for the development of teacher knowledge of mathematical content and practice is found in the 2014 ACT Profile Report for Montana. As shown in Table 2, the report finds that Montana lags behind national averages with only 39% of ACT test-takers in Montana meeting the benchmark for preparedness for college-level mathematics. While Montana’s decline in ACT performance in mathematics is certainly tied to an increase in the number of students taking the assessment, it points to a need for greater teacher knowledge of mathematics content and practice to better address the state’s growing college-bound population of students.

Table 2. ACT Profile Report 2014 for Montana

Five Year Trends – Percent of Students who Met College Readiness Benchmarks

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>National</th>
<th>State</th>
<th>National</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>6,222</td>
<td>1,568,835</td>
<td>51</td>
<td>43</td>
</tr>
<tr>
<td>2011</td>
<td>6,037</td>
<td>1,623,112</td>
<td>53</td>
<td>45</td>
</tr>
<tr>
<td>2012</td>
<td>6,024</td>
<td>1,666,017</td>
<td>54</td>
<td>46</td>
</tr>
<tr>
<td>2013</td>
<td>6,631</td>
<td>1,799,243</td>
<td>49</td>
<td>44</td>
</tr>
<tr>
<td><strong>2014</strong></td>
<td><strong>9,611</strong></td>
<td><strong>1,845,787</strong></td>
<td><strong>39</strong></td>
<td><strong>43</strong></td>
</tr>
</tbody>
</table>
Montana Math Teachers’ Circle will address these special needs by creating professional development opportunities where teachers will (a) deepen their mathematics knowledge for teaching through authentic mathematics investigation, and (b) increase their use of inquiry-based pedagogy through participating in and discussing the educational affordances of inquiry activities. Both of these teacher-level outcomes are associated with increases in student achievement.

Montana Math Teachers’ Circle will provide targeted professional development to high needs schools. While the Montana Math Teachers’ Circle is open to all teachers state-wide, the project will provide targeted professional development opportunities to teachers in high needs schools. We define “high needs” schools as those schools that are participating in the Montana GEAR UP program. The Montana GEAR UP program supports 18 high-poverty middle and high school systems to increase students’ college and career readiness. Thirteen of the partner schools on or near Montana’s seven American Indian reservations. All 18 schools have a high need in mathematics. As shown in Table 3, the schools have a high proportion of students that were categorized as below proficient in mathematics based on their performance on the 2013 Montana Comprehensive Assessment (the latest year for which data are available).
Table 3. Percentage of students in GEAR UP schools below proficient on 2013 Montana Comprehensive Assessment

<table>
<thead>
<tr>
<th>Middle &amp; High School System</th>
<th>Middle school</th>
<th>10th-grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlee Middle/High Schools</td>
<td>51</td>
<td>60</td>
</tr>
<tr>
<td>Box Elder Middle/High Schools</td>
<td>67</td>
<td>66</td>
</tr>
<tr>
<td>Browning Middle/High Schools</td>
<td>78</td>
<td>84</td>
</tr>
<tr>
<td>Eureka Middle School/Lincoln County High School</td>
<td>35</td>
<td>47</td>
</tr>
<tr>
<td>Hardin Middle/High Schools</td>
<td>64</td>
<td>72</td>
</tr>
<tr>
<td>Harlem Middle/High Schools</td>
<td>66</td>
<td>57</td>
</tr>
<tr>
<td>Heart Butte Middle/High Schools</td>
<td>92</td>
<td>81 *</td>
</tr>
<tr>
<td>Lame Deer Middle/High Schools</td>
<td>83</td>
<td>94 *</td>
</tr>
<tr>
<td>Libby Middle/High School</td>
<td>41</td>
<td>45</td>
</tr>
<tr>
<td>Lincoln Middle/High School</td>
<td>33</td>
<td>46</td>
</tr>
<tr>
<td>Lodge Grass Middle/High School</td>
<td>91</td>
<td>91</td>
</tr>
<tr>
<td>Pryor Middle School/Plenty Coups High school</td>
<td>82</td>
<td>93 **</td>
</tr>
<tr>
<td>Rocky Boy Middle/High School</td>
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<tr>
<td>St. Ignatius Middle/High Schools</td>
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<td>44</td>
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<tr>
<td>St. Regis Middle/High Schools</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>Thompson Falls Middle/High Schools</td>
<td>9</td>
<td>52</td>
</tr>
<tr>
<td>Troy Middle/High Schools</td>
<td>46</td>
<td>63</td>
</tr>
<tr>
<td>Wolf Point Middle/High Schools</td>
<td>70</td>
<td>76</td>
</tr>
</tbody>
</table>

* 2012 data (the latest year for which data are available)
** 2010 data (the latest year for which data are available)

Montana Math Teachers’ Circle will address this specific need by partnering with MT GEAR UP. The MT GEAR UP program director, Zach Hawkins, and Senior Project Manager, Suzin Kratina, will facilitate this partnership and will assist in recruiting teachers from the MT GEAR UP schools. Please refer to their letter of support for such partnership.

Montana Math Teachers’ Circle will work to overcome silos of isolation in K-12 mathematics. Montana is a state of geographic challenge. The state is over 600 miles wide and 255 miles long with a population density of only 6.86 people per square mile. Of the 824 public schools in Montana, 40% enroll under 50 students (OPI Educational Facts, 2015). The geographically dispersed population means that many
mathematics teachers work in relative isolation. Many are the only mathematics teacher in their middle- or high-school. Furthermore, institutional barriers and physical building boundaries often separate grades K-5, 6-8, 9-12 and university-level teachers of mathematics. These artificial barriers create “silos of isolation” which present a special challenge for students who have to traverse these silos as they learn mathematics across time and geographical distance. Montana Math Teachers’ Circle will address these special needs by breaking-down artificial barriers by creating a professional learning community of teacher-mathematicians (K-12 and post-secondary) across the entire state of Montana.

**Goals of the Project**

The overall goal of the Montana Math Teachers’ Circle is to develop a welcoming, supportive, exciting community for the mathematics educators in the state of Montana where they share their passion about learning and teaching of mathematics. The program has the following goals:

1. To establish a professional learning community (PLC) of teacher-mathematicians (K-12 and post-secondary) across the entire state of Montana.
2. To increase K-12 math teachers’ mathematics knowledge for teaching (MKT; Ball, Hill, and Bass, 2005).
3. To inspire teachers to discover (or rediscover) the joy of solving mathematics problems, and to foster teachers’ identities as mathematicians.
4. To transform teachers’ classroom practice, such that students participate more fully in the practice of mathematics, as defined by the Montana Common Core Standards for Mathematical Practice (SMP).

**Description of Project activities**

Founded in 2006, the Math Teachers’ Circle (MTC) movement ([www.mathteacherscircle.org](http://www.mathteacherscircle.org)) brings together communities of math teachers and professors who meet regularly to work on rich mathematical problems. The communities serve as a powerful bridge across a traditional education divides, providing an opportunity for K-12 teachers to enrich their understanding of mathematical content and practice while providing college and university professors an opportunity to learn more about K-12 education. Recent research on Math Teachers’ Circles provides evidence that the program affects participating teachers by increasing their sense of self-efficacy as math teachers, by promoting inquiry-based teaching practices (Khaliqi, Marle, & Decker, 2013) and by increasing mathematical knowledge for teaching (White et al., 2013), which leads teachers to make more mathematical connections in the classroom (Donaldson et al., 2014). Further, surveys of participants have revealed an increase in enthusiasm for mathematics (Fernandes, Koehler, & Reiter, 2011), an increase in student-centered problem solving in their classrooms (Khaliqi, Marle, & Decker, 2013), and an increased belief that all students are capable of doing mathematics. Many teachers report that they have started seeing themselves as mathematicians (White & Donaldson, 2011; Fernandes, Koehler, & Reiter, 2011). In turn, each of the above positively impacts student learning and motivation (Barron & Chen, 2008; Hill, Rowan, & Ball, 2005; Ito et al., 2012). It’s little wonder, then, that The College Board of Mathematical Sciences (2010) identifies MTCs as one of only a handful of professional development models recommended.
Within Montana, the Montana Math Teachers’ Circle (at Missoula and Billings) has been running for three years. In 2013 a team of University of Montana (UM) mathematics faculty (Drs. Ke Wu, Matt Roscoe, David Patterson) and two teachers (Jennifer Hudson from Billings High School and Nicole Jefferson from Hardin Middle School) went to Palo Alto, CA to participate in an one-week workshop on how to run a math teachers’ circle that was organized by the American Institute of Mathematics (AIM). The team then started the Montana Math Teachers’ Circle at two locations: Missoula and Billings with funding support from the National Math Teachers’ Circle Network and the American Institute of Mathematics (AIM). Currently, 15-20 teachers participate in each of the biannual math teachers’ gatherings at Missoula and Billings. These events are so popular that teachers drive long distances just to participate. In the most recent event, held on October 17 in Billings, teachers came from as far as 2.5 hours away.

This points to a statewide desire among teachers to participate in the Montana Math Teachers’ Circle. The proposed program will build statewide capacity to conduct MTCs and expand the Montana Math Teachers’ Circle to three more locations (Great Falls, Helena, and Polson) so that every teacher in the state of Montana has access to an MTC.

This proposal seeks funding for the first year of a planned three-year program that will involve over 100 teachers in a blend of face-to-face and virtual professional learning and community building opportunities during the school year and summer months. In the first year, we seek funding to support four components of this program: (I) a 3-day training workshop to prepare a “lead team” at each of five locations—Billings, Missoula, Polson, Great Falls, and Helena—to conduct MTCs; (II) biannual MTC gatherings at each of the five locations; (III) a 3-day inquiry-and-discovery-learning retreat for teachers in the summer; and (IV) a continuous, technology-assisted, virtual PLC. Each component is described in detail below.

I: A 3-Day Training Workshop to Prepare "Lead Teams" to Conduct Math Teachers’ Circles in spring 2016

Math Teachers’ Circles are run by “lead teams” of approximately five members that include one or two faculty members from a higher education institution, one or two K-12 math teachers, and one administrator (either K-12 higher education). These teams work closely with local schools, teachers, and college professors to build the MTC community and conduct MTC events.

The purpose of the training workshop is to train the members of the lead teams in the design and conduct of MTC activities, and best practices for recruiting and communicating with MTC participants. The location of the workshop will be Helena, MT, which is the most central city among all five locations of the Montana Math Teachers’ Circle.

We will partner with the American Institute of Mathematics (AIM) to run the workshop. AIM is a national organization that runs training workshops on MTCs. AIM has agreed to send their experts and professionals to come to Montana to run the workshop and provide partial funding support for our participants to join the workshop. Upon the agreement (please refer to the letter for support from AIM in Appendix C for details of the arrangement) AIM will cover: (1) Travel expenses and stipends for AIM facilitators to come to Helena to run the workshop; (2) Lodging expenses for 20 participants (participants from Helena will not need lodging); (3) Per diem expenses for 25 participants; and (4) Mileage reimbursement for participants. Our proposed project will cover a stipend of $300 for 25
participants and rental of the meeting room.

The workshop will be three days (including travel time), and will be held Friday-Sunday to minimize disruptions to the lead team members' teaching responsibilities. The proposed dates of the workshop are Friday April 22 - Sunday April 24, 2016.

The members of each lead team members are listed below (please refer to letters of support from each institution and school):

- Helena team: Amy Kong and Kim Haughee, math faculty from Helena College; Beth Walsh and Kathy Dummer, math teachers from East Valley Middle school; Dan Rispens, Principle of East Valley Middle School
- Polson team: Polly Dupuis and Matt Seeley, math faculty from Salish Kootenai College; Matt Bishop and Carrie LaPierre, math teachers from Polson School District; Scott Wilson and Bill Appleton, school administrators from Polson School District
- Missoula team: Drs. Fred Peck, David Erickson, Matt Roscoe, David Patterson, and Ke Wu, math and education faculty from University of Montana; Emily Wilson, math teacher from Washington Middle School; Nick Grener, math teacher from Hellgate High School; Lisa Hendrix, Principle of Hellgate High School
- Great Falls team: Dr. David Thomas, Meredith Berthelson, and Khim Raj Shrestha, math faculty from University of Great Falls; Chris Olszewski, Director of Curriculum & Instruction from the Great Falls Public School District; Margaret Kotthoff, Great Falls High School
- Billings team: Dr. Andy Wildenberg, computer science faculty from Rocky Mountain College; Jennifer Hudson, math teacher; Lisa Wood, Math Department Chair, Dennis Holmes, Principle, Tylor Blood, Assistant Principle from Billings Senior High School

**Part II. Biannual Math Teachers’ Circle at each location**

The Math Teachers’ Circle at each location will meet 2-3 hours in one evening (on Friday) in spring 2016 and one evening in fall 2016. —Teachers will receive a stipend of $50 in addition to 2 OPI renewal credits, and one night’s lodging for participation. We anticipate that 15-25 teachers will participate at each location, for a total of approximately 100 teachers.

An example of a Montana Math Teachers’ Circle activity is described below. The gathering, which follows the general structure of MTCs across the country (Donaldson et al., 2014) proceeds as follows:

1. Check in and social time (15 minutes)
2. Introduce the activity, playing and analyzing the mathematics in the Game of SET: Anticipating that many participants will not be familiar with the game, facilitators explain the rules of the game and participants to play the game with one another. (20 minutes)
3. Invite Mathematical Questions: Once participants have gained some familiarity with the game, the focus of the session will shift to mathematical inquiry. Facilitators invite participants to pose mathematical questions that the group might want to investigate in the second half of the session. Once a substantial list of questions has been generated, questions are prioritized by group consensus. (15 minutes)
4. Mathematical Inquiry: Participants engage in collaborative mathematical inquiry around the agreed-upon questions. Facilitators offer suggestions, encouragement, and guidance as needed to facilitate collective mathematical inquiry. Once a critical mass of participants has reached a
solution on a problem, participants engage in mathematical discussion in which they present and defend their solutions, and appreciate and critique the solutions of others (60 minutes).

5. Connection to the classroom: Participants discuss the mathematical content and practices from the evening, and develop ideas about how each can be incorporated into their classroom. (20 minutes)

Part III. A 3-day inquiry-and-discovery-learning retreat for teachers in the summer.

A three-day inquiry and discovery learning retreat for teachers will take place at the Montana Learning Center at Canyon Ferry Lake (MLC) during July 6-9, 2016 (Note: These dates are not conflict with the dates of MMRT summer workshop, verified with Polly Dupuis at SKC). In this teachers will engage in formal and informal problem-solving. During the day, teachers will participate in MTC activities, and during the evenings they will engage in recreational mathematics as they relax together on the lake. These activities will build a strong, state-wide professional learning community, which we will sustain via online collaboration throughout the year. In order to prepare teachers to participate fully in this virtual professional learning network (PLN, described in more detail below), we will take time during the summer retreat to explore technology for mathematics (e.g, Geogebra, Desmos online calculator, Wolfram Alpha), and technology for collaboration and communication (e.g., shared Google Docs, group discussion lists).

We anticipate that 25 teachers and 5 leaders will participate in the summer retreat, all of whom will stay in the facilities at the MLC for all three days and nights. Participants are eligible for one graduate credit through the University of Montana or 15 OPI renewal units and will each receive a stipend of $300 dollars in addition to reimbursement of mileage for travel. Food and lodging will be covered by the project (at the rate charged by MLC). In addition, teacher participants will be eligible for to be reimbursed for up to $500 (with proof of purchase) for technology purchases that enable the teacher to fully participate in the virtual PLN.

Part IV. The establishment of a continuous, technology-assisted, virtual PLN.

The lead teams, the teachers participating in the MTCs at all five locations, and the summer retreat participants will all be enrolled in an online Professional Learning Network (PLN). The virtual PLN will be hosted by the Montana Digital Professional Learning Network (MDPLN). The purpose of the virtual PLN is to nurture and sustain the state-wide professional learning community that will be developed as teachers participate in the biannual MTC activities and summer retreat. The virtual PLN is especially important due to the geographic dispersion of teachers in Montana, which limits opportunities for statewide face-to-face meetings. Virtual PLNs have been shown to provide support and opportunities for professional learning to teachers including those in rural areas (Hamos, et. al., 2009).

Each month, the participants will engage in a collaborative online activity. The activities will include: working in groups on a mathematical question that was not addressed during the MTC event, hosting a math circle for parents, students, or others and reporting the results, and/or designing a math circle activity. After each activity is complete, the participants will have the opportunity to vote on all of the submissions and select a favorite. Participants with the winning submission will receive prizes like mathematics books, technology, gift cards, and mathematics games. In addition to these planned
activities, members of the virtual PLN will be able to share ideas and resources and discuss content and teaching techniques.

**Recruitment Plan:**

The Montana Math Teachers' Circle will implement a statewide recruitment strategy, drawing on best practices for recruiting teachers to MTCs (Donaldson et al., 2014), and by partnering with multiple math teacher networks across the state, as described below:

- We have already secured participation from teachers in high-needs LEAs for each location.
- We will partner with Montana Council of Teachers of Mathematics (MCTM) and recruit teachers via its network and dissemination channels (email list of teachers, newsletters). Please refer to the letter for support from MCTM on our partnership.
- We will partner with the Montana Office of Public Instruction (OPI) to recruit teachers via their network. Jake Warner, the Mathematics Content and Instruction Specialist at OPI, will serve as key personnel on the grant and will facilitate the partnership. Please refer to the letter of support from OPI on our collaboration.
- We will partner with the Montana GEAR UP program. The GEAR UP program director, Zach Hawkins, and Senior Project Manager, Suzin Kratina, will facilitate this partnership and will assist in recruiting teachers from the MT GEAR UP schools. The project team will attend the GEAR UP Winter Liaison meeting scheduled 1/27/16 as part of the effort to recruit teachers (attendance at this meeting has been confirmed with Zach Hawkins via email). Please refer to their letter of support for such partnership.
- We will host “mini Math Teachers’ Circle” events at the annual MEA-MFT conference. We have run the mini Math Teachers’ Circle at the MEA-MFT conferences in the past a few years and this has led helped to attract some teachers to join the circles in Missoula and Billings. We will continue such effort during the funding period.
- We have access to other networks through which we will recruit teacher participants including UM professors who volunteer as MATHCOUNTS coaches and a High School Math Circle network (UM has a math circle project for middle school/high school students and we have a list of teachers who work with their students on the math circle activities);
- We will invite current students and alumni of the teacher education programs at the University of Montana, including two undergraduate programs and two graduate programs.
- We will invite current students and alumni of the teacher education program at Salish Kootenai College (SKC). Matt Seeley and Polly Dupuis will facilitate this partnership. Please refer to the letter of support from SKC on our collaboration.
- We will draw on the existing Montana Math Teachers’ Circle network. The Missoula and Billings MTCs each have 15-20 regular participants. These circles recruit new members largely through word-of-mouth, and we will draw on this network to recruit new members for the statewide MTCs.
- We will draw on the personal networks of the PIs, key personnel, and lead teams. For example, at Polson, Polly Dupuis, our leader for the Polson location, who works at both SKC and Polson High School, has established a good network of 30-40 teachers in surrounding areas.

**Dissemination Plan:**

Montana Math Teachers’ Circle will make contributions to Montana schools, teachers, and students by providing high quality professional development to teachers. We will make every effort to disseminate information about project activities widely throughout the state by partnering with statewide and local networks, as described in the recruitment plan above.

In addition, the project will make practical and theoretical contributions to the Math Teachers’ Circle community. These contributions include (a) how to conduct MTCs in rural and geographically
dispersed environments; (b) the affordances and constraints of conducting MTCs online; and (c) analyses of how communities of practice form in MTCs, and how teachers come to identify as mathematicians as they participate in MTCs (see the evaluation plan below for more details). We will disseminate these contributions via presentations at local and national conferences (including the MEA-MFT conference in Montana and the Annual Meeting of the National Council of Teachers of Mathematics) and via publications in practitioner journals (e.g., Mathematics Teaching in the Middle School, Notices of the AMS, MTCircular), and research journals (e.g., Journal for Research in Mathematics Education, Journal of Mathematical Behavior).

**Evaluation Plan**

The goals of the project are related to the proposed project activities by the following theory of action (Desimone, 2009).

1. Teachers experience *effective* professional development, defined as professional development that involves five core features: Content focus, active learning, coherence, sustained duration, and collective participation (Goal 1)
2. The PD affects teachers' knowledge and identities (Goals 2 and 3)
3. The changes in teachers' knowledge and identities lead to changes in the teachers' classroom classroom practice (Goal 4)
4. The changes to classroom practice have a positive effect on student outcomes.

Math Teachers' Circles have been shown to meet the five core features of effective professional development, defined in step 1 of our theory of action (White et al., 2013). To evaluate the extent to which the Montana Math Teachers' Circle address the goals of our project, we will use quantitative and qualitative methods, as described in Table 4, and elaborated below.

**Table 4. Brief description of evaluation plan for each goal**

<table>
<thead>
<tr>
<th>Goal</th>
<th>Method of evaluation</th>
</tr>
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<tbody>
<tr>
<td>1. To establish a professional learning community (PLC) of teacher-mathematicians (K-12 and post-secondary) across the entire state of Montana.</td>
<td>Qualitative. Ethnographic methods to determine the extent to which a community of practice is formed throughout the project</td>
</tr>
<tr>
<td>2. To increase K-12 math teachers' <em>mathematics knowledge for teaching</em> (MKT).</td>
<td>Quantitative. Pre-post design, using the <em>Learning Mathematics for Teaching</em> instrument</td>
</tr>
<tr>
<td>3. To inspire teachers to discover (or rediscover) the joy of solving mathematics problems, and to foster teachers' identities as mathematicians</td>
<td>Qualitative. Discourse analysis and comparative case studies to track the development of <em>practice-linked identities</em></td>
</tr>
<tr>
<td>4. To transform teachers' classroom practice, such that</td>
<td>Quantitative. Pre-post design using a</td>
</tr>
</tbody>
</table>
students participate more fully in the practice of mathematics, as defined by the Montana Common Core Standards for Mathematical Practice (SMP).

To evaluate Goal 1, we will evaluate the extent to which a community of practice (Lave & Wenger, 1991; Wenger, 1998) is formed as teachers and mathematicians participate in the project activities. A community of practice is defined by three features: mutual engagement, joint enterprise, and shared repertoire (Wenger, 1998). Using ethnographic methods, we will trace the development of these aspects over the course of the project, and ultimately, we will evaluate the extent to which these features are present in the community that develops.

To evaluate Goal 2, we will use items from the Learning Mathematics for Teaching instrument to measure changes in teachers’ Mathematical Knowledge for Teaching. This instrument is designed and validated to measure MKT (Schilling & Hill, 2007; Schilling, Blunk & Hill, 2007), and there are multiple forms that have been psychometrically equated. To determine changes in MKT, we will use a pre-post design, in which we give participants one form at the beginning of the project, and one at the end and then measure the difference. To ensure security and fidelity, prospective users must first be trained in the use of the LMT instrument. Co-PI Roscoe has completed this training and hence we have access to the instrument.

To evaluate Goal 3, we will explore the development of participants’ practice linked identities, that is, the identity that is developed through engagement in shared practice (Nasir & Hand, 2008). Practice-linked identities are formed in a “double-sided process of positioning ourselves and being positioned by others” (Stevens et al., 2008, p. 357) as we engage in shared practice. In this view, identities are not static “possessions” of individuals, but rather “ongoing project[s] of construction by a given individual together with the others with whom she comes into contact” (O’Connor et al., 2007). This dynamic process happens discursively, through social interaction (De Fina, Schiffrin, & Bamberg, 2006; Goodwin & Heritage, 1990, Hand & Gresalfi, 2015; Packer, 2011). Hence, we will use conversation analytic techniques (Goodwin & Heritage, 1990) and comparative case studies (Yin, 2013) to analyze discourse—both online and face-to-face—to uncover the ways in which participants position themselves and are positioned with respect to the practice of mathematics. Focusing on particular cases allows us to follow closely the ways in which practice-linked identities thicken (Wortham, 2004) over time.

To evaluate Goal 4, we will ask participants to complete a survey about their classroom practices, as they relate to the Standards for Mathematical Practice. To date, no such survey has been developed, hence we will develop our own. To determine changes in classroom practice, we will use a pre-post design, in which participants complete one survey prior to beginning the project, and one survey during the school year following their participation in the project.

Role of Key Project Personnel

The Montana Math Teachers’ Circle project team has strong experiences, skills, connections, and background to achieve the proposed goals and activities. In Appendix C please find curriculum vitae
and letters of support from key project personnel. The following is a description about responsibilities of each key personnel:

**Dr. Ke Wu, Principle Investigator (PI).** Wu will serve as the lead for managing and implementing the proposed project. She will recruit teacher participants, manage budget/payment to all project personnel and teacher participants, and write quarterly and annual reports to the funding agency. She will also facilitate communication and cooperation between the lead teams at each location.

**Dr. David Erickson, Co-PI.** Erickson will be in charge of the teacher recruitment effort, organizing and coordinating the 3-day summer retreat. He is part of the lead team for the Missoula Math Teachers’ Circle. He will also attend the 3-day AIM workshop on how to run a math teachers’ circle.

**Dr. Matt Roscoe, Co-PI.** Roscoe will be responsible for cooperating with teacher circles in Billings and SKC. He will work with Dr. Hilary Risser on the development and maintenance of the virtual PLN. He is also part of the leading team for the Missoula Math Teachers’ Circle.

**Dr. Fred Peck, Co-PI.** Peck will cooperate with teacher circles in Helena and Great Falls. He is in charge of the evaluation of the project and will work with Dr. Ke Wu on organizing/coordinating the AIM workshop on how to run a math teacher circle.

**Dr. Hilary Risser, Key Personnel.** Risser will work closely with Co-PI Dr. Matt Roscoe on the virtual PLN. She will provide expertise on, and contribute to, the development, construction, and training for the virtual PLN, and she will help to design activities and facilitate the PLN.

**Jake Warner, Key Personnel.** Warner is the math curriculum specialist at OPI. We will collaborate with OPI on project teacher recruitment, Common Core State Standards consulting, project dissemination, and having OPI host our virtual platform for the virtual professional development community.

**Adequacy of resources and cost effectiveness**

Our project team will work closely with all the five leading teams and our partners (OPI, MCTM, AIM, MT GEAR UP) to complete the project effectively with sufficient resources. The cross-institution collaboration means that the team will access the resources of UM and partner institutions at Polson, Billings, Helena, and Great Falls. We also have some funding support from our partners, contingent on receipt of the grant. The American Institute of Mathematics (AIM) has committed to send experts and facilitators to run one workshop for us, and partial funding ($7,003) to support our proposed project. Additionally, the MT GEAR UP program also committed that if our project is funded, they will provide funding resources to cover the cost of travel substitute teachers for teachers from the GEAR UP schools to participate the project.

The following describes funding and budget details:

**Funding Allocation**

The Montana Math Teachers’ Circle project requests a total amount of $108,792.72. The total funding allocation for School of Education is 4.17%. The Department of Curriculum and Instruction at UM prepares teachers and principals is categorized to the School of Education. The total funding allocation
for College of Arts and Sciences is 15.49%. The Department of Mathematical Sciences at UM is this category. The total funding allocation for LEAs is 69.32%. This largest proportion of the funding will provide resource for about 100 teachers to participate the project. We have 5 partnership schools and 18 GEAR UP schools officially committed to our program (see the list below). We anticipate teachers from many other schools across Montana will participate in the project. For example, in spring 2015 the Missoula Teachers’ Circle had teachers from Florence High School, Albertson High School, Butte High School, Two Eagle River Alternative School (Bureau of Indian Education school located in Polson), Polson High School, Charlo Middle School, Sussex School (private), Hellgate High School, and Washington Middle School. We are confident that having MTCs at five locations (Helena, Great Falls, Polson, Billings, and Missoula) will attract about 100 teachers to join our program. The total funding allocation for Additional Partners is 11.03%, which includes budgets for the five partner institutions and Dr. Hilary Risser from MT Tech.

The following is the list of schools who have officially committed to the program:

● Billings Public Schools
● Polson School District
● Missoula County Public Schools
● Great Falls Public Schools
● Helena East Valley Middle School

● Identified high-need LEA as described by OPI for each location:
  ● Missoula and surrounding area: Victor High School
  ● Billings and surrounding area: Ashland Public School
  ● Polson and surrounding area: Arlee Elementary School
  ● Great Falls and surrounding area: Browning High School
  ● Helena and surrounding area: Butte High School

● MT GEAR UP schools
  o Arlee Middle/High Schools
  o Box Elder Middle/High Schools
  o Browning Middle/High Schools
  o Eureka Middle School/Lincoln County High School
  o Hardin Middle/High Schools
  o Harlem Middle/High Schools
  o Heart Butte Middle/High Schools
  o Lame Deer Middle/High Schools
  o Libby Middle/High School
  o Lincoln Middle/High School
  o Lodge Grass Middle/High School
  o Pryor Middle School/Plenty Coups High school
  o Rocky Boy Middle/High School
  o St. Ignatius Middle/High Schools
  o St. Regis Middle/High Schools
  o Thompson Falls Middle/High Schools
  o Troy Middle/High Schools
  o Wolf Point Middle/High Schools

Cost Effectiveness

The Montana Math Teachers’ Circle project will provide funding support for about 100 teachers to join the program. We have faculty members from five IHE as well as partners from OPI, MTCM, GEAR UP, AIM to collaboratively work on and support the program. Considering the large number of anticipated
teacher participants and joint effort from multiple faculty members and national experts, the overall
cost of this program is very effective.

**Detailed Budget Narrative:** The narrative below details each line item on the budget form.

**A. Cost for School of Education**

a. Personnel Services: Dr. David Erickson is the Co-PI. His responsibilities to the program
are described in the “Role of Key Project Personnel” section of the proposal narrative.
Erickson will be paid approximately 0.023 FTE (equivalent to 4.3724 days) of summer
salary for his contribution to the project. His base salary is $112,981. UM policy is that
faculty summary salary requires 25% benefit rate. The total amount of personnel
service (i.e. summary salary) is $3,250 (112,981x0.023 + 112,981x0.023x25%).

b. Operating Expenses: $200 materials and supply for the 3-day summer workshop that
Dr. Erickson will be in charge of; $200 for recruitment/dissemination for the project;
and travel coverage for Erickson to recruit teachers and disseminate our program
results. **All travel costs for the project reflect the state travel policy, as follows:** $551 for
2 trips: one for the summer workshop at Helena (300 miles’ reimbursement at MT
state rate of .545/mile) and the other for the MEA-MFT conference at Helena (2 nights’
lodging at $89/night; 300 miles’ reimbursement at state rate of .545/mile; meal per
diem at $23/day for 2 days.)

c. Total cost for School of Education is: **Total direct cost ($4,201) + 8% indirect cost
($336.08) = $4,537.08**

**B. Cost for College of Arts and Sciences**

a. Personnel Services:
Drs. Ke Wu, Matt Roscoe, and Fred Peck are PI and Co-PIs. They will be paid
approximately 0.036 FTE (equivalent to 6.924 days) for Wu, 0.041 FTE (equivalent to
7.894 days) for Roscoe, and 0.043 FTE (equivalent to 8.32 days) for Peck, of summer
salary for their contributions to the project. Their base salaries are $85,959 (Wu),
$63,236 (Roscoe), and $60,000 (Peck). The total amount of their summer salary is
$8,300.

Maria Yost is a part-time permanent staff at the Math Department. She is going to be in
charge of all of the paperwork that is involved with payment and reimbursement for all
project participants (100 teachers and all the faculty members). The project will pay
summary salary of 40 hours at a rate of $15 per hour for her contribution. The total
amount of her summary salary is $600.

IT specialist: We will hire an IT specialist who is part-time permanent staff at UM to be
in charge of developing and maintaining a website for the project to help with the
recruitment/dissemination/communication about the program. The project will pay
summary salary of 30 hours at $20 per hour rate, total of $600 for the IT specialist.

UM policy is that faculty summary salary requires 25% benefit rate and 29% benefit
rate for permanent staff summary salary. The total amount of summer summary
salaries (including benefits) for three PIs and two staff is $11,923.

b. Operating Expenses:
Drs. Wu, Roscoe, and Peck will make trips to facilitate the math teachers’ circles at four
locations (Billings, Polson, Helena, and Great Falls) in spring and fall of 2016. They will
also travel to attend the GEAR UP Winter Liaison meeting in spring, the summer workshop, and MEA-MFT fall conference. Cost of travel is calculated at the MT state travel rate, and includes carpooling and sharing hotel rooms, as follows: To visit the math teachers’ circle at four location twice at each location, and to attend the GEAR UP meeting, we budget 9 trips at an average rate of $299/trip (each trip covers one night hotel for one room at $89/night/room, 300 miles’ reimbursement for one car at .545/mile, and meal per diem at $23/day/person for 2 people for 1 day), thus a total of $1,495 ($299 x 9 = $2,691). For the summer workshop at Helena, we budget in 300 miles reimbursement for one car at .545/mile (a total of 300 x .545= $164). For the MEA-MFT conference, the project will cover the cost of lodging for two rooms for two nights at $89/room/night, 300 mileage reimbursement at .545/mile for 2 cars and meal per diem at $23/day/person for 3 people for 2 days (a total of $821 = $89 x 2 x 2 + 300 x .545 x 2 + 23 x 3 x 2). The total operating expenses (for travel) is $3,676 (2,691 + 164 + 821).

c. Total Cost for College of Arts and Sciences: Total direct cost $15,599 ($11,923 +$3,676) + 8% indirect cost ($1,247.92) = $16,846.92

C. Cost for LEAs

a. Participants Costs:
Each lead team at the five locations (Missoula, Billings, Polson, Great Falls, and Helena) has 2-4 middle school or high school teachers. The list of teachers who will join the lead teams is included in the proposal narrative. The program will pay $1,000 salary for each location for the teacher leaders. How the $1,000 will be distributed among the leading teachers at each location will be determined by discussions among the leading teachers once the project is funded. The project anticipates that 15-25 teachers will join the MTC at each location, which is about 100 teacher participants total. Each teacher will be paid $50 for their participation, once in spring and once in fall. The budget for lead teams and 100 teacher participants is: $15,000 ($1,000 x 5 locations + $50 x 100 teachers x 2 teacher circle events).

For the AIM workshop, we will pay a $300 stipend per teacher for 15 teachers and for the summer retreat, we will pay a $300 stipend per teacher for 25 teachers. The budget for teacher stipends to participate in workshops is $12,000 ($300 x 15 + $300 x 25).

b. Materials and supplies: For each teacher circle we budget $200 to purchase materials. For the summer workshop, we will provide $500 per teacher for 25 teachers for technology support as discussed in the proposal narrative. The total budget for this category is $13,500 ($200 x 5 + $500 x 25).

c. Rental of meeting rooms: $500 for the 3-day AIM workshop and $500 for the summer retreat. Total: $1,000.

d. Food and lodging for 3-day summer workshop at the Montana Learning Center (MLC) at Canyon Ferry Lake: $252 per teacher x 25 teachers = $6,300. The lodging/food rate is calculated based on MLC program lodging and meal rate (http://www.montanalearning.org/program-rates/).
e. **Non Employee Travel:** The teacher circle at five locations will meet twice during the funding period. The project will provide one night lodging for teachers who travel far away. We anticipate that 100 teachers will participate the teacher circles, but not all of them will need lodging. **Thus we budget 50 rooms (double occupancy) at a rate of $89/room/night. The total travel (lodging) for teachers is $8,900 ($89 x 50 rooms x 2 nights).**

f. **Mileage reimbursement for summer workshop:** $228 per teacher for 25 teachers (average 418 miles per teacher at .545/mile), totaling $5,700. We will encourage teachers to carpool. During summer, carpooling may be difficult because teachers may be traveling to and from different locations before and after the workshop (the proposed workshop dates are July 6-9, 2016, which is right after 4th of July holiday).

g. **Summer workshop graduate credits registration fee:** UM charges a $135 registration fee per teacher to register the graduate credits. $135 x 25 teachers = $3,375.

h. **Employee Benefits:** 15% for teacher salary and stipends. 15% x ($15,000 + $12,000) = $4,050

**Total costs for LEA:** Total direct cost ($69,825) + 8% indirect cost ($5,586) = **$75,411.**

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**D. Cost for Additional Partners**

a. The institute of higher education of the lead team at each location (Rocky Mountain College, Helena College, Salish Kootenai College, University of Great Falls) will receive $1,000. Note there might be more than one faculty members from the same institution who will be on the lead team. How the $1,000 will be distributed is up to the faculty members. The project will just allocate the $1,000 to each institution. Thus, $1,000 x 4 = **$4,000.**

b. Dr. Hilary Risser is a project key personnel. Her responsibilities to the program are described in the "Role of Key Project Personnel" section of the proposal narrative. Riser will be paid approximately 0.02755 FTE (equivalent to 5.29 days) of summer salary for her contribution to the project. Her base salary is $65,345. UM policy is that faculty summary salary requires 25% benefit rate. The total amount of personnel service (i.e. summary salary) is $1,800 (65,345x0.02755 + 65,345x0.02755 x 25%).

c. The faculty from the leading teams will participate the AIM workshop on "how to run an MTC." The project will provide a stipend of $300 per faculty member for 10 faculty members. $300 x 10 = **$3,000.**

d. Dr. Hilary Risser will facilitate the summer workshop. The program will provide **$109 travel reimbursement for her travel (200 miles at .545/mile).**

e. UM requires 25% benefit for summer salary, thus the cost of employee benefits is $2,200.

**Total costs for Additional Partners:** Total direct cost ($11,109) + 8% indirect cost ($888.72) = **$11,997.72.**
References


FORM 5: BUDGET FORM

A: Costs for the School of Education

<table>
<thead>
<tr>
<th>Personnel Services</th>
<th>Cost Basis (salary, wage, item cost)</th>
<th>(# FTE or # of hours = amount)</th>
<th>Budgeted Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Salaries (Dr. David Erickson)</td>
<td>$113,981</td>
<td>$131,381x 0.90 FTE (equivalent 4.374 days)</td>
<td>2600</td>
</tr>
<tr>
<td>2 Hourly Wages</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Employee Benefits 25% for faculty</td>
<td></td>
<td>450</td>
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</tr>
<tr>
<td>4 Total Personnel Services</td>
<td></td>
<td>4250</td>
<td></td>
</tr>
</tbody>
</table>

Operating Expenses

5 Contracted/Professional Services

6 Stipends

7 Materials and Supplies $200 for 3-day Summer workshop; $200 for recruitment and dissemination $200+$200 400

8 Communications

9 Employee Travel $551 for 2 trips (summer workshop and MFA-MFT conf) 551

10 Other (Specify) | 951 |

11 Total Operating Expenses | 4201 |

12 Direct Costs (Lines 4+11) | 338 06 |

13 Indirect Cost (8%) Line 12 x 8% | 11109 |

14 Total for School of Education | 4537 08 |

B: Costs for College of Arts and Sciences

<table>
<thead>
<tr>
<th>Personnel Services</th>
<th>Cost Basis (salary, wage, item cost)</th>
<th>(# FTE or # of hours = amount)</th>
<th>Budgeted Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Salaries (Names: Ke Wu, Matt Roscoe, Fred Peck) $85,959 Wu; $63,236 Roscoe; $60,000 Peck</td>
<td>$95,959 ($83,607FTE 6.924 days) + $63,236 8300</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Hourly Wages (summer salary for Maria Hoyt, Math de $15/hour, 40 hours) $15 x 40</td>
<td>400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Hourly Wages (summer salary an IT specialist who is $20/hour, 30 hours) $20 x 30</td>
<td>600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Employee Benefits 25% for faculty, 25% for staff Line 1 x 25% + (Line 2 + Line 3) x 25%</td>
<td>2423</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Total Personnel Services</td>
<td></td>
<td>11573</td>
<td></td>
</tr>
</tbody>
</table>

Operating Expenses

5 Contracted/Professional Services

6 Stipends

7 Materials and Supplies

8 Communications

9 Employee Travel $299/trip for 9 trips (four MTC locations twice at each location, and GEAR UP meeting); $164 for summer workshop mileage reimbursement for 1 car; $821 for MEA-MFT conference 109734

10 Other (Specify) Employee benefits | 951 |

11 Total Operating Expenses | 55199 |

12 Direct Costs (Lines 4+11) | 1247 92 |

13 Indirect Cost (8%) Line 12 x 8% | 11573 |

14 Total for College of Arts and Sciences | 16546 92 |

C: Costs for LEA

<table>
<thead>
<tr>
<th>Participant Costs</th>
<th>Cost Basis (salary, wage, item cost)</th>
<th>(# FTE or # of hours = amount)</th>
<th>Budgeted Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Contracts (Name teachers from Billings, Missoula, Great Falls hire $12,000 a year salary for teachers of the leading team at each location; $50 per team; $12,000x teacher leading teams x $50x10 teams = 15000)</td>
<td></td>
<td>15000</td>
<td></td>
</tr>
<tr>
<td>2 Stipends/Substitutes $200/hour for AIM workshop and $200/hour for summer workshop; $300 x 15 teachers for AIM workshop x $300 x 15 teachers</td>
<td></td>
<td>12000</td>
<td></td>
</tr>
<tr>
<td>3 Materials and Supplies $200 each of the 5 teacher's circles; $500/hour teacher technology support fee; $200 x 5 circles x $500 x 25 teachers</td>
<td></td>
<td>13500</td>
<td></td>
</tr>
<tr>
<td>4 Rental of meeting rooms $500 for the 3-day AIM workshop and $500 for 3-day summer workshop $500 x 2</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Food/Lodging for Summer workshop</td>
<td>$752 x 20 teachers</td>
<td>6300</td>
<td></td>
</tr>
<tr>
<td>6 Non Employee Travel $89/room/night lodging for 50 rooms (double occupancy) at five MTC locations $89 x 50 rooms x 2 MTC</td>
<td>8900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 Mileage reimbursement for summer workshop $200/hour for 23 teachers $23875</td>
<td>5700</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 College Credits/Tuition: Graduate credits registration fee $155/teacher</td>
<td>$155 x 25 teachers (summer workshop)</td>
<td>3375</td>
<td></td>
</tr>
<tr>
<td>9 Other (Specify) Employee benefits 15% for teacher salary and stipends Line 1 + Line 2 + 15%</td>
<td>4050</td>
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<tr>
<td>10 Total Direct Cost</td>
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<tr>
<td>11 Indirect Cost 8% Line 10 x 8%</td>
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<tr>
<td>12 Total Budget for LEA</td>
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<td>75431</td>
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</table>

D: Costs for Additional Partner(s)

<table>
<thead>
<tr>
<th>Participant Costs</th>
<th>Cost Basis (salary, wage, item cost)</th>
<th>(# FTE or # of hours = amount)</th>
<th>Budgeted Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Contracts (Name faculty team from Rocky Mountain C) Each college team receives $1,000 $1,000 x 4 college teams</td>
<td></td>
<td>4000</td>
<td></td>
</tr>
<tr>
<td>2 Contacts (Name: Hilary Risser at MT Tech) $65,145 $65,145 x 0.2375 FTE (8.29 days)</td>
<td>1400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 Stipends/Substitutes $500/hour for their participation of AIM workshop</td>
<td>$500 x 10 faculty members</td>
<td>5000</td>
<td></td>
</tr>
<tr>
<td>4 Materials and Supplies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Communications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 Non Employee Travel (mileage for summer workshop) $109 for Hilary Risser to attend the summer workshop</td>
<td></td>
<td>109</td>
<td></td>
</tr>
<tr>
<td>7 College Credits/Tuition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Other (Specify) Employee benefits 25% for faculty Line 1 + line 2 + line 3 x 25%</td>
<td>2200</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 Total Direct Cost</td>
<td></td>
<td>11109</td>
<td></td>
</tr>
<tr>
<td>10 Indirect Cost 8% Line 9 x 8%</td>
<td>888 71</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 Total Budget for LEA</td>
<td></td>
<td>11997 72</td>
<td></td>
</tr>
</tbody>
</table>

A: Total for School of Education (not to exceed 50%) 4537 08 |

B: Total for College of Arts and Sciences (not to exceed 50%) 16546 92 |

C: Total Budget for LEA (not to exceed 50%) 75431 |

D: Total Budget for Additional Partners (not to exceed 50%) 11997 72 |

E: Total Direct Cost 25312 34 |

F: Total Indirect Cost 8% 8058 72 |

G: GRAND TOTAL 108732 72 |

Note: On the Budget Request forms used by the accounting officers, sections A through D are combined. However, for year-end fiscal and program reporting, these funds must be reported on this form, using sections A, B, C, and D (if relevant) to verify that no one partner received more than 50% of the total award.

Signature of Institutional Grants Officer/Fiscal Department
APPENDIX A

STATEMENT OF ASSURANCES

The applicant hereby provides assurance to the Montana Office of the Commissioner of Higher Education that if a grant is received under the terms of the Improving Teacher Quality State Grant, Title II, Part A, it will:

Comply with audit requirements in accordance with the Federal Office of Management and Budget (OMB) Circular A-128 or A-133 as appropriate, and supply the Office of the Commissioner of Higher Education with a copy of the audit report for each fiscal year in which grant funds were expended within 60 days of the completion of the audit;

Comply with the administrative procedures of the Office of the Commissioner of Higher Education and all regulations, policies, and requirements, including Public Law 107-110; Education Department General Administrative Regulations (EDGAR) and the Office of Management and Budget Circulars No. A-102, A-110, A-133, and applicable cost principles (Circulars: A-21 Educational Institutions, A-87 Cost Principles for State and Local Governments, and A-122 Nonprofit Organizations) as they relate to the application, acceptance, and use of federal funds for this federally assisted project;

Comply with Title VI of the Civil Rights Act of 1964 (race, color, national origin), Section 504 of the Rehabilitation Act of 1973 (handicapped), Title IX of the Education Amendments of 1972 (sex) and the Age Discrimination Act of 1975 (age);

Retain all records for a period of five years and give the Office of the Commissioner of Higher Education, the Federal sponsoring agency or the State Auditor through any authorized representatives access to and the right to examine all records, books, papers, or documents related to the grant;

Comply with all provisions of the Title II, Improving Teacher Quality State Grants, Part A and make public all products (e.g., example capstone curricular materials including student assignments, tasks, prompts, and research and project ideas, assessment rubrics, performance exemplars, etc.) resulting from the project and in a format that can be posted to a web site and used by Montana school divisions and teachers.

Seek to provide greater access to all core academic disciplines to historically underrepresented and underserved groups;

Enter into agreement for professional development with school(s), school district or consortium of school districts or nonpublic schools in the area of proposed grant activity; and

Ensure equitable participation of personnel from nonpublic (private) schools to the extent feasible.

University of Montana
Institution/Organization

Name: Judy Fredenberg

Title: Director, Office of Research and Sponsored Programs

Chief Academic Officer/ Executive Director
APPENDIX B

Page left intentionally blank.

Insert letters of agreement as well as assurances of teacher participation with signatures here or contact the Title II Grant Manager for other allowable methods of submitting this information.
Appendix C

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Insert one-page curriculum vitae for each project director and for other key project personnel, including principal instructional staff.