

Improving elementary Geoscience education in Montana: The Big Sky Science Partnership teacher professional development program

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What is the BSSP?

The Big Sky Science Partnership (BSSP) is an NSF-funded Math Science Partnership Teacher Institute that links Montana partners from:

- Salish Kootenai College
- University of Montana
- Montana State University
- 45 Montana K-8 schools
- Five Montana Tribes (Crow, Kootenai, Northern Cheyenne, Pend O'Reille, and Salish)

in a collaborative learning community. Its overarching goal is to improve science education in K-8 schools and increase science achievement of students, in particular American Indian students. Approximately 60% of the students impacted by this program are American Indians living on Montana Indian reservations.



at UM, is discussing the geologic history of Glacial Lake



sciences activities. A primary focus of our content is an understanding of the rock cycle and how it relates to



in activities to broaden their cultural perspectives. Here,

Built on a cohort model of two teacher cohorts per site (SKC, UM, and MSU) where teachers are formally partnered with the BSSP for three out the five project years, participation involves:

- A science content focused two-week Summer Institute (rotating between geosciences, astronomy, and
- A three-day Culture Camp focused on developing cultural competency
- An academic year course with online & on site components
- Leadership initiatives carried out by BSSP K-8 teachers

This poster describes the design and impacts of the 2010 UM Summer Institute and SKC/UM Culture Camp, which focused on the Geosciences.

The Geosciences Summer Institute

The primary focus of the BSSP 2010 Geosciences Summer Institute was to deepen K-8 teachers' Geoscience content knowledge. Seventeen teachers from the UM cohort engaged in a variety of learning experiences designed to investigate the past, present, and future behavior of Earth's interacting physical systems. Topics were aligned with the National Science Education Content Standards and included:

| | Plate tectonics | Earth Structure | Hydrologic cycle |
|--|----------------------|----------------------------|---------------------|
| | Rocks and Minerals | Geologic Time | Ground water |
| | Weathering & Erosion | Geologic structures & Maps | River geomorphology |





Field trip to Bitterroot Valley with Julie Baldwin



Students sketching imbricate clasts in the field



Inquiry with ground water models

Cultural connections are woven into the field experiences. Here, Tim Ryan, a member of the Salish and Kootenai tribes, discusses the use of lithic tools by

Our faculty included one Geosciences faculty, one Science Education faculty, a K-12 Education specialist (former high school teacher), and a middle school science teacher. We also engaged two other Geosciences faculty to lead field trips and invited American Indian consultants to support the development of cultural connections.

Academic Year Professional Development

During the 2010-11 academic year, the BSSP teachers will complete a course entitled "Geosciences Instruction and Professional Learning Communities for K-8 Teachers." The goals of this course are to 1) increase teacher knowledge of science, 2) increase teacher knowledge of science pedagogy, 3) improve teacher ability to effectively support science learning in diverse students, and 4) develop teacher professional skills for science teacher leadership.



BSSP teacher conducting an activity on volcanoes as part of the Professional Learning Community component of the academic course.



In this course, the teachers will engage in the study of Geosciences content (topics include volcanoes, earthquakes, fossils & geologic time, and watersheds) and will use these topics as contexts for developing their knowledge of effective science teaching, for learning about and practicing the art of Lesson Study (Stepanek et

al., 2007), for developing instructional materials that support conceptual understanding in diverse students, and for developing skills in peer mentoring. The course is delivered through a combination of four on-site meetings, meetings with individual Lesson Study groups, and online instruction.

Development of Culturally Competent Teaching

A primary goal of the BSSP is to improve our teachers' cultural competence in teaching students from diverse backgrounds. To that end, the SKC and UM teachers attended a three-day Culture Camp at the Blue Bay Tribal Campground on Flathead Lake in northwestern Montana. Forty-four teachers and forty tribal partners participated in the Culture Camp, building connections between tribal communities and schools. Activities included learning Salish and Kootenai language phrases that are relevant in the classroom; spending time talking with tribal elders; erecting lodges; and learning traditional songs, games, and dances. Each teacher made a number of culturally relevant items that they can use in their classroom science teaching, including hand drums, tule tipis, and stone tools. This event builds knowledge of Indigenous science and cultural protocol and deepens relationships between teachers and tribal members.



Teachers making stick game sets.



Hand drum-making activity

works with the teachers.



Mary Jane Charlo, one of the BSSP cultural consultants

Teachers learn bow hunting skills.

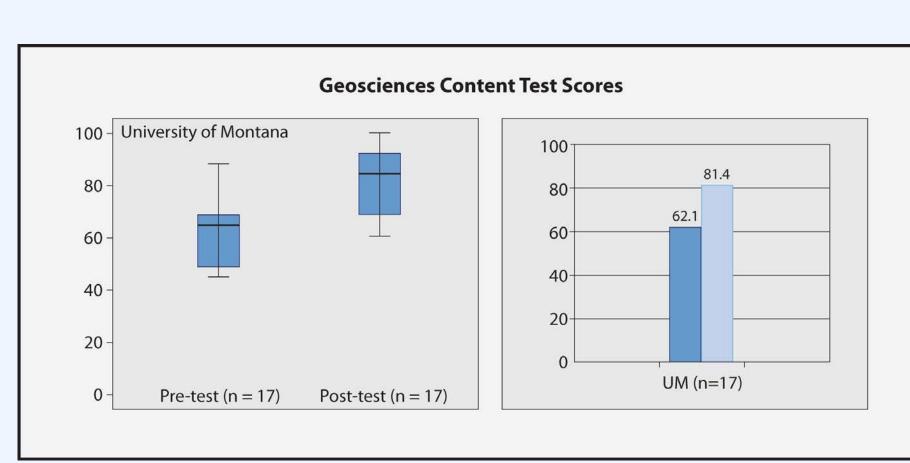


Teachers learning Native songs and hand drumming.

Teachers work on their stick games.

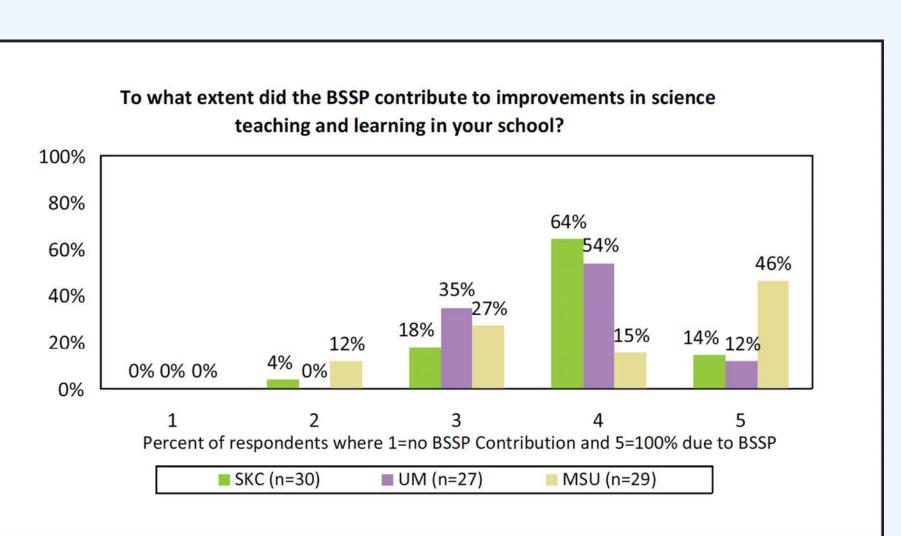
Project Evalution

The BSSP works with two external project evaluators to assess impacts on student and teacher content knowledge, teacher leadership, teacher cultural competentence, and institutional changes. We pre and posttest treatment and comparison teachers as well as students by grade band (3-4, 5-6, 7-8). Teacher content knowledge tests are administered at the beginning and end of each Summer Institute. The results for the 2010 Geosciences Summer Institute are summarized below.



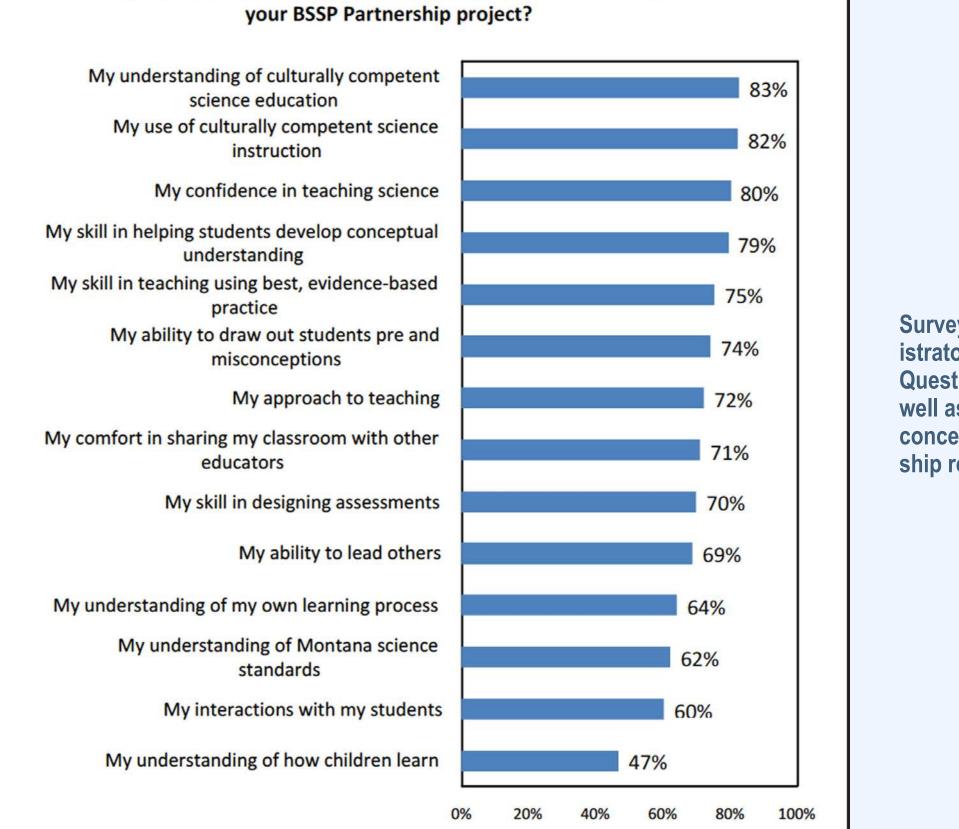
Results from teacher pre- and post-tests on Geosciences concepts. From left to right: all three sites, the UM site, and pre and post mean scores by site. For the UM site on average, treatment teachers scored 62.1 percent correct on the pretest and 81.4 percent on the posttest, a statistically significant gain (t=15.462, p<0.01, df=16). This size of the pre-post gain, 19.3 percentage points (+/- 2.7.1 percentage points), was found to be very large (r=0.97).

Teacher instructional impacts are measured through classroom observation data and teacher portfolios. In addition, teachers complete a Survey of Enacted Curriculum. Teachers are also asked about the impact of the partnership on science education in their schools as in the example question below:



All Respondents: What changes have you experienced as a result of

Results show that the BSSP is having a strong impact on transforming teaching and learning of science at partner schools.



Survey results from questions regarding changes that partners (IHE faculty, admin istrators, teachers) have experienced as a result of their participation in the BSSP. Questions assess teachers' understanding and confidence in teaching science, as well as skills in designing assessments, supporting the development of students' conceptual understanding, and ability to identify misconceptions, comfort in leadership roles, and ability in culturally competent science instruction.

Focus groups are conducted by our cultural project evaluator and teachers complete a Culturally Congruent Instruction Survey. Results of this survey indicate that teachers report statistically significant higher levels of culturally congruent instructional practices than comparison group teachers.

Findings, Implications, and Recommendations

The significant changes in teachers' knowledge and practices highlight the importance of engaging in professional development over an extended period of time. This is particularly true in our project, which emphasizes developing scientifically, pedagogically, and culturally competent grades K-8 educators. By integrating these elements into a three year trajectory of intensive professional development experiences, data analysis shows that our teachers are becoming increasingly competent and skilled in enacting effective science instruction with their students, and in becoming science education leaders in their schools and districts. A final highlight of our program is that twenty-four of the BSSP program teacher graduates received their M.S. in Science Education through MSU in the summer of 2010 and another thirty-three current BSSP teachers began the program this fall.

References

Stepanek, J., Appel, G., Leong, M., Mangan, M., and Mitchell, M. (2007). Leading Lesson Study: A Practical Guide for Teachers and Facilitators. Corwin Press, 207pp.