Scientific Literacy: The Effects of Prolonged Professional Development

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Project Goals and Data Instruments

Will planning and implementation of scientific literacy units that are aligned with *Montana Common Core Standards of Literacy in History/Social Studies, Science, & Technical Subjects* and *A Framework for K-12 Science Education Science and Engineering Practices* affect classrooms?

Will the treatment affect…	Data Source #1	Data Source #2	Data Source #3	Data Source #4
…student achievement?	Smarter Balanced Consortium English Language Arts Performance Assessment Released Item (pre/post)	Student Interviews	Teacher Interviews	
…student attitudes toward informational text?	Student Informational Text Attitude Survey (pre/post)	Student Interviews	Teacher Interviews	
…teacher attitudes toward informational text?	Teacher Informational Text Attitude Survey (pre/post)	Teacher Concept Map (pre/post)	Teacher Interviews	
…teacher pedagogy in science?	Reported Science Instructional Time Per Week (pre/post)	Student Interviews	Teacher Interviews	Teacher Concept Map (pre/post)

Project Rationale

Teachers reported limited time for science instruction due to standardized testing in math and English language arts

Since 2014, Montana has had state-tested standards in English language arts, Montana Common Core Standards in Literacy in History/Social Studies, Science, & Technical Subjects, in which the application of scientific literacy is required.

Science and engineering practices as described by *Framework for K-12 Science Education* specify student performance expectations regarding scientific literacy.

Will planning and implementation of scientific literacy units that are aligned with Montana Common Core Standards in Literacy in History/Social Studies, Science, & Technical Subjects and A Framework for K-12 Science Education Science and Engineering Practices affect classroom practices and student achievement?

Teachers participate in a workshop and engage in science and engineering practices.

Teachers use scientific literacy skills to support workshop objectives.

Conclusion

Results supported strong correlations between teacher attitudes, student attitudes, teacher conceptual framework, and student achievement.

Major Concept Citations

Concept: Concept Maps as Assessment of Conceptual Change
Miller, K. J., Koury, K. A., Fitzgerald, G. E., Hollingsead, C., Mitchem, K. J., Tsai, H., & Park, M. K. (2009). Concept mapping as a research tool to evaluate conceptual change related to instructional methods. *Teacher education and special education*, 32(4), 365-378.

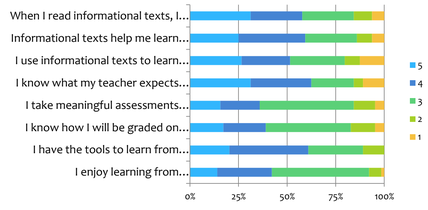
Concept: Science and Engineering Practices
National Research Council. (2012). *A framework for k-12 science education: Practices, crosscutting concepts, and core ideas.* Washington D.C.: National Academies Press. Retrieved from http://www.nap.edu/catalog.php?record_id=13165

Concept: Scientific Communication Skill Clusters
Spektor-Levy, O., Eylon, B., & Scherz, Z. (2009). Teaching scientific communication skills in science studies: Does it make a difference?. *International journal of science and mathematics education*, 7(5), 875-903.

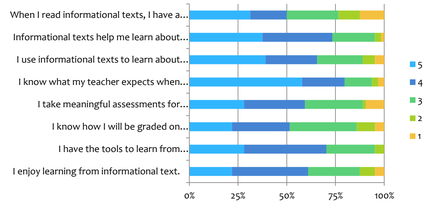
Concept: State Test Items
Smarter Balanced Assessment Consortium, (n.d.). http://www.smarterbalanced.org/smarter-balanced-assessments/=

Concept: Developing Scientific Literacy Units
Washburn, E., & Cavagnetto, A. (2014). Using argument as a tool for integrating science and literacy. *Reading Teacher,* 67(2), 127- 136.

Results

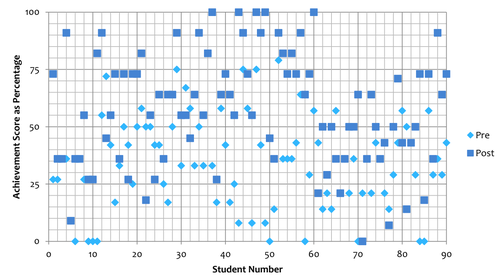


Student Pre (above) and Post (below) Informational Text Attitude Survey Results (n=90)



	Positive		Neutral		Negative	
	Students	Teachers	Students	Teachers	Students	Teachers
Pre	51.2%	52.5%	34.2%	20%	14.6%	27.5%
Post	63.8%	85%	25.2%	10%	7.7%	5%
Gain/Loss	+12.6%	+32.5%	-9%	-10%	-6.9%	-22.5%

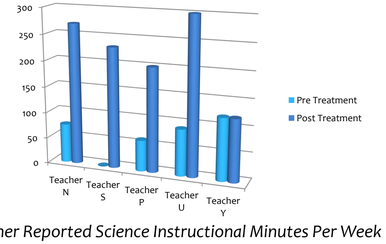
Teacher (n=5) and Student (n=90) Attitude Responses by Category



Pre and Post Smarter Balanced Consortium English Language Arts Performance Assessment Released Item Results (n=90)

	Unique Ideas		Depth		Cross-Connections		Sum	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Totals	93	121	10	12	32	55	135	188
Gain/Loss		30.1%		20%		71.9%		39.26%

Pre and Post Teacher Concept Map Results by Rubric Category (n=5)



Teacher Reported Science Instructional Minutes Per Week (n=5)

Project Timeline

Pretreatment Data Collection
(September 2015)

Teacher Workshops: Interdisciplinary Science and Engineering Practices
(32 total hours)

Online Course for Teachers: Best Practices in Science Education
(8 weeks)

Classroom Lessons: Students Learned Explicit Scientific Literacy Skills and Practices
(fall semester)

Coaching Sessions for Teacher Teams: Scientific Literacy Unit Design
(Fall/Spring Semesters)

Scientific Literacy Unit Implementation In Classrooms
(spring semester)

Post-treatment Data Collection
(May 2016)