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# SUPPORTING NEVADA STATEWIDE MATH IMPROVEMENT THROUGH STRATEGIC COLLABORATION

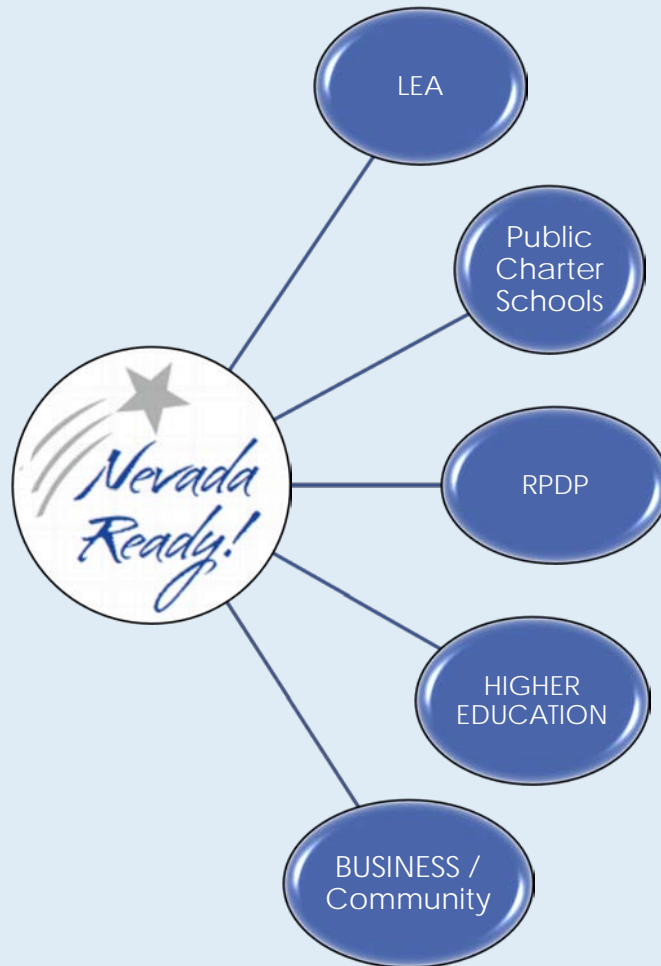
SCALING UP RESEARCH FINDINGS FROM NEVADA MATH PROJECT

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NEVADA MATHEMATICS INITIATIVE  
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# Nevada Mathematics Network



Nevada Math Project: <http://www.nevadamathproject.com>

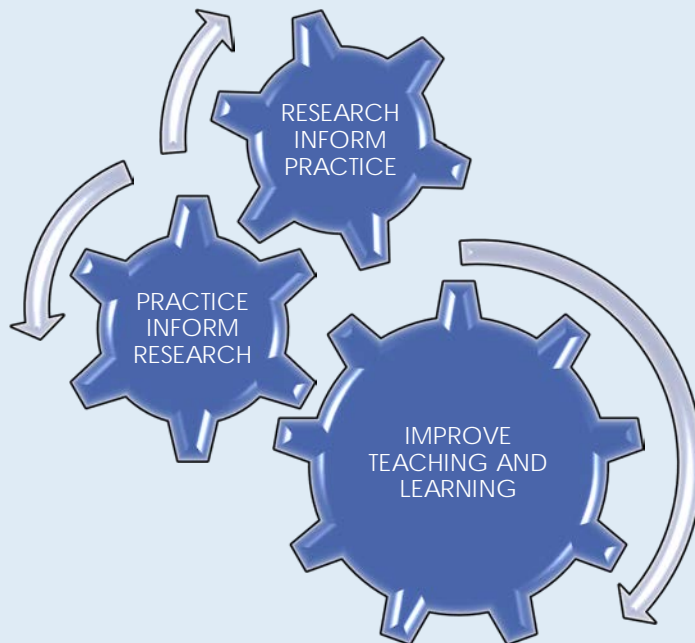
Nevada Mathematics Initiative: <https://www.unr.edu/education/centers-and-student-resources/centers/nevada-mathematics-project>

Math Resources for Nevada: <http://www.mathdiscussions.wordpress.com>

Lamberg, T. (2018) Leaders Who Lead Successfully, Rowman & Littlefield

Lamberg T. (2018) Conducting Productive Meetings, Rowman & Littlefield.

***Objective: Improve Nevada Mathematics Student Achievement through a partnership of sharing research, tools and collaborative***



## EVIDENCE BASED STRATEGIC PLAN

The goal is to engage in collaboration by combining knowledge (research and from the field) to develop a strategic plan to systematically improve math instruction statewide by combining knowledge, resource and human capital.

### FINDINGS


**Professional development that deepens content knowledge expands pedagogical understandings and fosters teacher mindset growth involves attending to the process of teaching.**

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## References

Lamberg, T (2013). Whole Class Mathematics Discussions: Improving in-depth Mathematical Thinking and Learning.

Lamberg, T (in-Press). Work Smarter, Not Harder: A framework for Math teaching and Learning (*Updated refined version of the framework that has been tested by hundreds of Nevada teachers over 15 years. A tool box*)



PROFESSIONAL DEVELOPMENT DESIGN  
SHOULD TAKE INTO ACCOUNT TEACHER  
KNOWLEDGE WHICH INCLUDES THE USE OF  
FORMATIVE ASSESSMENT AND THE  
PROCESS OF TEACHING WHEN  
SUPPORTING DEVELOPMENT OF CONTENT  
KNOWLEDGE THROUGH PROFESSIONAL  
DEVELOPMENT.

## Reference

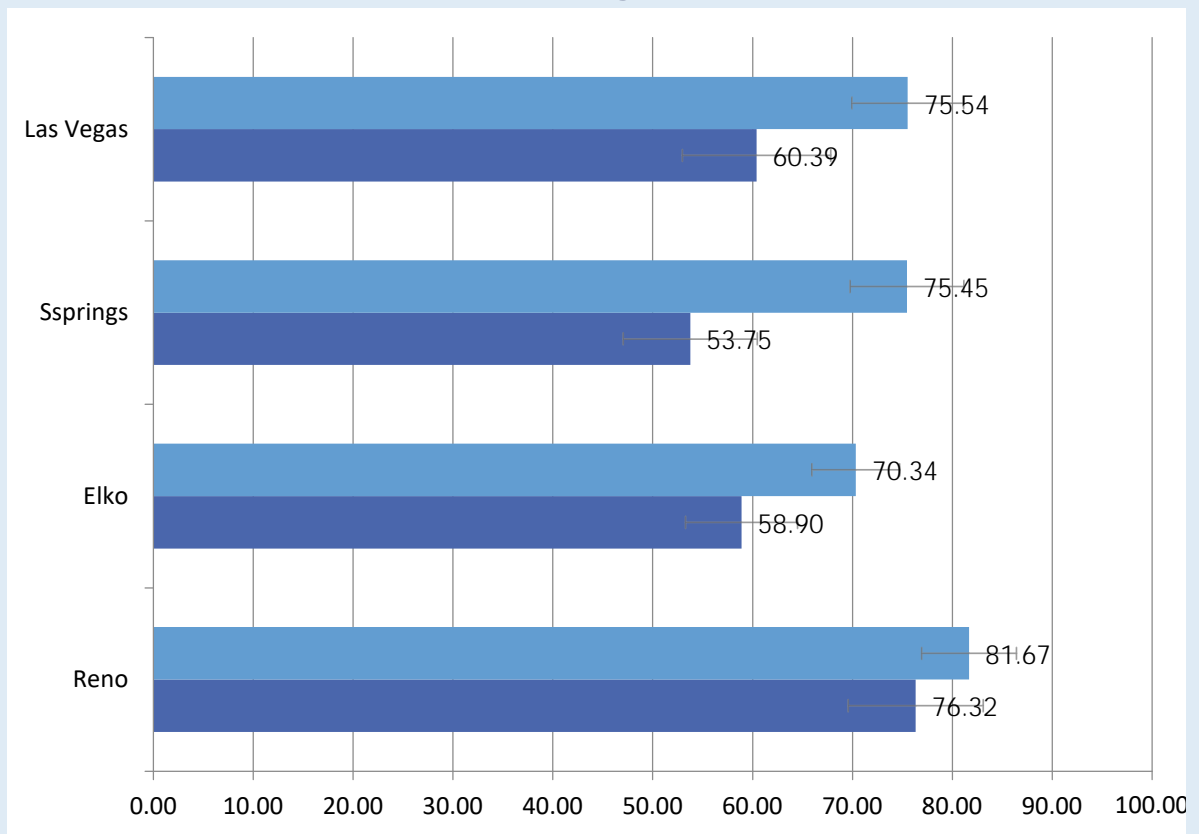
Lamberg, Koyen & Moss (in Press). Supporting Teachers to Use Formative Assessment for Adaptive Decision Making, Mathematics Teacher Educator (AMTE and NCTM research journal).

## EVIDENCE

- The PD Design and the development of the framework has been refined over 15 years in Nevada. (Northeastern Nevada Mathematics Project, Nevada mathematics Project and Lemelson STEM cohort Program).
- We collected data on the content based professional development. Teacher practice changed and teacher content knowledge grew.

## Nevada Math Project

- Teacher content knowledge increased.



Pre and Post test score growth across sites in year three. (Dark Blue is Pre-test, light Blue is posttest)

The teacher pre-and post-content test in mathematics and nanotechnology concepts showed growth. The Paired t-test of the composite test scores are statistically significant at  $p < 0.001$  for all sites. The percentage of growth increased across the four iterations of the professional development.

## Shifts in Teacher Practice – One Site

(Whole Class Discussion Framework)

<b>Setting Up the Classroom: Physical Space</b>		
<b>First Administration</b>	<b>Second Administration</b>	<b>Change</b>
$\mu=2.26$ (n=27)	$\mu=3.17$ (n=23)	$\Delta=0.91$
<b>Cultivating Classroom Environment/Routines</b>		
<b>First Administration</b>	<b>Second Administration</b>	<b>Change</b>
<b>Routines for Preparing for Discussion</b>		
$\mu=2.36$ (n=28)	$\mu=3.17$ (n=23)	$\Delta=0.81$
<b>Routines for Communicating</b>		
$\mu=2.32$ (n=28)	$\mu=3.35$ (n=23)	$\Delta=1.03$
<b>Routines for Listening/Reflecting</b>		
$\mu=2.21$ (n=28)	$\mu=3.04$ (n=23)	$\Delta=0.83$
<b>Lesson Planning</b>		
<b>First Administration</b>	<b>Second Administration</b>	<b>Change</b>
<b>First level Planning (Long term &amp; Short Term Goals) Concepts (big ideas) Unit Plan (Sequencing/learning trajectory)</b>		
$\mu=2.21$ (n=28)	$\mu=3.04$ (n=23)	$\Delta=0.83$
<b>Second Level of Planning 5 E-Lesson Plan- (Anticipating Student Reasoning/Misconceptions Errors, Format for using a problem solving approach to teaching and structuring time)</b>		
$\mu=1.93$ (n=28)	$\mu=2.83$ (n=23)	$\Delta=0.90$
<b>Third Level of Planning (Adapting discussion to support student understanding/needs) Making decisions on what to talk about based on student reasoning during lessons</b>		
$\mu=2.00$ (n=28)	$\mu=3.00$ (n=23)	$\Delta=1.00$
<b>Teacher Questioning/ Supporting Mathematical Connections</b>		
<b>First Administration</b>	<b>Second Administration</b>	<b>Change</b>
<b>Phase I: Making Thinking Explicit</b>		
$\mu=2.00$ (n=28)	$\mu=3.09$ (n=23)	$\Delta=1.09$
<b>Phase II: Analyzing Each Other's Solutions</b>		
$\mu=1.79$ (n=28)	$\mu=3.78$ (n=23)	$\Delta=0.99$
<b>Phase III: Developing New Mathematical Insights</b>		
$\mu=1.79$ (n=28)	$\mu=2.91$ (n=23)	$\Delta=1.12$

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This Whole Class discussion framework has been used in Lemelson STEM program at UNR. This framework helped impact student achievement when used with content-based PD. Student growth in MAP testing scores has been above national norms in the past 6 cohorts of teachers.

Northeastern Nevada Math Project- also resulted in growth of student pre and post test scores across the three years of the project. This project was identified as a Model project by the U.S department of Education and was selected to be presented at the annual conference.

Nevada Math Project got selected to be showcased nationally by STEM for All video show case.

<https://stemforall2019.videohall.com/presentations/1502>

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# RESEARCH

See Nevada Math Project Website Research Tab (Data Analysis is still ongoing-See website for updates as Manuscripts and tools are developed.) <http://www.nevadamathproject.com>

## Institutional Context /Policy

This project informs how to work with multiple communities of practices and work towards a common goal. This research will document the process involved in developing a statewide professional development project aimed at improving math/science instruction.

- Lamberg, T. (2018). [\\_Leaders Who Lead Successfully: Guidelines for Organizing to Achieve Innovation, Roman and Littlefield.](#)
- Lamberg, T. (2018). [Conducting Productive Meetings: How to Generate and Communicate Ideas for Innovation. Roman and Littlefield.](#)
- Lamberg, T. (2016). The design of a Professional Development Project aimed at creating System Wide Change: A Mathematics Education Scale-up Project. To appear in Proceedings of Educating the Educator Conference. Freiburg, Germany.
- Lamberg, T., Lakey P., Keppelman, E., Olson, T., & Shih, J. (2015). Partnership. Conference Proceedings, RCML Conference, Las Vegas, Nevada.

## Integrating STEM

The third year of the project involved collaborating with scientists/mathematicians and faculty from mathematics education and the learning sciences. A series of papers will be developed for STEM integration. A framework for designing integrated STEM professional development is being developed.

Lamberg, T. (2017) A framework for Integrating STEM and supporting teacher learning. A paper presented - Oxford University Research Symposium. Oxford, England.

## Teacher uses of Curriculum

The second year of the project focused on supporting teachers to effectively use the curriculum. A series of papers will be developed on how teachers used the curriculum. We have documented shifts teachers made on how they thought about an integrated curriculum.

- Lamberg, T., (in -preparation). Teaching as a Complex system of Planning, Teaching and Reflecting.
- Moss, D, Bertolone-Smith, C & Lamberg, T. (2017). Influence of Daily Reflection on a Middle School Teachers Practice, *Proceedings of the International Group of the Psychology of Mathematics Education Northern American Chapter Proceedings, Indianapolis, Indiana.*
- Lamberg, T. (2016). A Framework for Shifting Teachers' Instructional Approaches to Inquiry-Based Approaches. Educating the Educators Conference, Freiburg, Germany.



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## Formative Assessment

The first year of the project focused on supporting teachers to focus on student reasoning to make instructional decisions. Papers have been developed on how teachers thought about formative assessment and their shifting interpretations.

- Lamberg, T. & Koyen, L & Moss, D. (In Press). Supporting Teachers to Use Formative Assessment for Adaptive Decision Making. *Mathematics Teacher Educator*

## Teaching Domain-Specific Topics in Common Core Standards

The project focused on preparing teachers to increase their content knowledge and teach the Common Core Standards in mathematics. A series of papers will be developed on teacher's interpretation and understanding of specific math topics such as ratio and proportion and statistics etc.

- Lamberg, T & Campbell, G. (2016). Smarter Balanced Grade 3, Barrons
- Moss D. & Lamberg, T (in Press) Sixth-grade students' understanding of expressions, equations, and functions: An analysis of the emerging learning trajectory. *International Journal of Mathematics Education*.
- Moss, D., Crocher, J. & Lamberg, T. (2018) Frustrations with Understanding Variables? It's Natural! *Teaching Children Mathematics*.

## Design Research

The project used a design research methodology approach to professional development. A framework for using design research in professional development settings will be developed. Moss, Bertolone-Smith, Lamberg & Middleton have engaged in classroom design experiments as well. A Methodology paper is developed on how to do design research and keep track of data.

- Lamberg, T. Moss, D. & Middleton, J (in preparation). Learning Ecology Framework: A design experiment tool for reducing and organizing data for analysis, *Journal of Learning Sciences*.
- Lamberg, T, Moss, D, Bertolone-Smith, C (2018). An interpretive framework for collective learning in a mathematics classroom. *Proceedings of the International Group of the Psychology of Mathematics Education Northern American Chapter Proceedings*,

[Whole-Class Discussion Framework \(Lamberg, 2012\)](#). This framework was used to design professional development and also to document shifts in teacher practice. This [framework](#) is being validated for other projects to use as an instrument for documenting teacher self-reported practices. Also, this framework can also be used as a tool to design professional development or provide feedback to teachers.

- Lamberg, T. (forthcoming, 2019). Work Smarter, Not Harder: A Framework for Math Teaching and Learning. Roman and Littlefield.
- Lamberg, T. (2012). Whole-Class Mathematics Discussions: Improving In-depth Mathematical Thinking and Learning. Pearson Publishers. Boston, MA.

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## Supporting Teachers to effectively use gestures and discourse to support understanding–

Joint research with Mitch Nathan and Rebecca Bondocco.

They have an IES grant to do research on gestures. We combined projects. Data was collected from the Nevada Mathematics Project. Furthermore, the research on gestures was integrated into professional development. A framework for integrating cognitive science research in professional development. We also investigated how teachers think about using gestures as it emerged in the PD settings.

- Bondocco, R, Lamberg, T. Nathan, M (in Preparation). Teachers' use of gestures to support instruction.

### TOOLS

[Http://www.nevadamathproject.com](http://www.nevadamathproject.com)

<http://www.mathdiscussions.wordpress.com>

### ACTION ITEMS: OUR GOALS

- Align work with NDE Vision/Mission for the 2020 STIP to improve math in Nevada
- Work collaboratively to share research and resources with Nevada Math Network
- Continue to develop research and tools to support Nevada teachers

### FUTURE ACTION ITEMS

- Develop high quality and rigorous online courses to support teachers and PD Facilitators around content and pedagogical understandings to deepen their knowledge and to support the required re-certification credits.
- Seek grant funding or fiscal support to generate more research and resources for Nevada.