Reception
Welcome!

March 10, 2014
SDSU Noyce Mathematics and Science Master Teaching Fellowship Project: Project Learn

<table>
<thead>
<tr>
<th>Mathematics Educators</th>
<th>Science Educators</th>
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<tr>
<td>Randolph Philipp</td>
<td>Donna Ross</td>
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<td>Lisa Lamb</td>
<td>Meredith Houle Vaughn</td>
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<td>Susan Nickerson</td>
<td>Kathy Williams</td>
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Candace Cabral, Casey Hawthorne, Teresa Dunleavy

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Public

Mathematics Teachers

High School Teachers

San Diego State University
College of Education

Private

La Mesa-Spring Valley School District
Every Child Learning Every Day

Middle School Teachers

San Diego Unified School District

College of Sciences

Science Teachers

Qualcomm Foundation

College of Sciences
SDSU’s Noyce
Master Teaching Fellowship:
Project Learn
Project Learn, SDSU Noyce

- Five-year project, 2013-2018
- 32 Mathematics and Science Master Teaching Fellows

Goals
To support the Fellows to
- improve already-exemplary classroom practices, and
- emerge into teacher leaders,

so that the Fellows can continue to support other teachers and students long after this project ends.
Fellows are Special!

- 126 applications for 32 Fellowships
- Applicants asked to demonstrate evidence of
  - Depth of content knowledge
  - Ability to identify and respond to students’ mathematical and scientific thinking
  - Excellent teaching through submission of a video
  - Disposition as a learner who would contribute thoughtfully to a community of teachers
Intensive Professional Development

- Focus on students’ content-specific understandings;
- Summer and Academic Year – 10 days per year
  - Examining Common Core Standards for Mathematics and Next Generation Science Standards,
  - Engaging in mathematics and science tasks,
  - Examining their own practice by sharing video clips in small-group and whole-group settings, and
  - Interviewing middle and high school students about their mathematical and scientific thinking;
- In between PD sessions, small group meetings and “homework.”
- Work with colleagues
Emergence into Leadership Positions

- Serving as guide teachers for SDSU’s student teachers;
- Serving as mentors for other teachers; and
- Attending and presenting at conferences.
Recap

- Application process was selective and rigorous. The Fellows are special!
- Fellows are emerging into leaders;
- Effort is collaborative and integrated across disciplines, districts, colleges, grade level, and funding sources;
- Support from district administrators is critical. Thank you!
Professional Development

The way we are currently teaching mathematics in the U.S. is problematic.

But our biggest long-term problem related to mathematics and science teaching in the United States is not how we teach now, but that we have no way of getting better.

Effective Professional Development

The most effective prospective and practicing teacher-learning experiences are

(a) content-focused,
(b) sustained,
(c) collaborative, and
(d) linked to children and classrooms

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<tr>
<th>Role</th>
<th>Name</th>
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<tr>
<td>Principal Investigators</td>
<td>Randy Philipp, PI</td>
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<td>Vicki Jacobs, co-PI</td>
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<td>Faculty Associates</td>
<td>Lisa Clement Lamb</td>
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<td>Jessica Pierson Bishop</td>
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<tr>
<td>Graduate Student</td>
<td>John (Zig) Siegfried</td>
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<tr>
<td>Research Associate</td>
<td>Bonnie Schappelle</td>
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<tr>
<td>Project Coordinator</td>
<td>Candace Cabral</td>
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<tr>
<td>Student Assistants</td>
<td>Kelly Humphrey</td>
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<td>Jennifer Cumiskey</td>
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STEP Participant Groups ($N=129$, 30+ per group)

**Emerging Teacher Leaders**
- **ETLs**: At least 4 years of sustained professional development and some minimal leadership activities

**Advancing Participants**
- **APs**: 2 years of sustained professional development

**Initial Participants**
- **IPs**: 0 years of sustained professional development

**Prospective Teachers**
- **PSTs**: Undergraduates enrolled in a first mathematics-for-teachers content course

Average of 14–16 years of teaching per group; range 4–33 years
• Multi-year NSF-funded-project (2005–2012)

• Cross-sectional examination of the effects of sustained professional development focused on children’s mathematical thinking

We are studying the perspectives of four groups of teachers:

- Beliefs
- Interactions with children
- Professional Noticing
- Mathematical Content Knowledge

P.D. Matters!
Findings and Reflections

Beliefs about teaching

Beliefs about mathematics

Content items

Content (Ones, Andrew)

Noticing: Attending

Noticing: Interpreting

Noticing: Deciding how to Respond

Noticing Interpreting

Content (Division)

Noticing Deciding...Respond

Responsiveness

Initial Participants

Advancing Participants

Emerging Teacher Leaders
Findings and Reflections

Teachers’ Growth Over Time
Key Points

• Experience Matters
• But not everything is learned just from experience
• Professional development is not just a pedagogical luxury
• *Growth* mindsets and *Fixed* mindsets about students learning (Dweck)
• Mindsets about teacher learning?
The Common Core State Standards
Eight Mathematical Practices

1) Make sense of problems and persevere in solving them.
2) Reason abstractly and quantitatively.
3) Construct viable arguments and critique the reasoning of others.
4) Model with mathematics.
5) Use appropriate tools strategically.
6) Attend to precision (in language and mathematics)
7) Look for and make use of structure.
8) Look for and express regularity in repeated reasoning.
The Common Core State Standards
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The 8 Science Practices of the Next Generation Science Standards (NGSS)

1) Ask questions and define problems
2) Develop and use models
3) Plan and carry out investigations
4) Analyze and Interpret Data
5) Use mathematics and computational thinking
6) Construct Explanations and Design Solutions
7) Engage in Argument from Evidence
8) Obtain, Evaluate, and Communicate Information
Commonalities between Practices in NGSS and CCSS

Math

- M1. Make sense of problems & persevere in solving them
- M2. Reason abstractly & quantitatively
- M6. Attend to precision
- M7. Look for & make use of structure
- M8. Look for & express regularity in repeated reasoning

- S2. Develop and use models
- S4. Analyze & interpret data
- S5. Use mathematics & computational thinking
- S6. Construct explanations & design solutions
- S7. Engage in argument from evidence

Science

- E2. Build a strong base of knowledge through content rich texts
- E5. Read, write, and speak grounded in evidence
- M3 and E4. Construct viable arguments & critique reasoning of others
- S7. Engage in argument from evidence

ELA

- E1. Demonstrate independence in reading complex texts, and writing and speaking about them
- E3. Obtain, synthesize, and report findings clearly and effectively in response to task and purpose
- E6. Use technology & digital media strategically & capably
- E8. Obtain, evaluate & communicate information

Sources:
- Common Core State Standards for English Language Arts & Literacy* in History/Social Studies, Science, and Technical Subjects, p7.
- Common Core State Standards for Mathematical Practice p6-8.

These student practices and portraits are grouped in a Venn diagram. The letter and number set preceding each phrase denotes the discipline and number designated by the content standards or framework.

The Science Framework will be used to guide the production of the Next Generation Science Standards.
• Next Generation Science Standards for Today’s Students and Tomorrow’s Workforce
• Based on work done by the National Academies of Science and the National Research Council

• Honor the nature of science
• 26 states participated in development (including CA)
Three Dimensions

- Scientific and Engineering Practices
- Crosscutting Concepts
- Disciplinary Core Ideas
• **California** SBE adopted NGSS in Fall 2013

• 2013-2014 Year of Awareness

• 2014-2016 Transition to Implementation
  
  – K-5 Integrates Life, Physical, Earth and Space, Engineering along with the practices and cross-cutting concepts
  
  – 6-8 Preferred model integrates Life, Physical, Earth and Space, Engineering along with the practices and cross-cutting concepts
  
  – 9-12 Local choice for integration or discipline-specific, along with the practices and cross-cutting concepts
• Leaders in examining own practice
• Transitioning to NGSS
• Focusing on student thinking and learning
• Supporting other teachers
• Recognizing the depth and complexity in science teaching and learning
Learning mathematics and science...
...is *doing* mathematics and science!
And now, a word from our Fellows…