Assessing the Impact of the MSPs: K–8 Science (AIM)

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Student Success

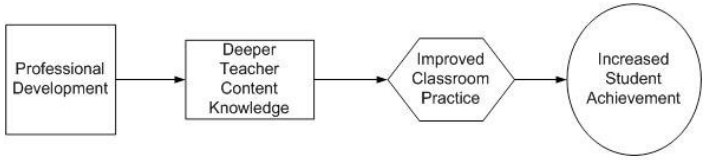
AIM defines student success as students having a deep, conceptual understanding of (1) important science ideas, and (2) the evidence-based nature of science as a way of knowing.

Research Design

Overview

AIM: K–8 Science is an MSP RETA designed to add to what the field knows about professional development strategies for deepening the content knowledge of science teachers. The study documents the PD offered to teachers (i.e., the interventions), and measures teacher content knowledge and student learning using rigorously-developed instruments. Component One of AIM is examining the impact of MSP professional development on teacher content knowledge and investigating the relative impacts of different approaches to the PD. Component Two is exploring the relationships among teacher content knowledge, classroom practices, and student achievement. The study will also examine which approaches appear most promising for closing historic achievement gaps. In short, AIM is conducting cross-MSP research to add to what the field knows about the connections in the logic model that implicitly drives most PD efforts.

Simplified Theory of Action for Professional Development



Many contextual factors mediate the effect of professional development on classroom practice and student learning (e.g., instructional materials, availability of instructional resources, state-mandated tests). AIM is gathering data about a number of these factors to better understand the particular contributions of the different professional development strategies.

AIM will cumulate data from across partner MSP projects to examine the relative impact of a number of factors on teacher and student knowledge gains.

Content Areas

Based on partner MSP feedback, we selected four topics from the 2009 *NAEP Science Framework* for our work:

1. Evolution and Diversity;
2. Force and Motion;
3. Interdependence; and
4. Properties of and Changes in Matter.

Instrument Development

In order to conduct this research, AIM has been developing several instruments using a process based upon HRI's work in our ATLAST project (EHR-0335328):

- A PD-provider log which gathers information on the goals, design, and approaches used in the PD, and the extent to which it aligns with learning theory;
- Teacher content knowledge assessments for each content area (elementary and middle school versions);
- Teacher questionnaires to measure beliefs about effective science instruction, instructional practices (including alignment with learning theory), and contextual factors that affect instruction; and
- Student science content knowledge assessments for each content area (elementary and middle school versions).

Challenges

- AIM's research design relies on substantial variation in teachers' professional development experiences. In our first year of data collection (2009–10), we found much less variation than we had anticipated. We had expected that projects would provide teachers with a menu of PD options, allowing them to pick and choose events to attend. However, projects tend to be providing more structured professional development programs. In addition, because of finite resources, projects that serve elementary teachers are usually forced to make a choice between addressing a small number of topics in depth and addressing more of the topics teachers are expected to cover in their own class. Most of the MSPs that are participating in AIM have chosen to advantage broader coverage, typically devoting only a small amount of time to the specific content covered by an AIM assessment.

- Another challenge AIM has faced is capturing the extent to which instruction (professional development or classroom) allows learners to engage with and draw meaning from evidentiary phenomena. For example, our PD-provider log asks whether participants had deliberate opportunities to "consider data/examples that provide evidence for [the targeted] ideas" and "use data/examples as evidence to support claims about these ideas." We have found that it is not uncommon for PD providers, and teachers, to indicate that these are true for any hands-on activity, even if the activity is only tangentially related to the targeted idea (e.g., you could apply the idea to understand what is going on in the activity, but if you did not know the idea, you would not learn it from the activity).

Overcoming Challenges

- To help address these challenges, AIM is adding a third component to its research plan. We are planning a week-long professional development program for elementary teachers that will focus on deepening teachers' understanding of science content and learning theory-based science instruction, as well as how to apply this knowledge in their own classrooms. Teachers attending the PD will also participate in Components One and Two of AIM. The inclusion of data from these teachers will increase the variation in our data. By working with local districts, we will also be able to conduct a greater number of classroom observations, providing us additional opportunities to test out other questionnaire items that may be more successful at measuring the extent to which instruction aligns with our vision for effective science instruction. Also, we may be able to use video clips from the professional development to help develop a broader understanding of a vision of science instruction that is aligned with learning theory.

Remaining Challenges

- A remaining challenge is developing a cost-effective (i.e., non-observational) measure of the extent to which instruction aligns with learning theory. The instrument needs to minimize the knowledge required to answer appropriately. Additionally, the measure needs to avoid eliciting socially-correct responses.

Project Partner Roles

- Several NSF- and state-funded MSP projects are participating in the AIM study:
  - For Component One, projects complete PD-provider logs and administer pre- and post-PD teacher assessments.
  - For Component Two, projects help coordinate the administration of the teacher assessment, teacher questionnaires, and student assessments.

  Participating projects receive the data from their participants and a summary of their project's results to use for their own evaluation and research purposes.

- STEM faculty play a critical role in the assessment development process. They help specify which ideas are part of, and which are beyond, the content domain to be assessed. They also assist with item development, reviewing items for content accuracy, and in some cases drafting items.

- AIM is also partnering with local school districts for Component Three. The districts will assist with recruiting teachers and implementing the professional development.

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For further information

Those interested in participating in AIM can sign up at:
http://www.horizon-research.com/aim/
All other inquiries should be directed to Eric Banilower by phone (919-489-1725) or email:
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