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It's About Discovery

Final Report

Executive Summary

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EXECUTIVE SUMMARY

In August 2009, The Ohio State University at Lima (OSU) received a three-year award from the NSF Division of Research on Learning Innovative Technology Experiences for Students and Teachers (ITEST) Program for *It's About Discovery* (IAD). IAD was a partnership between OSU Lima, the University of North Carolina Greensboro, and regional rural schools in Northwest Ohio and North Carolina that equipped teachers to teach new Ford Partnership for Advanced Study (PAS) science curriculum, focused on the theme of *Working Towards Sustainability*. Ford PAS is focused on transforming teaching and learning by preparing students for college and careers with a combination of academic knowledge and 21st century skills. The target audience for the project was 8th to 10th grade students and teachers in rural districts in Ohio and one high poverty rural district in North Carolina.

In March 2010, OSU Lima contracted with Goodman Research Group, Inc. (GRG) to conduct a three-year external summative evaluation of *It's About Discovery*. GRG's evaluation questions were:

1. To what extent does involvement in IAD change participating students:
 - Knowledge of, attitudes towards, and motivations to pursue STEM-related careers?
 - Related science content knowledge?
 - Knowledge of and attitudes towards STEM workforce skills, including attitudes about ICT?
2. To what extent does involvement in IAD change participating teachers:
 - Knowledge of STEM content and STEM careers?
 - Knowledge of relevant pedagogy (e.g., inquiry-based methods)?
 - Attitudes towards teaching about STEM careers and ICT?

GRG's core evaluation featured a pre-post design, in which participating teachers facilitated pre- and post-surveys of their students. The first year of evaluation also included pre- and post-surveys of teachers and site visits. Over the three project years, evaluation data were collected from a total of 1,008 students, with 440 pre-post matches.

FINDINGS

- Involvement in IAD had a moderate positive impact on students' knowledge of STEM careers. Students' knowledge about six of 16 careers increased from pre to post, and they learned about how STEM subjects are related to one another and what is required in particular careers.
- Taking part in IAD also had a moderate positive impact on students' interest in pursuing STEM-related careers. Fifty-nine percent to 69% of students indicated the curriculum increased their interest in STEM

careers. In one of the three years, there was also a significant increase in the number of specific STEM careers in which students were interested.

- While based on limited evidence, participation in IAD may have a positive impact on students' scientific reasoning skills. In the one year of the evaluation during which students' scientific reasoning was assessed, it increased significantly from fall to spring.
- There was not an association between IAD and students' STEM attitudes. Students' attitudes were relatively positive before IAD and remained so after involvement with the project.
- Involvement in IAD had a positive impact on teachers' knowledge of relevant pedagogy. After their first year with IAD, teachers felt more prepared to teach relevant skills to students. They also were more comfortable integrating non-STEM subjects into their science teaching.
- IAD participation was linked with improvements in teachers' knowledge about STEM careers. Teachers felt more comfortable about supporting students' knowledge of what professionals in a variety of STEM careers do for their work.
- IAD did not impact teachers' overall attitudes about using technology in the classroom. Teachers were relatively positive about using technology in their classrooms from the start of the project.

CONSIDERATIONS

In areas where no impact was measured, it is possible that because participating students and teachers already had positive attitudes, a ceiling effect was created, reducing the chances of any improvement. In addition, the phenomenon of "experience limitation" may be relevant. Students in programs such as IAD often overestimate their knowledge or perceptions about STEM subjects on the pre-tests (Nimon, Zigarmi, and Allen, 2010). Later, because of their experiences during the program, students develop a more realistic perception and hence give lower ratings on the post-test.

During the first year of the program, teachers identified some challenges with program implementation. Specifically, teachers mentioned the timing and the extent to which the curriculum was used in the classroom, the challenging reading level of the student materials, and difficulties related to using technology resources. These challenges may have contributed to no change or minimal attitudinal change.

Lastly, there could have been evaluation measurement issues in the modestly scoped study. Research on other evaluation studies suggests that it is often challenging to assess student interest and to make generalized statements about the effect of STEM education programming (UMass Donahue Institute, 2011).

Research shows that various indicators of student interest and self-confidence in science and math in high school are strongly associated with students continuing with STEM studies through college, above and beyond enrollment and achievement factors (Maltese & Tai, 2011). This was the case in the IAD program in that it helped maintain students' interest in STEM fields. Future iterations of the program may focus on *increasing* the interest and self- confidence of the students in STEM fields. A few recommendations to achieve this goal are:

- Achievement in a certain field helps boost a student's interest and self-concept in that field (Beier & Rittmayer, 2008). The IAD project staff may wish to add an aspect of achievement/competition to the IAD program. Similar programs in the past have used experiences such as Robot building contests to encourage healthy competition.
- Research has shown that out-of-school participation in STEM activities boosts/enhances STEM achievement in school. The IAD staff may wish to support program efforts with an out-of-school component. For instance, there could be an afterschool club and there could be a parent component. Parents or other role models could be encouraged to get involved in helping students cultivate and sustain interest in STEM fields.

Although reducing the gender gap in attitudes towards STEM was not a specific goal of the IAD project, project staff may wish to consider having future curricular activities address girls' lack of interest in STEM. This is warranted given the contrast between boys' interest and girls' lack of interest.

- Finally, the IAD program staff may wish to consider adding a summer component for students, in addition to the year-long activities. Research indicates that the intensive nature of the summer programs often works to achieve the student outcomes set forth by programs such as IAD (Hayden, Ouyang, Scinski, Olszewsk, & Bielefeldt, 2011).

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