



Moving the Needle on Student Achievement:

ASSET's Advanced Professional Development increases student science and math scores

WHY PROFESSIONAL DEVELOPMENT?

Systems do not change themselves; rather, they change through the actions of individuals and small groups. ¹ Over the past few decades, stakeholders in education have placed significant emphasis on student achievement. To advance student learning in the context of shrinking or stagnant education budgets, school officials can empower teachers as “agents of change” to positively transform classroom practices.

“What teachers know and can do makes the crucial difference in what teachers can accomplish.” ² Professional development for teachers and administrators remains a crucial part of the education profession. Teachers can acquire knowledge and understanding of curricular content, but how they deliver this information to students makes the greatest impacts. Teachers need effective ways to stay up-to-date on educational research, develop high-quality instructional techniques and be prepared to adapt to various learning styles.

From 2010 to 2015, ASSET STEM Education™ delivered a five-year program supported by a U.S. Department of Education Investing in Innovation (i3) Grant to validate the effectiveness of advanced, ongoing teacher professional development in increasing student achievement across rural and “high needs” Pennsylvania schools. Building on the success of ASSET’s statewide *Science: It’s Elementary* program³, which supported 180 school districts across 52 Pennsylvania counties between 2006 and 2011, ASSET’s i3 program model⁴ supported teachers in a sampling of SIE schools through: (1) improving pedagogy; (2) increasing understanding and content knowledge across science, technology, engineering and math (STEM); and (3) building leadership skills and collaboration.

The following summary of program results was adapted from an independent evaluation. The evaluator examined three research groups to gauge the program’s effectiveness and used accepted research and evaluation techniques to ensure the groups were similar in size, student demographics and student achievement in 4th grade science (e.g., propensity score matching; establishing baseline equivalence):

Treatment – 24 former SIE schools that received the i3 Advanced Professional Development program from ASSET; 23 schools were included in the evaluation⁺

Control: SIE – 23 former SIE schools that did not receive the i3 Advanced Professional Development program

Control: No PD – 23 schools that did not receive the i3 Advanced Professional Development program and did not participate in SIE or other statewide science initiatives prior to 2010

WHO DID WE IMPACT?

23⁺
Pennsylvania
Schools



565 Educators of Grades K-6

38,142
Students



\$566.75
Cost / Student

98% Rural & “High Needs”

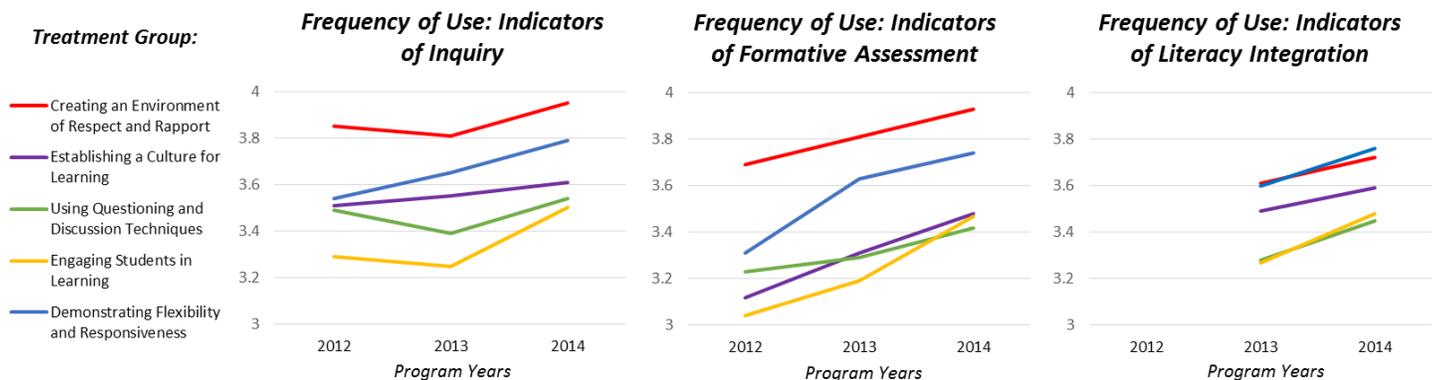
⁺ A Treatment school in which only one teacher received the intervention was excluded from the evaluation.

Key Findings: Treatment educators developed 1) increased understanding of inquiry-based science; 2) improved pedagogical practices; 3) increased content knowledge across science, technology, engineering and math (STEM); and 4) strengthened collaboration leading to 5) **increased student achievement in 4th grade science and 3rd-4th grade math.**

WHAT DID WE ACHIEVE?

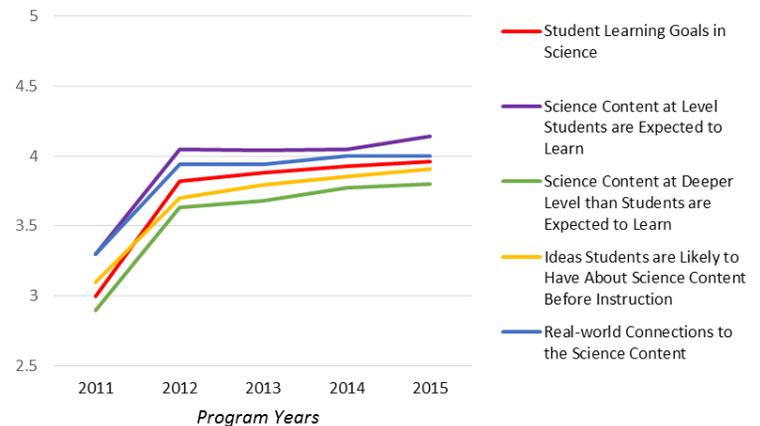
Better-Equipped Educators[▲]

Increased understanding of inquiry-based science: Teachers in the Treatment group increased their use of inquiry-based science approaches—namely inquiry, formative assessment and literacy integration—as well as inquiry-based math. Their frequency of using these strategies moved from *Sometimes* (≥ 3.0) toward *Often* (4.0). As documented during independent classroom observations, the teachers improved their abilities to: **(a)** create an environment of respect and rapport; **(b)** establish a culture for learning; **(c)** use questioning and discussion techniques; **(d)** engage students in learning; and **(e)** demonstrate flexibility and responsiveness.^a

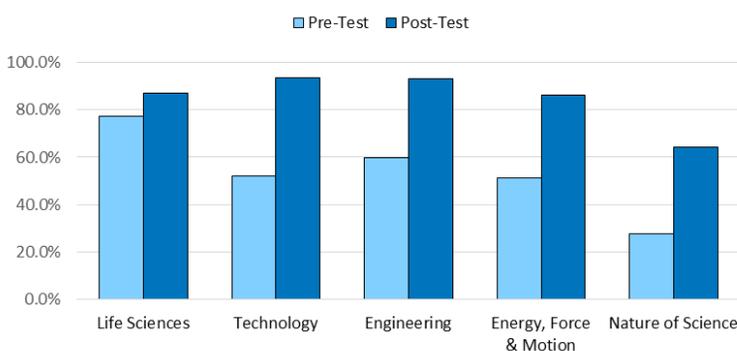


Improved pedagogical practices: Teachers in the Treatment group improved their understanding of pedagogical concepts presented in the i3 Advanced Professional Development program institutes—moving from *Moderate Understanding* (≥ 3.0) toward, and beyond, *Proficient Understanding* (≥ 4.0). Their learning surged early and then sustained gradual increases in: **(a)** student learning goals in science; **(b)** science content at level students are expected to learn; **(c)** science content at deeper level than students are expected to learn; **(d)** ideas students are likely to have about science content before instruction; and **(e)** real-world connections to science content.^b

Understanding of Pedagogical Concepts (Treatment Group)



Correct Responses to STEM Content Questions (Treatment Group)



Increased STEM content knowledge: Teachers in the Treatment group increased their knowledge of STEM content related to: **(a)** life sciences; **(b)** technology; **(c)** engineering; **(d)** energy, force and motion; and **(e)** Nature of Science.^c They achieved the greatest gains in Nature of Science, which is strongly emphasized throughout the Next Generation Science Standards⁵ and comprises 50 percent of Pennsylvania's standardized science assessment⁶.

[▲] Educators in the Treatment group developed better understanding of inquiry-based science and pedagogical practices than those in Control: SIE, which was the only comparison group evaluated on educator competencies (excluding content knowledge).

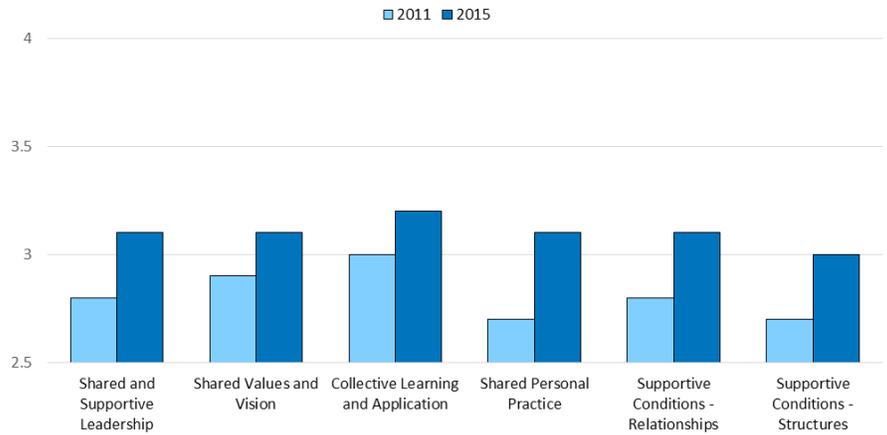


Strengthened Teacher Collaboration⁷

Professional Learning Communities (PLCs) are fundamental supportive cultures and learning environments that provide educators with ongoing discussion and staff support to sustain learning received during professional development.⁷

As the program progressed, teachers in the Treatment group increasingly felt part of healthy, supportive Professional Learning Communities. By the end of the program, the teachers collectively *Agreed* (≥ 3.0) the following conditions were in place in their schools: **(a)** shared and supportive leadership; **(b)** shared values and vision; **(c)** collective learning and application; **(d)** shared personal practice; **(e)** supportive conditions – relationships; and **(f)** supportive conditions – structures.^d

Perceptions of Conditions for a Healthy, Functioning Professional Learning Community (Treatment Group)



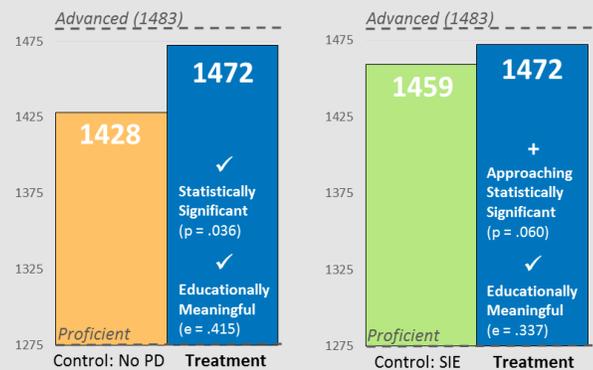
■ Control groups were not included in evaluations of teacher collaboration.



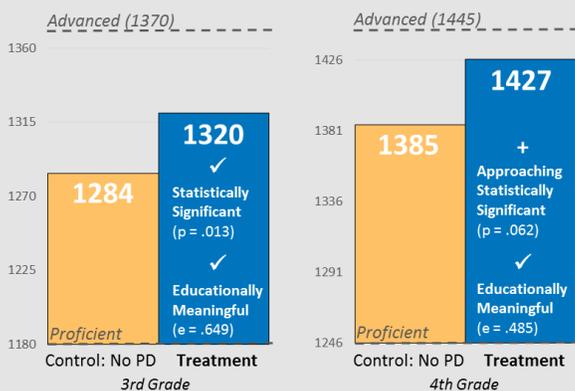
Increased Student Achievement⁸

Science: The program systemically increased student achievement in elementary science—measured using the Pennsylvania System of School Assessment (PSSA) in 4th grade science. After three years of program implementation (2014), the average student score in the Treatment group was 44.2 points above the Control: No PD group (statistically significant) and 13.5 points above the Control: SIE group (approaching statistically significant).^e Both results were educationally meaningful. The Treatment group collectively ended the program within 11 points of *Advanced* performance as four (4) schools improved from *Proficient* to *Advanced*.

Student Achievement in 4th Grade Science



Student Achievement in 3rd and 4th Grade Math



Math: While the program was designed to increase student achievement in science, exploratory analyses of math PSSA scores showed the program systemically increased student achievement in elementary math as well. After three years of program implementation (2014), the average student score in the Treatment group was 36.7 points higher than the Control: No PD group in 3rd grade math (statistically significant) and 41.8 points higher than the Control: No PD group in 4th grade math (approaching statistically significant).^e Both results were educationally meaningful.

● **Statistically significant** ($p < .05$) indicates results are reliable and likely not due to chance. If the treatment is repeated, there is very high probability the findings will be the same. **Educationally meaningful** based on effect size ($e \geq .25$)⁸ indicates the amount, or size, of change from the treatment is noteworthy relative to other approaches.

HOW DID WE ACHIEVE THESE RESULTS?

164 professional development sessions were facilitated to fully engage all participants in 12 courses and institutes (each teacher engaged in 30+ days of professional development)

85 percent (approximate) of professional development sessions met criteria for *high implementation*, meaning educators were actively engaged for the majority of time spent in these sessions

90 percent (approximate) of schools met the goal of 90 percent or greater teacher participation in professional development

HOW WERE THE RESULTS MEASURED?

^a *i3 Classroom Observation Instrument*: Developed by the evaluator with input from ASSET, this tool was used by pre-trained independent teacher observers (non-participants in the program) to identify artifacts of inquiry-based science instruction spanning five categories of evidence in Treatment and Control: SIE classrooms. *Scale*: (1) Not Observed; (2) Rarely Observed; (3) Sometimes Observed; (4) Often Observed

^b *Teacher questionnaires*: Developed during previous ASSET evaluation studies, this tool was used to assess teachers' understanding of science content and pedagogy in the Treatment and Control: SIE groups. Five statements from the questionnaire were presented to teachers at regular intervals throughout the project. *Scale*: (1) No Understanding; (2) Minimal Understanding; (3) Moderate Understanding; (4) Proficient Understanding; (5) Expert Understanding

^c *Content knowledge assessments*: Developed by ASSET, five different mini assessments were used to gauge Treatment teachers' knowledge before and after content-enrichment professional development was received. While the evaluator refrained from calculating overall scores, ASSET used evaluation findings to produce an "average percent of correct responses" measure for each pre- and post-test (i.e., sum of percent correct for each question divided by number of questions).

^d *Professional Learning Community Assessment – Revised (PLCA-R)*⁹: This tool was used to measure the development of six characteristics of a healthy, functioning Professional Learning Community in Treatment schools. The tool prompts teachers to rate descriptive statements related to each characteristic. *Scale*: (1) Strongly Disagree; (2) Disagree; (3) Agree; (4) Strongly Agree

^e *Pennsylvania System of State Assessment (PSSA)*: Statewide assessment data was used to measure student achievement against educational standards. Elementary science (4th grade only) and elementary math (beginning in 3rd grade) mean scores were analyzed to assess changes in student achievement between 2011 (baseline) and 2014 (final); the PSSA was revised in 2015.

References

¹ Fullan, M. (1993). *Change forces: Probing the depths of educational reform*. London, England: Falmer Press.

² National Commission on Teaching & America's Future. (1996). *What matters most: Teaching for America's future*.

³ ASSET Inc. (2010). *Science: It's Elementary results*. https://assetinc.org/files/public/content/publication/496/file/sie_results

⁴ ASSET Inc. (2011). *Investing in Innovation logic model*. https://assetinc.org/files/public/content/publication/367/file/i3_logic_model

⁵ Next Generation Science Standards. (2013). *Appendix H -- Understanding the scientific enterprise: The Nature of Science in the Next Generation Science Standards*.

⁶ Pennsylvania Department of Education. (2014). *PCS PSSA Test Design: Science PSSA test content blueprints*.

⁷ Morrissey, M. S. (2000). *Professional learning communities: An ongoing exploration*. Austin, TX: Southwest Educational Development Laboratory.

⁸ What Works Clearinghouse. (2014). *Procedures and Standards Handbook, Version 3.0*.

⁹ SEDL. (2010). *Professional Learning Communities Assessment – Revised (PLCA-R)*. American Institutes for Research.

The independent evaluation of the program, *ASSET Regional Professional Development Centers for Advancing STEM Education in Pennsylvania (2010-2015)*, was led by Dr. Shula Nedley, Visiting Professor at Point Park University in Pittsburgh, PA. The evaluation report is available upon request by contacting communications@assetinc.org.