OLD DOMINION UNIVERSITY

DARDEN COLLEGE OF EDUCATION

THE CENTER FOR EDUCATIONAL PARTNERSHIPS

A Technology-facilitated Scale Up of a Proven Model of Mathematics Instruction

Year 2 (2013) i3 Project Status Report

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The Center for Educational Partnerships

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Project Overview

The goals of the i3 project are (a) to scale up a proven model of mathematics instruction called "PowerTeaching Math (PTM)" to schools serving over 100,000 high needs students nation-wide; (b) to implement a systems redesign process to continually improve implementation processes and supports, and (c) to conduct a highly rigorous, third party evaluation of the effectiveness of the scale up effort. The PT math model, developed by Johns Hopkins University and the Success for All Foundation, provides an instructional framework that links educational standards and school curricula to research-based strategies and resources that actively engage students in rigorous learning (http://sfapowerteaching.org/15161). Students work together in teams to solve math problems resulting in an increased understanding of mathematics concepts through a student-centered environment. PT uses the Success for All cycle of effective instruction. This model incorporates active instruction, teamwork, assessment, and team celebrations. PowerTeaching emphasizes teamwork so that team goals and the resulting team celebration are achieved when all members of the team show evidence of improved achievement. The total budget for the five-year project is $26.25 million, with approximately $25 million provided by the U.S. Department of Education and $1.25 million provided by private matching funds ($750,000) and private in-kind support ($500,000).

Project Implementation Status

In 2012-2013, the i3 PowerTeaching project was implemented in 8 pilot schools located in Virginia, Texas, and Kansas, and served about 7,000 students. Participating Virginia school divisions included Norfolk, Portsmouth, and Halifax County. We conducted intense recruiting efforts in 2013 for the formal third party evaluation study being conducted by MDRC. Schools were required to meet exacting criteria and complete an initial buy-in process for inclusion in the randomized control study. We offered to begin our scale-up efforts in schools that were not selected for the study but otherwise met the definition of a high needs school and completed our initial orientation and buy-in process. Consequently, this year we are implementing the program in 40 schools serving over 35,000 students in 13 states—more than double our original goal in terms of number students impacted.

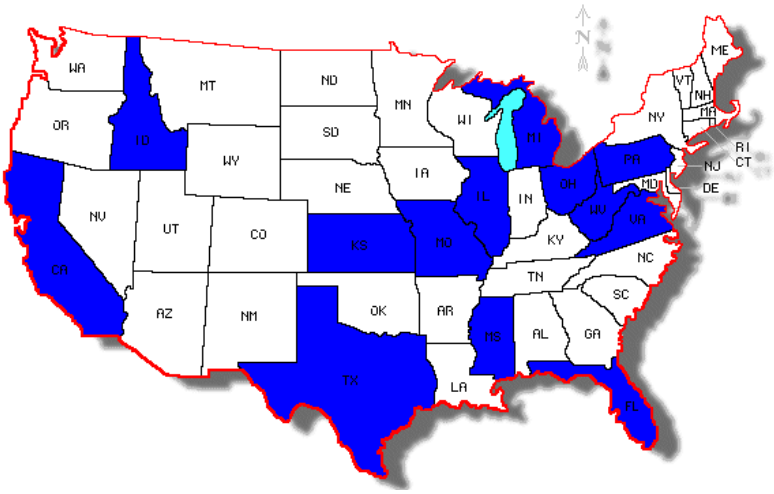

Figure 1. ODU i3 project states, 2013.

According to our latest project management report filed with the US Department of Education, we have completed or are making timely progress on 98% of planned project objectives. In 2013, we accomplished a number of objectives, including (a) designing and conducting two week-long institutes for school-based coaches and principals (one in Los Angeles and one in Portsmouth, VA); (b) providing two initial days of professional development to all participating teachers; (c) deploying a redesigned online "hub" that provides curriculum, assessment, and professional development resources to participating teachers; (d) collecting and reporting systems redesign data to improve the online hub and the overall professional development process provided to schools; and (e) providing 8 days of job-embedded professional development to teachers in participating schools.

We are expanding the size of the study school group from an initially planned 20 treatment and 20 control sites, to 30 treatment and 30 control sites. The randomized experimental impact study is in an exploratory phase this school year, and the formal confirmatory impact study will begin next school year. In the 2012-2013 school year, a research team of six ODU faculty comprised of experts in mathematics education, instructional design and technology, teacher and coach professional learning, and evaluation conducted a formative study to identify systems redesign goals for improving the effectiveness of program implementation supports. Data collection included 39 days of on-site field observation of PowerTeaching training and implementation at eight pilot schools; 131 classroom observations; 63 interviews with teachers, principals and coaches; and nine focus groups with teachers and school-based coaches. Two questionnaires were also administered to all PowerTeaching teachers across schools in the fall and in the spring. Additionally, two usability studies on the PowerTeaching Hub website that supports

implementation were conducted, and ongoing website use was tracked through analytics data. Findings with recommendations for redesign of the program informed by school personnel perceptions and experiences were disseminated to program developers through a series of formative evaluation reports and systems redesign conference presentations. (See Appendix A for a preliminary overview of project highlights extracted from 2012-2013 data.)

Systems redesign recommendations have resulted in extensive development of mathematics curricular resources available to teachers that align with new standards to support student achievement with national and state shifts towards more rigorous assessments of mathematics learning. Recommendations have also resulted in adjustments to training for coaches and teachers to accelerate and extend their ability to implement PowerTeaching. Development of additional online resources to support teachers and coaches in the implementation of the PowerTeaching program with fidelity for the best possible outcomes is currently underway.

Project Outcomes

Teaching and Learning Behaviors

Observations, along with interview and questionnaire data from teachers and other school personnel indicate increased levels of student academic engagement, enhanced opportunities for students to engage in high-level thinking and problems solving, and more positive classroom environments in most sites. Related to student engagement, qualitative data suggests that some teachers have noticed that PowerTeaching supports *all* students' sense of accountability and ownership for their learning because of the importance of each individual to their team. One teacher in a focus group described this process as follows:

> On the homework check, they are accountable to themselves. Previously someone did not do their homework, and it was just between that child and the teacher. Homework is now between child and team mates, not just child and teacher. They now have a sense of accountability to team. They have to do the work and have to bring something to the table.

Similarly, other teachers have noticed greater participation across all students, including those from groups that initially presented as difficult to engage in mathematics. For example, another teacher described a shift in mathematics engagement among English language learners and students with learning challenges in the classroom:

> I have one class that's considered a "low" class. It's a lot of ESL, a lot of kids with learning issues, and somehow they got lumped together which happens. Initially working together and having discussions was hard because a lot of them were the ones that kept quiet. But now they don't have

that. So it required more training them to interact, talk. But now I can't tell the difference between the two classes.

Although these data primarily represent stakeholder perceptions of the impact of PowerTeaching on students, taken with the early achievement data presented in the following sections, a picture of evolving mathematics learning through PowerTeaching implementation emerges.

Student Achievement

Within-group statistical comparisons were conducted for the six Virginia pilot study schools versus all other (non-study) middle schools in the Commonwealth for grades six through eight mathematics, Algebra I, and Geometry SOL average scaled scores. The results reported here are for paired-samples *t*-tests for within group changes from the 2011-2012 to 2012-2013 test administrations. Note that these are comparisons to state-wide norms based on non-random samples; thus, the results are suggestive and do not necessarily represent the cause-and-effect relationships as would be tested in a true experimental design. Analyses are based on over 278,000 middle school students state-wide and approximately 5,000 pilot school students. Student enrollment and demographic information is reported in the table in Appendix B. Because only two of the six project pilot schools administered grade 7 subject tests (i.e., most gave only grade 8 or Algebra I tests to their seventh grade students), these results are not included in the graphs but are included in the narrative. For students classified as Limited English Proficient, none of the pilot project schools administered Geometry tests so this subject area is not included in the summary chart for that group.

Achievement Results: All Students

Study schools showed a 2.1% increase in average SOL scores overall, across grades and subject areas. They showed a 0.9% increase for grade 6, a 2.1% increase for grade 8, a 4.0% increase for Algebra I, and a 2.6% increase for Geometry (see Figure 2). There was a decrease of 1.9% for grade 7, however only two study schools administered the grade 7 assessment both years. Increases overall and in Algebra I were statistically significant at $p < .01$.

Non-study schools showed a 0.7% increase overall, a 2.1% increase for grade 6, a 1.4% increase for grade 7, a 0.3% increase for grade 8, and a 0.5% increase for Algebra I. They showed a 0.6% decrease in average Geometry scores (Figure 2). The overall increase, the grades 6 and 7 increase, and the Algebra I increase were statistically significant at $p < .01$.

Study schools had a higher overall gain than non-study schools across tests (2.1 versus 0.7%), and stronger gains in grade 8, Algebra I, and Geometry. They showed a lower gain (0.9%) for grade 6 relative to non-study schools (2.1%).

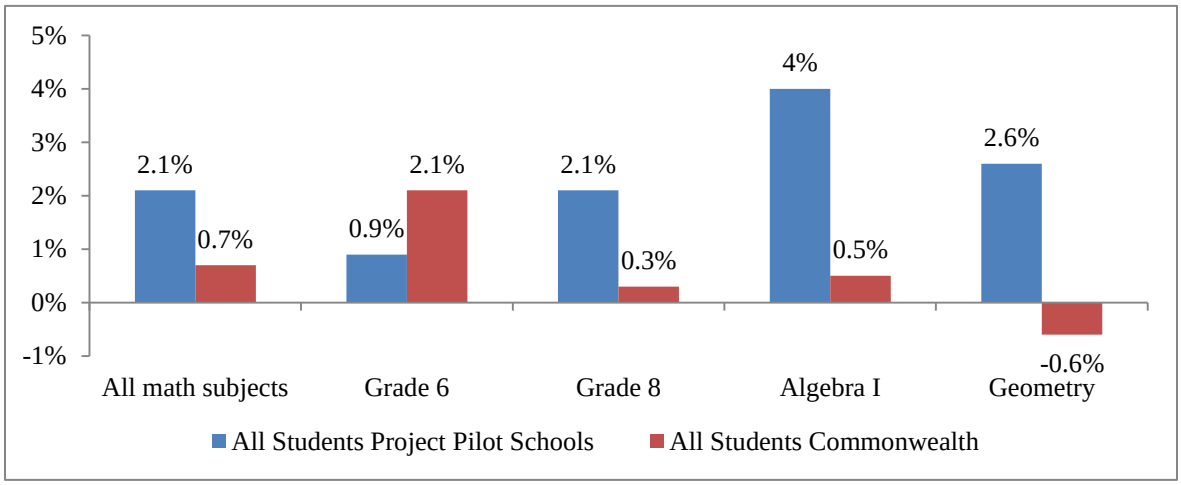

Figure 2. Percentage gain in SOL scale scores by test subject: Project pilot schools versus Commonwealth of Virginia.

Achievement Results: Economically Disadvantaged Students

Study schools showed a 1.8% increase in average test scores overall (across tests and grade levels). These schools also experienced a 0.6% increase for grade 6 average SOL scores, a 1.4% increase for grade 8, a 4.6% increase for Algebra I, and a 1.3% increase for Geometry. There was a decrease of 1.1% for grade 7 (see Figure 3). The overall increase Algebra I increase was statistically significant at $p < .01$.

Non-study schools showed a 1.0% increase overall, a 2.2% increase for grade 6, a 1.9% increase for grade 7, a 0.6% increase for grade 8, and a 0.5% increase for Algebra I. They showed a 0.8% decrease in average Geometry scores (Figure 3). The overall increase and the increase in grades 6 through 8 were statistically significant at $p < .01$.

Compared to non-study schools, study schools had stronger gains overall (across test and grade levels – 1.8% to 1.0%), for grade 8 (1.4% to 0.6%), and Algebra I (4.6% to 0.5%). In addition, while study-schools showed an increase in Geometry average scores the non-study schools experienced a decrease in these scores. The study schools showed a lower gain for grade 6 (0.6% to 2.2%) and they experienced a decrease for grade 7 where non-study schools showed an increase.

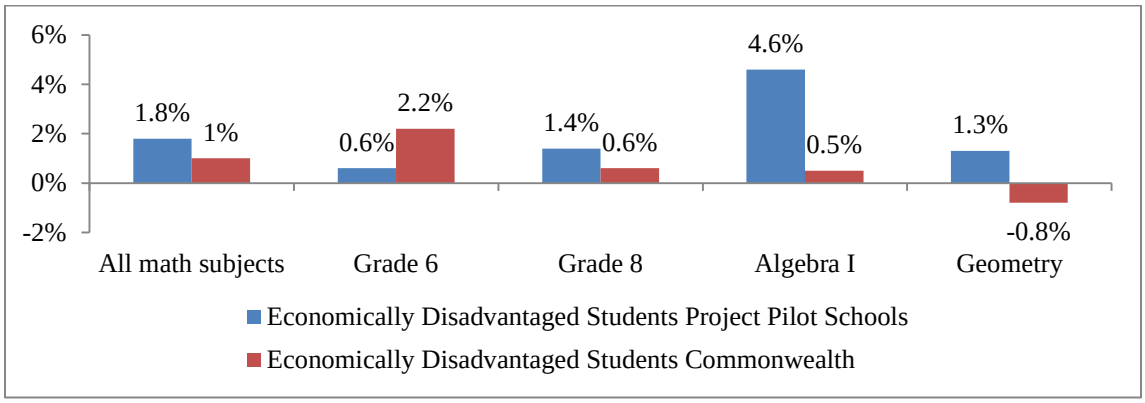

Figure 3. Percentage gain in SOL scale scores by test subject: Project pilot schools versus Commonwealth of Virginia.

Achievement Results: Students with Disabilities

Study schools experienced a 2.3% increase in average SOL scores overall, across grades and subject areas. They showed a 7.5% increase for grade 8, a 4.4% increase for Algebra I, and a 2.0% increase for Geometry. There was a decrease of 0.9% for grade 6, and a 9.3% decrease for grade 7 (see Figure 4). The grade 8 increase was statistically significant at $p < .01$.

Non-study schools showed a 0.4% increase overall, a 1.2% increase for grade 6, and a 1.2% increase for grade 7. They showed a 0.1% decrease for grade 8, a 0.5% decrease for Algebra I, and a 3.8% decrease for Geometry (Figure 4). The grade 6 increase and the Geometry decrease were statistically significant a $p < .01$.

Compared to non-study schools, study school had a higher overall gain (2.3% to 0.4%). Study schools showed increases for grade 8, Algebra I, and Geometry, where non-study schools experienced decreases. However, study schools experienced a decrease for grade 6 and grade 7, where non-study schools showed an increase.

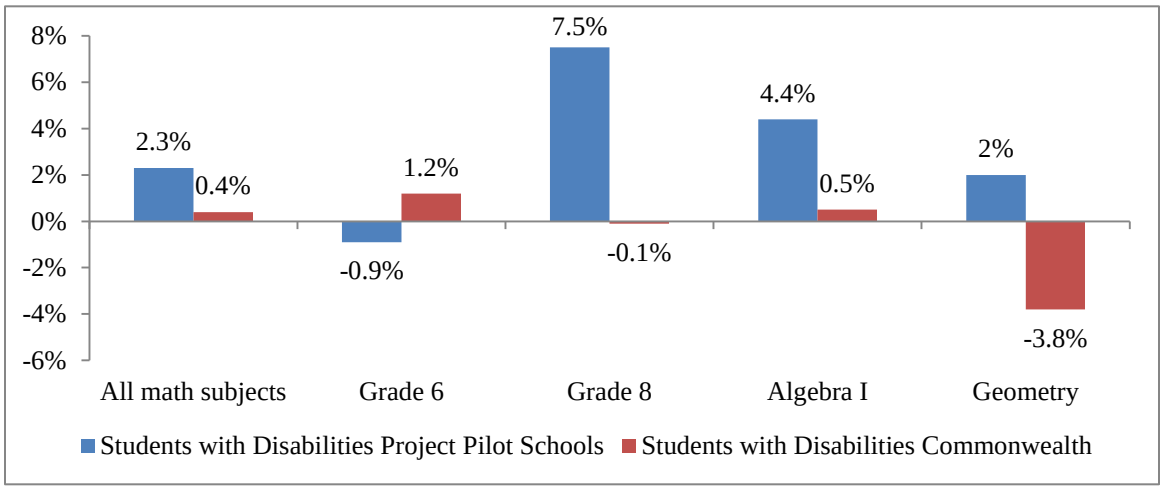

Figure 4. Percentage gain in SOL scale scores by test subject: Project pilot schools versus Commonwealth of Virginia

Achievement Results: Limited English Proficient (LEP) Students

Comparisons for study schools were only available for the across tests comparison and the Algebra I, grade 6, and grade 8 average SOL scaled scores for LEP students. Each of these levels experienced gains from the 2012 to the 2013 SOL administration, with a 6.0% overall gain across tests, a 7.9% gain for Algebra I, a 2.7% increase for grade 6, and a 7.0% increase for grade 8 (see Figure 5). The overall increase was statistically significant at $p < .01$.

Comparisons for non-study schools showed an increase in average SOL scores for grades 6 and 7, 1.0% and 0.7% respectively. However, the comparisons indicated a decrease in average SOL scores across tests (0.4%) and for Algebra I (0.6%), and grade 8 (2.3%) (Figure 5). None of the changes were statistically significant for the non-study schools.

Compared to the non-study schools, the pilot study schools showed stronger gains overall and across the three test areas for which data were available. Study schools showed a gain in average scores overall and for Algebra I, grade 6, and grade 8, where non-study schools experienced decreases overall, for Algebra I, and grade 8.

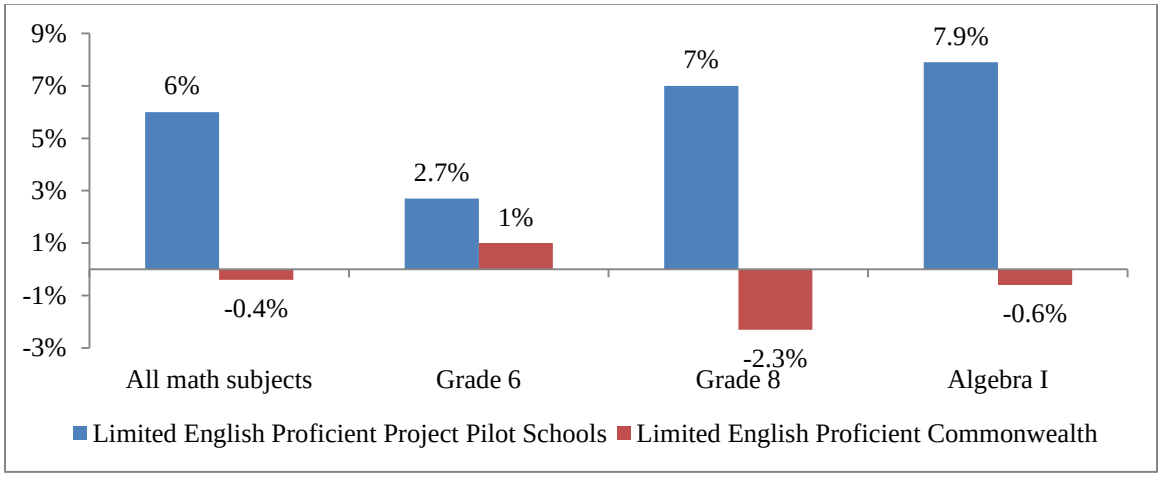

Figure 5. Percentage gain in SOL scale scores by test subject: Project pilot schools versus Commonwealth of Virginia.

Summary: An Emerging Picture of Improved Mathematics Instruction and Achievement

Data from PTi3 pilot schools collected and analyzed through the systems redesign process suggest that stakeholders across pilot schools, including teachers, administrators and coaches, are noticing beneficial shifts in mathematics teaching and learning with PowerTeaching when implemented with fidelity. Some of these identified benefits are higher levels of student engagement and participation, increased opportunities for higher level thinking and problems solving, increases in student ownership for mathematics learning, and improved classroom environments in which students experience a sense of belonging and responsibility for each other. Furthermore, teachers who work with diverse learners in some sites are articulating specific benefits for these students, such as improved classroom participation and interaction with peers.

Teachers, administrators and coaches are key informants in schools and classrooms. They are responsible for attention to and generally knowledgeable about students' learning behaviors in the classroom and responses to instruction. Their perceptions are a key source of information for understanding how the project is having impact in context. Observations conducted by the external formative evaluation team triangulate these perceptions, lending further insight into the impact of PowerTeaching in pilot schools, and the apparent shift towards more engaging, rigorous and student-centered mathematics classrooms.

Preliminary analysis of achievement data from six of the pilot sites included in the systems redesign research indicate overall improvements across tests and gains in grade 6, grade 8, Algebra I and Geometry, with statistically significant increases in Algebra I scores. PTi3 pilot schools showed higher overall gains than non-study schools across the state for four out of five middle school math courses. Furthermore, average test scores across tests and grade levels in pilot schools were found to have increased at statistically significant

levels for economically disadvantaged students, students with disabilities and students with limited English proficiency. These gains for each of these subgroups were higher overall than those achieved in non-study schools state-wide.

These findings are preliminary, limited to a small number of pilot sites, and non-experimental. However, taken together the results suggest an emerging picture of enhanced engagement, higher level teaching and learning, and improved classroom environments in PowerTeaching mathematics classrooms with associated benefits for student learning and achievement. Ongoing, quick turn-around formative evaluation findings through the systems redesign process have served to assist program developers in making decisions informed by school stakeholders and contexts that have enhanced the scope and delivery of supports and services for implementation. The externally conducted randomized experimental impact study will provide more definitive evidence regarding program impacts on student learning.

Appendix A

Systems Redesign Formative Evaluation Highlights 2012-2013

Systems Redesign Team Purpose: Conduct quick turn-around data collection and analyses to identify goals to improve the effectiveness of implementation supports for schools and teachers.

Systems Redesign Team Composition: Six Old Dominion University faculty and two doctoral graduate research assistants comprised of experts in mathematics education, instructional design and technology, teacher and coach professional learning and formative evaluation.

Systems Redesign Team 2012-2013 Activities:

- 39 days of on-site field observation of PT training and implementation in 8 pilot schools
- 131 observations of PowerTeaching classrooms
- 63 interviews with PT teachers, principals, PT coaches and SFAF coaches
- 9 focus groups with PT teachers and coaches
- Two teacher questionnaires (Fall, 2012 N=82; Spring, 2013 N=83)
- Two task-based usability studies of the PT Hub
- Ongoing tracking of PT Hub usage through Google analytics and web site statistics

Systems Redesign Guiding Questions:

1. How are teachers responding to PT in terms of their (a) beliefs in the efficacy of the model, and (b) level and consistency of classroom implementation?
2. What strategies might be employed to accelerate and maintain implementation of PowerTeaching with high fidelity?
3. What were the perceived supports and challenges for implementing PowerTeaching?
4. How could the project be restructured to enhance capacity to support PowerTeaching?

Systems Redesign Team Dissemination Activities and Products:

- October 3, 2012 Systems Redesign Conference Presentation, Norfolk, VA
- Fall 2012 Systems Redesign Cycle 1 Formative Evaluation Report (January, 2013)
- February 7, 2013 Systems Redesign Conference Presentation, Orlando, FL
- Spring 2013 Systems Redesign Cycle 2 Formative Evaluation Report (October, 2013)
- Summer 2013 PowerTeaching New Leaders Institute Formative Evaluation Report (October, 2013)
- November 19, 2013 Systems Redesign Conference Presentation, Baltimore, MD

Participants perceive teamwork has beneficial academic outcomes for students:

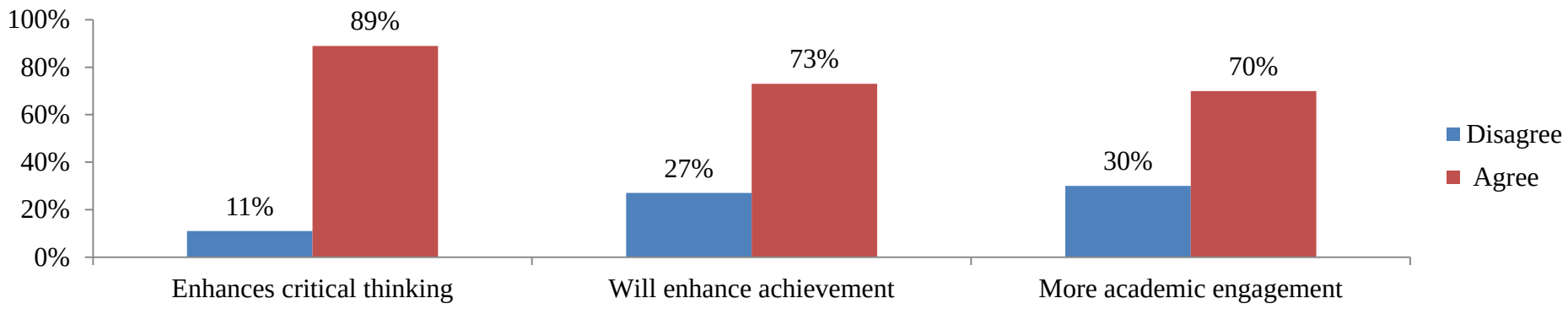

Figure 1. Teacher perceptions of academic outcomes of PowerTeaching teamwork, spring 2013.

Identified Benefits of PT	Illustrative Quote
Enhanced higher order thinking and teaching	*"They're challenged, if someone says the answer is 5 and someone else says the answer is 3, well they say, how did you get that?...So they're analyzing different situations, analyzing their own errors so they're not just working towards the right answer. They're able to defend their answers and support their answers and discover the errors together."* -Teacher, spring 2013 *"For teachers that embraced the PT program, their teaching has changed from looking at answers to looking at the process and thinking about how they can guide students through instruction."* -Principal, spring, 2013
Higher levels of academic engagement	*"Now it's like, I'm going to give you a little bit, and then you're going to figure it out. It was a lot more engaging. They were a lot more eager to try instead of saying, no, I don't know this and I'm just going to sit here. They're a lot more eager to try."* -Teacher, spring 2013
Academic benefits specific to diverse learners	*"I have one class that's considered a "low" class. It's a lot of ESL, a lot of kids with just learning issues, and somehow they got lumped together which happens. Initially them working together and having discussions was hard because a lot of them were the ones that kept quiet, and now they don't have that. So it required more training them to interact, talk. But now I can't tell the difference between the two classes."* -Teacher, February 2013

Figure 2. Salient themes of academic benefit of PowerTeaching emerging from qualitative interviews across stakeholders, fall 2012-spring 2013.

Participants perceive teamwork has beneficial social outcomes for students.

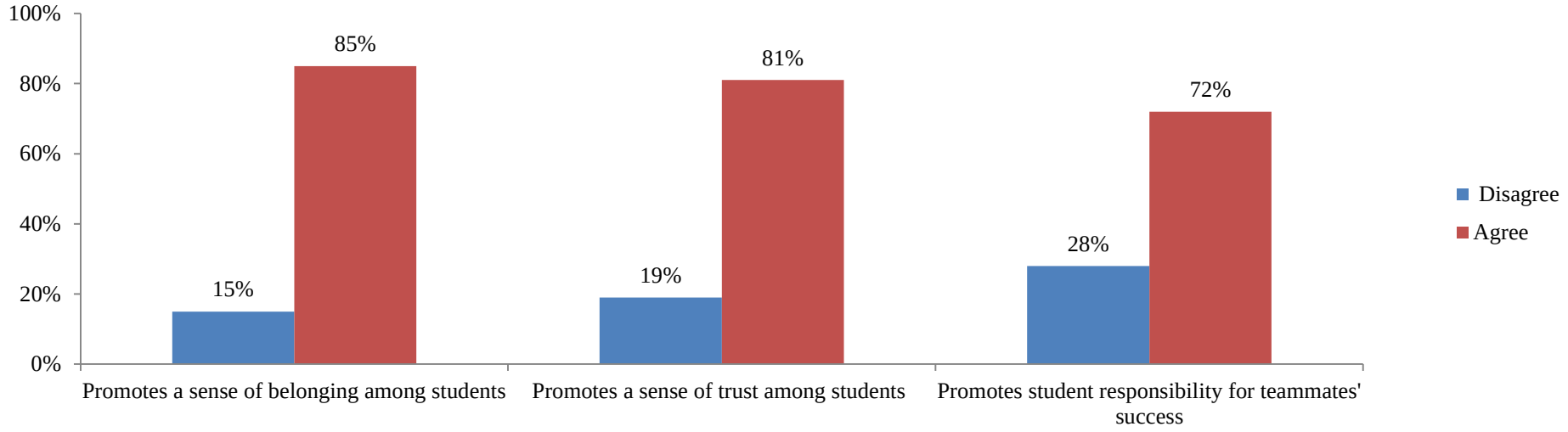

Figure 3. Teacher perceptions of social outcomes of PowerTeaching teamwork, spring 2013.

Identified Benefits of PT	Illustrative Quote
Increased peer mutual support	*"They ask for help more and they help each other. It is very good working together, they really want to help and show each other."* -Teacher, spring 2013
Increased student accountability	*"On the homework check, they are accountable to themselves. Previously someone did not do their homework, and it was just between that child and the teacher. Homework is now between child and team mates not just child and teacher. They now have a sense of accountability to team."* -Teacher, spring 2013
Social benefits specific to diverse learners	*"When I saw it first, I saw hesitancy, sometimes a non-acceptance because the kids were talking so they are involved in a conversation, but they* [student with disabilities] *are not the ones who jump into the conversation. But what I have seen throughout the year is really a great switch - with them talking, they found what out the kids know. The kids with IEPs often end up being the more knowledgeable kids and so the kids listen to them better and they totally accept them now. It has really been a growth for them so I think it has been a huge impact on them."* -Teacher, spring 2013

Figure 4. Salient themes of social benefit of PowerTeaching emerging from qualitative interviews across stakeholders, fall 2012-spring 2013.

Observational data indicate close to target ratios of student to teacher talk.

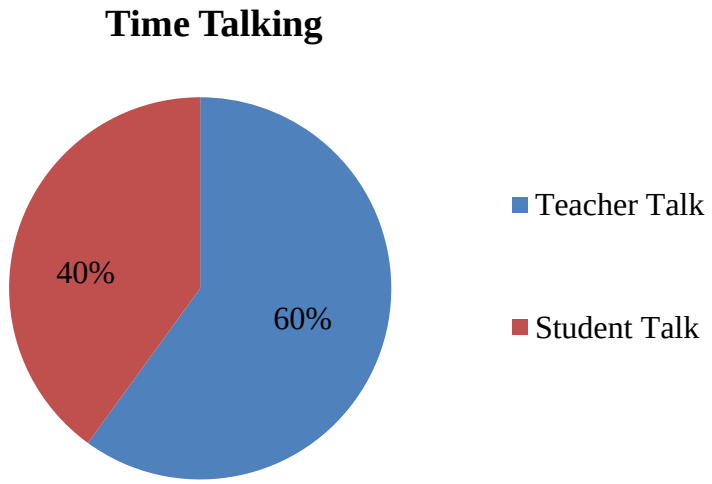

Figure 5. Observer estimates of the percentage of teacher versus student talk across pilot schools, spring 2013.

Teachers perceive learning benefits from increased student to student mathematics discourse.

> *They are not listening to me talk all the time; they are listening to themselves do it. They feel empowered because they are doing a lot of their own teaching.*
>
> *-Teacher, spring 2013*

> *The fact that you're having it explained not only by me, but in the team work activities—the team huddle, team mastery—they get an extra support network from their team as well as from just me. So when a student who needs stuff read to them or needs more assistance, needs further understanding, it explained more thoroughly, it helps out that student having other people to go to besides me.*
>
> *-Teacher, spring 2013*

Participants view PT Coaches as a critical resource for implementation, and sustaining implementation.

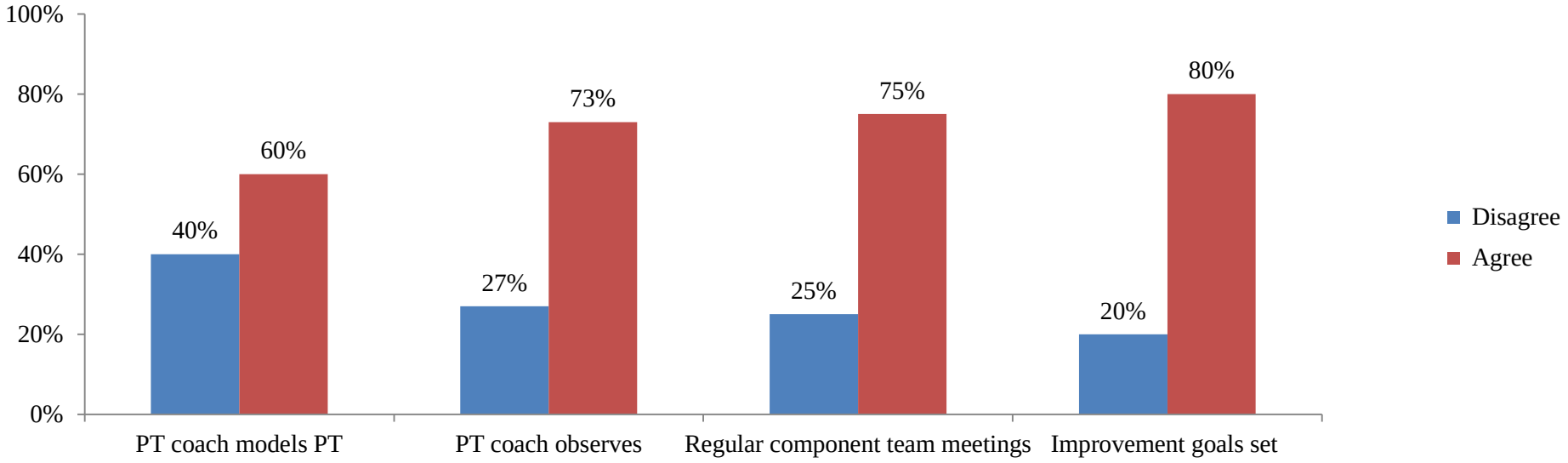

Figure 6. Teachers' perceptions of PT coaches implementation functions, spring 2013

> *In 16 years, almost every year, I started with cooperative learning …I would do the cooperative learning, go crazy in the first few months of school, then go back to rows. So this has been the first year in the eleven years at the middle school that it's February and we're still in groups. So that's kind of exciting. Just that stick with it. The coach comes in, and when I'm having trouble with teams, s/he's there. I can say, 'It was a row day.' And s/he's like, well let's sit down. And a lot of times it's just her letting me vent, just the listening, that's helped a lot. I'm still in groups. I've always believed in it, but if you don't have that coaching support and somebody else, and everybody else in the building doing it to discuss the same struggles* [you give up].
>
> -Teacher, February 2013

Summer institutes for school leaders have provided opportunities to build necessary leadership buy-in and support skills.

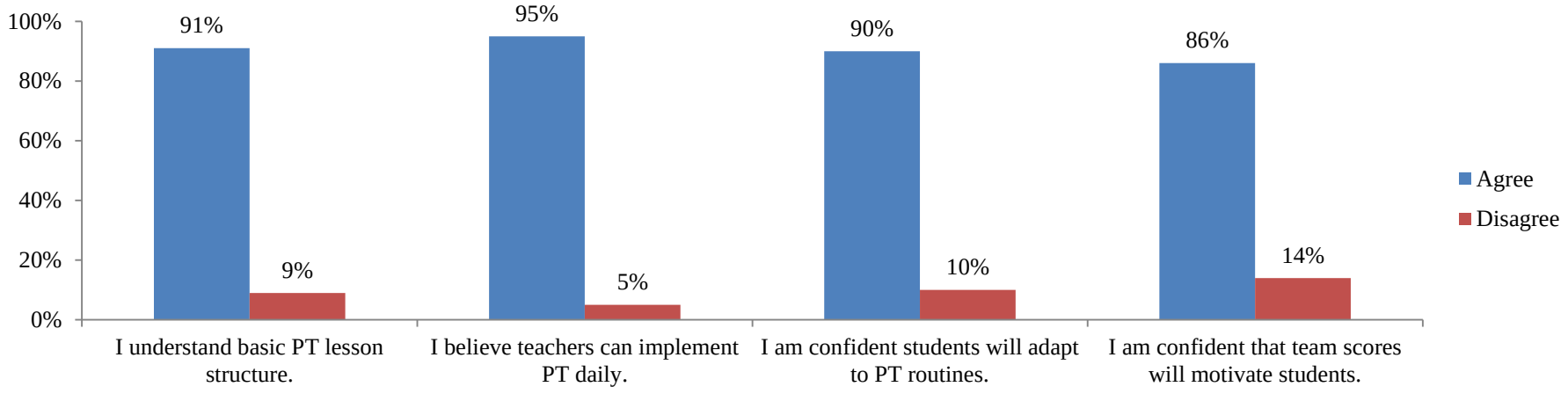

Figure 7. Leader perceptions of PT, post PT Leaders' Institute, summer 2013

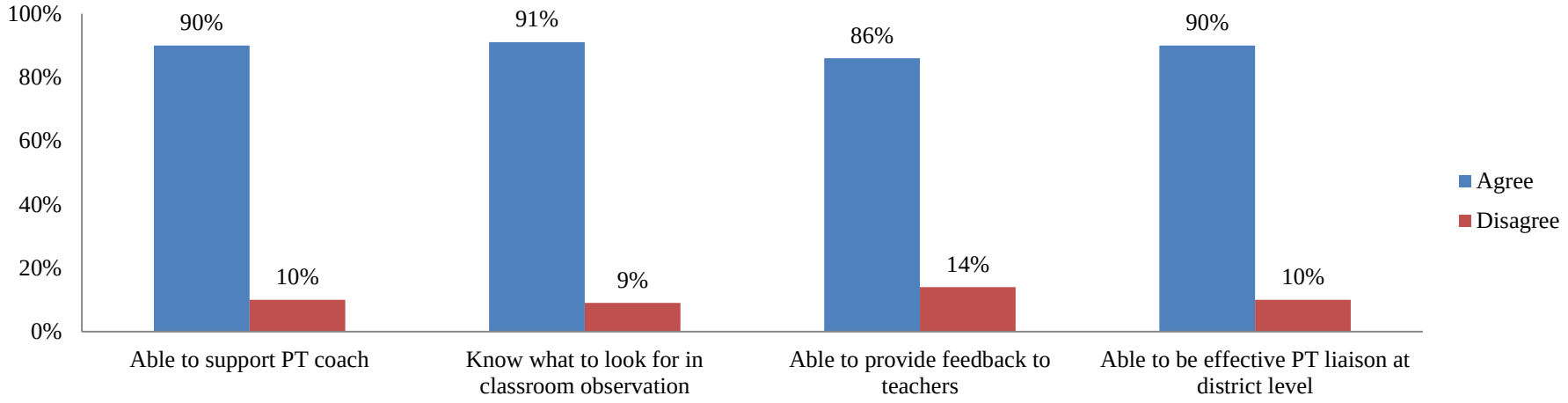

Figure 8. Leader perceptions of readiness to support PT implementation, post PT Leaders' Institute, summer 2013

Appendix B

Table 1

Virginia Student Enrollment and Demographic Data

Non-study schools	Grade 6	Grade 7	Grade 8
All students	93,398	93,303	92,022
Economically disadvantaged	36,220	35,207	33,291
Students with disabilities	12,262	11,972	11,493
Limited English Proficient	7,473	6,429	5,635
Study schools	**Grade 6**	**Grade 7**	**Grade 8**
All students	1,469	1,830	1,746
Economically disadvantaged	996	1,185	1,122
Students with disabilities	236	270	250
Limited English Proficient	28	27	27