MONTGOMERY COUNTY PUBLIC SCHOOLS

Evaluation of the Howard Hughes Science Grant Project, Year One

Office of Shared Accountability

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Executive Summary

Background and Evaluation Questions

The Office of Shared Accountability in Montgomery County Public Schools (MCPS) is conducting a multiyear evaluation of the implementation and outcomes of a science professional development (PD) initiative at the elementary school level. The implementation and evaluation of this three-year program (2013–14 through 2015–16) are supported by a grant from the Howard Hughes Medical Institute (HHMI). The evaluation was requested by the Office of Curriculum and Instructional Programs. This report will document the status of implementation of HHMI grant components during the first year of the program and provide feedback to relevant stakeholders for the program's improvement as well as its ongoing development.

The goal of the HHMI supported science program is to train one staff member within each of the elementary schools in the district to become a science lead. The specific objectives of the first year of the HHMI grant project were to: a) provide approximately 20 teacher leaders with an increased understanding of targeted Next Generation Science Standards (NGSS) practices and the skills needed for them to create a training plan; and b) to deliver this knowledge to 100 elementary classroom teachers during a week-long Science Summer Institute (SSI).

An additional goal of the HHMI grant initiative is to impact school science culture through these cohorts of trained elementary classroom teachers who can support science instruction in their school as well as bring ideas to support science, technology, and engineering related school activities.

This year one evaluation describes the implementation and impact on: a) teacher leaders as they went through a series of PD, including creating and implementing the SSI training for other elementary level teachers; and b) elementary classroom teachers who attended the week-long SSI PD.

Toward this end, the evaluation for year one addresses the following questions for the two learning components:

Professional Development for Teacher Leaders

1. How were the PD activities for the teacher leaders implemented?
2. What were the characteristics of the teacher leaders and their perceptions of science instruction and culture?
3. What were the immediate outcomes of the teacher leader training sessions (i.e., perception, knowledge, and comfort level)?

The Summer Science Institute

4. How were the PD activities for the SSI implemented?
5. What were the characteristics of the SSI participants and their perceptions of science instruction and culture?
6. What were the immediate outcomes of the SSI (i.e., perception, knowledge, and comfort level)?

Summary of Methodology

A nonexperimental design utilizing surveys and review of program documents and records was applied. Two groups of teachers constitute the sample for this evaluation.

- *Teacher leaders:* 22 elementary teacher leaders enrolled in the grant project and attended the first training; 21 teachers completed all sessions to be trained as SSI trainers.

- *SSI participants:* All 68 classroom teachers for Grades 2–5 who attended the SSI PD.

Summary of Key Findings

The findings are presented in two sections. Findings related to each evaluation question for the PD of teacher leaders are organized under the first section and findings related to each evaluation question for the SSI are organized under the second section.

Section I: Findings Related to Professional Development for Teacher Leaders

Question 1. How were the PD activities for the teacher leaders implemented?

Thirty-one elementary teachers applied for the role of teacher leader, and a total of 22 teachers were selected and agreed to participate in a series of trainings to plan, prepare, and facilitate grade-level PD. The purpose of the training sessions was to provide teacher leader participants with an understanding of targeted NGSS science and engineering practices and the skills needed to create a training plan to deliver to Grades 2–5 classroom teachers during a week-long SSI. Five teacher leader training sessions were held from January to May 2014, and many of the sessions had dedicated time for grade-level groups to work on their training plans. Grades 2–4 teacher leaders developed their training plans for the SSI around the NGSS practice, Planning and Carrying Out Investigations; and Grade 5 teacher leaders developed their training plan around the NGSS practice, Developing and Using Models.

Question 2. What were the characteristics of the teacher leaders and their perceptions of science instruction and culture?

There were 22 teacher leaders representing 20 elementary schools, and most had at least five years of experience teaching at MCPS. Almost all of the teacher leaders were Grades 2–5 teachers, with one kindergarten teacher and one Science, Technology, Engineering, and Math school-based specialist. Participants gave the following reasons for becoming a teacher leader: for their own professional development and leadership opportunity; to get science into elementary classrooms and help other teachers; and because they enjoy science. The teacher leaders were asked to rate a series of possible hindrances to their effective instruction. Approximately one half of the teacher leaders reported that the time available for their own science PD and the science kits hindered their effective instruction. Some teachers commented that not enough time is given to science because of the focus on reading and mathematics or that there is limited time in the school’s master schedule for science. Furthermore, there is not enough time to set up or complete a science project, and there were limited or broken materials in the science kits.

Question 3: What were the immediate outcomes of the teacher leader training sessions (i.e., perception, knowledge, and comfort level)?

Pre- and post-training survey findings showed an increase after training for teacher leaders' overall knowledge of the NGSS science and engineering practices and their knowledge and comfort level for the specific NGSS practice that was a focus for their grade-level training. Overall, teacher leaders expressed positive experiences with the training. They thought the objectives of the training were met, trainers were knowledgeable, expectations were clear, and the sessions were helpful to their teams' progress, just to name a few. They also increased their reported knowledge of developing training plans, teaching adult learners, the dimensions of NGSS, and the area of science concentrated in the curriculum for their grade level. One half of the teacher leaders reported that they plan to implement more NGSS into their classrooms and that working on this project has had an impact on their capacity to be a teacher leader by giving them PD on teaching adult learners, educating others, and planning science lessons at their school.

Section II: Findings Related to the Science Summer Institute

Question 4: How were the PD activities for the SSI implemented?

The SSI was held for five days, June 23–27, 2014, and a total of 68 teachers participated. Prior to the start of the SSI, the goal of 100 teachers enrolled was reached, but another required summer training was announced which caused a scheduling conflict for many of the teachers, resulting in a decline in the final participation numbers. The week-long session was delivered by the teacher leaders to grade-level breakout groups; a total of four sessions were conducted simultaneously (Grades 2–5 sessions). A key component of the SSI was that participants further enhanced a lesson seed from their grade-level curriculum (either individually or in a small group), while incorporating their targeted NGSS science practice. Time was given throughout the week to work on their lesson. Lessons were then presented to the rest of the grade-level group at the end of the SSI week. Most of these lessons were posted on the MCPS Instruction Center, which is the online curriculum platform.

Question 5. What were the characteristics of the SSI participants and their perceptions of science instruction and culture?

A total of 68 Grades 2–5 teachers (including two school-based specialists: English for Speakers of Other Languages and mathematics), participated in the SSI. They represented 38 elementary schools. More than one half of the participating teachers had been teaching for eight or more years. Similar to the teacher leader findings, one half reported that time available for science hindered effective instruction. Teacher participants reported teaching an average of 120 minutes of science per week, although responses ranged from 0 minutes to 300 minutes per week.

Question 6: What were the immediate outcomes of the SSI (i.e., perception, knowledge, and comfort level)?

Pre- and post-training survey responses showed an increase after training in the overall knowledge of the NGSS practices and knowledge and comfort level for the specific NGSS practice that was a focus for their grade-level training. Overall, elementary teachers who attended the SSI were happy with the week-long session. For example, they saw a relevant connection with their own instruction, thought the objectives were met, trainers were knowledgeable, expectations were clear, and they now have a good understanding of how to implement what they learned. Most reported that the SSI had a major effect on their ability to modify a lesson using an NGSS practice. Furthermore, most reported plans to incorporate what they've learned into their classrooms as well as share what they've learned with other staff at their school. Teacher participants reported the anticipated need for online resources and materials in the upcoming school year to support them in successfully implementing what they learned about their assigned NGSS practice; many also reported a need for more PD and a science mentor or coach. In fact, a vast majority reported being extremely or very interested in an onsite science coach to support them.

Future Plans and Recommendations

SSI participants were given the opportunity for a science lead teacher to give them one day of onsite coaching as well as be available to contact for any other assistance if needed. All SSI participants were contacted by program staff at the beginning of the school year but only approximately a dozen teachers scheduled the onsite coaching.

Another SSI will take place in the summer of 2015 and throughout the 2015–2016 school year. The second SSI will target elementary classroom teachers who did not participate in the first year.

The following recommendations are to provide feedback for the program's improvement and ongoing development and are based on findings from year one of the evaluation.

- Explore ways to target and recruit more elementary school classroom teachers to participate in the SSI. Enrollment for the first SSI was lower than anticipated, mainly due to a scheduling conflict with another mandatory training.

- Consider spending more time on lesson seeds for science instruction and resources during the SSI, as suggested by participants.

- Continue to provide and expand online science instructional support, resources and materials for elementary classroom teachers, and explore ways to encourage their use.

Evaluation of the Howard Hughes Science Grant, Year One

Natalie L. Wolanin and Julie H. Wade, M.S.

The Office of Shared Accountability (OSA) in Montgomery County Public Schools (MCPS) is conducting a multiyear evaluation of the implementation and outcomes of a science professional development (PD) initiative at the elementary school level. The implementation and evaluation of this three-year initiative (2013–14 through 2015–16) are supported by a grant from the Howard Hughes Medical Institute (HHMI). The evaluation was requested by the Office of Curriculum and Instructional Programs (OCIP). This report will document the status of implementation of HHMI grant components during the first year of the initiative and provide feedback to relevant stakeholders for the program's improvement as well as its ongoing development.

Background

Grants from the HHMI support MCPS's vision for science instruction. MCPS' long-standing partnership with HHMI has allowed teachers to have access to PD and experiences that otherwise would not be possible or would be greatly restricted due to fiscal limitations of the school district.

The objective for the portion of the three-year HHMI grant addressed by this evaluation is to build the science content knowledge of elementary teachers and provide support for implementation of the updated elementary curriculum—Curriculum 2.0. Although Curriculum 2.0 sustains many of the scientific concepts and ideas present in the previous curriculum materials, the integration of science with other subject areas presents new challenges for elementary teachers. Furthermore, the Science, Technology, and Engineering (STE) office collected various forms of feedback from elementary teachers who expressed a need for resources and training to support the new curriculum, specifically related to science.

Concurrent with the implementation of Curriculum 2.0, Maryland adopted the *Next Generation Science Standards* (NGSS), which specifically focus on scientific literacy for all students. To ensure the successful introduction of both Curriculum 2.0 and the NGSS, the science program's vision is that MCPS must align PD for teachers to Curriculum 2.0 and the NGSS. The PD will have an emphasis on students engaging with content, and teachers will be coached in the design and facilitation of opportunities for students to apply their content knowledge within the context of real world problems. HHMI grant efforts center on research-based, well-designed PD and instructional support to carry this vision forward. Learning components for the project include training teacher leaders, development and delivery of a summer training institute, and ongoing support and coaching to ensure sustainable transfer of content and pedagogy.

First Year of Grant

The goal of the HHMI supported science PD initiative is to train one staff member within each of the elementary schools in the district to become a science lead. The specific objectives of the first year of the HHMI grant project were to: a) provide approximately 20 teacher leaders with an increased understanding of targeted NGSS practices and the skills needed for them to create a training plan; and b) to deliver this knowledge to 100 elementary classroom teachers during a week-long Science Summer Institute (SSI).

An additional goal of the HHMI grant project is to impact school science culture through these cohorts of trained elementary classroom teachers who can support science instruction in their school as well as bring ideas to support STE related school activities.

Literature Review

"Increasing the effectiveness of professional learning is the leverage point with the greatest potential for strengthening and refining the day-to-day performance of educators" (Learningforward, 2013, p.1).

In an earlier study, teachers reported that PD focusing on content knowledge was one of two elements that had the greatest effect on their knowledge and skills and led to changes in instructional practice (Garet, Porter, Desimone, Birman, & Yoon, 2001). Consistent with this finding, two recent nationwide studies, (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009; Wei, Darling-Hammond, & Adamson, 2010) documented that teachers rated PD in their subject area as their highest priority for further training. In their review, Darling-Hammond and her colleagues (2009) found that PD is most effective when it focuses on specific curriculum content.

In a recent article, Eisenburg & Medrich (2013) argue that many school leaders recognize that professional learning in the form of instructional coaching, if provided with regularity, can help teachers become better at their teaching. These authors assert that "Real-time, side-by-side support is infinitely more effective than drop-in or drive-by professional learning that offers no opportunity for collaboration and collective problem solving" (Eisenberg & Medrich, p. 1). In addition, the authors' state that the coaching teachers report that collaborating with other teachers improves their own teaching.

Although rigorous experimental or quasi-experimental studies are limited in number, well-designed research does suggest some general principles of PD that may be associated with better student outcomes (Darling-Hammond et al., 2009). Among the most important factors are the length and intensity of PD. Intensive, ongoing PD has a greater chance of influencing teacher practices especially when it is connected to practice (Darling-Hammond et al., 2009).

Design and Scope of the Study

The grant evaluation was designed using Guskey's (2000) model for evaluating PD and is used as a framework for measuring the impact of the PD components of the HHMI grant. Guskey describes five sequential levels to be addressed in an evaluation of PD. All five levels were addressed in this evaluation. The five levels of the model are described below.

Level 1: Participants' reactions. Did they like it? Was it useful? Was the leader knowledgeable and helpful?
Level 2: Participants' learning. Did participants acquire the intended knowledge and skills?
Level 3: Organization support and change. Was implementation advocated, accommodated, facilitated, and supported?
Level 4: Participants' use of new knowledge and skills. Did participants effectively apply the new knowledge and skills?
Level 5: Student learning outcomes. What was the impact on students?

This year one evaluation addresses all five levels of Guskey's model. The evaluation describes the implementation and impact on: a) teacher leaders as they went through a series of PD as well as creating and implementing the SSI training for other elementary level teachers; and b) elementary classroom teachers who attended the week-long SSI PD.

Toward this end, the evaluation for year one addresses the following questions for the two learning components:

Professional Development for Teacher Leaders

1. How were the PD activities for the teacher leaders implemented?
2. What were the characteristics of the teacher leaders and their perceptions of science instruction and culture?
3. What were the immediate outcomes of the teacher leader training sessions (i.e., perception, knowledge, and comfort level)?

The Summer Science Insitutute (SSI)

4. How were the PD activities for the SSI implemented?
5. What were the characteristics of the SSI participants and their perceptions of science instruction and culture?
6. What were the immediate outcomes of the SSI (i.e., perception, knowledge, and comfort level)?

Methodology

Since participation in the HHMI grant project is limited to a group of teacher leaders selected by program staff and a group of elementary teachers voluntarily signing up for SSI, a nonexperimental design utilizing a variety of data collection methods was applied. These data collection methods for the first year of the study included surveys and review of program documents and records.

Study Samples

Two groups of teachers constitute the samples for this evaluation.

- *Teacher Leaders:* 22 elementary teacher leaders enrolled in the grant project and attended the first training; 21 teachers completed all sessions to be trained as SSI trainers.

- *SSI Participants:* All 68 SSI elementary classroom teachers for Grades 2–5 who attended the SSI.

Data Collection Activities

Review of Program Documents, Training Records, and Materials

Program documents, training records, and materials were reviewed including session agendas, session handouts, and session attendance records to determine the content of the program and the extent to which it was implemented as planned. Reviews were conducted for both the training of the teacher leaders and the SSI.

Surveys

Based on program goals and objectives and PD materials and curricula, survey instruments were developed by OSA evaluators, in collaboration with staff from OCIP. The following instruments were developed during the first year of the evaluation:

Surveys of teacher leaders. Pre-training surveys collecting baseline data on teacher leader participants' perception of school science culture and instruction, as well as their skills and knowledge of the NGSS practices, were administered at the beginning of the first teacher leader training session. The last session's survey included appropriate post-training questions about skills and knowledge of the NGSS practices to compare to the baseline results. All 21 teachers had pre- and post-training survey data for comparison.

Additionally, all teacher leader participants at each of the training sessions completed a survey at the end of the day. Surveys were administered at four of the five training sessions and assessed teacher leaders' perceptions of the training received in the program.

Surveys of SSI teacher participants. Pre-training surveys collecting baseline data on SSI participants' perception of school science culture and instruction, as well as their skills and knowledge of the NGSS practices, were administered at the beginning of the SSI week. At the end of the SSI week, a post-training survey was administered which included appropriate questions about skills and knowledge of the NGSS practices to be able to compare to the baseline results. All 68 participants completed a pre-training survey, and 66 of the participants completed a post-training survey.

Additionally, the SSI participants' post-training survey included participants' perceptions of the SSI; 66 of the participants completed this survey.

Summary of Data Analysis Procedures

Data analysis procedures included descriptive statistical analyses of:

Teacher Leaders

- Characteristics of teacher leader participants and instructional science practices and school culture at their school
- Attendance at PD sessions
- Teacher leaders' survey feedback about PD as well school culture, science instruction, and knowledge of NGSS practices
- Characteristics of training plans developed for the SSI

SSI Participants

- Characteristics of SSI teacher participants and instructional science practices and school culture at their school
- Attendance at SSI
- SSI participants' survey feedback about the SSI, as well school culture, science instruction, and knowledge of NGSS practices

Findings

The findings are presented in two sections. Findings related to each evaluation question for the PD of teacher leaders are organized under the first section and findings related to each evaluation question for the SSI are organized under the second section.

Findings Related to Professional Development for Teacher Leaders

Question 1: How were the PD activities for the teacher leaders implemented?

Recruiting teacher leaders. Program staff recruited elementary teachers to become HHMI science teacher leaders by contacting elementary staff development teachers, posting in the STE newsletter, and on the Elementary Integrated Curriculum (EIC) implementation folders, as well as inviting elementary teachers who had participated in a previous leadership training program. A sample application may be seen in Appendix A. When reviewing applications, STE staff looked for applicants who possessed the following (some candidates were observed):

- Proven excellent leadership skills
- Solid communication skills
- Strong critical and analytical thinking skills
- Demonstrated ability to meet the needs of diverse groups of learners
- At least one year of successful science instruction at the grade level
- Experience delivering PD and supporting elementary instruction preferred

Applicants were told that as a science lead teacher, they would be expected to develop a training plan that meets the needs of teachers in their grade level as well as deliver this training to teachers in their grade level the week of June 23, 2014. STE program staff rated applicants and extended invitations to 31 teachers. A total of 22 teachers agreed to participate and complete a series of trainings during spring 2014 to plan, prepare, and facilitate grade-level PD. One of the teacher leaders dropped out after the first training; the number of teacher leaders who completed the training was 21.

Teacher leader training sessions. In addition to learning about targeted NGSS scientific and engineering practices, many of the training sessions for teacher leaders had dedicated time for grade-level groups to work on their SSI training plans. The trainers were allowed to choose which NGSS practice they wanted to concentrate on based on what they felt fit best with their grade-level curriculum. Teacher leaders were given feedback data from focus groups conducted by STE staff to drive the design of their plans and the selection of their practice. Grades 2–4 built their plans for the SSI around the practice, Planning and Carrying Out Investigations, and Grade 5 built their plans around the practice, Developing and Using Models. A summary of the sessions is shown in Table 1.

Table 1
Summary of Teacher Leader Training Sessions

January 2014 • Learned about the HHMI grant, their role as an elementary science lead teacher, the NGSS standards and NGSS practices 1 and 4 (*Asking Questions and Defining Problems* and *Analyzing and Interpreting Data*). • Introduced to Paul Anderson's video series on NGSS (Anderson, 2014). • Learned about the expectations of the grant work and developed a proposal for a training plan for a week long science summer institute (SSI) PD for teachers at their grade level. • Conducted a group engineering activity. • Received two books: *Cooperative Learning & Hands on Science* by Laura Candler and *A Framework for K–12 Science Education* by The National Research Council. They also received a camera, a flash drive, a personal response system device, subscription to *Science and Children* magazine, and optional admission to the 2014 Science Teacher's conference in Boston, MA.
February 2014 • Learned about NGSS practices 3 and 8 (*Planning & Carrying Out Investigations and Obtaining*, *Evaluating, and Communicating Information*). • Explored formative assessment probes, while also conducting an activity on melting and dissolving. • Participated in an engineering design challenge. • Worked on their proposals and content for the SSI. They were encouraged to use their cameras to capture classroom work that would support the SSI.
March 2014 • Reviewed the four NGSS practices they learned about in the previous two sessions. • Met with MCPS representative from the science center about science kits and materials. • Continued to develop grade-level summer training plans for the SSI.
April 2014 • Learned about characteristics of adult learners and how they might apply that to PD. • Grade-level teams worked on finalizing their training plans and scripts for the SSI.
May 2014 • Shared examples from their training plans, received feedback, and clarified expectations for the week of the SSI. • Updated their training plans and finalized the work to be done.

Question 2: What were the characteristics of the teacher leaders and their perceptions of science instruction and culture?

Characteristics. The 22 teacher leaders who started the grant project were from MCPS elementary schools and most were Grades 2, 3, or 5 teachers; there was also a kindergarten teacher, two Grade 4 teachers, and a school Science, Technology, Engineering, and Mathematics (STEM) specialist (Table 2). All of the teacher leaders reported having at least two years teaching experience at MCPS (including science), with most having more than five years' experience teaching at MCPS and teaching science.

Table 2
Characteristics of Teacher Leaders

Characteristics of Teacher Leaders	*n*	%
Current position		
Kindergarten	1	4.5
Grade 2 teacher	7	31.8
Grade 3 teacher	6	27.3
Grade 4 teacher	2	9.1
Grade 5 teacher	5	22.7
Specialists (STEM)	1	4.5
Total years teaching MCPS		
1 year (last year 1st year)	0	0.0
2–4 years	4	18.1
5–7 years	5	22.7
8–10 years	7	31.8
More than 10 years	6	27.3
Total years teaching Science		
1 year (last year 1st year)	0	0.0
2–4 years	5	22.7
5–7 years	6	27.3
8–10 years	7	31.8
More than 10 years	4	18.2

Science PD experience. Although there was a variety of science PD experience ranging from no experience to being a science PD instructor, most of the teacher leaders reported, in an open-ended survey question, having some type of experience with a science PD. Examples of PD reported were: with the Maryland State Department of Education (MSDE); with MCPS (i.e., Carderock Insititute, science kit training); with a previous HHMI grant; participation in a professional learning community, college science course, or conferences.

School characteristics. The 22 teacher leaders represented 20 schools; two pairs of participants were from the same elementary school. Schools represented by the teacher leaders, on average were similar in school population and percentage of students receiving Free and Reduced-price Meals System (FARMS) and English for Speakers of Other Languages (ESOL) services compared to all MCPS elementary schools (Table 3).

Table 3
Characteristics of Elementary School Participants

School-level Characteristics		Elementary HHMI (20 schools)	Elementary MCPS[a] (133 schools)
Number of students	Mean (SD)	584 (134)	554 (157)
	Range	398–958	99–986
% of students receiving FARMS	Mean (SD)	34.3 (25.7)	37.9 (26.6)
	Range	≤5.0–80.0	≤5.0–94.3
% of students enrolled in ESOL	Mean (SD)	19.9 (10.9)	21.7 (15.1)
	Range	≤5.0–44.8	≤5.0–72.6

[a]MCPS schools include the schools represented in the HHMI column. Also, MCPS schools include one charter school.

School STEM personnel. Teacher leaders indicated that one third of the represented schools have a STEM or science committee, and a few of the schools have a STEM or science focus teacher (Table 4).

Table 4
STEM School Personnel Reported by Teacher Leaders (N = 20)

School STEM Personnel	Yes *n*	Yes %	No *n*	No %	Not Sure/No Answer *n*	Not Sure/No Answer %
Science or STEM committee at school	7	35.0	12	60.0	1	.05
Science or STEM focus teacher position at school	3	15.0	14	70.0	3	15.0

School STEM culture. Three fourths (n = 15) of 20 teacher leaders reported that their school offered an after-school program for science or engineering and more than one half (n = 12) reported that their school has offered a family science or engineering event (Table 5). More than one third reported that their school offered a science or engineering club (n = 8) or participated in a local or regional science fair or event (n = 8).

Table 5
STEM School Activities Reported by Teacher Leaders

School STEM Activities	Total Participants (N = 20) *n*	Total Participants (N = 20) %
Offer after-school programs for science and/or engineering enrichment	15	75.0
Hold family science and/or engineering nights/events	12	54.5
Offer one or more science and/or engineering clubs	8	36.4
Participant in local or regional science or engineering fair/event	8	36.4
Visit to science/engineering sites	4	20.0
Other science or engineering activities outside of classroom instruction	3	13.6
Sponsor meeting with science or engineering professionals	2	9.1
Host AAAS volunteers in your science classrooms	0	0.0

Note. AAAS = American Association for the Advancement of Science.

Teachers were given a list of aspects to rate surrounding school science culture which may have hindered or promoted their effective instruction of science in the classroom. They were asked to rate each area using a 5-point scale from, "hindered effective instruction" to "promoted effective instruction," which is shown in Table 6. More than half (n = 13) reported that time available for their own science PD hindered effective instruction. Almost one half (n = 10) reported that the science kits hindered effective instruction. Almost two thirds (n = 14) reported that the administrative support that was provided promoted their effective instruction.

Table 6
School Science Culture Reported by Teacher Leaders

	Total SSI Participants (N = 22)							
	Hindered Effective Instruction = 1/2[a]		Neutral = 3		Promoted Effective Instruction = 4/5[b]		Don't Know	
Aspects of School Culture	*n*	%	*n*	%	*n*	%	*n*	%
Time available for your own science Professional Development (outside of planning)	13	59.1	2	9.1	7	31.8	0	0.0
Contents of materials in the science kits	10	45.5	4	18.2	8	36.4	0	0.0
Availability of other science resources such as books or materials to support curriculum instruction	8	36.4	8	36.4	6	27.3	0	0.0
Time that was available for you to plan, individually and/or with colleagues	7	31.8	4	18.2	11	50.0	0	0.0
Importance that your school places on science	5	22.7	6	27.3	11	50.0	0	0.0
Parent expectation and involvement	2	9.1	11	50.0	8	36.4	1	4.5
Administrative support that was provided	0	0.0	8	36.4	14	63.6	0	0.0

[a]Ratings 1 and 2 on a 5-point scale, were combined, where 1 = hindered effective instruction.
[b]Ratings 4 and 5 on a 5-point scale, were combined, where 5 = promoted effective instruction.

Participants were given the opportunity to list anything else that may have hindered effective science teaching in their classroom. Most elaborated on the aspects that they rated above. But the most common hindrance mentioned was not having adequate time to teach science or to plan for a science lesson.

- Nine teacher leaders mentioned not enough time because of the focus on reading and math or that there's limited time in the school's master schedule.
- Seven teacher leaders mentioned not enough time to plan, set up, or complete a science project.
- Five teachers mentioned the limited materials in the science kit or that the materials did not work correctly.
- Two teachers also mentioned lack of technology at home and background knowledge among students.

Motivation and goals. At the first training session in January, participants were asked, in an open-ended question, why they applied to be a science lead teacher. The responses were combined and broken into three categories of answers:

- For their own PD/leadership opportunity (11 of 22 reported).
- To get science into classrooms/To help other teachers teach science (10 of 22).
- They enjoy science/Have a passion for science (8 of 22 reported).

Not surprisingly, responses were very similar when teachers were also asked at the first PD, what they were hoping to accomplish from being a science lead teacher.

- They would like to educate other teachers in the area of science (11 of 22 reported).
- They want to learn more about teaching science/science curriculum/NGSS (10 of 22 reported).

Question 3: What were the immediate outcomes of the teacher leader training sessions (i.e., perception, knowledge, and comfort level)?

Perceptions of training sessions. At the end of three training sessions, the teacher leaders were asked to rate the sessions on various factors. All or almost all strongly agreed that: the objectives of the training were met; trainers were knowledgeable and well prepared; they were comfortable taking risks; they had opportunities to process and reflect; their questions were answered adequately; the sessions helped with their team's progress; and expectations for their team were clear (Table 7).

Table 7
Teacher Leaders' Perceptions of Training Provided in January, March, and April Sessions

Aspects of Training Sessions	January (N = 22)			March (N = 20)			April (N = 20)		
	Strongly Agree	Agree	Disagree/ S.D.	Strongly Agree	Agree	Disagree/ S.D.	Strongly Agree	Agree	Disagree/ S.D.
	%	%	%	%	%	%	%	%	%
Objectives of today's training met.	95.0	5.0	0.0	95.0	5.0	0.0	100.0	0.0	0.0
Trainers knowledgeable/well prepared.	95.0	5.0	0.0	95.0	5.0	0.0	100.0	0.0	0.0
Comfortable environment taking risks.	95.0	5.0	0.0	95.0	5.0	0.0	100.0	0.0	0.0
Opportunities to process and reflect	95.0	5.0	0.0	90.0	5.0	5.0	100.0	0.0	0.0
My questions were answered adequately.	95.0	5.0	0.0	100.0	0.0	0.0	95.0	5.0	0.0
Today's session has helped with team's progress.	n/a	n/a	n/a	95.0	5.0	0.0	90.0	10.0	0.0
Expectations for teacher team is clear.	n/a	n/a	n/a	95.0	0.0	5.0	95.0	5.0	0.0

Specific tasks differed among each of the training sessions. For example, at the January session, teacher leaders participated in an engineering challenge and in March, a representative from the Taylor Science Center attended to give information about resources available. In several of the training sessions, the teacher leaders were asked to rate the helpfulness of specific tasks from that day, using a 3-point scale (i.e., very, somewhat, or not at all). The tasks that were found to be very helpful by all or almost all of the participants were: the guest representative from the science center, developing a grade-level model to share, an overview of the expectations to upgrade a lesson, identifying and learning how to apply characteristics of adult learners to PD, conducting the "fair test" activity, and clarifying the expectations and specifics for the SSI (Table 8). The least rated training activities were sharing information about the four practices (75% gave a rating of very helpful) and the engineering challenge (71% gave a rating of very helpful).

Table 8
Teacher Leaders' Perceptions of Training Provided in January, March, April, and May Sessions

Trainings	Helpfulness of….	Very %	Somewhat %	Not at All %
January (*N* = 21)	Engineering Challenge	71.0	29.0	0.0
March (*N* = 20)	A rep from Taylor Science Center (about materials)	90.0	5.0	5.0
	Developing a grade-level model to share	100.0	0.0	0.0
	Overview of expectations to upgrade a lesson	100.0	0.0	0.0
	Sharing information about the four practices	75.0	25.0	0.0
April (*N* = 20)	Learning how to apply characteristics of adult learners to PD	100.0	0.0	0.0
	Identifying characteristics of adult leaners	100.0	0.0	0.0
May (*N* = 21)	Reviewing the NGSS intro for SSI	80.0	20.0	0.0
	Conducting the "fair test" activity[a]	100.0	0.0	0.0
	Clarifying expectations for SSI outcomes, lab time, scripting	95.0	5.0	0.0

[a]*N* = 12; only some conducted the "fair test" activity.

Ratings of their knowledge. The following charts compare the teacher leaders' self-reported knowledge using a 3-point rating scale at the beginning of the first PD session (pre-training survey) to the post-training survey, given at the end of the last PD session (Figure 1). In all aspects, a higher percentage of participants gave a rating of very knowledgeable in the post-training survey compared to the percentage from the pre-training survey. Additionally, none of the participants gave a rating of not at all knowledgeable in the post-training survey.

Ratings of very knowledgeable of the NGSS dimensions increased from 5% (*n* = 1) in the pre-training survey to 29% (*n* = 6) in the post-training survey; the area of science for their grade level increased from 5% (*n* = 1) to 38% (*n* = 8); developing training plans went from 10% (*n* = 2) to 57% (*n* = 12); and teaching adult learners went from 29% (*n* = 6) to 52% (*n* = 11) (Figure 1). At the end of the teacher leader training sessions, all teacher leaders were very or somewhat knowledgeable with these aspects; no one gave a rating of not at all knowledgeable.

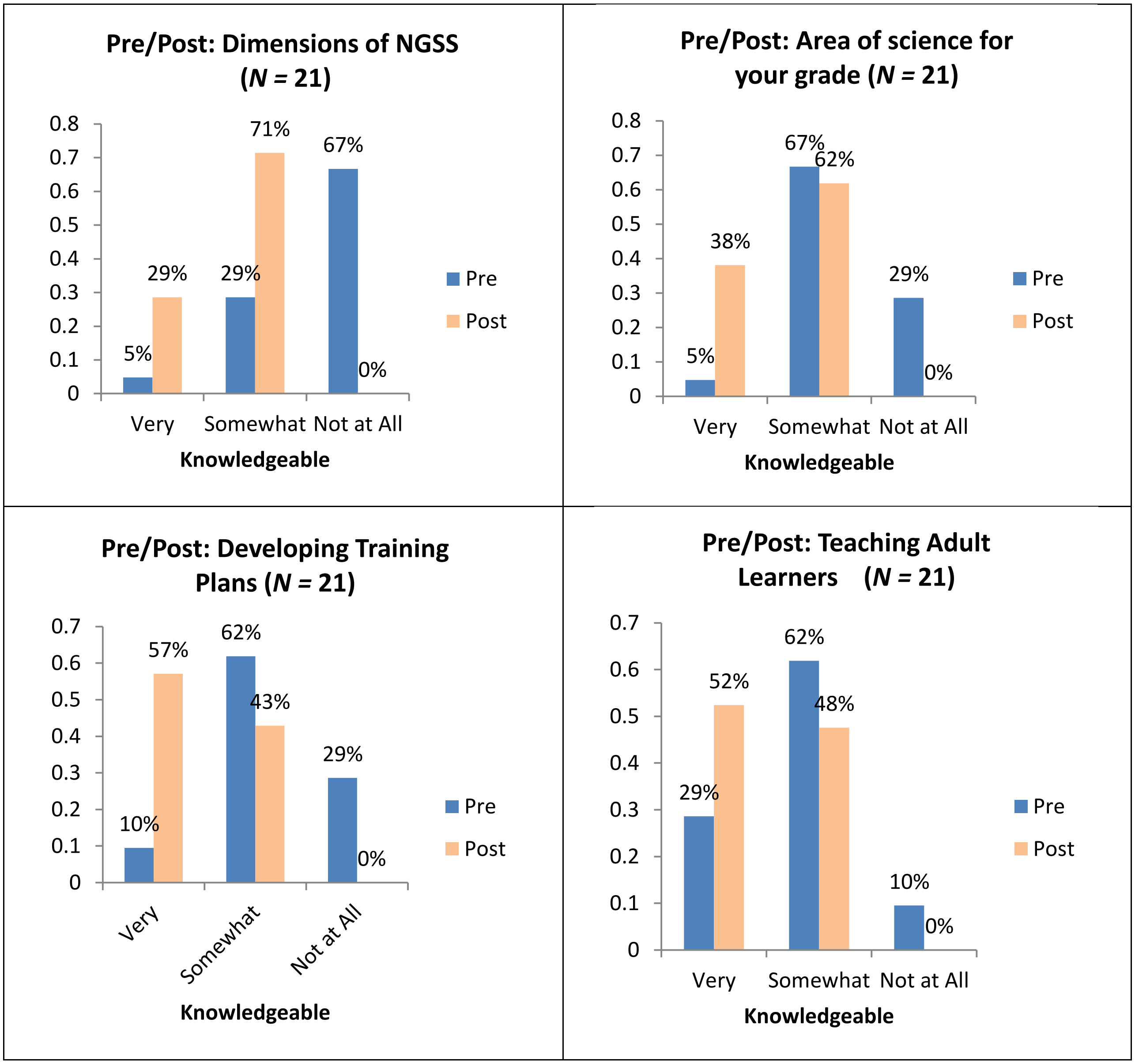

Figure 1. Pre/post ratings of knowledge of: NGSS dimensions, grade-level science area, developing training plans, and teaching adult learners.

Teachers leaders were asked in both the pre- and post-training surveys to rate their knowledge of the NGSS practices: Asking Questions and Defining Problems, Planning and Carrying Out Investigations, and Analyzing and Interpreting Data (Figure 2). Although the practice, Developing and Using Models, ended up being an area of focus for the teacher leaders and SSI, the knowledge for this practice was not asked in the pre-training survey. As a result, this practice is not included in Figure 2.

Once again, the percentage of teacher leaders rating their level of knowledge as very or somewhat knowledgeable increased from the pre- to the post-training survey. The very knowledgeable rating for the NGSS practices went from 5% (n = 1) to 38% (n = 8); the practice, Asking Questions and Defining Problems, went from 10% (n = 2) to 33% (n = 7); the practice, Analyzing and Interpreting Data, went from 0% to 29% (n = 6); and the practice, Planning and Carrying Out Investigations, went from 0% to 71% (n = 15) (Figure 2). None of the teacher leaders gave a not at all rating in the post-training survey of these NGSS practices.

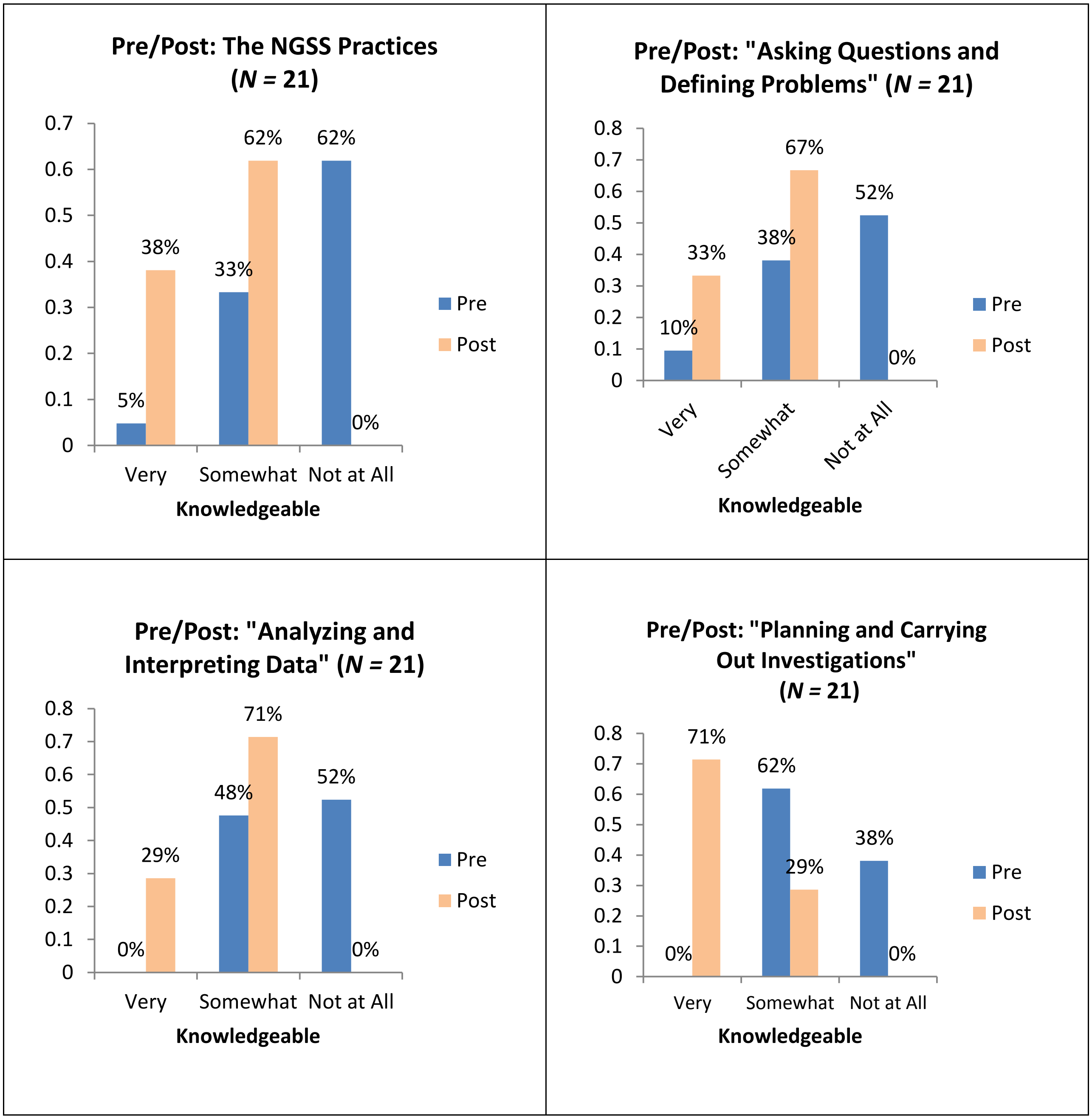

Figure 2. Pre/post ratings of knowledge of overall and selected NGSS practices.

Changes in ratings of knowledge. Additionally, each teacher leader's pre- and post-training ratings of their knowledge of the NGSS practices, the science discipline area for their grade level, and teaching adult learners, was compared. Changes in differences of ratings were coded as: increased, stayed the same, or decreased.

Most of the 21 teacher leaders had an increase in their ratings of reported knowledge of the NGSS dimensions, the overall NGSS practices, and three of the NGSS practices: Asking Questions and Defining Problems, Developing and Using Models, and Planning and Carrying Out Investigations. For example, a teacher leader may have given a pre-training rating of not at all knowledgeable for the practice, Analyzing and Interpreting Data, and in the post-training survey gave a rating of somewhat knowledgeable. Only a few reported the same knowledge rating in both the pre- and post-training surveys (Table 9). Just under one half of the teacher leaders' knowledge ratings increased from the pre- to post-training survey when asked about the area of science discipline for their grade level and about teaching adult learners.

Table 9
Number of Teacher Leaders' Change in Knowledge Pre vs. Post Survey

	(*N* = 21)		
Measured Areas of Knowledge	Increased	Stayed Same	Decreased
Dimensions of NGSS[a]	17	3	0
The area of science discipline that each of your grade-level units fall under	9	11	0
Developing professional training plans	14	6	0
Teaching adult learners	10	8	2
The NGSS practices	17	3	0
NGSS practice: Asking Questions and Defining Problems	15	4	1
NGSS practice: Planning and Carrying Out Investigations	19	1	0
NGSS practice: Analyzing and Interpreting Data	16	4	0

Note. Reported ratings, using a 3-point scale (very, somewhat, not at all), were compared.

Comfort level teaching subject areas. Teacher leaders were asked to rate their comfort level teaching science, mathematics, reading/language arts, and social studies in a pre-training and post-training survey. A 5-point scale ranging from 1 = not at all, to 5 = extremely, was used. The ratings for all the subjects increased a little from pre-training to post-training surveys, but the increase in science was the largest (Figure 3). Ratings of comfort level teaching science went from 55% (n = 11) of participants reporting being extremely comfortable before training to 81% (n = 17) reporting being extremely comfortable rating after the training.

Among the 19 participants who had both pre- and post-scores, 6 gave a higher rating on their post-training survey than their pre-training survey in their comfort teaching science; 13 rated their comfort at the same level; and no one gave a lower rating (Table 10).

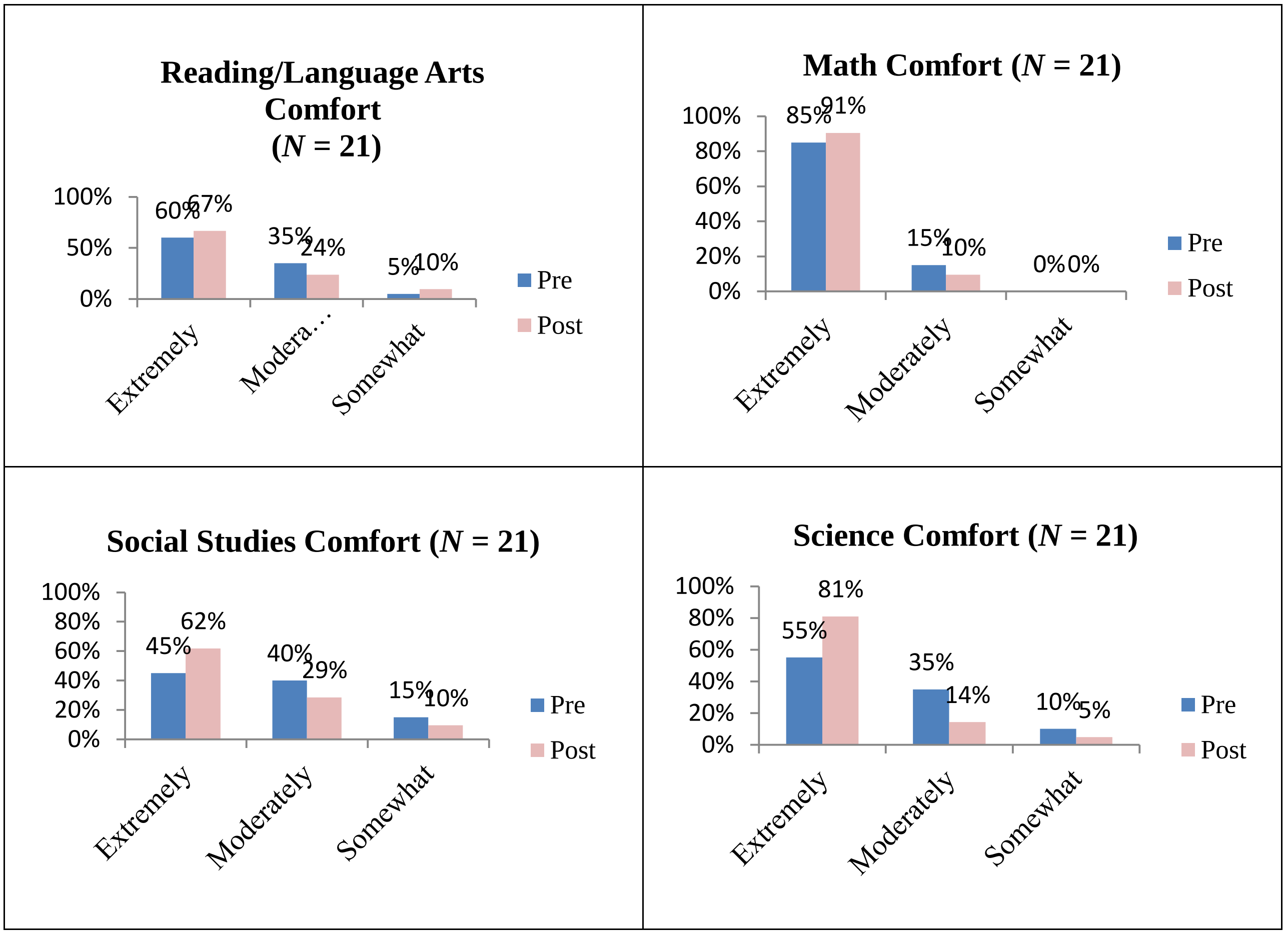

Figure 3. Pre/post comfort level with subject areas.

Table 10
Number of Teacher Leaders' Change in Subject Comfort Level Pre vs. Post Survey

		Increased	Stayed Same	Decreased
Subject	*N*	*n*	*n*	*n*
Reading/Language Arts	18	2	14	2
Math	19	1	18	0
Social Studies	19	5	13	1
Science	19	6	13	0

Note. Only responses with pre and post data could be used.

Comfort with NGSS practices. In the post-training survey administered at the last training in May, all of the teacher leaders were asked to rate their comfort level with creating a lesson around four practices: Asking Questions and Defining Problems, Developing and Using Models, Planning and Carrying Out Investigations, and Analyzing and Interpreting Data. Although Grade 5 teachers designed a training plan focused on the practice, Developing and Using Models, and the Grades 2 through 4 teachers designed a training plan focused on the practice, Planning and Carrying Out Investigations, they all were exposed to these four practices during the span of training sessions and therefore were asked their comfort level with all.

In the post-training survey, all teacher leaders gave a rating of somewhat, moderate, or extremely comfortable; no one gave a rating of slightly or not at all comfortable (Figure 4). One half (*n* = 10, 48%) reported they were extremely comfortable with the practice, Asking Questions and Defining Problems. Just under one half (*n* = 9, 43%) were extremely comfortable incorporating the practice, Developing and Using Models, which is what the Grade 5 teachers focused on. One half (*n* = 11, 52%) of the teacher leaders reported they were extremely comfortable with the practice, Planning and Carrying Out Investigations, which was the focus for the Grades 2–4 teachers. Finally, one third (*n* = 7, 33%) reported that they were extremely comfortable with the practice, Analyzing and Interpreting Data.

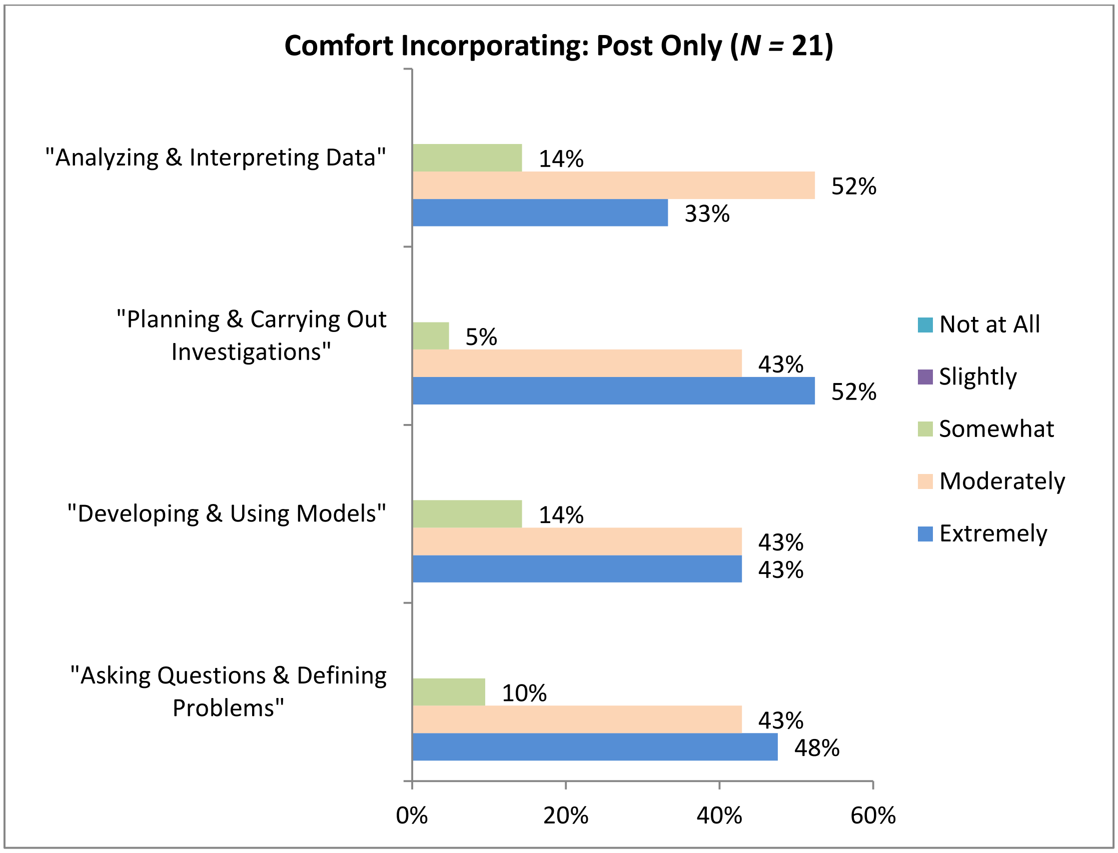

Figure 4. Comfort level creating a lesson around selected practices.

Important aspects of training. At the end of the January, March, and April teacher leader training sessions, participants were asked in an open-ended question to identify the most important thing gained from the training. In May, they were asked about the most important thing they gained from working on the project. The most important gains reported across the teacher leader training sessions were teaching adult learners, learning about NGSS and the practices, and time to work on their plan and with their team. The most frequently mentioned important aspects for each training session are shown below in Table 11.

Table 11
Important Aspects of Training Sessions Reported by Teacher Leaders

Training Session	Important Aspects from Training (Jan, March, April)/ Important Gains from Project (May)
PD1: January (N = 22)	• Learning about NGSS and the practices (n = 11) • Understanding the expectations for the project (n = 5) • Networking with other teachers (n = 5)
PD3: March (N = 20)	• Time to work on plan, time to work with team (n = 9) • Expectations, understanding of how to build training plan, knowledge (n = 5) • Support, support on training plan, on using NGSS website and standards (n = 3) • Miscellaneous other (n = 3)
PD4: April (N = 18)	• Teaching adult learners (n = 14) • Time to work with our groups (n = 6) • Miscellaneous Other (n = 1)
PD5: May (N = 19)	• NGSS Standards, connections to curriculum 2.0 (n = 7) • Training plans, being a leader (n = 7) • Improving teaching (n = 3) • Working with others (n = 2) • Attending Boston Conference (n = 2) • Miscellaneous other (n = 2)

Suggestions for improving the training. At the end of four of the five teacher leader training sessions, teacher leader participants were asked, "Was there anything that would have been more effective had it been done differently?" There were no common suggestions mentioned by more than three respondents, but many left positive comments about the training and trainers rather than suggestions.

Plans to use new knowledge. At the last PD day in May, participants were asked in an open-ended question, "In what ways will you use what you've learned in your science instruction?" One half (n = 10) reported that they plan to implement more of NGSS, and one third (n = 7) gave specific examples of changes they plan to make in the classroom. For example, one teacher responded, "I will approach planning with my team differently, using NGSS, and make sure each of my lessons includes the NGSS;" and another responded, "[I will] change lessons to incorporate more NGSS practices and hand-on applications in the classroom." Another wrote, "I will continue to incorporate what I've already learned—making sure that students understand the steps for carrying out experiments. I've spent a lot of time clearing up misconceptions as well."

Impact of grant project on teacher leaders. At the last PD day in May, participants were asked the open-ended question, "How has the work on this Howard Hughes Grant impacted your capacity to be a science leader in your school?" Of the 21 respondents, 16 answered the question. The two themes that emerged were: adult learners/delivering PD/educating others (n = 8); and planning science and STEM at school (n = 6). For example, for the first theme, one teacher responded, "[It has] given me the confidence and strategies to teach adult learners;" and another replied, "Wow! The work has impacted me so much! I have gained so much knowledge that I am now able to share and educate others." For the second theme, one teacher wrote, "[It has] dramatically changed my understanding and my capability to lead change in how science is being taught at my grade level." Another replied, "[I have a] much better understanding of important science standards and helping my team in planning meaningful lessons."

Findings Related to the Science Summer Institute

Question 4: How were the PD activities for the SSI implemented?

The SSI was advertised to Grades 2 through 5 teachers on the MCPS Professional Development Online (PDO) system. Information about the institute also was shared with principals during a meeting, and e-mailed to a pre-existing list of elementary teachers and staff development teachers. The SSI was held for five days, June 23–27, and a total of 68 teachers participated. Initial registration for SSI was 100 teachers, which was the goal of this initiative. However, prior to the start of SSI, a mandatory training was announced for many of the teachers, and a number of teachers had to cancel their enrollment in SSI.

Sessions were created and led by the teacher leaders who received PD throughout spring 2014. The week-long session was delivered to grade-level breakout groups; a total of four sessions were conducted simultaneously (Grades 2 through 5 teachers). An overview of the weeks' sessions may be viewed in Appendix B.

All grade-level sessions included:

- Exploration of NGSS, using Paul Anderson's video series (Anderson, 2014).
- Exploration of a specific NGSS science practice
    - o Grade 5—Practice: Planning and Carrying Out Investigations
    - o Grades 2 through 4—Practice: Developing and Using Models
- Participants (individually or in a small group) further enhanced a lesson seed from their grade-level curriculum, while incorporating their targeted NGSS science practice. Time was given throughout the week to work on their lesson. Lessons were presented to the rest of the grade-level group at the end of the SSI week. Several of the lessons will be placed on the MCPS share site for other science teachers to access.
- Exploration of various assessment probes using Page Keeley's *Uncovering Student Ideas in Science* book series (Keeley, 2005–2009).
- Activity(s) which incorporated engineering design.

Sessions also may have included, depending on the grade level: a connection between literacy and science, samples of lesson upgrades using current lesson seeds, and technology spotlights (tips on online or technology resources that can be used).

Question 5: What were the characteristics of the SSI participants and their perceptions of science instruction and culture?

Characteristics. Teachers participating in the SSI were fairly evenly divided among Grades 2–5 teachers; there were also two specialists participating (Table 12). A wide range of years of experience was reported by the participants with 17% in their first or second year of teaching at MCPS, and almost one third having more than 10 years' experience teaching at MCPS and teaching science.

Table 12
Characteristics of SSI Participants

SSI Participant Characteristics	Total Teacher Leaders (N = 68) n	%
Position for upcoming school year		
Grade 2 teacher	18	26.5
Grade 3 teacher	14	20.6
Grade 4 teacher	21	30.9
Grade 5 teacher	13	19.1
Specialists (ESOL and Math)	2	2.9
Total years teaching MCPS		
1 year (last year 1st year)	6	8.8
2 years	6	8.8
3–4 years	8	11.8
5–7 years	13	19.1
8–10 years	13	19.1
More than 10 years	22	32.4
Total years teaching Science		
0	1	1.5
1 year (last year 1st year)	6	8.8
2 years	5	7.4
3–4 years	11	16.2
5–7 years	14	20.6
8–10 years	9	13.2
More than 10 years	22	32.4

STEM PD experience. Teachers who participated in the SSI reported a variety of STEM PD experience as seen in Table 13. The top mentions were: science kit training (16%), personal STEM exploration such as webinars (16%), and being an MSDE STEM representative (12%).

Table 13
STEM PD Experience Reported by SSI Participants

STEM PD Experience	Total SSI Participants (N = 68) n	%
Science kit training	11	16.2
Personal STEM exploration such as webinars	11	16.2
MSDE STEM representative for Educator Effectiveness Academy	8	11.8
MCPS PDO science course offering	6	8.8
STEM rep at school	5	7.4
STELP participant	3	4.4
Attended NSTA Conference	3	4.4
STEM institute at Carderock	3	4.4
College Level STEM course	3	4.4
STEM Master's program	1	1.5
Other (ONOW workshop, ESLP cohort, school training, none, etc.)	6	8.8

Note. Participants could choose more than one option. ONOW = Our Neighborhood, Our Watershed; ESLP = Elementary Science Leadership Program.

School level participation. Thirty-eight schools had staff participating in the SSI. Of the 38 schools, 21 had one teacher participating, and 10 had two teachers participating (Table 14). Seven schools had three to five teachers who participated in the SSI.

Table 14
School Level Participants

Number of Teachers Participants from the Same School	Total Number of Schools Represented (*N* = 38) *n*
1 teacher participant	21
2 teacher participants	10
3 teacher participants	3
4 teacher participants	2
5 teacher participants	2

School STEM personnel. Less than one half (41%) of the participants reported that their school has a science or STEM committee, and less than one third (29%) have a science or STEM focus teacher position at the school (Table 15).

Table 15
STEM School Personnel Reported by SSI Participants (*N* = 68)

	Yes		No		Not Sure/No Answer	
School STEM Personnel	*n*	%	*n*	%	*n*	%
Science or STEM committee at school	28	41.2	27	39.7	13	19.1
Science or STEM focus teacher position at school	20	29.4	39	57.4	9	13.2

Science instructional time. When SSI participants were asked on average, how many minutes of science they taught per week during the last school year, teacher participants reported a range of 0–300 minutes per week with an average of 120 minutes per week, as well as a median of 120 minutes (standard deviation of 62).

Comfort level teaching science. At the beginning of the SSI, participants were asked to rate their comfort level with teaching science as well as teaching reading, math, and social studies. About one half (54%) said they were very or extremely comfortable teaching science (Table 16). Over 86% of the same teachers reported that they were feeling extremely or very comfortable teaching reading, and 87% extremely or very comfortable teaching math.

Table 16
Subject Teaching Comfort Level Reported by SSI Participants Before Training

	Total SSI Participants					
	Extremely/Very Comfortable		Somewhat Comfortable		Not all/Slightly Comfortable	
Subject	*n*	%	*n*	%	*n*	%
Reading/Language Arts (*N* = 64)	55	85.9	5	7.8	4	6.3
Mathematics (*N* = 67)	58	86.6	7	10.4	2	3.0
Social Studies (*N* = 65)	38	58.5	24	36.9	3	4.6
Science (*N* = 67)	36	53.7	22	32.8	9	13.4

School STEM culture. One half of the participants reported that their school holds family science or engineering events; 43% reported that their school offers science or engineering after-school programs; 34% reported that their schools offers science or engineering clubs; and 24% reported that their school participates in a science fair or event (Table 17).

Table 17
STEM School Activities Reported by SSI Participants

	Total SSI Participants (*N* = 68)	
School STEM Activities	*n*	%
Hold family science and/or engineering nights/events	34	50.0
Offer after school programs for science and/or engineering enrichment	29	42.6
Offer one or more science and/or engineering clubs	23	33.8
Participant in local or regional science or engineering fair/event	16	23.5
Visit to science/engineering sites	12	17.6
Sponsors meeting with science or engineering professionals	6	8.8
Host AAAS volunteers in your science classrooms	1	1.5
Other science or engineering activities outside of classroom instruction	8	11.8

When given a list of aspects to rate on whether certain areas of school science culture hindered or promoted their effective instruction, participants were split (Table 18). Using a 5-point scale, one half (52%) of the participants rated time available for science PD, a 1 or 2, where 1 = hindered effective instruction. Just under one half (45%) rated availability of science resources, and 42% rated time to plan a 1 or 2 (i.e., hindered their instruction).

Table 18
School Science Culture Reported by SSI Participants

	Total SSI Participants (N = 67)							
	Hindered Effective Instruction = 1/2[a]		Neutral = 3		Promoted Effective Instruction = 4/5[b]		Don't Know	
Aspects of School Culture	*n*	%	*n*	%	*n*	%	*n*	%
Time available for your own science professional development (outside of planning)	35	52.2	22	32.8	10	14.9	0	0.0
Availability of other science resources such as books or materials to support curriculum instruction	30	44.8	13	19.4	22	32.8	2	3.0
Time that was available for you to plan, individually and/or with colleagues	28	41.8	13	19.4	26	38.8	0	0.0
Contents of materials in the science kits	26	38.8	10	14.9	30	44.8	1	1.5
Importance that your school places on science	16	23.9	26	38.8	22	32.8	3	4.5
Administrative support that was provided	7	10.4	37	55.2	19	28.4	4	6.0
Parent expectation and involvement	6	9.0	42	62.7	12	7.9	7	10.4

[a]Ratings 1 and 2 on a 5-point scale, were combined, where 1 = hindered effective instruction.
[b]Ratings 4 and 5 on a 5-point scale, were combined, where 5 = promoted effective instruction.

Participants were given the opportunity to list anything else that hindered effective science teaching in their classroom. Other hindrances mentioned were time in the schedule to teach science and lack of science content knowledge or PD. Many participants who answered this question elaborated on the indicators they rated as hindered effective instruction. All of the verbatim comments may be seen in Appendix C.

Question 6: What were the immediate outcomes of the SSI (i.e., perception, knowledge, and comfort level)?

Perceptions of SSI. At the end of the SSI, all or almost all participants strongly agreed or agreed with aspects about the SSI including: seeing a relevant connection with their science instruction (100%); objectives were met (100%); trainers were knowledgeable and well-prepared (100%); they were given appropriate tools to modify a lesson (99%); there was a comfortable environment (100%); they had time to process and reflect (99%); there were clear expectations (100%); questions were answered adequately (100%); and there was a good understanding of how to implement the practice they learned (99%). These are shown in Table 19. They especially could see a relevant connection between what they learned and science instruction in their classroom (92% strongly agreed), and that the objectives were met and trainers were knowledgeable and prepared, with 86% strongly agreeing with these statements.

Table 19
Perceptions of SSI Reported by Participants

Aspects of SSI	Total SSI Participants (N = 66)							
	Strongly Agree		Agree		Disagree		Strongly Disagree	
	n	%	*n*	%	*n*	%	*n*	%
I could see a relevant connection between what I learned this week and science instruction in my classroom.	61	92.4	5	7.6	0	0.0	0	0.0
The objectives of the summer institute were met.	57	86.4	9	13.6	0	0.0	0	0.0
The trainers were knowledgeable and well-prepared.[a]	56	86.2	9	13.8	0	0.0	0	0.0
I was given the appropriate tools to modify a Curriculum 2.0 Lesson Seed with a NGSS practice.	54	81.8	11	16.7	1	1.5	0	0.0
An environment was created in which I felt comfortable taking risks (i.e., asking questions, expressing my ideas, working with unfamiliar content).	51	77.3	15	22.7	0	0.0	0	0.0
Opportunities were provided for me to process and reflect upon the application of the knowledge and skills learned.	51	77.3	14	21.2	1	1.5	0	0.0
The expectations for what myself or team was accomplish were clear.	46	69.7	20	30.3	0	0.0	0	0.0
My questions during the summer institute were answered adequately.	45	68.2	21	31.8	0	0.0	0	0.0
I have a good understanding of how to implement my grade levels' NGSS practice in my classroom.	43	65.2	22	33.3	1	1.5	0	0.0

[a]N = 65.

SSI participants from Grades 2–4 learned knowledge and skills for the NGSS practice, Developing and Using Models, and were asked survey questions surrounding that practice. Grade 5 participants learned knowledge and skills for the NGSS practice, Planning and Carrying Out Investigations, and were asked survey questions surrounding that practice.

At the end of the SSI, a vast majority of the participants found the following aspects very helpful (see Table 20): modifying a lesson seed using the practice they learned about (93% among Grades 2–4 staff and 92% among Grade 5 staff); learning about their assigned NGSS practice (93% among Grades 2–4 staff and 83% among Grade 5 staff); learning about best practices using the science kits (89%); using formative assessment probes (86%); and listening to grade-level presentations on modifying a lesson seed (83%).

Table 20
Helpfulness of SSI Activities Reported by Participants

Aspects of SSI	Very Helpful n	Very Helpful %	Somewhat Helpful n	Somewhat Helpful %	Not at All Helpful n	Not at All Helpful %
Grades 2–4 staff respondents (*N* = 54)						
Modifying a lesson seed using the practice “Planning and Carrying Out Investigations” to implement in the coming school year	50	92.6	4	7.4	0	0.0
Learning about the NGSS practice, Planning and Carrying Out Investigations	50	92.6	4	7.4	0	0.0
Grade 5 staff respondents (*N* = 12)						
Modifying a lesson seed using the practice, Developing and Using Models. to implement in the coming school year	11	91.7	1	8.3	0	0.0
Learning about the NGSS practice, Developing and Using Models	10	83.3	2	16.7	0	0.0
All staff respondents (*N* = 66)						
Learning about best practices using the science kits to meet the needs of Curriculum 2.0	59	89.4	7	10.6	0	0.0
Utilizing formative assessment probes	57	86.4	9	13.6	0	0.0
Listening to grade-level presentation on modifying a lesson seed	55	83.3	10	15.2	1	1.5

As shown in Table 21, a vast majority of SSI participants reported that the SSI had a major effect on their ability to modify a lesson (89% among Grades 2–4 teachers and 92% among Grade 5 teachers). Almost three fourths (74%) reported there was a major effect on their ability to use the science kits more, and two thirds (67%) reported a major effect on their understanding of the NGSS practices. More than one half (62%) reported a major effect on their science content knowledge.

Table 21
Effect of SSI Reported by Participants

	Total SSI Participants (N = 66)							
Aspects of SSI	Major Effect n	Major Effect %	Moderate Effect n	Moderate Effect %	Minor Effect n	Minor Effect %	No Effect n	No Effect %
Grades 2–4 staff respondents (*N* = 54)								
Ability to modify a lesson using the practice, Planning and Carrying Out Investigations	48	88.9	6	11.1	0	0.0	0	0.0
Grade 5 staff respondents (*N* = 12)								
Ability to modify a lesson using the practice, Developing and Using Models	11	91.7	1	8.3	0	0.0	0	0.0
All staff respondents (*N* = 66)								
Ability to use the science kits more effectively in your room	49	74.2	15	22.7	1	1.5	1	1.5
Understanding of the NGSS practices	44	66.7	22	33.3	0	0.0	0	0.0
Science content knowledge	41	62.1	16	24.2	8	12.1	1	1.5

When asked to rate their overall experience with the SSI, most (95%) rated it excellent on a 5-point scale, and no one gave it a rating of average, poor, or very poor.

Content knowledge. Not surprisingly, at the beginning of the SSI week, most participants reported they were not at all knowledgeable with the practice, Planning and Carrying Out Investigations (89%); the practice, Developing and Using Models (67%); the NGSS practices (80%); and the three dimensions of NGSS (80%), shown in Table 22. After the week-long SSI, teachers' reported knowledge shifted in all three of these areas in the post-training survey. Most participants were very knowledgeable with the practice, Planning and Carrying Out Investigations (82%) and the practice, Developing and Using Models (100%). The largest percentage of respondents rated their knowledge as somewhat for the three dimensions of NGSS (71%) and the NGSS practices (60%).

Additionally, at the beginning of the week, only 14% said they were very knowledgeable about the area of science discipline for their grade level, while at the end of the week, 61% said they were very knowledgeable.

Table 22
Knowledge Reported by SSI Participants

	Total SSI Participants (N = 66)											
	Pre-Training Knowledgeable						Post-Training Knowledgeable					
	Very		Somewhat		Not at All		Very		Somewhat		Not at All	
Measured Areas of Knowledge	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Grades 2–4 staff respondents (N = 54)												
The NGSS practice, Planning and Carrying Out Investigations	0	0.0	6	11.1	48	88.9	44	81.5	9	16.7	1	1.9
Grade 5 staff respondents (N = 12)												
The NGSS practice, Developing and Using Models	1	8.3	3	25.0	8	66.7	12	100.0	0	0.0	0	0.0
All staff respondents (N = 66)												
The area of science discipline under which each of your grade-level units falls	9	13.8	34	52.3	22	33.8	40	60.6	25	37.9	1	1.5
The NGSS practices	1	1.5	12	18.2	53	80.3	25	38.5	39	60.0	1	1.5
The three dimensions of NGSS	0	0.0	13	19.7	53	80.3	17	26.2	46	70.8	2	3.1

Comfort level teaching NGSS practice. In the pre- and post-training surveys, participants were asked their comfort level with modifying a lesson around the NGSS science practice that their grade level learned about during the week. Grades 2–4 teachers learned about the practice, Planning and Carrying Out Investigations, and the Grade 5 teachers learned about the practice, Developing and Using Models. Table 23 shows that only 17% of Grades 2–4 teachers were extremely or very comfortable with the practice, Planning and Carrying Out Investigations at the start, but most all (96%) were extremely or very comfortable at the end of the week. Also, among Grade 5 teachers, only 17% were extremely or very comfortable with the practice, Developing and Using Models at the start, but 100% were extremely or very comfortable at the end of the week.

Table 23
NGSS Practice Comfort Level Reported by SSI Participants

NGSS Practice	Pre-Training Comfortable: Extremely/ Very *n*	%	Somewhat *n*	%	Slightly/ Not at All *n*	%	Post-Training Comfortable: Extremely/ Very *n*	%	Somewhat *n*	%	Slightly/ Not at All *n*	%
Grades 2–4 staff respondents (*N* = 54)												
The NGSS practice, Planning and Carrying Out Investigations	9	16.7	19	35.2	26	48.1	52	96.3	2	3.7	0	0.0
Grade 5 staff respondents (*N* = 12)												
The NGSS practice, Developing and Using Models	2	16.7	3	25.0	7	58.4	12	100.0	0	0.0	0	0.0

Note. Only responses with pre and post data could be used.

Sharing new knowledge. After attending the SSI, participants were asked if and how they would share what they've learned. All participants who took the post-training survey said they definitely will share (67%) or probably will share (33%).

Table 24 shows that more than three fourths (80%) plan to share at a grade-level meeting, and two thirds (68%) plan to share with a colleague. One third, or almost one third, plan to share at a staff-level meeting (33%) or a science or STEM committee (32%).

Table 24
Sharing New Knowledge Reported by SSI Participants

Plans to Share Knowledge	Total SSI Participants (*N* = 66) *n*	%
Share at a grade-level meeting	53	80.2
Share with a colleague	45	68.2
Share at a staff meeting	22	33.3
Share with the Science or STEM committee	21	31.8
Other: specified administration, leadership team and/or staff development teacher	8	12.1
Other: PTA, other grade levels, STEM teacher, parents	5	7.6

Note. Respondents could choose more than one response.

Support needs. Participants were asked in the post-training survey what support they anticipated needing over the next school year to help them successfully implement the learned NGSS practice in their classroom. From a list given to the respondents, most indicated that they would like online resources and materials (91%); almost one half chose more PD (47%); and one third indicated that they would like a grade-level mentor that they could contact (Table 25).

Almost one fourth (24%) of the participants indicated that they would like an onsite visit from a trainer or coach.

Table 25
Support Needs Reported by SSI Participants

Support Needs	Total SSI Participants (*N* = 66) *n*	%
Online resources and materials	60	90.9
More PD session(s)	31	47.0
A grade-level mentor that I can contact	22	33.3
On site visit from a trainer or coach	16	24.2
Other (specify): sharing of resources, more time, principal's knowledge, peer visits, materials, staff meeting trainer, e-mail with trainer, collaborative planning sessions with team, kits to align to new standards	10	15.2

Note. Respondents could choose more than one response.

Participants were asked the specific question, "If there was an opportunity for a science coach to come visit you or your team to provide onsite support to implement your grade-level NGSS practice, how interested would you be?" A vast majority of participants (86%) were extremely interested or very interested (Table 26).

Table 26
Interest in On-Site Science Coach Reported by SSI Participants

	Total SSI Participants (*N* = 65)							
	Extremely Interested		Very Interested		Might or Might Not be Interested		Not at all Interested	
	n	%	*n*	%	*n*	%	*n*	%
Science coach to provide onsite support to you or your team	41	62.1	16	24.2	8	12.1	1	1.5

Most important aspects. In an open-ended question asking what they found to be the most important aspects of the SSI, participants reported learning: how to upgrade lesson seeds, about NGSS and the connection to curriculum 2.0, how to make science more engaging and hands-on, and about resources and what strategies were important (Table 27). They also found the following items important: how to carry out investigations, sharing and working with other grade-level teachers, and how to integrate science with other subjects.

Table 27
Most Important Aspects Reported by SSI Participants

Most Important Aspects (Open-Ended Responses)	Total SSI Participants (*N* = 65) *n*	%
How to upgrade lesson seeds	18	27.7
Learning about NGSS/Connection to curriculum 2.0	14	21.5
How to make science more engaging, hands on, have student ownership	13	20.0
Resources/strategies	13	20.0
How to plan and carry out investigations	10	15.4
Share/work with other grade-level teachers	8	12.3
How to integrate with other subjects	7	10.8
Probes to use	6	9.2
Discovering/eliminating misconceptions	4	6.2
Other	6	9.2

Note. Respondents could provide more than one response.

Suggestions. Participants were asked the open-ended question, "Was there anything about the SSI you think would have been more effective if it were done differently?" Less than one half of the participants (*N* = 31) left a response (Table 28). Out of those responding participants, suggestions were: to gain more ideas and take-aways; that there was too much filler and busy work; that they want more time during the institute (i.e., a second week or shorter lunches); and they want more or deeper content and better computers during training. Almost one third (29%) of the responding participants left an assortment of suggestions that were each unique and therefore were not categorized.

Table 28
Suggestions Reported by SSI Participants

Suggestions (Open-Ended Responses)	Total SSI Participants (*N* = 31) *n*	%
Want more ideas: for each quarter, challenges for each units, which lessons to rewrite, more examples, take-aways	7	22.6
There was too much filler/busy work/a lot of work time	4	12.9
Want more time: more computer time, second week, shorter lunches, more time	4	12.9
Want more content/deeper content	4	12.9
Faster, better computers/access to printer	4	12.9
More curriculum background/separate new teachers	2	6.5
Other: a variety of different suggestions	9	29.0

Other comments. Participants were given the opportunity to leave comments at the end of the post-training survey. These comments were primarily gratitude towards the trainers and praises for the SSI.

Summary

The training and PD provided for Grades 2–5 teacher leaders and teachers greatly increased their overall knowledge of the NGSS science practices and their knowledge and comfort level for the specific NGSS practice that was a focus for their grade-level training.

Overall, teacher leaders expressed positive experiences with the training provided to them, where they learned about NGSS practices and developed a training plan for the SSI. They reported the objectives of the training were met, trainers were knowledgeable, expectations were clear, and the sessions were helpful to their teams' progress, just to name a few. They also reported an increase in their knowledge of developing training plans, teaching adult learners, the dimensions of NGSS, and the area of science concentrated in the curriculum for their grade level.

Likewise, elementary teachers who attended the SSI were happy with the week-long session. For example, they saw a relevant connection with their own instruction, thought the objectives were met, trainers were knowledgeable, expectations were clear, and now have a good understanding of how to implement what they learned. Most reported that the SSI had a major effect on their ability to modify a lesson using an NGSS practice. Furthermore, most have plans to incorporate what they've learned into their classrooms as well as share what they've learned with other staff at their school. Teacher participants anticipate the need for online resources and materials in the upcoming school year to support them in successfully implementing what they learned about their assigned NGSS practice; many also anticipate a need for more PD and a science mentor or coach. In fact, a large majority reported being extremely or very interested in an onsite science coach to support them.

Future Plans and Recommendations

SSI participants were given the opportunity for a science lead teacher to give them one day of onsite coaching as well as be available to contact for any other assistance if needed. All SSI participants were contacted by program staff at the beginning of the school year, but only approximately a dozen teachers scheduled the onsite coaching.

Another SSI will take place in the summer of 2015 and throughout the 2015–2016 school year. The second SSI will target elementary classroom teachers who did not participate in the first year.

The following recommendations are to provide feedback for the program's improvement and ongoing development and are based on findings from year one of the evaluation.

- Explore ways to target and recruit more elementary school classroom teachers to participate in the SSI. Enrollment for the first SSI was lower than anticipated, mainly due to scheduling conflicts with another mandatory training.
- Consider spending more time on lesson seeds for science instruction and resources during the SSI, as suggested by participants.
- Continue to provide and expand online science instructional support, resources, and materials for elementary classroom teachers and explore ways to encourage their use.

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Appendix A

Science, Technology, and Engineering
Montgomery County Public Schools
TRAINER APPLICATION – 2013-2015 SCHOOL YEARS

Job Title:	Elementary Science Lead Teacher Trainer	**Send in application by:**	November 15, 2013

Responsibilities:

- Collaborate with STE team members and other Elementary Science Lead Teacher Trainers to plan, prepare and facilitate grade-level professional development trainings.
- Align curriculum instruction with the scientific and engineering practices outlined in the Next Generation Science.
- Deliver grade-level professional development to teachers in in the form of an elementary science institute during the summer of 2014.
- Develop and deliver follow up grade-level specific science professional development quarterly during the 2014 – 2015 school year.

Training Location:	CESC & multiple MCPS school based locations	**Training Dates:**	TBD
Job Role:	Trainer	**Payment:**	Stipend

Skills:

- Proven excellent leadership skills
- Solid communication skills
- Strong critical and analytical thinking skills
- Demonstrated ability to meet the needs of diverse groups of learners
- At least one year of successful science instruction at the grade level
- Experience delivering professional development and supporting elementary instruction is preferred

Please Send Completed Application to:

Pony:	Carrie Zimmerman CESC Room 253	**Email:**	Carrie_L_Zimmerman@mcpsmd.org

Please submit page two, a letter of recommendation and your current resume

Personal Information

Name	
Outlook Address	
Current Position/Grade Level	
School	
Principal's Name and Contact Information	
Work Phone	
Home Phone	
Cell Phone	

Please respond to each of the following questions using the space provided and attach your letter of recommendation and your current resume.

What grade level(s) are you most comfortable providing professional development if selected to be an Elementary Science Lead Teacher Trainer?

2nd 3rd 4th 5th

Choose one of the science kits you are most familiar with and describe how you used it with your students.

Consider the diversity reflected in classrooms throughout MCPS and the importance of providing instruction that engages and meets the needs of all students. What would a culturally responsive classroom environment look like?

Appendix B

Second Grade Science Summer Institute Overview
June 23 – June 27

Day	Monday, 6/23	Tuesday, 6/24	Wednesday, 6/25	Thursday, 6/26	Friday, 6/27
Morning	HHMI Grant/Purposes Introduce NGSS and Practice “Planning and Carrying Out Investigations” Lesson Seed Upgrade Example	Activator Science through folktales and fairytales Questions that give us questions Example Lesson Seed Upgrade	Activator Introduction to Page Keely and Assessment Probes Explore Habitat Lesson Seeds	**Days’ Focus on marking period 3: Weather** Activator: road blocks Science Kits Marking period 3 overview Science and Literacy	Activator Engineer Design Process Finish lesson seed upgrade – **COMPUTER LAB**
Lunch - 11:20-12:30					
Afternoon	Comfort Level Activity Science Kits Explore Lesson Seeds Form small groups/choose lesson seed upgrade	Activator: Name that Scientist Explore lesson seeds and upgrade Work on lesson seed upgrade – **COMPUTER LAB**	Use Assessment Proble Explore Lesson Seed Upgrade Continue lesson seed upgrade – **COMPUTER LAB**	Continue lesson seed upgrade – **COMPUTER LAB** Probe: rainfall Lesson upgrade example	Lesson Seed Upgrade Presentations

Third Grade Science Summer Institute Overview
June 23 – June 27

Day	Monday, 6/23	Tuesday, 6/24	Wednesday, 6/25	Thursday, 6/26	Friday, 6/27
Morning	HHMI Grant/Purposes Demonstrate variables Introduction/ Expectations Introduce NGSS Discuss Practice “Planning and Carrying Out Investigations”	Activator: Favorite science lesson and link to Practice “Planning and Carrying Out Investigations” Evaluate Methods + Tools for Collecting Data Form Groups for Lesson Seed Upgrade/Select Marking Period Choose Lesson Seed – **COMPUTER LAB**	Activator: Science Pictionary Work on Lesson Seed - **COMPUTER LAB** Gobstopper Activity – Make Predictions if variable changes	Activator: 3-2-1 Summarizer Review Conduct Investigations connected to Practice Explore Force and Motion Probe Feedback about technology comfort	Activator: Solo Cup Engineering Activity Review Elements for Upgraded Lesson Seed Group Work on Lesson Seed
Lunch					
Afternoon	Go through an upgraded Lesson Seed: Popsicle Puzzle Investigate Science Kit Contents Model Example of Practice: Team Juggle Recap	Activator: Connecting Lesson Seed with Practice “Planning and Carrying Out Investigations” Explore Page Keeley’s Assessment Probes and FACTS Group work on Lesson Seed Review/Questions	Activator: Connect Energy State Park with Practice “Planning and Carrying Out Investigations” Engineering Tower Challenge: Testing two different models Group work on Lesson Seed Summarizer	Activator: Probe – Is it Melting? Mini-lesson on Flip charts Work on Lesson Seed – **C. Lab** Mini-lesson on integrating literacy with science **Review/Questions**	Lesson Seed Project Presentations for Grade 3

Fourth Grade Science Summer Institute Overview
June 23 – June 27

Day	Monday, 6/23	Tuesday, 6/24	Wednesday, 6/25	Thursday, 6/26	Friday, 6/27
Morning	Team Builder HHMI Grant/Purposes SSI Expectations/Comfort Survey Introduce NGSS Discuss Practice "Planning and Carrying Out Investigations"	**Days' Focus on marking period 1+2: Ecosystems** Activator on Ecosystems Science Kits Content and Lesson Development	**Days' Focus on marking period 4: Rocks+Minerals** Activator: Assessment Probe- Rocks Science Kits Science and Literacy	**Days' Focus on marking period 3: Weather** Activator: road blocks Science Kits Marking period 3 overview Science and Literacy	Activator Engineer Design Process Finish lesson seed upgrade – **COMPUTER LAB**
Lunch - 11:20-12:30					
Afternoon	Engineering Design Process: Cup Activity Explore Elementary Design Folio Explore Lesson Seeds Form small groups/choose lesson seed upgrade	Work on lesson seed upgrade – **COMPUTER LAB** Content: Lesson seeds and Practice "Planning and Carrying Out Investigations"	Continue lesson seed upgrade – **COMPUTER LAB** Planning and Designing Investigations	Continue lesson seed upgrade – **COMPUTER LAB** Probe: rainfall Lesson upgrade example	Lesson Seed Upgrade Presentations

<u>Fifth Grade Science Summer Institute Overview</u>
June 23 – June 27

Day	Monday, 6/23	Tuesday, 6/24	Wednesday, 6/25	Thursday, 6/26	Friday, 6/27
Morning	HHMI Grant/Purposes Demonstrate variables Introductions Introduce NGSS Discuss Practice "Developing and Using Models" Tower Design Challenge	Explore NGSS Website – **COMPUTER LAB** Introduce probes Probe – Go-Cart Test Run Technology Spotlight – Q1	Probe – Constellations Gravity Assist Design Challenge Technology Spotlight – Q3 Continue lesson seed upgrade – **COMPUTER LAB**	STEM Design Challenges explanation 2 Design Challenge Rotations Continue lesson seed upgrade – **COMPUTER LAB**	NGSS Practices Finish lesson seed upgrade – **COMPUTER LAB** Take-aways from the week
Lunch - 11:20-12:30					
Afternoon	Crane Design Challenge View model lesson upgrade Disciplinary Core Ideas Share expectations for final product Form small groups for lesson seed upgrade	Probe – Battery/Bulb/Wire Circuit Design Challenge Technology Spotlight – Q2 Begin lesson seed upgrade – **COMPUTER LAB**	Probe – Cells & Size Technology Spotlight – Q4 Free Choice – technology exploration, microscope practice, or materials kit assistance Continue lesson seed upgrade – **COMPUTER LAB**	2 Design Challenge Rotations Last Design Challenge Rotation Continue lesson seed upgrade – **COMPUTER LAB**	Lesson Seed Upgrade Presentations

Appendix C

Table C1
Aspects that Hinder Effective Science Instructions Reported by SSI Participants

Hindrances	Verbatim Comments	*n*
Contents of materials in the science kits (*N* = 26)	• Science kits weren't always complete. Some of the items were very old and unusable. • Incomplete science kits - not consistent supplies based on other teammates kits. Minimal direction with materials—consumable or nonconsumable. • Science kit was missing materials to go with lessons to be taught. • Not having all resources needed for experiments inside of the kits. • Incomplete science kits hindered instruction. • Knowledge of materials in science kits. • There were times the materials in the science kit were defective (e.g. corroded batteries). This made the electricity and light lessons very challenging. • Would have been nice to know, or have an idea, about what materials could (or should) be used with certain experiments, particularly the consumable items. Once used, you can't re-use.	8
Time that was available for you to plan, individually and/or with colleagues (*N* = 28)	• The time that was available to review and prepare materials was a factor in completing some of the lessons. • Besides the limited amount of time, I did not have a teammate to plan science instruction. • Planning time and gathering materials from various stores with my own kids in tow. • Lack of time for prep. • Team planning and sharing. • More time for planning would help improve instruction. • Time needed to prepare some of the lesson (materials, set- up, gathering materials, going thru the kits). • Not enough time to plan.	8
Importance that your school places on science (*N* = 16)	• We had a significant number of snow days and delayed openings this year. On these days, reading and math took priority. • Focus on integrated reading/lack of focus on science. • Pressure to have all kindergarten students reading. Lack of support for students w/special needs that were not identified prior to KG. • Time allotted for content instruction (focus is on reading writing). • The many important emphases that demand instructional time. Unfortunately, science's slice of the pie tends to be smaller than that of reading, writing, math, etc. Our kids do not get daily science instruction so it can be hard to get momentum. • Time allotted for science. • The lack of time to teach science. Either science or social studies gets cut depending on how much time is left and how many lessons have not been taught.	7

Table C1
Aspects that Hinder Effective Science Instructions Reported by SSI Participants

Hindrances	Verbatim Comments	*n*
Availability of other science resources such as books or materials to support curriculum instruction (*N* = 30)	• For lessons I developed on my own, I procured additional resources…. Additional materials were required in each quarter in order to deliver the lessons I felt were most beneficial to students • Lack of age appropriate science content materials. Articles provided were not on a 4th grade level, especially for low readers. Lack of hands on activities! Mostly reading/research. • Lack of support (time and resources). PD for science kits. • PD for project based learning and resources to teach project based learning. • Resources available.	5
Other Hindrances Mentioned: Rigid schedule and not enough time in schedule (*N* = 20)	• Rigid scheduling that impedes inquiry based teaching and learning. • Master schedule. • The main struggle was having enough time to complete everything. • Not enough time to allow students to fully engage themselves in lessons. Lack of consistency to carry information from one day to next. • Time allocation. • A lack of time to teach all of the lessons/objectives. • Interrupted schedules. • Time is always an issue - not enough time in the school day to meet the suggested minutes for teaching science. Balancing teaching Science and Social Studies. • Lack of time in a school day. • Scheduling of "specials" which typically left only 25 minutes, 4 days per week for science and social studies (and that time included transitioning for lunch and recess). • Time constrain: There were too many other subjects to cover, but I think that my team had maximized science instructions as much as we could maximized. • Not enough time to teach. • Time is always the biggest factor because science inquiry/experiments generally share a block with social studies. • Time was the main issue because we only had 30-minute time slot and that had to be alternated between science and social studies. • Time—I only had 20/25 minute blocks for science which I could not switch…. • Time for instruction. • No—Just time in the day to teach, while trying to teach all the other subjects as well (always seemed rushed). • Time to teach it—3 days a week with some weeks having 5 seeds. • Being able to choose the best out of 9 weeks of science lessons to present in 4 1/2 weeks. Never enough time. • Time—The curriculum is great. However, trying to get to everything was a challenge!	20

Table C1
Aspects that Hinder Effective Science Instructions Reported by SSI Participants

Hindrances	Verbatim Comments	*n*
Other Hindrances Mentioned: Content knowledge/Professional Development	• Lack of training and knowledge. • Not having a clear understanding of the content per measurement topic. • Knowledge of subjects. • Needed PD to improve science instruction. • Background knowledge/resources provided for building background. Knowledge that I need to research on my own in order to know the science content to teach. • I taught Reading and Language Arts only in 2013–2014. I wanted to attend to really learn more about science and how it can integrate with the other subjects.	6
Other Hindrances Mentioned: Miscellaneous	• Lack of help to conduct experiments. • Working in a portable classroom that does not have easy access to water. • Lack of background knowledge; many students come to us lacking a strong instructional base. Science is taught sporadically and inconsistently in lower grades. • Science curriculum is not engaging for students. • Available field trips that coincide w/ the curriculum. • (Specialists) are generally overlooked and completely disregarded when it comes to professional development, distribution of resources, training and time for planning specially around science. • Nervousness on my part.	7