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STEM Academy for Teachers and Leaders: 2017-18 Coaching and PLC Evaluation

Technical Report 18-03

STEM Academy for Teachers and Leaders: 2017-18 Coaching and PLC Evaluation

Elizabeth L. Adams • Cassandra Hatfield • Caitlin Taylor Cox • Alain Mota • Anthony Sparks • Leanne Ketterlin-Geller

Southern Methodist University

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Department of Education Policy & Leadership
Simmons School of Education & Human Development
PO Box 750114
Dallas, TX 75275-0114
Contact information: rme@smu.edu

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Executive Summary

Despite evidence showing that pursuing a STEM career is promising in terms of job security and pay, several subgroups, including individuals who are Black or Hispanic, women, or from low socio-economic backgrounds, are underrepresented in STEM careers (Tytler & Osborne, 2012; Landivar, 2013; Palmer, Maramba, & Dancy, 2010; Miyake et al., 2010). Dallas Independent School District (ISD) is a large school system serving a majority percentage of students who identify as Black or Hispanic and from low socio-economic backgrounds. In an effort to increase Dallas ISD's student interest and achievement in STEM, district leadership partnered with the Texas Instrument Foundation, Southern Methodist University (SMU), and the O'Donnell Foundation to develop and implement the *STEM Academy for Science Teachers and Leaders*. As a part of the Academy, teachers and leaders engage in two primary components including: (a) intensive summer professional development on the SMU campus, and (b) one-on-one coaching with an SMU coach during the school year. Teachers participate in the STEM Academy for up to three years. This report focuses on the coaching component of the STEM Academy during the 2017-18 school year. The purpose of this report is to describe: (a) the coaching model in detail, (b) participating teachers and their school characteristics, (c) the fidelity of coaching implementation during the first year, and (d) teachers' perceptions of the coaching based on responses to a coaching evaluation survey.

The Coaching Model. The structure of the STEM Academy coaching includes a one-on-one pre-conference, observation, and post-conference, which is defined as a full cycle of coaching. Teachers also participated in a coach-led professional learning community (PLC) meeting during each cycle. During the first year, fifteen teachers engaged in up to seven coaching cycles and PLC meetings with an instructional coach from SMU. The coaching model offered teachers support in understanding and implementing aspects that were learned during the summer professional development academy. These aspects included an emphasis on: (a) active learning, (b) scientific process standards, (c) deepened content knowledge, and (d) differentiation. In addition, during the STEM Academy summer professional development, teachers were encouraged to utilize community-based STEM education resources such as the Dallas Zoo and the Trinity River Audubon Center.

Participating Teachers and their Schools. Fifteen teachers participated in STEM Academy coaching during the first year (2017-18). The majority of teachers taught Grade 8 (60%), identified as Black (53%), and identified as female (80%). These teachers taught in six Dallas ISD middle schools. Relative to the district and state, the schools in which these teachers taught tended to include more Black students, fewer White students, more economically disadvantaged students, and more English Language Learners.

Fidelity of Implementation. On average teachers completed six of the seven targeted coaching cycles, supporting that the STEM Academy coaching was implemented with strong fidelity. During the 2017-18 school year, the SMU instructional coach engaged in 275 coaching sessions (i.e., pre-conferences, observations, or post-conferences), resulting in a total of 91 complete coaching cycles across the school year. On average, the pre-conference occurred in 24 minutes, the observation occurred in 46 minutes, and the post-conference occurred in 25 minutes.

Information on the fidelity of implementation of PLC meetings, in addition to the one-on-one coaching, will be tracked systematically during the 2018-19 academic year.

Teachers' Perceptions of Coaching. Overall, 83% to 91% of teachers agreed or strongly agreed that coaching was a valuable professional development experience and supported their understanding and utilization of active learning strategies including project-based learning (PBL) and maker-based instruction (MBI). Eleven of 12 teachers (92%) responded positively on open-ended items on the coaching evaluation. One teacher said, "[the coach] is one of the most professional, polished yet accessible and personable people with whom I've ever had the pleasure of working. [The coach is] a gem, always reassuring and encouraging me. [The coach] pushes and challenges me just the right amount, motivating me to think outside the box and believe in myself." Teachers felt most positively about the post-conference session, with 100% of teachers agreeing or strongly agreeing that the post-conference encouraged them to use the scientific process standards, implement active learning, reflect on their lesson, and was confidential. In general, teachers also perceived the PLC meetings positively. Almost all teachers (over 90%) agreed or strongly agreed that the PLC delivered high-quality information about active learning.

Teacher responses to the survey indicated opportunities for improvement. With regard to the one-on-one coaching cycles, teachers were least likely to agree that the STEM Academy coaching provided them with the tools necessary to apply community-based STEM education resources in the classroom (58% of teachers agreed or strongly agreed). Additionally, teachers were less likely to agree that the STEM Academy coaching deepened their content knowledge (67% of teachers agreed or strongly agreed). When comparing teachers' perceptions of the post-conference and pre-conference, they were less slightly likely to agree that the pre-conference helped them incorporate scientific process standards or helped increase the personal science content knowledge.

These results support three key recommendations. First, the coaching cycles were perceived favorably by teachers and should continue to be implemented with few, if any, modifications. The model was implemented with strong fidelity and was perceived as an overall valuable experience by teachers that helped them increase their understanding and utilization of active learning and differentiation. Second, the coaching cycles may benefit from an explicit emphasis on deepening content knowledge and incorporating community-based STEM education resources. An emphasis on these goals could be woven into the coaching cycle by adding a question to the coaching pre-conference and post-conference asking teachers how they intend to incorporate community-based STEM education into the lesson or unit of study. Finally, district and school leadership should continue to emphasize and support the implementation of the STEM Academy coaching. In order to affect change in teacher and student outcomes, the STEM Academy coaching should continue to be implemented with a strong level of adherence to the core components of the coaching model including the pre-conference, observation, and post-conference. In order to continue to implement this model with a growing number of teachers, it is critical that district and school leadership continue to emphasize the importance of the one-on-one coaching and PLC meetings and encourage teachers to make these sessions a priority.

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STEM Academy for Teachers and Leaders: 2017-18 Coaching and PLC Evaluation

Background Information

Seven of the ten highest paying starting salaries in the United States require a degree in science, technology, engineering, or mathematics (STEM) (National Association of Colleges and Employers, 2018). However, many students in the United States, particularly female students, students of color, and students from low socio-economic households, are hesitant to consider a STEM career for their future (Tytler & Osborne, 2012; Landivar, 2013; Palmer, Maramba, & Dancy, 2010; Miyake et al., 2010). School leaders in Dallas Independent School District (ISD) were concerned that only 17% of Grade 8 students expressed interest in STEM careers (Perry, Reeder, Brattain, Hatfield, & Ketterlin-Geller, 2017). This statistic is startling because Dallas ISD is situated in a major metropolitan area where many STEM careers exist. A large percentage of students in Dallas ISD identify as students of color or are from low socio-economic backgrounds. In 2017-18, 93% of students identified as Black or Hispanic and 86% of students were economically disadvantaged (Dallas ISD, 2018). In addition, students in Dallas ISD perform lower in science on state standardized tests relative to students in the state of Texas. In 2017, only 41% of Grade 8 students in Dallas ISD performed at grade level on the state standardized test in science; whereas, 52% of students in the state of Texas were at grade level on the same measure (TEA, 2018).

Based on this evidence, Dallas ISD identified a need to increase students' interest, motivation, and achievement in STEM, focusing specifically on science. Dallas ISD partnered with Southern Methodist University (SMU), the Texas Instruments Foundation, and the O'Donnell Foundation to develop, implement, and evaluate the *STEM Academy for Science Teachers and Leaders*. The STEM Academy was designed to increase Dallas ISD middle school students' science interest, motivation, and achievement by first increasing middle school science teachers': (a) utilization of inquiry-based instruction or active learning, (b) utilization of the scientific process standards, (c) science pedagogical content knowledge, and (d) differentiated support for all learners through the incorporation of social-emotional learning. These four foundational pillars of the STEM Academy were selected to increase both teacher and student success in STEM. Furthermore, in an effort to encourage systemic and comprehensive school reform, participation in the Academy during the 2017-18 school year was contingent upon the interest of both school leadership (i.e., the principal and a campus instructional leader) and at least two-thirds of the grade-level science teachers. This school-level commitment was meant to ensure that the components of the Academy were woven throughout the structure of the school and embedded in the schools' pedagogical culture.

The STEM Academy was implemented using a cohort model. Initially, one cohort of teachers began participation in summer 2017. These teachers participate in the STEM Academy for three years. In summer 2018, additional teachers began participation in the Academy, which continues for up to two years. During the first year of the STEM Academy (2017-18), 15 science teachers and 6 campus instructional leaders (e.g., campus instructional coach or assistant principal) participated.

The STEM Academy includes two main components: (a) summer professional development and (b) one-on-one coaching and PLC meetings throughout the academic year. The summer professional development focuses on active learning strategies including maker-based instruction (MBI) and project-based learning (PBL) (see Perry et al., 2017 for a full description). An evaluation of the teacher summer professional development found that teachers either agreed or strongly agreed that the STEM Academy was a valuable professional development opportunity and that the summer professional development would help them improve their science teaching (Perry et al., 2017). In addition to summer professional development and support during the academic year, district leadership allocated a total of $50,000 split among the participating campuses to purchase curricular materials for leaders and teachers to support the implementation of active learning. While not a focus of this report, one instructional leader at each school, either an instructional coach or assistant principal, also received instructional coaching throughout the 2017-18 school year. These leaders received coaching in supporting teachers' in implementing active learning strategies in their classrooms.

Coaching Evaluation Questions

The purpose of this report is to focus on the *teacher coaching component* of the STEM Academy. This report provides an overall description of the components of the STEM Academy coaching. In addition, this report focuses on two primary evaluation questions:

1. To what extent was coaching implemented with fidelity?

2. What are teachers' perceptions of coaching and PLC meetings?

Description of STEM Academy Teacher Coaching and PLC Meetings

Instructional coaching and PLC (Professional Learning Communities) meetings during the academic year are core components of the STEM Academy. After attending the Academy, teachers worked individually with an instructional coach from SMU up to seven times throughout the school year, about every four to six weeks. In addition, participating teachers met as a PLC, which was led by the SMU instructional coach and an instructional leader from the school. Similar to one-on-one coaching, PLC meetings occurred up to seven times during the school year. Extant research shows that this type of individualized support (i.e., coaching and PLC meetings) facilitates the effective implementation of instructional strategies and practices (Kraft et al., 2017). In a meta-analysis examining existing experimental and quasi-experimental research, Kraft and colleagues (2017) found that coaching affects long-term, sustained change in teachers' instructional practices and student outcomes. Whereas the summer professional development occurred over one specific period of time, coaching and PLC meetings were sustained throughout the school year. In addition, the one-on-one nature of the coaching allowed dialogue to be highly individualized, context specific, and targeted toward specific pedagogical skills (Kraft et al., 2017). The logic model for STEM Academy Coaching and PLC Meetings is depicted in Figure 1. The coaching and PLC meetings were defined to include:

- *Individualization*: coaching sessions were one-on-one
- *Intensive support*: coaches and teachers interacted approximately every four to six weeks
- *Sustained support*: teachers received coaching and PLC meetings throughout the academic year
- *Context-specific feedback*: teachers were coached on their practice in the context of their own environment, which varied across schools in terms of affordances and constraints
- *Focused feedback*: coaches' feedback encouraged teachers to practice targeted and specific skills
- *Emphasis on active learning and scientific process standards*: coaching was designed to support teachers in implementing active learning (i.e., MBI and PBL) and the scientific process standards (see Appendix A for a description of the scientific process standards)

These inputs of the STEM Academy Coaching and PLC Meetings were hypothesized to influence teachers' efficacy for science teaching, beliefs about science, and teaching practices. Specifically, coaching was designed to increase:

- Teachers' efficacy for teaching science
- Teachers' confidence in and perceived importance of using active learning strategies
- Teachers' use of active learning strategies

These teacher outcomes were identified as the short-term outcomes of the STEM Academy Coaching and PLC Meetings. Long-term, the STEM Academy Coaching and PLC Meetings were designed to increase:

- Students' positive perceptions of science and interest in STEM careers
- Students' science academic achievement

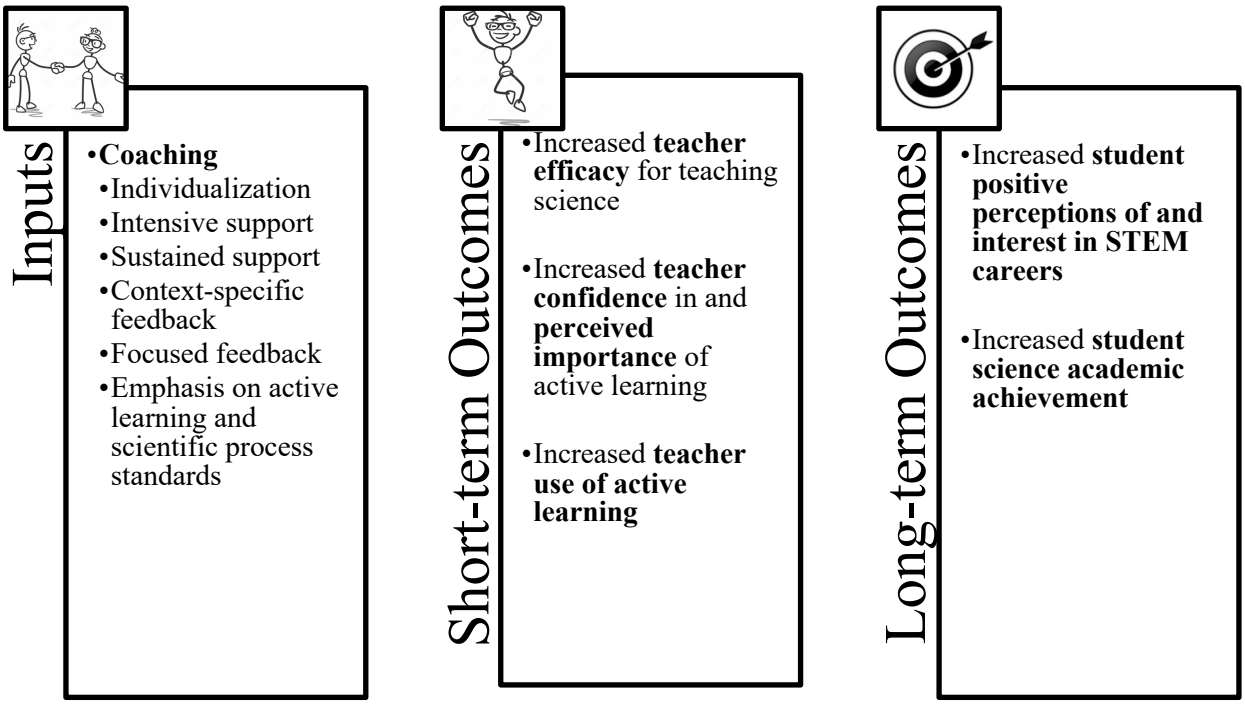

Figure 1. Logic Model for STEM Academy Coaching and PLC Meetings

Structure of the STEM Academy Teacher Coaching and PLC Meetings

One coach was hired by SMU to provide instructional coaching to and lead PLC meetings with the STEM Academy's 15 teachers. One-on-one coaching was comprised of three main components including a pre-conference, observation, and post-conference. Participating teachers received one hour of graduate course credit for their participation in coaching and PLC meetings. Teachers were enrolled as graduate students at SMU during the 2017-18 school year and had access to SMU's online teaching platform Canvas, which they utilized to complete requirements of the coursework and take surveys.

SMU Instructional Coach Biography

The STEM Academy coach has extensive experience in education and is fluent in Spanish. Specifically, the coach has twelve years of experience in education. The coach began his career in education as a bilingual teacher and department chair for Grades 5 through 8 mathematics and science. He advanced as a leader in STEM education by serving two years as the Science Coordinator and Lab Facilitator at a Dallas ISD elementary school. He then served five years as the Mathematics and Science Instructional Coach and Technology Facilitator for several Dallas ISD elementary and middle schools. The coach completed an alternative certification program and he is certified to teach Life Sciences Grades 8 through 12, Math and Science Grades 4 through 8, and Bilingual Education Early Childhood through Grade 4.

In addition to extensive experience in education, the coach possesses deep content knowledge in science and has experience as an industry professional. He earned a Bachelor of Science degree in Biology with a minor in Chemistry and a Master of Science degree in Environmental Science and Engineering Interdisciplinary Studies. The coach has four years of experience in environmental consulting related to aquatic toxicology in the private sector. The coach's experiences as an educator and industry professional, as well as his contextual knowledge within the district, are an asset to the coach's role.

The Teacher Coaching Model

The one-on-one coaching model depicted in Figure 2 provides the framework for the STEM Academy teacher coaching. This model was adapted based on an existing coaching model (Houser, 2017).

Figure 2. Coaching Cycle (Houser, 2017)

When the coach worked with teachers, he focused on a specific classroom lesson. During the pre-conference, the coach focused on the phases of the coaching cycle depicted in Figure 2 including: (a) reflection, (b) goal-setting, and (c) learning. To guide this pre-conference, the coach utilized the teacher pre-conference planning form (see Appendix B). Specifically, the coach met with the teacher virtually or in person to:

- Reflect on the needs of students,
- Set goals for the lesson, and
- Engage in targeted dialogue focused on infusing active learning into the lesson or other instructional needs (e.g., facilitating productive student dialogue, understanding and implementing effective questioning, or effective use of scientific models).

During the observation, the coach engaged in the observation and data collection phase of the coaching cycle. Specifically, the coach observed the teacher's lesson in-person, from start to finish. During the observation phase, the coach utilized the Teacher Coaching Checklist while observing teachers (see Appendix C).

During the post-conference, the coach met with the teacher virtually or in-person to circle back to the following phases of the coaching cycle: (a) reflection, (b) goal-setting, and (c) learning. To guide the post-conference, the coach utilized the post-conference planning form (see Appendix D). Specifically, the coach worked with the teacher to:

- Reflect on the lesson's strengths (i.e., area of reinforcement) and weaknesses (i.e., area of refinement),
- Set goals for the future, and
- Engage in targeted dialogue focused on the areas of reinforcement or refinement related to lesson implementation.

After the post-conference, the coach sent an email to the teacher reiterating the areas of reinforcement and refinement. Teachers were at liberty to share the feedback; however, the feedback was not shared with administrators or other school staff. This report focuses on the fidelity of implementation of the coaching model and teachers' perceptions of the STEM Academy coaching.

PLC Meetings (Professional Learning Community)

The PLC meetings were designed to continue professional learning based on individualized campus need and the foundational pillars of the STEM Academy (e.g., active learning, scientific process standards, content knowledge, and differentiation). The content of the PLC meetings was explicitly connected to relevant Texas Essential Knowledge and Skills Standards (TEKS). The focus of each PLC meeting varied based on each school's individualized needs, which were informed by observations and conversations that the SMU instructional coach had while visiting the school for one-on-one teacher coaching. With the support of a designated school instructional leader, the SMU instructional coach planned and led the PLC meetings. Participating teachers, the leader, and the SMU instructional coach met as a PLC up to seven times during the school year.

Participating Teachers and Their Schools

This section of the report describes the participating teachers, who engaged in coaching during the 2017-18 school year.

Participating Teachers

During the first school year of the STEM Academy implementation (2017-18), fifteen teachers participated in STEM Academy teacher coaching. The descriptive information for the participating teachers is depicted in Table 1. Nine teachers taught Grade 8; nine teachers taught Grade 7; and one teacher taught in Grade 6. Some teachers taught in more than one grade level. Three teachers had previously earned a master's degree.

Table 1. *Descriptive Information for Participating Teachers (n=15)*

Characteristic	# (%) of Teachers
Female	12 (80%)
Male	3 (20%)
White (Not Hispanic)	3 (20%)
Black (Not Hispanic)	8 (53%)
Hispanic	4 (27%)
Master's Degree	3 (20%)
Teach at least one advanced placement course	8 (53%)
Grade 6 Teacher	1 (7%)
Grade 7 Teacher	9 (60%)
Grade 8 Teacher	9 (60%)

Note: Some teachers taught more than one grade level.
Source: STEM Academy Teacher Information Survey, Summer 2017

Table 2 shows participating teachers' average number of years teaching and in other professional careers. The average years of experience for teachers was six, with a range from one to 17 years. Participating teachers had an average of eight years in other professions, suggesting that on average teachers had several years of experience in careers other than education.

Table 2. *Participating Teachers' Average Number of Years Teaching (n=15)*

# of Years	Average # of Years (SD)	Min	Max
Teaching	5.7 (4.9)	1	17
Teaching science	5.4 (5.0)	1	17
In other professional careers	8.1 (6.8)	0	20
At current school	4.2 (3.1)	0.5	11

Note: Standard deviation (SD) is a measure of the variance or spread in the observed data.
Source: STEM Academy Teacher Information Survey, Summer 2017

Overall, the majority of participating teachers were female (80%); identified as non-white (80%); did not have a master's degree (80%); and taught Grade 7 or 8 (60%).

Participating Schools

The 15 participating teachers taught at six middle schools in Dallas ISD. Descriptive information for each school relative to the district and state overall are depicted in Table 3. On average, participating schools had 30 percentage points more economically disadvantaged (ED) students relative to other Texas middle schools. Participating schools had 30 percentage points more English Language Learners (ELL) relative to other Texas public schools,. The average percentage of male students in participating schools was nine percentage points higher than both other Dallas ISD middle schools and other Texas public schools, likely because one of the participating schools only enrolls male students.

In general, participating middle schools were majority Hispanic (69%) and enrolled high populations of students who were economically disadvantaged (88%). On average, participating middle schools tended to have more Black and Hispanic students than other Texas middle school and more Black students than other Dallas ISD middle schools. Specifically, participating

schools had 17 percentage points more Black students than other Texas public middle schools and ten percentage points more Black students than other Dallas ISD middle schools.

Table 3. *Descriptive Information for Participating Schools*

School Name	% Hisp.	% Black	% White	% Asian	% ED	% ELL	% Male
School A	79.6	19.1	0.5	0.0	96.2	55.2	52.2
School B	32.5	66.1	0.7	0.2	93.8	25.8	52.5
School C	96.2	3.2	0.1	0.1	94.7	74.7	52.4
School D	77.0	21.4	1.0	0.0	78.7	57.7	100.0
School E	29.3	69.4	0.6	0.0	79.3	20.7	56.9
School F	72.4	17.4	8.3	0.1	83.8	50.4	53.4
STEM Academy middle schools	*66.9*	*30.0*	*2.2*	*0.1*	*88.1*	*48.8*	*60.3*
District middle schools	*71.7*	*21.9*	*4.2*	*1.2*	*86.6*	*47.7*	*51.5*
Texas public middle schools	*52.1*	*12.5*	*28.6*	*4.3*	*58.2*	*18.9*	*51.3*

Note: ED indicates students who are identified as economically disadvantaged. The Texas Education Agency report does not list enrollment by grade and gender or by grade and ELL. The percentages listed in the table for "Male" and "ELL" describe the total percentage of male students and ELL students at all grade levels in Texas Public Schools (Texas Education Agency, 2017).

Source: Texas Education Agency. (2017). *Enrollment in Texas public schools, 2016-17*. (Document No. GE17 60112). Austin TX: Author.

Overall, participating schools were majority Hispanic, and tended to include more Black, Economically Disadvantaged, and ELL students, fewer White students, and more male students than other Dallas ISD middle schools and other Texas public schools. This evidence supports that these schools are important contexts in which to intervene with students' interest and achievement in STEM because these schools include higher percentages of students who belong to subgroups that have been historically underrepresented in STEM.

Method

To answer the evaluation questions specified in this report, information about the fidelity of coaching implementation was tracked by the SMU instructional coach and project team. In order to understand teacher perceptions of the coaching, teachers completed a coaching evaluation near the end of the 2017-18 academic year. Data collection methods are summarized in this section.

Fidelity of Implementation

Across all coaching sessions, the SMU instructional coach recorded the number of minutes for each coaching session (i.e., pre-conference, observation, and post-conference). The method by which this information was tracked changed mid-way through the year. Initially, the number of minutes for each session was tracked in an Excel document. During the last two coaching cycles, the coach entered these data via an online survey platform called Qualtrics (Qualtrics, 2018). Completion of the coaching components was also tracked in SMU's online course platform called Canvas as participation in individualized coaching was a part of the course grade (Canvas, 2018). To ensure that the number of minutes was entered for each coaching session, the Excel or Qualtrics data were compared to the Canvas tracking system. This step identified coaching

sessions that occurred but were missing information about the number of minutes. In 33 of 275 instances (12%), the number of minutes for the coaching session was not recorded. In these cases, teachers completed the sessions; however, the number of minutes spent in each session was not recorded.

Coaching Evaluation Survey

The 15 participating teachers were invited to complete a coaching evaluation survey via Qualtrics through Canvas. The survey required approximately five minutes of teachers' time and was completed in February 2018 as a part of their coursework with SMU. Of the 15 teachers, 12 teachers (80%) completed the survey. Coaching cycles occurred September through March. Thus, teachers completed the coaching evaluation survey after engaging in either five or six full coaching cycles including a pre-conference, observation, and post-conference.

The survey included items measuring teachers' perceptions of coaching overall (13 items), the pre-conference session (4 items), the post-conference session (10 items), and the PLC meeting (6 items). The majority of the items were statements, and teachers rated their agreement on a four-point Likert scale (i.e., strongly disagree, disagree, agree, strongly agree). In addition, the survey included three open ended items asking teachers about: (a) the aspects of coaching and PLCs that were most useful; (b) the aspects of coaching and PLCs that needed the most improvement; and (c) any other information they would like to share about the coaching and PLCs. The coaching evaluation survey is included in Appendix E.

Results

This section describes the results based on the two evaluation questions.

To what extent was coaching implemented with fidelity?

In this section, we summarize the number of coaching cycles teachers received and the number of minutes teachers engaged in those sessions. The frequency and duration of the teacher coaching sessions are summarized in Tables 4 and 5 respectively. Because the number of minutes was missing for 33 coaching sessions, Table 4 includes 33 more coaching sessions than Table 5. A primary goal for the project was for the 15 participating teachers to engage in up to seven complete coaching cycles, each of which included a pre-conference, observation, and a post-conference. Due to constraints in campus schedules, teachers' schedules, and the coach's availability, the team recognized that it would be ambitious to engage in all seven full coaching cycles with each teacher. Even so, if all teachers had participated in the seven full coaching cycles, 105 cycles would have occurred during the 2017-18 school year. Table 4 shows that the coach engaged in a total of 91 of the targeted 105 complete coaching cycles with teachers; thus 87% of the targeted coaching cycles were completed. In total, the coach engaged in 275 coaching sessions including 92 pre-conferences, 92 observations, and 91 post-conferences with the 15 participating teachers.

Teachers at School A and School B completed 100% of the goal coaching cycles per teacher, with all teachers at this school completing seven coaching cycles.

On average, each teacher engaged in six of the seven coaching cycles. Only small differences in this number were observed across schools. Teachers at School A and School B completed 100% of the goal coaching cycles per teacher, with all teachers at each school completing seven coaching cycles. Teachers at School D on average completed one fewer coaching session due to a request from leadership and teachers at School D. Based on qualitative notes across all participating schools, sessions were missed due to: (a) teacher illness, absence, or family emergency, and (b) a request from leadership in the school district to pause coaching for one month while a legal scope of work document between the district and the university was processed. In each case, the coach scheduled or rescheduled and attempted to hold the coaching session.

Table 4. *Number of Coaching Sessions by School*

School	***# of Teachers***	**# of Sessions at Each School**			**# of Coaching Cycles including Pre-Conference, Observation, and Post-Conference**			***Average # of Cycles per Teacher***
		Pre-Conference	*Observation*	*Post-Conference*	Complete	Goal	% of the Goal Complete	
School A	*2*	14	14	14	14	14	100%	7
School B	*2*	14	14	14	14	14	100%	7
School C	*4*	24	25	24	24	28	86%	6
School D	*2*	10	10	10	10	14	71%	5
School E	*2*	12	11	11	11	14	79%	6
School F	*3*	18	18	18	18	21	86%	6
All	***15***	***92***	***92***	***91***	**91**	**105**	***87%***	***6***

Source: Canvas Course 2017-18; Teacher Coaching Logs 2017-18

On average, the coach met with teachers for 24 minutes during the pre-conference, observed teachers for 46 minutes, and met with teachers for 25 minutes during the post-conference. The length of the pre-conference, observation, and post-conference varied slightly across teachers and schools due to teachers' availability. Table 5 shows the average number of minutes teachers engaged in the pre-conference, observation, and post-conference. On average, teachers at School D: (a) spent nine minutes less pre-conferencing than teachers overall (15 minutes compared to the overall average of 24 minutes), and (b) spent slightly less time in the pre-conference, observation, and post-conference compared to others. On the other hand, teachers at School B: (a) were observed for five minutes more than teachers overall (51 minutes compared to the overall average of 46 minutes) and (b) spent slightly more time in the pre-conference, observation, and post-conference compared to others.

Table 5. *Average Number of Minutes Teachers Engaged in Coaching Sessions by School*

School	***# of teachers***	**Average # of Minutes**		
		Pre-conference	*Observation*	*Post-conference*
School A	*2*	25.6	45.4	28.0
School B	*2*	27.0	50.8	25.3
School C	*4*	26.5	45.0	26.8
School D	*2*	14.6	45.0	21.3
School E	*2*	21.7	45.9	20.5
School F	*3*	23.5	45.0	26.1
All	***15***	***23.7***	***46.2***	***25.3***

Source: Teacher Coaching Logs 2017-18

Note: The Teacher Coaching Log recorded minutes in intervals of five minutes ranging from "5 minutes or less" to "60 minutes or more."

Altogether, evidence of program implementation was strong, supporting that coaching was implemented as intended. A main goal of the STEM Academy was for teachers to engage in up to seven coaching cycles, each of which included a pre-conference, observation, and post-conference. Almost 90% of these coaching cycles were completed in full, despite the fact that some sessions were canceled due to teacher absence and a pause in the project implementation, which was necessary to process a scope of work between the school district and the university. PLC meetings were not systematically tracked during the 2017-18 school year, but will be tracked during the 2018-19 school year.

What are teachers' perceptions of coaching?

The results of the teacher coaching evaluation are summarized in this section. The quantitative and qualitative results of the survey are summarized in four sections focused on teachers' perceptions: (a) overall, (b) focused on the pre-conference, (c) focused on post-conference, and (d) focused on the PLC.

Overall. Figure 3 shows that overall between 83% and 91% of teachers agreed or strongly agreed that coaching was a valuable aspect of their professional development and supported their understanding and implementation of PBL and MBI. Teachers were least likely to agree that coaching provided them with the tools necessary to apply community-based STEM educational resources in their classroom; 58% of teachers agreeing or strongly agreeing with this statement.

Based on responses to open-ended questions on the survey, 11 of 12 teachers (92%) responded positively to the open-ended items on the coaching evaluation. One teacher did not respond to the open-ended items. Overall, 6 of 12 teachers (50%) said that the coach was the strongest aspect of the coaching. One teacher said, "The coaching sessions are AWESOME with [the coach]! [The coach] is one of the most professional, polished yet accessible and personable people with whom I've ever had the pleasure of working. [The coach is] a gem, always reassuring and encouraging me. He pushes and challenges me just the right amount, motivating me to think outside the box and believe in myself." This teacher went on to say, "The PLCs are helpful, but the coaching is what stands out. It's fabulous to get tailored feedback, knowing that it is given solely with our growth and development in mind and does not impact our salary. There's a freedom there that isn't afforded when getting feedback from an evaluator." Another teacher said that she appreciated the "great ideas, great feedback and the warm and fuzzy feeling that [the coach] has your back and is there for you! [The coach is] the best spirit in the world and a great person to have on your team! I have really enjoyed [the coach] and look forward to learning new things from [the coach] and the academy!" Three other teachers reported that they appreciated the coach's instructional suggestions and ideas. Two teachers reported that they valued the coach's willingness to listen. Another teacher simply reported, "[The coach] is awesome!" With regard to areas that could be improved, two teachers expressed an interest in co-teaching with the coach and one teacher said that timing of the meetings with the coach was challenging.

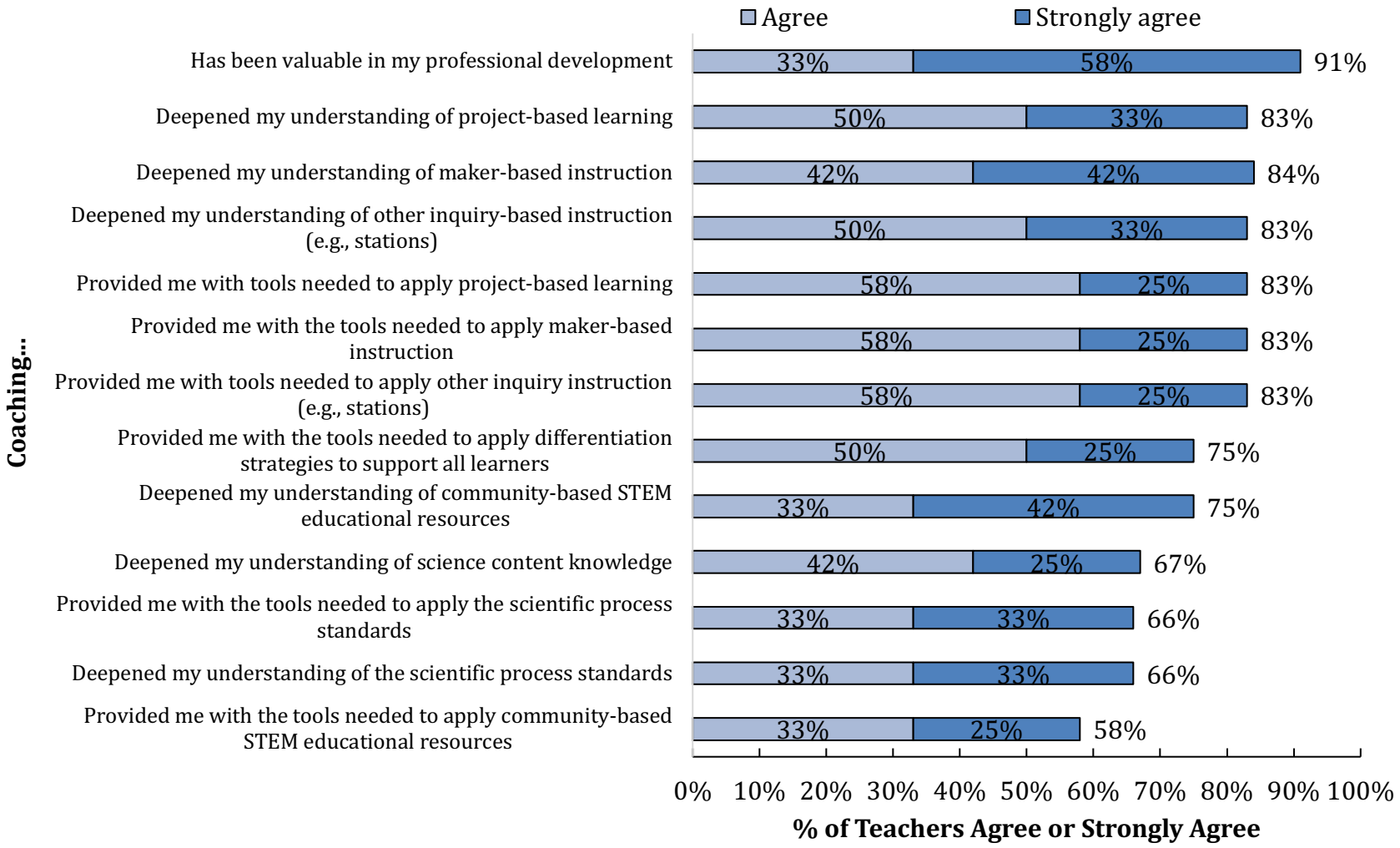

Figure 3. Teachers' Perceptions of Coaching (n=12)

Pre-conference sessions. Teacher responses to items specifically examining perceptions of the pre-conference session are depicted in Figure 4. Almost all of teachers (92%) agreed or strongly agreed that the pre-conference session helped increase their use of active learning, and most of teachers (83%) agreed or strongly agreed that the session helped provide differentiated support for all learners. Compared to the other items, teachers were slightly less likely to endorse that the pre-conference helped them incorporate scientific process standards or increased their personal science content knowledge, with 75% of teachers agreeing or strongly agreeing with those statements.

Teachers did not explicitly reference the pre-conference as helpful in their open-ended responses. Instead, they spoke more generally about the feedback and support they received from the coach as described in the previous section focused on coaching overall. With regard to areas that could be improved, one teacher was interested in receiving more feedback during the pre-conference based on previous observations.

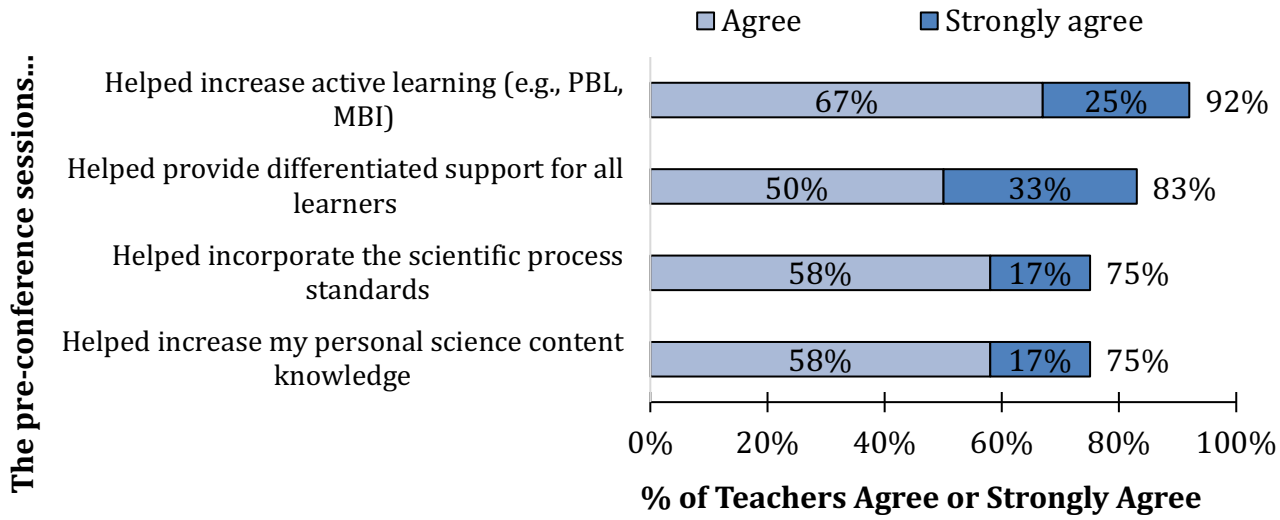

Figure 4. Teachers' Perceptions of Pre-Conference Sessions (n=12)

Post-conference sessions. Teacher responses to the items specifically examining perceptions of the post-conference sessions are illustrated in Figure 5. All teachers agreed or strongly agreed that the post-conference encouraged them to use the scientific process standards, implement active learning, reflect on their lesson, and was confidential. About 80% of teachers agreed or strongly agreed that the post-conference session encouraged them to use differentiation strategies and increased their personal science content knowledge.

The survey included four items focused on teacher confidence following the post-conference. Over 80% of teachers agreed that they felt confident implementing differentiation strategies, active learning, and the scientific process standards after the post conference. Relatively fewer (75%) of the teachers agreed or strongly agreed that they felt confident in new science content knowledge after the post-conference.

Based on responses to open-ended questions, six of 12 teachers (50%) reported that the post conference was the most useful aspect of coaching. One teacher reported, “I think having my coach debrief after each observation and take the time to explain what [the coach] saw and areas of improvement was extremely useful.” With regard to ways that the post-conference could be improved, one teacher reported that she or he would like to receive more “pro-active or achievable” feedback that takes into account contextual differences across school environments and cultures.

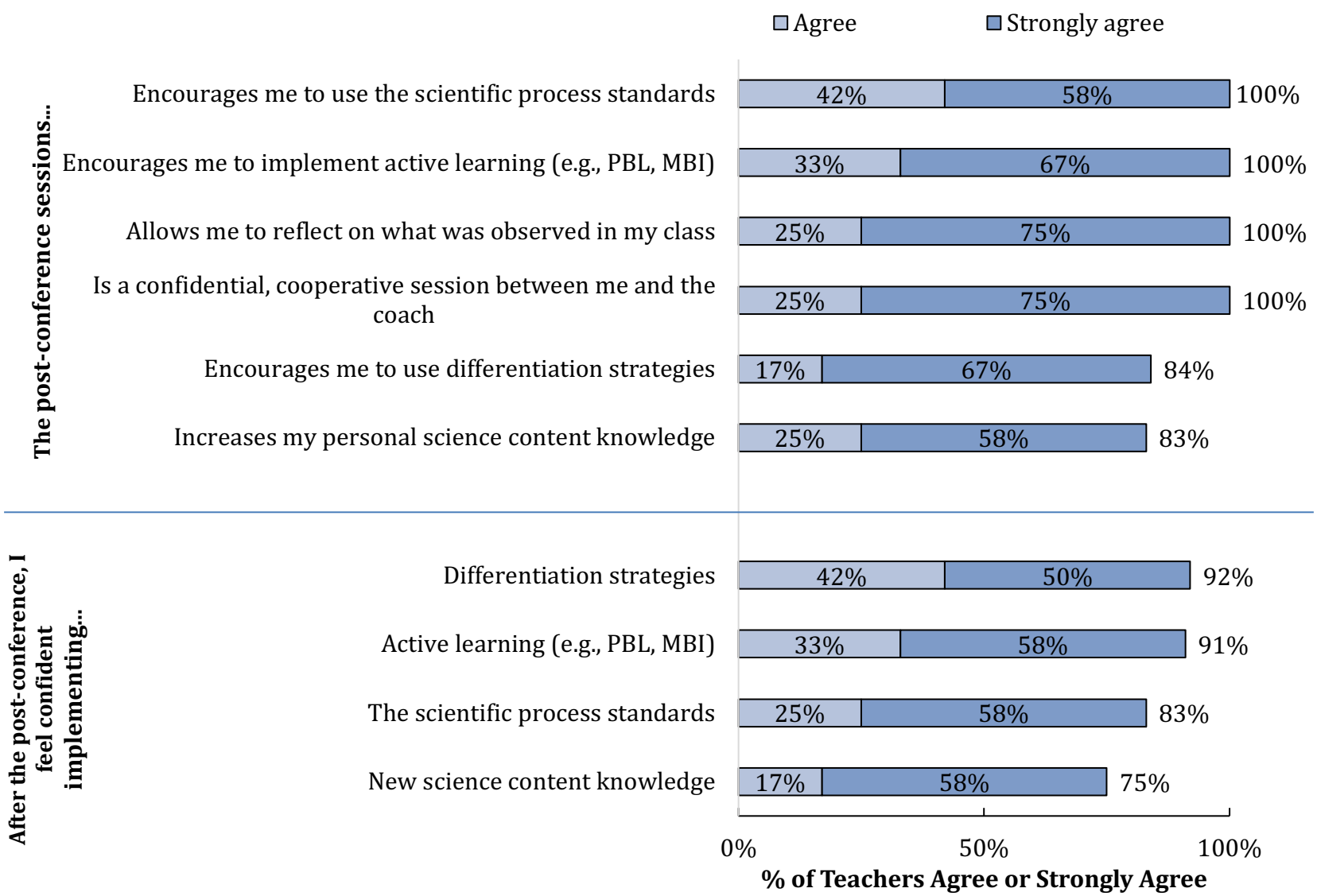

Figure 5. Teachers' Perceptions of the Post-Conference Sessions (n=12)

PLC Meetings. Teachers participated in monthly PLC meetings with their science team, which were co-facilitated by the campus science instructional leader and the SMU instructional coach. Teacher responses to items specifically examining the PLC are depicted in Figure 6. Almost all teachers (over 90%) agreed or strongly agreed that the PLC delivered high-quality information about PBL, MBI, and differentiation. Teachers were relatively less likely to endorse that the PLC delivered high-quality information about science content, with 75% of teachers agreeing or strongly agreeing with this statement.

Based on the responses to the open-ended items, three of 12 teachers (25%) explicitly described the PLC meetings as helpful. Two teachers reported that the emphasis on the structure of MBI during the PLC was helpful. One teacher said the "demonstrations of the Maker Space" was the most useful aspect of coaching. Another said that the "knowledge and lesson structure of the maker-based learning process" was the most useful aspect of coaching. When offering suggestions, one teacher said, "[The coach] does a phenomenal job of leading our PLCs. My beef with those meetings lies only with the level of interest and motivation (or lack thereof) among my [colleagues]. If they participated more eagerly and contributed, I think it would be a vastly more beneficial activity for me."

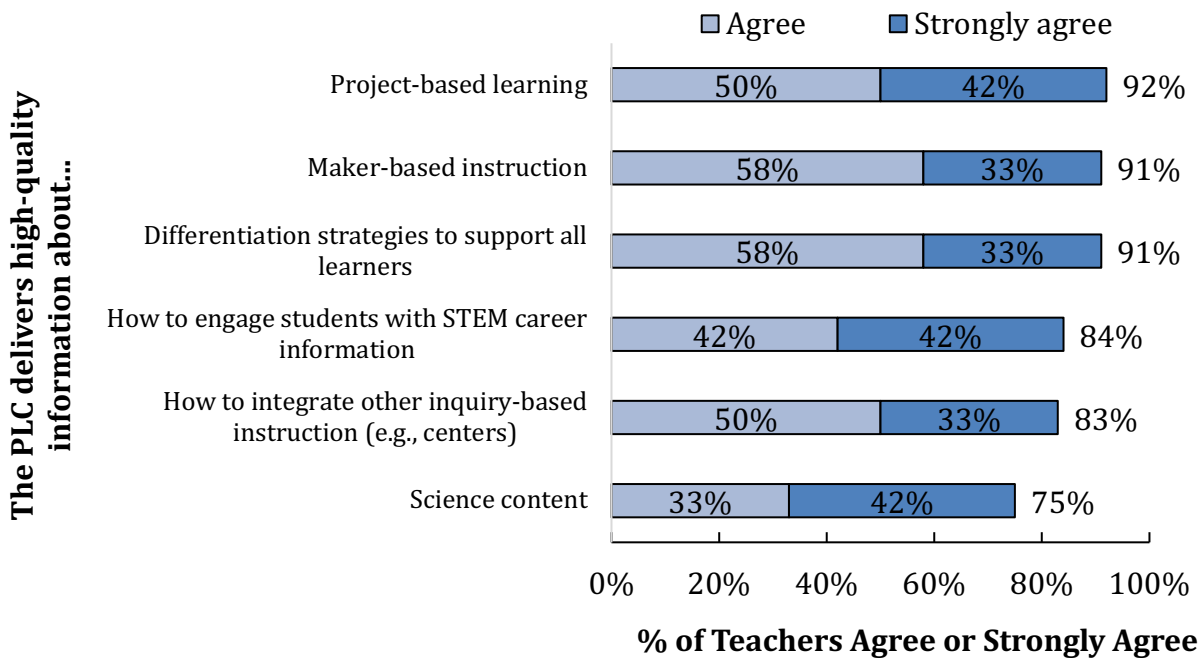

Figure 6. Teachers' Perceptions of the PLC Meetings (n=12)

Overall, teachers' responses on the coaching evaluation survey indicated that the most beneficial aspect of the coaching was the post-conference, with almost all teachers agreeing or strongly agreeing that the post-conference supported them in implementing and feeling confident about active learning. In general, teachers reported that coaching focused more on active learning and differentiation and less on content knowledge, which aligns with the intended focus of the first year of coaching. Coaching was designed to intensively support teachers in their implementation and use of foundational active learning strategies during the first year. The evidence overall

suggests that teachers perceived the coaching as effective in encouraging their use of active learning strategies.

Summary

The STEM Academy one-on-one coaching and PLC Meetings during the 2017-18 school year were designed to encourage and reinforce active learning instructional strategies such as PBL and MBI, which were a main focus during the STEM Academy summer professional development. Teachers worked individually with the SMU instructional coach for up to seven coaching cycles and PLC Meetings. Each coaching cycle included a pre-conference, observation, and post-conference. The coaching cycles, coupled with the PLC Meetings, were designed to affect long-term change in teachers' instructional practices, guided by the four foundational pillars of the STEM Academy, which included (a) active learning strategies, (b) scientific process standards, (c) deepened content knowledge, and (d) differentiation across students' needs.

Participating teachers and schools. Fifteen teachers participated in the STEM Academy teacher coaching during the 2017-18 school year. Most teachers (60%) taught Grade 8 science. Teachers taught in six Dallas ISD middle schools. Relative to the state and district overall, participating middle schools included higher percentages of students who belong to subgroups who have been historically underrepresented in STEM. Specifically, these schools tended to include more Black students, fewer White students, more ED students, and more ELL students, supporting that these schools were important contexts in which to intervene with students' STEM outcomes.

Fidelity of implementation. A primary goal of the STEM Academy Coaching was for participating teachers to receive up to seven coaching cycles, each of which included three sessions (i.e., pre-conference, observation, and post-conference). During the first year, 275 coaching sessions including 92 pre-conferences, 92 observations, and 91 post-conferences were completed. Overall, the coach facilitated 91 complete coaching cycles with the 15 teachers, with an average six complete coaching cycles per teacher. Implementation was relatively similar across schools. Teachers at School A engaged in the highest number of complete coaching cycles (7 of 7 coaching cycles on average); whereas, teachers at School D engaged in slightly fewer complete coaching cycles (5 of 7 coaching cycles). On average, the coach pre-conferenced with teachers for 24 minutes, observed the teacher for 46 minutes, and engaged in a post-conference for 25 minutes. Collectively, the evidence of implementation is strong supporting that participating teachers received at least six of seven complete coaching cycles designed to support and increase their utilization of active learning strategies, content knowledge, and differentiation across students' needs. Fidelity of implementation information for both the one-on-one coaching and the PLC meetings will be tracked during the 2018-19 school year.

Teachers' perceptions overall. Overall, between 83% and 91% of teachers agreed that coaching was a valuable aspect of their professional development and supported their utilization of PBL and MBI. Ninety-two percent of teachers responded favorably to open-ended items. Half of the teachers stated that their interaction with the coach was the most valuable aspect of the coaching. Teachers valued the coach's professionalism, accessibility, ability to listen, and offer specific feedback in an environment that was not high-stakes or connected to their performance evaluation. With regard to opportunities for improvement, only 58% of teachers agreed or

strongly agreed that the coaching provided them with the tools necessary to apply community-based resources in their classrooms.

Teachers' perceptions of the pre-conference. Almost all teachers (92%) agreed or strongly agreed that the pre-conference helped them increase their use of active learning. A relatively lower percentage of teachers (75%) reported that the pre-conference helped them incorporate scientific process standards and increased their personal science content knowledge.

Teachers' perceptions of the post-conference. The post-conference was perceived as the most important component of coaching. All teachers (100%) agreed the post-conference encouraged them to use the scientific process standards, implement active learning, reflect on their lesson, and was confidential. More than 80% of teachers felt confident using differentiation strategies, active learning, and scientific process standards following coaching. A relatively smaller percentage of teachers (75%) felt confident using new science content knowledge after the post-conference.

Teachers' perceptions of the PLC. Almost all teachers (over 90%) agreed or strongly agreed that the PLC delivered high-quality information about PBL, MBI, and differentiation. Relatively fewer teachers (75%) agreed or strongly agreed that the PLC delivered high-quality information about science content. Two teachers appreciated the emphasis on MBI during the PLC.

Overall, teachers felt that coaching had a strong emphasis on active learning and differentiation, which supported their implementation and helped them feel confident about active learning and differentiation. Teachers were least likely to endorse that coaching provided them with tools necessary to apply community-based resources in their classrooms or improve their content knowledge.

Recommendations

As the coaching model is brought to scale to include additional teachers, we hope that this report will highlight areas of strength and opportunity. As such, the evidence presented in this report supports three key recommendations including:

1. The coaching model as a whole should continue to be implemented with only minor modifications. Almost all teachers appreciated the opportunity to receive feedback and felt that that feedback helped them implement and feel more confident about active learning strategies. Based on teacher perceptions, the post-conference was the most valuable component of the coaching model. As such, coaches and school leadership should emphasize the importance of this aspect and encourage teachers to make this a priority. Based on teacher perceptions, the pre-conference was not as highly regarded as the post-conference. Program staff might consider minor revisions to the pre-conference. For example, one teacher expressed that it would be helpful if coaches explicitly connected feedback to previous observations during the pre-conference.

2. Program staff should carefully consider ways in which to integrate feedback and tools that support: (a) teachers' increased understanding of community-based STEM education

resources, and (b) teachers' deepening their science content knowledge. Relative to items focused on active learning strategies and differentiation, teachers were less likely to agree that coaching supported them by deepening their content knowledge or providing knowledge or tools supporting community-based STEM education. For example, coaching sessions could be planned with explicit emphasis on these topics across the school year or in the future years, as teachers continue participation in coaching.

3. District and school leadership should continue to emphasize the importance of coaching and encourage teachers to prioritize feedback sessions with coaches. The fidelity of implementation data support that the model was implemented with strong fidelity. Given the demands on teachers' time, it is important for the coach and teachers to understand that issues will arise when scheduling coaching sessions due to schedule changes or unanticipated events on campuses. It is critical for the success of this model that the district and school leadership support these sessions and model for teachers that these session are of both high value and importance to their growth and development.

Overall, these results show the importance of coaching when it is coupled with intensive professional development. Future reports will investigate the influence of the full treatment on teachers' science beliefs, efficacy for teaching science, and instructional practices.

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Appendix A – Scientific Process Standards

The *Scientific Process Standards* serve as a focal point for science educators on the specific processes scientists use when they are engaged in scientific work (NRC, 2000). These *Standards* informed the development of the Texas Essential Knowledge and Skills Standards (TEKS). The processes outlined in the *Standards* mimic the actions of actual scientists. The process standards outline *Student Expectations*, which provide a framework and investigative tools for educators focused on conceptual understanding. Examples of *Student Expectations* include:

- Testing a hypothesis,
- Observing a specific organism or natural event,
- Collecting and recording data, and
- Constructing tables and graphs, using repeated trials and means, and organizing data.

For each of these *Student Expectations*, specific levels of knowledge and skills are outlined for students at each grade level. These levels of knowledge and skills build toward conceptual understanding. In addition, behaviors and practices for student performance and learning are addressed for each student expectation. These behaviors and practices emphasize the actions that are useful for scientists when performing scientific activities. Examples of these outlined in the *Standards* include specific process standards such as making observations, asking relevant questions, generating hypothesis, testing their hypothesis and gathering data, interpreting data and generating conclusions. In addition the process standards encourage students to:

- Analyze, evaluate, and critique scientific explanations,
- Use of models to represent aspects of the natural world, and
- Identify advantages and limitations of models.

The *Standards* provide guidelines for educators on the percentage of instructional time spent conducting student investigations. Specifically, the *Standards* recommend that the student, for at least 40% of instructional time, should conduct investigations following safety procedures and environmentally appropriate and ethical practices. Overall, the *Standards* provide a specific framework for students to develop scientific competencies, encouraging interdisciplinary life-long learning.

Appendix B – Pre-Conference Planning Form

SMU Annette Caldwell Simmons School of Education & Human Development

STEM Coaching Pre-Conference

Teacher: _____ Campus: _____ Coach: _____ Date: _____

Elapsed Time:_____

(Verbally state from PLC reflection and Post conference the teacher's actionable points) Have you been able to implement some of your action items from PLC and our coaching cycle? Can you share a reflection on your experience?

What is the objective(s) of your lesson? What are the TEKS?

How will you know that students have mastered the objectives in this lesson?

What are the prerequisite skills that the students have to know in order to be successful in this lesson?

How will you incorporate active learning and process standards into your lesson?

Are there any particular grouping structures in place (pairs, cooperative groups, etc.)?
If so, how will you hold students accountable for their work?

What are your plans for lesson closure and reflection?

Is there anything you want me to particularly observe of your lesson?

Is there anything else you want me to be aware of before observing this lesson?

Appendix C – Teacher Coaching Checklist

SMU | Annette Caldwell Simmons School of Education & Human Development

STEM Teacher Observation Report

Teacher: _____ Coach:_____Observation Date:_____

Campus:_____ Coach Initials: _____Teacher Initials: _____

Classroom Observations: Checked items were observed and a recurrence is noted with a tally or number for each time observed. Question marks indicate a need for reflection/discussion with coach.

Start Time: _____ End Time: _____

Student Participation

- ☐ Students are actively engaged in learning
- ☐ Self-directed learning occurs
- ☐ Connection of learning ismade to the real world
- ☐ Mistakes are openly shared, and discussed
- ☐ Students engage in the scientific behaviors represented by the process standards

Learner Centered Instruction

- ☐ Instruction promotes critical thinking
- ☐ Motivational strategies are present
- ☐ Variety of instructional techniques used
- ☐ Interactive learning occurs
- ☐ The teacher avoids reducing rigor before students have had a chance to explore and struggle
- ☐ Challenging, open-ended questions are posed
- ☐ Students explain and justify their thinking

Evaluation and Feedback

- ☐ Academic progress ismonitored/assessed formally or informally
- ☐ Assessment strategies are varied
- ☐ Positive reinforcement of learning occurs
- ☐ Constructive feedback is given
- ☐ Relearning opportunities are provided

Management and Discipline

- ☐ Student self-discipline is taught
- ☐ Interaction with students is equitable
- ☐ Specific expectations for behavior known
- ☐ Disruptive behavior is redirected
- ☐ Desired behavior is positively reinforced
- ☐ Materials and time are managed efficiently
- ☐ Classroom procedures/routines known

Praise/Reinforcement:

Polish/Refinement:

Recommendations/Questions

8/24/17

Appendix D – Post-Conference Planning Form

SMU | Annette Caldwell Simmons School of Education & Human Development

STEM Coaching Post-Conference

Teacher: _____ Campus: _____ Coach: _____
Date: _____

Elapsed Time: _____

How do you think the lesson went?

Why do you think the lesson went the way it did?

What would you like to work on for the next time?

Reinforcement Area:

Refinement Area:

Recommendations:

Appendix E – Teacher Coaching Evaluation Survey

STEM Academy for Teachers and Leaders: On-Campus Support Evaluation

To what extent do you agree with the following statements?

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. The STEM Academy coaching has been valuable in my professional development.				
2. The STEM Academy coaching deepened my understanding of: o project-based learning o maker-based instruction o other inquiry-based instruction (e.g., labs, stations, centers) o community-based STEM education resources o science content knowledge o the scientific process standards				
3. The STEM Academy coaching provided me with tools I need to apply in my classroom using the principles of: o project-based learning o maker-based instruction o other inquiry-based instruction (e.g., labs, stations, centers) o community-based STEM education resources o the scientific process standards o differentiation strategies to support all learners				
4. The pre-planning session of the coaching cycle helps me think about how my lesson will:				

• increase active learning (e.g., PBL, MBI, labs, stations, centers). • incorporate the scientific process standards. • provide differentiated support for all learners. • increase my personal science content knowledge.				
5. The post conference session of the coaching cycle: o is a confidential, cooperative session between me and the coach. o allows me to reflect on what was observed in my class. o encourages me to implement active learning (e.g., PBL, MBI, labs, stations, centers)in future lessons. o encourages me to use the scientific process standards in future lessons. o encourages me to use differentiation strategies to support all students in future lessons. o increases my personal science content knowledge.				
6. After the post conference session, I feel confident I will be able to implement: • active learning (e.g., PBL, MBI, labs, stations, centers • the scientific process standards • differentiation strategies to support all learners • new science content knowledge				
7. The STEM Academy Professional Learning Community delivers high-quality information about: o project-based learning o maker-based instruction				

○ how to integrate other inquiry based instruction (e.g., stations, centers, labs) ○ how to engage students with STEM career information ○ differentiation strategies to support all learners ○ science content				

8. Which areas of the STEM Academy on-campus support (e.g., coaching and PLCs) were most useful to you?

9. Which areas of the STEM Academy on-campus support (e.g., coaching and PLCs) need improvement?

10. Is there anything else you would like to share about the STEM Academy on-campus support (e.g., coaching and PLCs)?