# STEM Academy for Science Teachers and Leaders: Teacher Survey Administration

Internal Report

RESEARCH IN MATHEMATICS EDUCATION

# STEM Academy for Science Teachers and Leaders: Teacher Survey Administration

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# STEM Academy for Science Teachers and Leaders: Teacher Survey Administration

## Overview of Project

The STEM Academy for Science Teachers and Leaders, funded by the Texas Instruments Foundation and the O'Donnell Foundation, is a partnership between the Dallas Independent School District (DISD) and Southern Methodist University (SMU). The STEM Academy for Science Teachers and Leaders (STEM Academy) consisted of two main components across three years. These components include: (a) 70 hours of face-to-face and 20 hours of online summary academy coursework at SMU, and (b) ongoing support during the academic year with up to seven one-on-one coaching cycles and up to seven professional learning community meetings at teachers' schools with an SMU instructional coach. The project adopted a cohort model. At the time of this report, one cohort of teachers was in their third year of participation (Cohort 1), and a second cohort was in their second year of participation (Cohort 2).

## Purpose of this Report

This report focuses on the teacher survey process for teachers participating in the STEM Academy. This report describes the survey use and administration, communication involved in distributing surveys, eligibility for incentives, and procedures for closing surveys and exporting data.

## Survey Administration

### Survey Use

The STEM Academy team used nine surveys to understand STEM Academy implementation and outcomes. Some surveys were given once and other surveys were given multiple times over the course of the year.

Teacher surveys include:

- Teacher Information Survey

- STEM Practices Perceptions & Culture (STEM PPC)

- Science Teaching Efficacy Belief Instrument (STEBI)

- Pedagogy of Science Teaching Test (POSTT) Pre-Test

- Pedagogy of Science Teaching Test (POSTT) Post-Test

- [STEM Academy Evaluation 1](#)

- [STEM Academy Evaluation 2](#)

- [STEM Academy Evaluation 3](#)

- [Coaching Evaluation](#)

Leader Surveys include:

- [Leader Information Survey](#)

- [Leader STEM PPC](#)

- [Leader Coaching Evaluation](#)

- [Leader Academy Evaluation](#)

STEM Academy teachers and leaders completed each of the surveys up to three times throughout the year. Figure 1 shows which surveys teachers took at each time point, and Figure 2 shows which surveys leaders took at each time point. All surveys were administered online through the survey platform Qualtrics.

*Figure 1: Teacher Surveys*

| Instrument | Summer | Fall | Spring |
| --- | --- | --- | --- |
| Teacher Information | X | | |
| Teacher STEM PPC | X | X | X |
| STEBI | X | X | X |
| POSTT Pre | X | | |
| POSTT Post | X | | |
| Teacher Academy Evaluation | X | | |
| Teacher Coaching Evaluation | | X | X |

Note: All summer surveys were administered before the summer teacher academies except the POSTT Post and Teacher Academy Evaluation. These two summer surveys were administered after the summer academies.

*Figure 2: Leader Surveys*

| Instrument | Summer | Fall | Spring |
|---|---|---|---|
| Leader Information | X | | |
| Leader STEM PPC | X | | |
| Leader Coaching Evaluation | X | | X |
| Leader Academy Evaluation | X | | |

Note: Leaders also took the Leader STEM PPC in spring 2020.

## Survey Administration Timeline

Researchers created a survey administration timeline prior to the school year. Timelines were adjusted during survey cycles if teacher responses were low. Initially, teachers were invited to take the Information Survey, STEM PPC, and STEBI during their online course work for the academy. Teachers took the POSTT Pre at the start of the academy, and the POSTT Post and Academy Evaluation at the conclusion of the academy. The fall survey cycle included STEM PPC and STEBI in October. The fall cycle of surveys included the Coaching Evaluation in December. Teachers took the spring STEM PPC and STEBI in February/March and the Coaching Evaluation in May/June.

# Survey Descriptions

## Information Survey

Teacher Information Survey was used to gather demographic data, including gender, race, and ethnicity. Additionally, the Teacher Information Survey asked teachers for years of experience in education, teaching, teaching science, in other professional careers, and at their current school. The survey also asks for their current teaching assignment. Next, the survey asked teachers to list their education, including degree type, major, and year of graduation. The survey also asks teachers if they are currently enrolled in a Master's or Doctorate program, as well as the type of program, anticipated graduation date, program title, and university name. Finally, the survey asked teachers how many formal courses they have taken at a college or university in science and methods of teaching science, the number and type of certifications they hold, and total hours of professional development in science content, project-based learning, maker-based education, social and emotional learning, students with disabilities, and English language learners.

## Teacher STEM PPC

The purpose of the survey was to investigate teachers' perceptions on instructional behaviors that teachers may or may not engage in when providing instruction. The scale includes five sub-scales:

- Importance: How important the teacher thinks that instructional behavior is;
- Confidence: How confident the teacher is in engaging in such behavior during instruction;
- The average frequency with which the teacher engages that behavior during daily instruction;
- Attitudes toward statements related to instructional behaviors; and
- Open-ended questions related to instructional behaviors.

The developers of this measure had deep knowledge focused on science. The items focused on capturing teachers' confidence, perceptions of importance, and implementation focused on active learning (e.g., PBL, MBI) and social-emotional learning (SEL). The items were consulted by four experts with experience on classroom instruction. One developer helped to develop the statements that identify the most critical characteristics of PBL/active learning. Another wrote statements for MBI and a third for MBI-content based on their teaching experience. The STEM Culture Tool (White, 2015) was referenced to help develop the items related to culture.

## STEBI

The Science Teaching Efficacy Beliefs Instrument (STEBI) is a self-reporting elementary efficacy belief instrument that is also designed to target teachers' efficacy belief in science teaching (Riggs & Enochs, 1990). STEBI utilizes a Likert scale format with response categories from ranging from "strongly agree" to "strongly disagree". STEBI was designed under Bandura's (1977) theoretical framework of social learning.

Exploratory factor analyses (Riggs & Enochs, 1990) determined the number of factors present among the 25 items. Results indicated a two-factor model was appropriate with two eigenvalues obtaining values over one. The two factors indicated were Personal Science Teaching Efficacy and Science Teaching Outcome Expectancy with total scale alphas of .92 and .77, respectively.

Reliability coefficients to the latent factor of Personal Science Teaching Efficacy Belief Scale range from 0.87 (Bleicher, 2004) to 0.90 (Riggs & Enochs, 1990). Likewise, reliability coefficients to the Science Teaching Outcome Expectancy latent factor range from 0.72 (Bleicher, 2004) to 0.76 (Riggs & Enochs, 1990).

## POSTT Pre/POSTT Post

The assessment aimed to assess teachers' science pedagogical content knowledge. We selected items that were appropriate for middle grades science teachers, resulting in a pre-test and post-test, each consisting of 10 science pedagogy items. The responses are categorized into four basic pedagogies: didactic direct, active direct, guided inquiry, and open inquiry. The assessment is based on the theoretical framework derived from David Ausubel's theory of learning and instruction (Ausubel, Novak, & Hanesian, 1986). Ausubel identified two types of learning- rote learning and meaningful learning, and four types of instruction- didactic direct, active direct, guided inquiry, and open inquiry. The construction of items was guided by Ausubel's idea that

instruction for meaningful learning can potentially range from reception to discovery modes and that we should reflect this in the item options.

## Teacher STEM Academy Evaluation

The Teacher STEM Academy Evaluation was adjusted each year based on the content of the subsequent academies. As such, we developed three versions of the STEM Academy Evaluation. The Teacher Academy Evaluation focused on understanding teachers' overall impressions of the academy structure, content, and speakers. The survey was administered immediately following the implementation of Academy. Results allow the STEM Academy team to continue working to improve the STEM Academy each summer. The Academy Evaluation included 15 questions, six of which had multiple components, and allowed teachers to report their level of agreement with statements about the quality of the academy. Items focused on understanding teachers' overall impressions of the Academy structure, content, and speakers.

## Teacher Coaching Evaluation

The Teacher Coaching Evaluation 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.

## Leader Information Survey

The Leader Information Survey is similar to the Teacher Information Survey. The survey begins with demographic information including gender, race, and ethnicity, followed by years in education, years teaching, years teaching science, years as an instructional coach, years as an assistant principal, years in other professional careers, and years employed at current school. Next, the survey asked leaders to list their current role on campus, education level, major, and year of graduation. Finally, the survey asked about certifications, in-service outside of the STEM Academy, and professional development designed or delivered in the past year.

## Leader STEM PPC

Leader STEM PPC investigates STEM perceptions and practices, and the STEM culture at leaders' schools. The survey presents leaders with a list of practices, and asks them to rank the importance of the practice, confidence in the practice, and frequency of the practice. Seven practices are listed, and some of which include participating in professional learning communities within the science department, observing science teacher instruction, leading science professional learning communities, and actively engaging in the review of science student assessment data with teachers. Next, leaders are asked to rank their level of agreement on a four-point Likert scale ranging from strongly disagree to strongly agree for nine statements

regarding practices of their teachers as well as the STEM culture at their school. The survey concludes with two open-ended questions about how leaders provide feedback to teachers and participating in professional learning communities.

## Leader Academy Evaluation Survey

Leader Academy Evaluation survey aims to understand the leaders' perspective of the impact of the STEM Academy on their STEM leadership. This survey is given at the conclusion of the STEM Academy. The survey asks leaders to rank their level of agreement with five statement related to the STEM Leader Academy on a four-point Likert scale ranging from strongly disagree to strongly agree. Next, the survey lists seven concepts covered in the STEM Academy, and asks leaders to what extent the Academy deepened their understanding of each concept. Some concepts include STEM integration in middle school, project-based learning, maker-based learning, and team building. Next, the survey uses a similar format to the previous questions to ask leaders to what extent they agree the Academy provided them with the tools they need to apply the principles of project-based learning, maker-based learning, non-traditional classroom observation, and crucial conversations. The Leader Academy Evaluation concludes with open-ended questions asking for feedback on areas of the Academy were the most useful, which areas need improvement, topics they would like to see in the future, and any additional feedback.

## Updates to Surveys Over Time

Over time, the lead researcher made various changes to the surveys based on reviews of the content. The researcher used track changes in the word document to submit to the Institutional Review Board (IRB) for approval. Upon approval of the changes, project staff updated surveys in Qualtrics. The lead researcher then verified changes to ensure the surveys in Qualtrics matched the surveys approved by the IRB.

# Survey Creation

Researchers sent the surveys to the Institutional Review Board (IRB) for approval once finalized. Once approved by IRB, project staff manually entered surveys into Qualtrics, a survey platform. Project staff created four copies of each teacher survey in Qualtrics in order to separate responses by cohort and semester (i.e. Cohort 1 STEBI-Fall 2018, Cohort 2 STEBI-Fall 2018, Cohort 1 STEBI-Spring 2019, Cohort 2 STEBI-Spring 2019). Additionally, project staff stored surveys in folders within Qualtrics by semester and year, (i.e. Fall 2018 and Spring 2019). This allowed project staff to easily preserve and export data.

# Summer Survey Communication

Project staff utilized the Canvas course used for the online portion of the STEM Academy to administer the summer surveys. Summer surveys taken prior to the start of the STEM Academy include Teacher Information survey, STEM PPC, and STEBI. Project staff uploaded the surveys as modules so teachers were invited to complete the surveys within their online coursework. Teachers were asked to complete each survey before the start of the face to face portion of the STEM Academy. Teachers completed the POSTT Pre on the first day of the face to face STEM

Academy. Teachers completed the POSTT Post and Academy Evaluation during the final week of the online STEM Academy, which occurred after the face to face academy concluded.

# Fall and Spring Survey Communication

Project staff conducted the majority of email communication related to teacher and leader surveys during the fall and spring semester through Qualtrics. Email features in Qualtrics allowed staff to send personalized messages and links to each leader and teacher, which helped track survey completion. The personalized messages were intended to improve survey completion among teachers. Additionally, project staff and SMU instructional coaches texted teachers with incomplete surveys towards the end of the fall and spring survey cycles in order to maximize participation.

Project staff generated contact lists from a master list of teachers participating in STEM Academy. Project staff created two contact lists in Microsoft Excel, one for Cohort 1 teachers and one for Cohort 2 teachers. Contact lists include first name, last name, email, and SMU ID. Additional fields can be added to the spreadsheet manually, such as cohort. Project staff uploaded the contact lists Qualtrics so communication could be streamlined through the Qualtrics platform. The contact list feature in Qualtrics allowed project staff to send survey communication to teachers by cohort. This feature also allowed us to personalize messages using teachers' names, as well as including teachers SMU IDs. This was important because teachers needed their SMU ID to access the surveys.

## Initial Email Communication

Project staff drafted communication in an excel spreadsheet including email content and dates for emails to be sent (Appendix A). Initially, project staff planned to send out a first email with the information about the survey, timeline, incentives, and survey link. Once approved by project manager, the emails were entered into Qualtrics. Project staff set up and queued emails to go to teachers at specific times and dates decided upon during planning. Once typed, project staff saved the emails as messages in the Qualtrics Messages Library so they could be saved and used again. Qualtrics functionality allowed project staff to set the initial emails and follow-up emails to go out at certain times to certain people. For more information, see the Qualtrics training handout attached here. This was especially helpful because the same emails were sent to cohort 1 and cohort 2; as such, the messages only had to be typed once then copied over to the next survey.

## Follow Up Communication

Similar to initial communication, project staff planned and set up follow up communication in Qualtrics.  Three follow up emails were planned to remind teachers to take the surveys. As project staff entered emails into Qualtrics, we set up reminders to go to participants who had not completed the survey. The reminders were an important tool in the communication process because they were scheduled ahead of time, and only went to participants who had either opened the survey but not finished it or had not opened the survey yet. The personalized links allowed the team to see who had and had not completed the survey. This information was very useful

when sending additional communication outside of Qualtrics.

## Project Staff Communication

In addition to email communication, project staff used text messages to remind teachers to complete surveys. Project staff and SMU instructional coaches sent personalized text reminder towards the end of the survey cycles only to teachers who still had not completed the surveys. Teachers received up to two reminder text messages for STEM PPC and STEBI in fall and spring. SMU instructional coaches also texted the teachers they coached if additional support was needed.

## SMU Instructional Coach Communication

SMU coaches communicated with teachers who had not completed the surveys because coaches spend the most time with their teachers during the school year. Coaches interacted with teachers over email, phone, and face to face throughout the coaching cycles. The relationship coaches had with teachers gave them an advantage when asking teachers to complete surveys. The only survey coaches did not have any part in communication on was the coaching evaluation. It may be a conflict of interest to have coaches encourage teachers to evaluate the coaching process.

# Progress Monitoring

## Tracking Survey Completion

Project staff monitored teachers' completion of surveys and provided weekly updates to the project manager. Project staff updated the list at the end of week one, the beginning of week two, and daily in the last week the surveys were open. This allowed the project manager to see the progress made over time, and make any decisions on revisions to the communication plan. When completion rates seemed to be low, the project manager would suggest additional steps to support completion of teacher and leader surveys.

## Tracking Incentives

The STEM Academy informed teachers prior to beginning the STEM Academy that they were eligible for incentives if they completed all of the required surveys in summer, fall and spring within the weeks that the survey was open. During 2018-19, the options for the incentive were maker-based or inquiry based instructional materials for their classroom valued at $50. The teachers were informed that they could choose from a list of materials provided by project staff. The incentive option was implemented in an attempt to achieve full participation from all teachers on all surveys. During 2019-20, teachers were eligible for a $75 Amazon gift card if they completed all project surveys during fall ($20), spring ($20), and end-of-year ($20), plus a $15 bonus for completing all surveys.

# Closing

## Survey Closing Procedures

Once all teachers completed their surveys, project staff closed the surveys in Qualtrics and prepared to export the data. Data were exported as choice text, and recoded later if needed. Although Qualtrics has the ability to recode data before exporting it, we preferred to export the data file without manipulating the file. We correct mistakes (e.g., incorrect teacher identification numbers) using a statistical program such as R or Stata. In this way, we were able to keep annotated cleaning syntax, which tracked all changes that we made to the file.

## Teacher Survey Data

Teacher surveys were uploaded to a secure box folder for raw data files. The raw data files were not modified, and remain in their original formatting as specified in the data structure document (saved in the secure data folder). Column F of the data structure document identifies how the data should be exported (i.e., numeric or choice).

# References

Ausubel, D. P., Novak, J. D., & Hanesian, H. (1986). Educational psychology: A cognitive view (2nd ed.). New York, NY: Werbel & Peck

Bandura, A. (1977). Self-efficacy: Toward a unifying theory for behavioral change. *Psychological Review, 84*(2), 191-215.

Bleicher, R. E. (2004). Revisiting the STEBI-B: Measuring self-efficacy in pre-service elementary teachers. *School Science and Mathematics, 104*(8), 383-391.

Cobern, W. W., Schuster, D., Adams, B., Skjold, B. A., Muğaloğlu, E. Z., Bentz, A., & Sparks, K. (2014). Pedagogy of Science Teaching Tests: Formative assessments of science teaching orientations. *International Journal of Science Education*, *36*(13), 2265-2288.

Riggs, I. M., & Enochs, L. G. (1990). Towards the development of an elementary teacher's science teaching efficacy belief instrument. *Science Education, 74*(6), 625-637.

White, C. (2015). The creation and validation of an instrument to measure school STEM culture" *All Dissertations*. 1584. https://tigerprints.clemson.edu/all_dissertations/1584

# Appendix A – Teacher & Leader Communication Plan

| Communication Type | Date | Time | Teacher Message | Leader Message |
|---|---|---|---|---|
| Qualtrics Email | 5/8/19 | 7:00 AM | Dear ${m://FirstName},<br><br>We need your feedback on your SMU coaching experience! We wanted to let you know that you will receive a coaching evaluation survey from us on Monday, May 13. Please mark your calendars and look for this email from us!<br><br>This survey will help us improve the SMU STEM Academy in the coming years. We look forward to receiving your feedback next week! | Dear ${m://FirstName},<br><br>We need your feedback on your SMU coaching experience! We wanted to let you know that you will receive a coaching evaluation survey from us on Monday, May 13. Please mark your calendars and look for this email from us!<br><br>This survey will help us continue to improve the SMU STEM Academy in the coming years. We look forward to receiving your feedback next week! |
| Qualtrics Email | 5/13/19 | 7:00 AM | Dear ${m://FirstName},<br><br>We need your feedback on your SMU coaching experience! Please complete the coaching evaluation survey below. The survey will require less than 20 minutes of your time. Your feedback will greatly support the improvement of the SMU STEM Academy. Your feedback is important to us.<br><br>Please follow the directions below to access the survey links. You will need your SMU Student ID to take the surveys. Your SMU ID is ${m://ExternalDataReference} | Dear ${m://FirstName},<br><br>We need your feedback on your SMU coaching experience! Please complete the coaching evaluation survey below. The survey will require less than 20 minutes of your time. Your feedback will greatly support the improvement of the SMU STEM Academy. Your feedback is important to us.<br><br>Please follow the directions below to access the survey links. You will need your Dallas ISD employee ID to take the survey. |
| Qualtrics Email | 5/16/19 | 7:00 AM | Dear ${m://FirstName},<br><br>We wanted to remind you to please complete the coaching evaluation. Your feedback will greatly support the improvement of the SMU STEM Academy. Your input is very important to us!<br><br>If you are currently still eligible for the incentive, your participation in this survey is required for you to receive your selection of maker-based or inquiry-oriented instructional materials.<br><br>Please follow the directions below to access the survey links. You will need your SMU Student ID to take the surveys. Your SMU ID is ${m://ExternalDataReference} | Dear ${m://FirstName},<br><br>We wanted to remind you to please complete the coaching evaluation. Your feedback will greatly support the improvement of the SMU STEM Academy. Your input is very important to us!<br><br>Please follow the directions below to access the survey links. You will need your Dallas ISD employee ID to take the survey. |
| Qualtrics Email | 5/20/19 | 7:00 AM | Dear ${m://FirstName},<br><br>We wanted to remind you again to please complete the coaching evaluation by the deadline to complete the survey is THIS Friday, May 24 at 5:00 PM. We value your input, and appreciate the time you take to complete these surveys.<br><br>Your participation in this survey is required for you to receive your selection of maker-based or inquiry-oriented instructional materials. If you are no longer eligible for the incentive, we ask that you still provide feedback to help us continue improving the SMU STEM Academy.<br><br>Please follow the directions below to access the survey links. You will need your SMU Student ID to take the surveys. Your SMU ID is ${m://ExternalDataReference} | Dear ${m://FirstName},<br><br>We wanted to remind you again to please complete the coaching evaluation by THIS Friday, May 24 at 5:00 PM. We value your input, and appreciate the time you take to complete these surveys.<br><br>Please follow the directions below to access the survey links. You will need your Dallas ISD employee ID to take the survey. |
| Qualtrics Email | 5/23/19 | 7:00 AM | Dear ${m://FirstName},<br><br>We wanted to remind you that TOMORROW, Friday May 24, is the FINAL DAY to complete the coaching evaluation! We value your perceptions in improving the STEM Academy.<br><br>Your participation in this survey is required for you to receive your selection of maker-based or inquiry-oriented instructional materials. If you are no longer eligible for the incentive, we ask that you still provide feedback to help us continue improving the SMU STEM Academy. | Dear ${m://FirstName},<br><br>We wanted to remind you that TOMORROW, Friday May 24, is the FINAL DAY to complete the coaching evaluation! We value your perceptions in improving the STEM Academy.<br><br>Please follow the directions below to access the survey links. You will need your Dallas ISD employee ID to take the survey. |