# VISTA Research and Evaluation Annual Report
# New Science Coordinator Extract

Years 1 - 5

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# New Science Coordinator Academy (NSCA) Implementation Evaluation – Years 1-5

## Introduction

The Virginia Initiative for Science Teaching and Achievement (VISTA) project addresses a critical need to support the professional development of science teachers and improve science achievement for students in the elementary and secondary grades in Virginia. VISTA is funded as an Investing in Innovation (i3) validation grant by the Office of Innovation and Improvement in the U.S. Department of Education and is funded from October 2010 to October 2015. VISTA is a partnership among 47 school districts, six universities, and the Virginia Department of Education to build an infrastructure to provide sustained, intensive science teacher professional development to increase student performance.

The goal of VISTA is to improve science teaching and student learning throughout Virginia. The program is based on two teacher professional development programs developed to improve science instruction and student performance that have been found to be statistically significant (Sterling & Frazier, 2010; Sterling, Matkins, Frazier, & Logerwell, 2007). In conjunction with validating prior program research efforts, the grant-funded project has been designed to build leadership and shape policy and practice through four intensive professional development programs.

The goal of the VISTA New Science Coordinator Academy (NSCA) is to build, support, and sustain the infrastructure of school district science leaders. Many science coordinators are district leaders with a Master's of Education in Administration and Supervision. Often, their preparation does not focus on their role as a district-level science leader and/or science is not their primary job responsibility. Thus, the NSCA provides science liaisons/coordinators across school districts the opportunity to learn and network. During the NSCA, school district science coordinators focus on strategic planning for effective science teaching, data-driven decision making, and leadership.

## Description of the New Science Coordinator Academy Components

The primary purpose of the VISTA NSCA was to build the state infrastructure to support effective science teaching and learning and was implemented by a team of instructors and facilitators.

The stated objectives of the NSCA were:

1. Learn to make improvements in leadership, teacher learning, quality teaching, and student learning.
2. Develop a common understanding of inquiry, nature of science (NOS), and problem-based learning (PBL).
3. Identify aspects of effective science teaching and learning.
4. Compare district models of creating standards-based science curricula.
5. Investigate data sources available to use to provide a focus to improve district science programs.
6. Develop a science program strategic plan.

Over the five days of the Academy, participants engaged in presentations, activities, and discussions that addressed each of these objectives. Each day began with an overview of the topics and concluded with a participant-written reflection designed to help the participant identify what they learned, how they could apply it in their own setting, and to provide the implementation team with feedback. Integrated throughout each day were opportunities for

collaboration and discussion. Table 1 provides an overview of the topics/activities each day and the corresponding objective.

Table 1. *Overview of the NSCA (Corresponding objectives in parentheses)*

| Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
|---|---|---|---|---|
| Developing professional development plans (1) | Inquiry, PBL, and NOS (2) | Data analysis to evaluate science programs (5) | Strategic Planning (6) | Analyzing Student work (1, 5) |
| | Identifying effective teaching (3) | Assessing science programs (5) | Discourse & Misconceptions (1, 3) | Aligning and Assessing Curriculum (4, 5) |
| | Observation protocols for effective science instruction (1, 5) | Strategic planning (6) | Nature of Science (2, 3) | Inquiry (2, 3) |
| | Strategic Planning (6) | | Update from the State (5, 6) | Strategic Planning (6) |

## Implementation Analysis

The purpose of this implementation analysis is to examine the extent to which the NSCA was implemented as intended and the extent to which program goals for this component of VISTA were achieved. The following implementation questions guided the analysis:

1. Did the participants attend the NSCA consistently and regularly?
2. Was the content of the NSCA delivered to the participants?
3. Did participants' understanding of key concepts and methods improve as a result of attending the NSCA?

### Participants

Participants in Year 1 of the VISTA NSCA included 3 males and 10 females ranging in age from 30 to 54 years from 12 different school districts in Virginia. There were 1 Asian, 2 African American, and 10 Caucasian participants. All of the participants hold a M.Ed. or M.S. degree and 7 participants hold or are in the process of earning an Ed.D. or Ph.D. in Education. Participants' years of experience in an administrative or supervisory role ranged from 7 months to 13 years.

Participants in Year 2 of the VISTA NSCA included 5 males and 10 females ranging in age from 31 to 58 years from 13 different school districts in Virginia. There were 3 African American and 12 Caucasian participants. All of the participants hold a M.Ed. or M.S. degree and 3 participants hold an Ed.D. or Ed.S. degree. Year 2 participants' experience in an administrative or supervisory role ranged from 0 months to 8 years.

In Year 3 of the VISTA NSCA, participants included 5 males and 14 females from 19 different school districts in Virginia. All participants were Caucasian. There were 4 participants whose highest degree was a B.S. or B.A degree, 15 participants who held a M.Ed. or M.S. degree and 4 of these 15 held or were in the process of earning an Ed.D or Ph.D in Education. Participants' years of experience in an administrative or supervisory role ranged from 0 months to 9 years.

Year 4 participants of the VISTA NSCA included 2 males and 11 females from 13 different school districts in Virginia. There were 2 African American, 10 Caucasian, and 1 Hispanic/Latino. Of these participants, 7 held a B.S. or B.A. as their highest degree, 4 participants held a M.Ed. or M.S. degree and 2 held a Ph.D or Ed.S. in Education or a related field. Year 4 participants' experience in an administrative or supervisory role ranged from 0 to 7 years.

Participants in the Year 5 of the VISTA NSCA included 3 males and 13 females from 15 different school districts in Virginia. All 16 participants were Caucasian. Of the participants at least 12 hold at least a Master's degree, 2 participants are in the progress of receiving a Ph.D., and 2 of the participants hold a Ph,D. Participants' years of administrative and/or supervision experience range from 0 to 9 years with an average of 1.19 years of experience.

All participants were currently in leadership positions in their respective school division. Ten of the Year 1 participants, 11 of the Year 2 participants, 12 of the Year 3 participants, 10 of the Year 4 participants and 11 of the Year 5 participants have led science professional development. Table 2 indicates the science coordinator's gender, highest degree earned or in progress, position in the district, and years in an administrative or supervisory position. To maintain confidentiality, all participants were assigned a participant ID.

**Data Collection**

Data consisted of a survey administered pre- and post- the NSCA, a delayed-post-NSCA Perceptions survey, follow-up interviews of a subset of participants, observations, and artifacts including planning documents and participant-generated reflections.

**Pre-NSCA Perceptions Survey.** This survey contained 14 Likert-scale items and was administered on site, prior to the NSCA. Nine items assessed participants' understanding of and capacity to evaluate and implement professional development associated with PBL, NOS, and inquiry science instruction. Additional questions assessed participants' proficiency in supporting research-based and standards-based science instruction, using data to improve district science programs, and developing division-wide strategic planning and infrastructure support for science education. The scale ranged from 1 (not very proficient) to 5 (highly proficient).

**Post-NSCA Perceptions Survey.** The post-survey contained the same 14 Likert-scale items as the pre-survey and 4 additional open-ended questions. The open-ended questions were designed to elicit participants' perceptions of the strengths and weaknesses of the NSCA and the quality of the NSCA relative to other professional development experiences. This survey was administered on site at the end of the NSCA.

**Delayed-post NSCA Perceptions Survey.** This survey was administered approximately one year after science coordinators participated in the NSCA. It was emailed to participants as a link for submission. The purpose of the survey was to collect data on the perceptions of participants' experience a year later. It also addressed how the science coordinators implemented learned concepts from the NSCA. The survey included the same 14 Likert-scale items as the pre-survey and 8 open-ended questions designed to elicit participants' perceptions of the effectiveness of the NSCA and how they have implemented aspects of the NSCA. Open-

ended questions also addressed participants' implementation of professional development and the impact it may have had on their district.

**Interviews.** Following analysis of the post- and delayed-post NSCA surveys, participants were purposefully selected for a follow-up semi-structured interview about their experience. These participants were selected because their pre-, post- or delayed-post survey responses indicated little, moderate, or great changes in their proficiency of the key NSCA objectives (inquiry, PBL, and NOS instruction) following the Academy. Interview questions elicited participants' perspectives on the most and least valuable aspects of the Academy, components of the NSCA they plan to implement, and suggestions for improvement. These interviews also served as a member-check of these participants' survey responses.

Table 2. *NSCA Year 1, 2, 3, 4, & 5 Participant Demographic Information.*

| Year | Total | Gender | | Highest Degree | | | | Current Position | | | Years In Administrative Position | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Female | Male | B.A. or B.S. | M.Ed. or M.S. | Ed.D. or Ph.D. (in progress) Ed.S. | Ed.D. or Ph.D. | District Science Coordinator/ Specialist | Science Lead Teacher/ Instructional Coach | Other[1] | 0-2 | 3-5 | 6-7 | 7< |
| 1 | 13 | 10 (77%) | 3 (23%) | 0 (0%) | 6 (46%) | 4 (31%) | 3 (23%) | 5 (38%) | 4 (31%) | 4 (31%) | 6 (46%) | 4 (31%) | 1 (8%) | 2 (15%) |
| 2 | 15 | 10 (67%) | 5 (33%) | 0 (0%) | 11 (73%) | 3 (20%) | 1 (7%) | 12 (80%) | 2 (13%) | 1 (7%) | 4 (27%) | 8 (53%) | 1 (7%) | 2 (13%) |
| 3 | 19 | 14 (74%) | 5 (26%) | 4 (21%) | 10 (53%) | 3 (16%) | 2 (10%) | 12 (63%) | 3 (16%) | 4 (21%) | 12 (63%) | 2 (10%) | 3 (17%) | 2 (10%) |
| 4 | 13 | 11 (85%) | 2 (15%) | 7 (55%) | 4 (31%) | 1 (7%) | 1 (7%) | 9 (69%) | 4 (31%) | 0 (0%) | 8 (62%) | 3 (23%) | 2 (15%) | 0 (0%) |
| 5 | 16 | 13 (81%) | 3 (19%) | 0 (0%) | 12 (76%) | 2 (12%) | 2 (12%) | 6 (37% | 6 (37%) | 4 (26%) | 8 (50%) | 4 (26%) | 2 (12%) | 2 (12%) |

*Note:* [1] Principals, central office administrators, beginning teacher advisors, curriculum support, department chair

**Observations.** Observations occurred to observe the activities coordinators participated in during the NSCA and to ensure implementation was being carried out as planned. These observations occurred on several occasions each year of the NSCA. A total of ten days of observations occurred over the five years of the NSCA. Observations were made about activities the science coordinators participated in, their engagement with the material, the methods used by the implementation team to deliver instruction, and the presence of characteristics of effective professional development. Observations illuminated the behaviors and interactions participants were involved in and allowed for meaning making to occur as aligned with an interpretive paradigm. Observation field notes captured descriptions of the professional development provided and interactions between the coordinators, implementers, and colleagues. Transcription and initial analysis of field notes occurred within two days of the original observations.

**Artifacts.** All planning materials and participant-generated reflections were collected. These artifacts allowed for detailed characterization of the Academy components and triangulated with survey data and interview responses.

**Data Analysis**

Data from each participants' pre-, post- and delayed-post-NSCA survey were analyzed using descriptive statistics. For each participant, an overall sum of all of the items and mean scores pre-, post- and delayed-post-assessment were calculated along with an aggregate mean score for those survey items assessing inquiry, NOS, and PBL. Changes in participants' scores pre-, post- and delayed-post-Academy were also calculated as overall change, average change, and change for those items assessing inquiry, NOS, and PBL.

Data from Year 1, 2, 3, and 4 participants' pre-, post-, and delayed-post-NSCA Perceptions surveys were analyzed using a repeated measures design in order to allow each participant to serve as their own control. An aggregate summed score of 3 survey items assessing inquiry was calculated for each participant. Aggregate summed scores for PBL and NOS were also calculated. Other items analyzed included the participants' ability to support high-quality research-based science instruction and to develop a strategic plan for their respective districts. The data were assumed to follow an additive model (i.e., scores for each participant were assumed to have the same trend over the three time points). Follow-up non-orthogonal simple contrasts were used to determine whether the scores selected on the pre-survey differed significantly from the scores received on the post- and delayed-post-NSCA surveys. Alpha slippage was controlled through the use of a Bonferroni adjustment (i.e., both contrasts were evaluated at a per comparison alpha rate of .05/2 = .025). To determine whether the F statistics were properly distributed, the homogeneity of difference score variances was also assessed (i.e., sphericity).

Analytic induction, as described by Bogdan and Biklen (1992), was used to analyze the open-ended survey responses, follow-up interviews, observations, and artifacts. Patterns were identified in the data set with the goal of characterizing the experiences of NSCA participants. From these patterns, preliminary categories were developed, which were refined through comparison with the original data set.

## Results

**Attendance**

In Year 1, the VISTA NSCA took place March 23-25, 2011 and May 12-13, 2011 at George Mason University. Of the 13 participants, 11 attended both the March and May sessions, for a total of 30 instructional contact hours over the 5 days of the Academy; 2 only attended the

March session for a total of 19 instructional contact hours. Overall, the attendance rates were high and consistent during the first year.

In Year 2, the VISTA NSCA took place October 3-5, 2011 and April 26-27, 2012 at George Mason University. All 15 participants attended both the October and April sessions, for a total of 33 instructional contact hours over the 5 days of the Academy. One participant missed a half-day during the October session and a half-day during the April session, and another participant missed a day during the April session, for a total of 26 instructional contact hours. The attendance rates during the second year were high and consistent.

In Year 3, the VISTA NSCA took place October 3-5, 2012 and April 18-19, 2013 at George Mason University. All 19 participants attended all of the October sessions and 18 of the participants attended all of the April sessions for a total of 33 instructional contact hours over the 5 days of the Academy. One participant missed a day during the April session for a total of 27 instructional contact hours. In general, the attendance rates during the third year were high and consistent.

In Year 4, the VISTA NSCA took place October 2-4, 2013 and April 16-17, 2014 at George Mason University. Of the 13 participants, 12 attended all of the October and April sessions for a total of 33 instructional contact hours over the 5 days of the Academy. One participant missed a day during the October session for a total of 26 instruction contact hours. The attendance rates during the fourth year were high and consistent.

In Year 5, the VISTA NSCA took place October 1-3, 2014 and April 16-17, 2015 at George Mason University. Of the participants, 15/16 attended both the October and April sessions in their entirety, for a total of 30 instructional contact hours over the 5 days of the Academy. One participant had to withdraw prior to the spring sessions. Overall, the attendance rates were high and consistent for year 5.

**Implementation**

In general, the implementation of the NSCA occurred as planned and scheduled. The facilitators developed a curriculum and agenda for the NSCA, which was followed closely.

**Impact on Participants**

**Descriptive analysis.** Table 3 indicates the average pre-assessment, post-assessment, delayed-post-assessment and changes in Year 1, Year 2, Year 3, Year 4, and Year 5 participants' NSCA Perceptions survey scores on selected outcomes. Preliminary analysis of the NSCA Perceptions Year 1 survey data indicate that participants' average scores prior to the NSCA ranged from 1.6 to 4.2, with a mean score for all participants of 3.0. Following the NSCA, participants' average scores ranged from 2.9 to 4.8, with a mean score for all participants of 3.9. Changes in participants' average scores ranged from -0.1 to 1.6, with a mean change of 0.9. These results suggest the professional development improved participants' proficiency and understanding, ability to develop professional development, and to evaluate teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and develop a strategic plan for science instruction. Participants in Year 1 of the NSCA exhibited the greatest gains in their self-reported proficiency in identifying, evaluating and supporting teachers' implementation of PBL and to develop a district strategic plan for science teaching and learning. Participants also exhibited gains in their proficiency in identifying, evaluating and supporting teachers' implementation of inquiry and NOS instruction and using research to improve science instruction, though these gains were not as large.

Preliminary analysis of the NSCA Perceptions Year 1 post- and delayed-post survey data indicate that participants' average scores ranged from 3.0 to 4.8, with a mean score of 3.9 on the

delayed-post survey. Changes in participants' average scores ranged from -1.6 to 0.5, with a mean change of 0.07. These results suggest the material learned during the professional development was maintained for all but one participant (-1.6); all other participants had small, positive changes from the post- to delayed-post survey scores indicating their understanding was maintained and/or slightly improved. This seems to indicate the NSCA may be effective in sustaining long-term change in participants' practice and understandings. The delayed-post survey also asked participants to describe how they had used the content, materials and/or strategies from the NSCA and to estimate the number of in-service teachers and PK-12 students that were directly and indirectly impacted. These estimates are presented in Table 4. Results show that all but one participant implemented aspects of the VISTA NSCA in their district and that participants perceived their activities to have direct and indirect impacts on in-service teachers and PK-12 students.

Table 4. *Estimated Impact on In-service Teachers and PK-12 Students.*

| Participants | Direct Impact | | Indirect Impact | |
|---|---|---|---|---|
| | In-service Teachers | PK-12 Students | In-service Teachers | PK-12 Students |
| Year 1 (n=9) | 1,020 | 31,300 | 2,930 | 58,400 |
| Year 2 (n=12) | 1,139 | 13,130 | 2,463 | 63,160 |
| Year 3 (n=18) | 1,373 | 58,620 | 1,775 | 78,438 |
| Year 4 (n=11) | 1,417 | 4,085 | 2,511 | 67,500 |
| **TOTAL** | **4,949** | **107,135** | **9,679** | **267,498** |

Preliminary analysis of the NSCA Perceptions Year 2 survey data indicate that participants' average scores prior to the NSCA ranged from 1.6 to 4.4, with a mean score for all participants of 3.1. Following the NSCA, participants' average scores ranged from 2.5 to 4.8, with a mean score for all participants of 3.7. Changes in participants' average scores ranged from -0.1 to 1.7, with a mean change of 0.7. These results suggest the professional development improved participants' proficiency and understanding, ability to develop professional development, and to evaluate teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and develop a strategic plan for science instruction. Participants in Year 2 of the NSCA exhibited the greatest gains in their self-reported proficiency in identifying, evaluating and supporting teachers' implementation of NOS and to develop a district strategic plan for science teaching and learning. Participants also exhibited gains in their proficiency in

identifying, evaluating and supporting teachers' implementation of inquiry and PBL instruction and using research to improve science instruction.

Preliminary analysis of Year 2 delayed-post-NSCA Perceptions survey data indicate participants' average scores ranged from 3.0 to 4.9, with a mean score for all participants of 4.1. Changes in participants' average scores ranged from -0.5 to 1.6, with a mean change of 0.36. These results suggest the material learned during the professional development was maintained for all but one participant (-0.5); all other participants had no change or positive change from the post- to delayed-post survey scores indicating their understanding was maintained or improved. This seems to indicate the NSCA may be effective in sustaining long-term change in participants' practice and understandings. The delayed-post survey also asked participants to describe how they had used the content, materials and/or strategies from the NSCA and to estimate the number of in-service teachers and PK-12 students that were directly and indirectly impacted. These estimates are presented in Table 4. Results show that all participants implemented aspects of the VISTA NSCA in their district and that participants perceived their activities to have direct and indirect impacts on in-service teachers and PK-12 students.

Preliminary analysis of the NSCA Perceptions Year 3 survey data indicate that participants' average scores prior to the NSCA ranged from 1.4 to 4.2, with a mean score for all participants of 2.8. Following the NSCA, participants' average scores ranged from 2.4 to 4.7, with a mean score for all participants of 3.8. Changes in participants' average scores ranged from 0.2 to 2.0, with a mean change of 1.0. These results suggest the professional development improved participants' proficiency and understanding, ability to develop professional development, and to evaluate teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and develop a strategic plan for science instruction. Participants in Year 3 of the NSCA exhibited the greatest gains in their self-reported proficiency using research to improve science instruction and to develop a district strategic plan for science teaching and learning. Participants also exhibited gains in their proficiency in identifying, evaluating and supporting teachers' implementation of inquiry, NOS and PBL instruction.

Table 3. *Impact of VISTA NSCA Professional Development on Selected Outcomes.*

| | Overall | Inquiry | NOS | PBL | Improve Science Instruction | Strategic Planning |
|---|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) |
| Year 1 | | | | | | |
| Pre (n=13) | 3.0 (0.7) | 3.2 (0.9) | 2.8 (0.9) | 2.8 (1.0) | 3.2 (0.6) | 2.8 (1.0) |
| Post (n=11) | 3.9 (0.6) | 4.2 (0.6) | 3.5 (0.8) | 4.2 (0.7) | 3.9 (0.5) | 4.0 (0.9) |
| Delayed Post (n=9) | 3.9 (0.7) | 3.9 (0.9) | 3.7 (0.7) | 4.0 (0.8) | 3.9 (0.9) | 3.8 (0.6) |
| Year 2 | | | | | | |
| Pre (n=15) | 3.1 (0.8) | 3.2 (0.9) | 2.8 (0.8) | 3.2 (1.1) | 3.1 (1.1) | 2.8 (1.1) |
| Post (n=14) | 3.7 (0.6) | 4.0 (0.7) | 3.6 (0.8) | 3.9 (0.7) | 3.5 (0.8) | 3.5 (1.1) |
| Delayed Post (n=12) | 4.1 (0.8) | 4.4 (0.7) | 4.0 (0.9) | 4.2 (1.0) | 4.1 (0.9) | 4.0 (1.1) |
| Year 3 | | | | | | |
| Pre (n=19) | 2.8 (0.7) | 3.1 (1.2) | 2.7 (0.8) | 2.9 (0.9) | 2.6 (0.6) | 1.9 (0.8) |
| Post (n=19) | 3.8 (0.7) | 3.9 (0.8) | 3.7 (0.9) | 3.7 (0.8) | 3.8 (0.8) | 4.1 (0.8) |
| Delayed Post (n=18) | 3.8 (0.6) | 4.1 (0.7) | 3.7 (0.8) | 3.9 (0.8) | 3.6 (0.8) | 3.9 (0.7) |
| Year 4 | | | | | | |
| Pre (n=13) | 2.9 (0.7) | 3.2 (0.7) | 3.1 (0.8) | 2.8 (1.1) | 2.9 (0.6) | 2.3 (1.1) |
| Post (n=13) | 4.0 (0.6) | 4.2 (0.6) | 3.9 (0.9) | 3.9 (0.9) | 3.8 (0.5) | 4.2 (0.8) |
| Delayed Post (n=12) | 3.8 (0.7) | 3.8 (0.7) | 3.9 (0.8) | 3.8 (0.9) | 3.8 (0.9) | 3.8 (1.0) |
| Year 5 | | | | | | |
| Pre (n=16) | 2.9 (0.5) | 3.0 (0.6) | 2.8 (0.7) | 2.9 (0.6) | 2.7 (0.6) | 2.6 (0.6) |
| Post (n=15) | 4.0 (0.6) | 4.0 (0.6) | 3.9 (0.8) | 4.1 (0.6) | 4.1 (0.7) | 4.1 (0.7) |

Preliminary analysis of Year 3 delayed-post-NSCA Perceptions survey data indicate participants' average scores ranged from 2.7 to 4.6, with a mean score for all participants of 3.8. Changes in participants' average scores, from post to delayed-post, ranged from -1.1 to 0.8, with a mean change of 0. These results suggest the material learned during the professional development was maintained for the majority of participants. This seems to indicate the NSCA may be effective in sustaining long-term change in participants' practice and understandings. The delayed-post survey also asked participants to describe how they had used the content, materials and/or strategies from the NSCA and to estimate the number of in-service teachers and PK-12 students that were directly and indirectly impacted. These estimates are presented in Table 4. Results show that all participants implemented aspects of the VISTA NSCA in their district and that participants perceived their activities to have direct and indirect impacts on in-service teachers and PK-12 students.

Preliminary analysis of the NSCA Perceptions Year 4 survey data indicate that participants' average scores prior to the NSCA ranged from 2.0 to 4.7, with a mean score for all participants of 2.9. Following the NSCA, participants' average scores ranged from 3.1 to 4.9, with a mean score for all participants of 4.0. Changes in participants' average scores ranged from 0.1 to 2.4, with a mean change of 1.0. These results suggest the professional development improved participants' proficiency and understanding, ability to develop professional development, and to evaluate teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and develop a strategic plan for science instruction. Participants in Year 4 of the NSCA exhibited the greatest gains in their self-reported proficiency in identifying, evaluating and supporting PBL instruction and in developing a district strategic plan for science teaching and learning. Participants also exhibited gains in their proficiency in identifying, evaluating and supporting teachers' implementation of inquiry and NOS, and in using research to improve science instruction.

Preliminary analysis of Year 4 delayed-post-NSCA Perceptions survey data indicate participants' average scores ranged from 2.5 to 4.8, with a mean score for all participants of 3.8. Changes in participants' average scores, from post to delayed-post, ranged from -1.0 to 0.9, with a mean change of -0.1. These results suggest the material learned during the professional development was maintained for the majority of participants. This seems to indicate the NSCA may be effective in sustaining long-term change in participants' practice and understandings. The delayed-post survey also asked participants to describe how they had used the content, materials and/or strategies from the NSCA and to estimate the number of in-service teachers and PK-12 students that were directly and indirectly impacted. These estimates are presented in Table 4. Results show that all participants implemented aspects of the VISTA NSCA in their district and that participants perceived their activities to have direct and indirect impacts on in-service teachers and PK-12 students.

Preliminary analysis of the NSCA Perceptions Year 5 survey data indicate that participants' average scores prior to the NSCA ranged from 2.0 to 3.8, with a mean score for all participants of 2.9. Following the NSCA, participants' average scores ranged from 3.1 to 4.8, with a mean score for all participants of 4.0. Changes in participants' average scores ranged from 0.3 to 1.9, with a mean change of 1.2. These results suggest the professional development improved participants' proficiency and understanding, ability to develop professional development, and to evaluate teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and develop a strategic plan for science instruction. Participants in Year 5 of the NSCA exhibited the greatest gains in their self-reported proficiency in developing

a district strategic plan for science teaching and learning and in using research to improve science instruction. Participants also exhibited gains in their proficiency in identifying, evaluating and supporting teachers' implementation of inquiry and NOS, and in identifying, evaluating and supporting PBL instruction.

**Inferential analysis.** Results suggest attending the NSCA improved participants' perceptions of their proficiency and understanding of, developing professional development for, and evaluation of teachers' inquiry, NOS, and PBL instruction, their capacity to improve science instruction, and to develop a strategic plan for science instruction. Furthermore, the results indicate these improvements were maintained a year following their attendance (Table 5). These results are discussed in detail below.

Table 5. *Changes in Participants' Proficiency and Confidence on Selected Outcomes (n = 51).*

| | Supporting Science Instruction^ | Inquiry$^{+}$ | NOS$^{+}$ | PBL$^{+}$ | Strategic Planning^ |
|---|---|---|---|---|---|
| | M (SD) | M (SD) | M (SD) | M (SD) | M (SD) |
| Pre | 3.16 (0.97) | 9.33 (2.92) | 8.34 (2.48) | 8.69 (3.02) | 2.38 (1.09) |
| Post | 3.82 (0.79)* | 12.01 (2.20)* | 11.11 (2.54)* | 11.49 (2.42)* | 3.77 (0.96)* |
| Delayed-Post | 3.88 (0.7) | 12.14 (2.12) | 11.41 (2.45) | 11.80 (2.67) | 3.90 (0.85) |

Note: ^Indicates a 1-5 point scale. $^{+}$Indicates an aggregate score of three items with a total possible score of 5-15 points. *Indicates statistical significance at $p < 0.001$.

***Supporting science instruction.*** Mauchly's chi-square approximation confirmed that sphericity was obtained, $\chi^2(2) = 3.26$, $p = .20$. Tukey's test of additivity revealed the data followed an additive model, $F$ (2, 99) = 2.0, $p = .16$. The mean score on coordinators' perceptions of their ability to support high-quality, research-based science instruction was found to be statistically significant, $F$ (2, 100) = 19.67, $p < .001$. Follow-up non-orthogonal contrasts between the pre-, post- and delayed-post-survey data indicated there was a significant increase in scores from the pre- ($M = 3.16$) to post- ($M = 3.82$), $F$ (1, 50) = 22.07, $p < .001$. However, there was no significant increase from post- to delayed-post ($M = 3.88$), $F$ (1, 50) = .269, $p = .606$. Omega squared indicated 19% of the variance in the participants' scores on supporting science instruction was attributable to the times when the scores were evaluated. This suggests that coordinators perceive their ability to support science instruction was improved by attending the NSCA and this belief was maintained a year later.

***Inquiry.*** Mauchly's chi-square approximation revealed that sphericity was not violated, $\chi^2(2) = 2.74$, $p = .254$. Tukey's test of additivity was violated, $F$ (2, 99) = 8.71, $p = .004$. The mean score on coordinators' perceptions of their ability to identify, evaluate, and enhance teachers' inquiry instruction was found to be statistically significant, $F$ (2, 100) = 50.88, $p < .001$. Follow-up non-orthogonal contrasts between the pre-, post- and delayed-post-survey data evidenced there was a significant increase in scores from the pre- ($M = 9.33$) to post-survey ($M = 12.01$), $F$ (1, 50) = 65.03, $p < .001$. However, there was no significant increase from post- to delayed-post-survey scores ($M = 12.14$), $F$ (1, 50) = .183, $p = .671$. Omega squared indicated 35% of the variance in the participants' scores on inquiry instruction was attributable to the times

when the scores were evaluated. This suggests that coordinators believe inquiry was an appropriate method to teach science and this belief was maintained a year later.

***NOS.*** Mauchly's chi-square approximation confirmed that sphericity was obtained, $\chi^2$ (2) = 1.82, $p$ = .40. Tukey's test of additivity revealed the data followed an additive model, $F$ (2, 99) = .233, $p$ = .63. The mean score on coordinators' perceptions of their ability to identify, evaluate, and enhance teachers' NOS instruction was found to be statistically significant, $F$ (2, 100) = 48.83, $p$ < .001. Follow-up non-orthogonal contrasts between the pre-, post- and delayed-post-survey showed there was a significant increase in scores from the pre- ($M$ = 8.34) to post-survey ($M$ = 11.11), $F$ (1, 50) = 59.94, $p$ < .001. However, there was not a significant increase in scores from the post- to delayed-post-survey ($M$ = 11.41), $F$ (1, 50) = .975, $p$ = .328. Omega squared indicated 36% of the variance in the participants' scores on NOS instruction was attributable to the timing of the surveys.

***PBL.*** Mauchly's chi-square approximation revealed sphericity had been violated, $\chi^2$(2) = 6.59, $p$ = .037; therefore, degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ($\varepsilon$ = .92). Tukey's test of additivity confirmed the data followed an additive model, $F$ (2, 99) = .705, $p$ = .40. The mean score on coordinators' perceptions of their ability to identify, evaluate, and enhance teachers' PBL instruction was found to be statistically significant, $F$ (1.84, 91.86) = 40.17, $p$ < .001. Follow-up non-orthogonal contrasts between the pre-, post- and delayed-post-surveys indicated there was a significant increase in scores from the pre- ($M$ = 8.69) to post-survey ($M$ = 11.49), $F$ (1, 50) = 48.67, $p$ < .001. However, there was no significant increase in scores from post- to delayed-post-survey ($M$ = 11.80), $F$ (1, 50) = 1.024, $p$ = .316. Omega squared showed 32% of the variance in the scores on PBL instruction was attributable to the time when the scores were evaluated.

***Strategic planning.*** Mauchly's chi-square approximation revealed that sphericity was obtained, $\chi^2$(2) = 3.26, $p$ = .20. Tukey's test of additivity evidenced the data followed an additive model, $F$ (1, 99) = 1.63, $p$ = .21. The mean score on coordinators' perceptions of their ability to develop a strategic plan for their respective districts was found to be statistically significant, $F$ (2, 100) = 63.86, $p$ < .001. Follow-up non-orthogonal contrasts between the pre-, post- and delayed-post-surveys indicated there was a significant increase in scores from the pre- ($M$ = 2.38) to post-survey ($M$ = 3.77), $F$ (1, 50) = 77.76, $p$ < .001. However, there was no significant increase in scores from post- to delayed-post-survey ($M$ = 3.90), $F$ (1, 50) = .019, $p$ = 0.890. Omega squared showed 46% of the variance in the scores on strategic planning was attributable to the timing of the surveys. The significant difference found in pre- to post-survey scores for the coordinators' perceptions of their ability to develop a strategic plan is evidence of the coordinators' ability to implement what they are learning. Furthermore, the statistical results revealed there was no reversion from the post- to delayed-post-survey as there was no significant difference in these scores. This showed that not only do coordinators believe strategic plans are important, but also that this belief remains a year after they participated in the professional development.

**Qualitative analysis.** Analysis of qualitative survey, interview, and artifact data suggested participants valued many components of the NSCA, including the targeted nature of the NSCA, the opportunity for collaboration with peers, developing a strategic plan, and the emphasis on evaluating and providing effective professional development to teachers. Participants also indicated they planned to implement what they learned in their own districts, and they had some suggestions for the future.

***Targeted nature of the NSCA.*** Participants indicated that the targeted nature of the NSCA was an effective component of the NSCA. It was clear participants valued the opportunity to experience professional development that was focused specifically on their area of leadership. There is little, if any, professional development designed exclusively for science coordinators, which makes this opportunity of great value to participants. For example, participants said:

> I would say is how appreciative I am of the targeted nature of this opportunity. While I have studied these topics before, I have not done so with a group of "parallel" leaders who are experiencing the topic through such a specific lens. I could not be more grateful for that. (I especially appreciated the "leadership" lens on our study of this topic – very helpful for me right now). (Post Perceptions Survey, SC1M1)

> First, the significance of breaking bread and discussing issues with our counter parts around the state is extremely powerful. Various approaches to curriculum writing and Strategic planning are helpful. These leadership topics are presented in such limited forums that this has been very helpful. I remarked to someone at lunch that this job has no handbook. Helped to fill in the gaps. (Post Perceptions Survey, SC2M5)

> The collaboration between the different people that we got to work with, from the specialists who came in to just other people that have the same type job as I have and seeing what's going on in their district and sharing that information, sharing resources. Every day was a different learning experience, but every day it was something that I could bring back. (Interview SC1F6)

> Although I have participated in previous professional development experiences, none have been focused on the responsibilities of science coordinators or the planning, implementation, and evaluation of professional development opportunities for teachers. (Post Perceptions Survey, SC3F47)

> None, it was my first training on how to train others on critical and key issues of science. I had my first conversation on discourse today! I learned how to design professional development here. I thought I knew what I was doing but I was wrong after I learned what I learned here. It has left me wanting more. I love it. I would come again and again. It was the single most valuable training of my career. I really learned how to plan development and how to evaluate what the level of my development was on and the need to evaluate it in the future. (Post Perceptions Survey, SC4F75)

> The VISTA program has helped our science teachers with both knowledge and technique. The NSCA has helped me to speak the same language as our VISTA teachers allowing us to move forward with our science program. All of our spring SOL scores are not available, however, one of our fifth grade science teachers has better than an 90% pass rate with 38% of the students passing advanced. (Delayed-Post Perceptions Survey, SC3M20)

***Collaboration with peers.*** It was clear from the surveys, interviews, and observations

that one of the most beneficial aspects of the NSCA was the opportunity for participants to collaborate with peers. Participants indicated there were few opportunities for collaboration with peers in their day-to-day environment. The NSCA provided the time for peers to interact and get to know one another. Participants also indicated these relationships continued past the NSCA. For instance, some participants said:

> I would say the opportunity to work with other science coordinators from across the state. We don't get very many opportunities to communicate and work together face to face. So that was probably the most valuable component. (SC1F12, Interview)

> One of the most beneficial aspects of this academy was networking and discussing common challenges among other science coordinators. Please continue to promote and foster this collaboration. (Post Perceptions Survey, SC1F5)

> Networking with others in similar roles: leadership roles tend to be isolated in nature, and this opportunity gave me ways to learn from others. (Delayed-Post Perceptions Survey, SC1M1)

> ...She saw that my conference went well on Saturday and she already sent me a note, oh that's great and I want us get together and share some ideas, I did something different but I want to move more in that direction. So there's more of a personal relationship that we can call each other and I see more of a collegiality. (Interview, SC1F2)

> Over the last few months, I realized that this is my support group and I think that's huge. There's a lot of value in hearing what other groups are doing that are similar. I think whenever you put heads together, especially when we're at a point in Virginia where we're really trying to get into some substance and some substantial changes. Instead of just 'here's the vocabulary' but to 'here are some really meaningful experiences for students'. And whenever you're pushing to do something that's harder, I think you're going to have more push back, it's more complex, you need to spend more time with them so that's been really helpful. (Observation, SC3F46)

> I have tried to think of what was least important and I feel that everything was planned for my job description - VISTA NSCA is what I do. All aspects were important, and most importantly working with coordinators across the state was the best part. (Post Perceptions Survey, SC3M16)

> I have appreciated the training as new administrator trying to navigate the school board office waters and system. The game we played in the fall has helped me see the importance of administrative support and how to get it. Also, the network I have developed here as been extremely helpful as I am in a small county with very limited resources. I have no other direct colleagues in my position so it is helpful to talk to others and see how they handle situations, find resources, brainstorm, etc. (Post Perceptions Survey, SC4F71)

> The most valuable components were probably collaborating with other coordinators

> mainly because being able to see what initiatives and some of the struggles that they were facing and how they're overcoming them that was extremely, extremely helpful. (Interview, SC5F85)

***Strategic planning.*** A majority of the participants indicated the opportunity to think about and develop a strategic plan for their district was one of the most valuable components of the NSCA. Participants clearly realized the importance of having a strategic plan and appreciated the chance to collaborate with one another. This is evidenced in the following quotes:

> The VISTA Science Coordinators Academy has given me the opportunity to impact my division in helping me to create a vision that is evident in our strategic plan. Without a vision, it is impossible to get teacher buy-in. Everything that we have learned in these 5 days has helped me become more confident in my leadership role, more aware of the strengths and weaknesses in my divisions' science program, and more informed about resources, and professional development strategies to support growth. I have also appreciated the development of a professional network of colleagues that I can connect to share both accomplishments and struggles with. (Post Perceptions Survey, SC1F11)

> Being able to sit down with a sample strategic plan. One of the implementers brought a sample strategic plan from his work in a district so that we could use that as a jumping off point for our own next steps….we don't often have folks sitting and thinking about that level of strategy when thinking about the programs we offer. So just being able to have that and the model and other folks to collaborate with in terms of their ideas, what strategies they're taking on to meet their goals. I think that that was really powerful for me. (Interview, SC1M1)

> I found the sessions on strategic planning and breaking down the different approaches (PBL, Inquiry, and Hands on Science) to be the most beneficial. Both topics provided useful targeted instruction that I could take back to my district and apply right away. (Delayed-Post Perceptions Survey, SC2F22)

> As a coordinator, I really appreciated going through the process of developing a professional development plan and strategic plan. This forced my hand to sit down and visualize where we are as a division and where we need to be in three years. (Post Perceptions Survey, SC3F49)

> Well, I used the strategic planning sheet that they had given us, to come up with what I was going to focus on throughout this year. And one of my big goals was to, once they helped me to look at my data and my information, I was able to analyze what were some weaknesses for my division. And so, I set about how I was going to work on those… So, I felt that VISTA really gave me the tools on how to do that effectively. So, I thought that was very helpful. (Interview, SC475)

> I will use the strategic planning and evaluation process throughout my career. This I will immediately bring back to my team as we create a strategic plan for the district. As we

> continue to refine and align curriculum documents, I will be using the color-coding alignment activity to make sure that we have comprehensive units included in our documents. (Post Perceptions Survey, SC5F95)

***Professional development.*** Participants appreciated the opportunity to learn about providing effective professional development to teachers. It was clear the chance to create a professional development plan and to learn about evaluating its effectiveness was beneficial to participants. This is demonstrated by the following excerpts:

> Right now, I'd have to say the most useful is looking at evaluating professional development. We had done some stuff in the second set of days. I don't know how you're identifying it, but the second set of days we did some work on looking at, really identifying professional development. How do we know professional development is effective? And we had a lot of resources that they had given us that. And I had actually, some of the references in those resources; I've actually gone out and purchased some additional stuff. (Interview, SC1M3)

> I will look at the PD evaluation information to refine my PD evaluations. (Post Perceptions Survey, SC2M8)

> The first thing is doing the professional development plan that helped me get a little bit more organized in what I was planning on doing. And to focus on what we need and to structure out how we were gonna attack professional development this year. That was one. The second one is I used a lot of the activities that we did with my curriculum study team. It helped bring them up to where I thought I needed to be on things like inquiry-based learning and problem-based learning, and where science education is right now. (Interview, SC2F22)

> There's also no common language on words such as, 'hands-on science,' 'inquiry,' 'rigor,' 'nature of science,' all of that, and so, I think looking at the types of professional development that I would be giving over a three-year period would help guide us and lead us more into that direction. And I kind of systematically over my professional development plan have placed strategically certain professional developments that I want to give on all three of those to get our teachers where we need to be three years from now. And I can't, I think…I just have the typed up one, but you get the idea. So it really had me thinking about where I wanted to be and my strategic plan was just not for one year, it was really over a three-year period and my professional development plan really tied into my strategic plan to help me get where I wanted to go. (Interview, SC3F49)

> We're very careful about planning our lessons but planning professional development, I think sort of takes a back burner sometimes, and so I think planning professional development in the same way that we have planned our lessons with sort of the outcome in mind and planning on not just evaluating it that day but evaluating long-term how that's going. And so that'll definitely be a change for us looking at long-term effects of professional development as opposed to just the end of the seminar survey or whatever we had done in the past. (Interview, SC3F66)

> I read the book on professional development they gave us cover to cover. Everything is marked up and highlighted and dog eared and I had a notebook journal going along with the reading of the book. It's was very useful and it was also very frustrating because, like I said, I've never read a book where I had to stop to think so much, but that's not a bad thing. (Interview, SC5F93)

***Future intentions.*** Participants had specific plans for how they would implement what they learned in the NSCA in the following year. It was clear the participants found the material and resources provided in the NSCA useful and indicated it would be used in professional development in their districts. These plans reflected the stated goals of the NSCA. Below are some examples of participants' intentions:

> Well, this summer I plan on working to get a written statement of goals for the science program for the school division. I've got my notes and I've got the structure and samples and all that in my notebook, so that will definitely be a good resource. I've got lead science teachers in each building and I'm thinking, you know, that as we meet throughout the year and as we plan professional development and look at lesson plans throughout the school division that it will help to serve as the charge and assist what we're gearing towards. This is why we're doing what we do and this is, you know, what we, schools are trying to reach. And what we want to accomplish, and how much of it we will accomplish by the end of the year. So I'm hoping it's going to set the tone for decision making and set the tone for looking at curriculum and looking at, you know, the big picture of what we want to do with science in the division. (Interview, SC1F7)

> I will use these resources to lead professional development in my own county. I've already used some of these tools with goals and actions in my own County's Science Curriculum Committee. I've used the inquiry rubric to more clearly identify what is/isn't inquiry lessons. Teachers have been given these tools to use with their own colleagues. Given the resources from the VISTA training, I feel like I have an arsenal of tools to help teachers assess their own science practice and ultimately towards impacting the change towards more inquiry in the schools. (Post Perceptions Survey, SC1F2)

> I used a lot of the strategies from the academy. It was integrated in the professional development workshops that were provided to all science teachers, both new and veteran. I also modified the PowerPoint™ materials from the NSCA and shared it with teachers and other administrators in our district. The handouts were very helpful, too. Those were given to new teachers. (Delayed-Post Perceptions Survey, SC1M2)

> I have already started to use the nature of science activities and strategies with the science lead teachers. A future activity I envision is the teachers rewriting current science activities to be more inquiry based. I would also like to see our county start examining curriculum and looking at possible changes. (Post Perceptions Survey, SC2M7)

> And then, the last thing I had is I wanted to do some professional development where we look at student work, and that was something that we talked about and learned about at

> VISTA, and that's something that I want to do math and science and I have not done that yet. Because we weren't quite ready for that yet. We needed to sort of do the first steps, but that is huge and that's something that I really want to incorporate next year and I think that if I was to get my task force together, it wouldn't be so much work. (Interview, SC2F18)

> The one other thing that I wanted to do in my plan actually was to update our pacing guide. We've updated our benchmark assessment. But also I wanted to create a professional learning community among the science teachers, so we have started to have content-based meeting for all science teachers to attend in all grade levels. We started that this year after attending the training, and hopefully we can continue that next year. (Interview, SC3F24)

> -I have worked with teachers to help them increase inquiry in their classrooms -I have worked on the science strategic plan for our district -I have developed and presented a problem-based learning activity for use in our district and delivered it to students and teachers -I have designed and presented PD on brain-based learning to the faculty at our school -I will help teachers incorporate discourse, address misconceptions -I will work on a science curriculum for the district that is aligned to science standards. (Post Perceptions Survey, SC4F66)

> I plan to approach my Director of Curriculum and Instruction as soon as I return to discuss developing a PD to complete the curriculum alignment. We have nothing in place and desperately need to develop a tool that will provide consistency. I can literally use everything that was covered. I really need some time to process everything and sort through. I would like for you to ask me this question again in three months. (Post Perceptions Survey, SC4F76)

***Recommendations for future NSCA.*** Overall, participants in Year 4 of the NSCA seemed to feel there was very little that needed to be changed in the future. There were four suggestions that were brought up by more than one participant and should be considered for the next NSCA: more time for tasks, more opportunities to share with one another, being able to drink in the lab, and providing follow-up opportunities. Examples of these suggestions are:

> More time to complete tasks during the session. (Post Perceptions Survey, SC3F61)

> Allow more "digestion" time. So much new information is presented to us that it would be nice to have a bit more time to assimilate the information. (Post Perceptions Survey, SC4F73)

> I would like to see more time built in to the training to work on Strategic Planning and sharing of best practices with other school divisions represented. (Post Perceptions Survey, SC3F57)

> This was great! I would request that we have class in a room that would allow food and drinks (when appropriate). We all got dehydrated:) (Post Perceptions Survey, SC4F66)

> Write a grant so we can continue to meet at least once a year. (Post Perceptions Survey, SC4F69)

> Invite us back to reflect. (Post Perceptions Survey, SC4F75)

> I would like to have revisited the strategic plan template for a reality check. I plan to call the instructors to determine if I am on the right track. Since this is a document that is required to be turned in, I would like to have had time to sit with someone one on one for additional ideas and course corrections. Could also have done this with the PD plan. (Post Perceptions Survey, SC4F76)

## Conclusion

From the data presented in this report it appears clear that the NSCA component of the VISTA program was implemented successfully and to fidelity. Overall, the participants were present and engaged in the work. The content and instruction of the NSCA were delivered with fidelity to program intentions. Content goals were attained to a satisfactory level and participants' comments indicated they had clear plans of how they will implement what they learned in their districts in the upcoming academic year. It is also clear participants' key understandings improved as a result of attending the NSCA and that for Years 1, 2, 3, and 4 there was little reversion in understandings a year later. Participants clearly valued the opportunity to collaborate with peers, to create a strategic plan, to learn more about effective professional development, and the targeted nature of the NSCA.

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