1-2017

Investigating the role of a district science coordinator

Brooke A. Whitworth

Jennifer L. Maeng

Lindsay B. Wheeler

Jennifer L. Chiu

JOURNAL OF RESEARCH IN SCIENCE TEACHING VOL. 9999, NO. 00, PP. 1–23 (2017)

Research Article

Investigating the Role of a District Science Coordinator

Brooke A. Whitworth,[1] Jennifer L. Maeng,[2] Lindsay B. Wheeler,[3] and Jennifer L. Chiu[2]

[1] *Center for Science Teaching and Learning, Northern Arizona University, Science & Health Building #36, Room 525, Flagstaff 86011, Arizona*
[2] *Curry School of Education, University of Virginia, Charlottesville, Virginia*
[3] *Center for Teaching Excellence, University of Virginia, Charlottesville, Virginia*

Received 23 August 2015; Accepted 31 January 2017

Abstract: This study explored the professional responsibilities of district science coordinators, their professional development (PD) experiences, the relationship between their role, responsibilities, district context, and background, and barriers encountered in their work. A national sample ($n = 122$) of self-identified science coordinators completed a Science Coordinator Role Survey. Participants' responses were analyzed using descriptive and correlational statistics. Following analysis of survey data, 16 participants (13.1%) were purposefully selected for semi-structured follow-up interviews. Results indicated the majority of respondents identified themselves as Caucasian, female, and had served in their position for less than 10 years. The typical science coordinator held a degree in a science content area and was a former science teacher. Respondents without science degrees tended to hold positions at small, remote, or rural school districts with responsibilities in multiple content areas. Participants also reported barriers of not having enough PD opportunities, lack of time, lack of emphasis on science instruction, and a lack of power to enforce policies within a district. Results characterize the professional responsibilities of coordinators, provide insight into the role of a science coordinator, and into how to create targeted PD for coordinators. © 2017 Wiley Periodicals, Inc. J Res Sci Teach 9999:XX–XX, 2017
Keywords: science coordinators; professional development; district leadership

Teacher professional development (PD) has the potential to play a vital role in improving teacher change and student achievement (Desimone, Porter, Birman, Garet, & Yoon, 2002; Hewson, 2007; PCAST, 2010). School districts implement a variety of PD for teachers that costs districts billions of dollars annually (Birman et al., 2007; Pianta, 2011). These PD experiences include administrator and curriculum coordinator-directed district-based PD, PD by external educational companies, school-based professional learning communities for teachers, and partnerships with universities and organizations (Spillane, 2002). Thus, school districts have the potential to play a large role in improving teaching and learning in K-12 education (Corcoran, Fuhrman & Belcher, 2001).

Contract grant sponsor: National Science Education Leadership Association.
Correspondence to: B. A. Whitworth; E-mail: brooke.whitworth@nau.edu
DOI 10.1002/tea.21391
Published online in Wiley Online Library (wileyonlinelibrary.com).

District leaders (i.e., staff developers, science coordinators, math coordinators, testing coordinators, etc.) are closely tied to a district's effectiveness in improving teaching and learning and often play an intermediary role between teacher needs and schools' division requirements (Firestone, Mangin, Martinez & Plovsky, 2005; Leithwood, Seashore-Louis, Anderson & Wahlstrom, 2004; Marsh, 2002). These district leaders help shape the support a district provides their teachers by selecting and implementing specific PD programs (Ogawa & Bossert, 1995). However, little research examines the roles of these district leaders or how to help them better fulfill their role in supporting teachers (Higgins, 2008; Luft & Hewson, 2014; Whitworth & Chiu, 2015).

Understanding the roles and PD needs of district leaders is crucial to facilitating teacher change and student learning, especially as many states face implementing new reforms including the *Next Generation Science Standards* (Domina, Lewis, Agarwal, & Hanselman, 2015; NGSS Lead States, 2013). As the NGSS call for a fundamental shift in instruction and assessment approaches toward an integration of practices, core ideas, and crosscutting concepts, this creates numerous and pressing challenges for science educators at the K-12 level (e.g., Purzer, Moore, Baker, & Berland, 2014; Roseman, Fortus, Krajcik, & Reiser, 2015). As the field looks to support teacher change to achieve the goals of the NGSS, it is critical to investigate the district leaders who are responsible for teacher PD. For science, a district leader is typically a science coordinator, defined as an individual responsible for science curriculum and instruction within a district (e.g., Edmondson, Sterling, & Reid, 2012).

The present study seeks to understand the diversity of roles and backgrounds of science coordinators across the country, the kinds of PD activities they seek out, and barriers they encounter. Describing roles and backgrounds of science coordinators can help the field understand the various contexts and characteristics that may influence or shape their practice. Exploring the kinds of PD activities science coordinators would like to receive helps the field provide more targeted support to science coordinators. Identifying barriers encountered by district science coordinators helps the field understand how to more effectively support science coordinators. By investigating characteristics, challenges, and needs of science coordinators, this study provides insight into how to support these leaders in the midst of NGSS-based reforms.

Literature Review

District Science Coordinators

Despite the potential influence of science coordinators on teacher practice, relatively little research explicitly investigates these leaders. Past research has found that science coordinators usually hold at least a Master's of Education, are experienced in the classroom, and are most often the person responsible for overseeing science PD and the science curriculum (Edmondson, Sterling, & Reid., 2012). For example, Perrine (1984) investigated how elementary teachers and science coordinators perceived the science supervisor position and practices. In this study, a sample of 29 coordinators and 470 elementary teachers were surveyed in the state of New Jersey. Results indicated teachers and coordinators felt the leadership behavior of the science coordinator was not ideal, and the science coordinator had different expectations than the actual supervisory practices. The author identified two components as critical to supervisory effectiveness: providing teachers with content and pedagogical supports and effective communication with teachers. The author called for the science coordinator role to be more clearly defined so all district stakeholders (e.g., principals, teachers, district administrators) could hold the same expectations for the position.

In another study, Madrazo and Hounshell (1987) investigated the perception of the science coordinator role by a variety of stakeholders in the state of North Carolina. Participants in the study included 23 superintendents, 23 science supervisors, 100 randomly selected principals, 208 elementary teachers, 208 secondary teachers, and 25 college professors. The Science Coordinator's Role Expectations Questionnaire was sent to the participants for completion and 89% of the population responded. Findings revealed the science coordinator role was perceived differently by different individuals. It was recommended that the role of the science coordinator be constantly evaluated in order to understand the different perceptions of this role and the changing attitudes of stakeholders. These results reinforce the importance of continuing to research stakeholder perceptions and definitions of the science coordinator role in light of NGSS-based reform.

A more recent study suggests that district structure and background experience may play a role in the effectiveness of coordinators. In a case study of three science coordinators, Whitworth (2014) found that a coordinator with an elementary teaching background responsible for working with teachers of grades PK-12 students perceived she was less effective when working with secondary teachers. In contrast, the two coordinators with secondary teaching backgrounds and more science content expertise were perceived by teachers as effective across grade levels. Furthermore, the science coordinators in smaller districts experienced barriers in finding the time and resources to support their teachers in improving science instruction. The results of this investigation suggest that there may be specific needs of science coordinators working with teachers outside of their content-area or grade level expertise. Results also indicate that as coordinators work to support teachers, they may encounter barriers specific to their role.

Additionally, research on district size demonstrates differences in teachers' characteristics between rural and non-rural districts, which has implications for students (Fowles, Butler, Cowen, Streams, & Toma, 2014), yet no studies examine the impact of differences in science coordinators across varying districts on teachers and students. However, there is some research to indicate these differences do exist. Lee, Leary, Sellers & Recker (2014) compared support for technology integration by district science coordinators and the resulting teacher adoption of the tool across five school districts. In this case study, Lee et al. (2014) found the science coordinator played an important role in teacher use of the tool. However, the results also indicated the practices enacted by coordinators varied widely across districts. Overall, these studies suggest understanding a district science coordinator's role, district size, and degree should inform what and how we support coordinators with differing backgrounds and contexts. Furthermore, research is needed to determine if the barriers observed are pervasive and if so, how they impact coordinators in effectively supporting teachers.

Together, the results of these investigations suggest district science coordinators play an important role in supporting teacher science instruction. Additionally, it is clear from these studies that science coordinators serve as intermediaries between teachers and other district leaders. It is evident that in this intermediary role, it is important for coordinators to understand the characteristics of effective PD as well as effective leadership practices. However, these studies also reveal large gaps in our understanding of the district science coordinator role. For example, what are current backgrounds, contexts, and roles of science coordinators? How do district science coordinators perceive and characterize opportunities to develop professionally? What barriers do district science coordinators encounter in their role?

Conceptual Framework

The conceptual framework guiding this investigation pulls from literature on effective science teacher PD. A large body of research suggests effective science teacher PD is characterized by opportunities for active learning, coherence, collective participation, content focus, and duration (Desimone, 2009; Loucks-Horsley & Matsumoto, 1999; Luft & Hewson, 2014; Whitworth & Chiu, 2015). For teacher growth to occur, teachers should be actively engaged in their learning, which can occur through a variety of strategies, including practice teaching, planning, presenting, and reviewing student work (Heller, Daehler, Wong, Shinohara, & Miratrix, 2012). PD should also be incorporated into a program of teacher learning that provides coherence with national, state, district, and school policies and standards (Garet, Porter, Desimone, Birman, & Yoon, 2001). Furthermore, PD should allow for some level of collective participation, whether it includes teachers from the same school or department, or allows teachers from the same grade or subject area to work together (Desimone, 2009). Content-focused PD allows teachers the opportunity to develop their content knowledge and can lead to changes in teacher practices (Garet et al., 2001). Finally, PD of a significant duration, meaning PD that it is spread out over time (e.g., a year or semester) appears to be more effective in changing teacher practices (Loucks-Horsley & Matsumoto, 1999; Pianta, 2011). Specific to science teacher PD, recent studies that incorporate these characteristics into their PD suggest that science teachers are more likely to incorporate new strategies into their practice when they engage in PD that provides multiple opportunities for practice (Heller et al., 2012; Jeanpierre, Oberhauser, & Freeman, 2005; Roth et al., 2011).

Despite a large body of research supporting the integration of these features into effective teacher PD, district-offered PD for teachers is often ineffective and delivered in the format of short in-service workshops with little or no follow-up (Loucks-Horsley & Matsumoto, 1999; Pianta, 2011; Spillane, 2002). Furthermore, these "one shot" workshops often lack coherence or relevance for teachers (Spillane, 2002) and instead of being content-focused they address administrative, management, or discipline issues (Desimone, Smith, & Phillips, 2007; Pianta, 2011). This disconnect between best practices in PD and what is actually implemented by district leaders suggests a need for further research to understand how the individuals who design and conduct PD are educated and supported (e.g., Luft & Hewson, 2014; Whitworth & Chiu, 2015).

The characteristics of effective PD described above serve as the conceptual framework for the present investigation. For example, school districts that are aligned with national and state standards are more likely to engage in continuous improvement efforts and tend to implement more successful PD activities (Desimone et al., 2002). Districts with coherent and content-focused PD can greatly support change in teaching practice, and district decisions related to vision, PD activities, and human resources can influence the coherence and content-focus of PD programs (Firestone et al., 2005). Effective district leadership involves district leaders collaborating and working together to support teacher instruction and student learning (Leithwood, 2012; Leithwood et al., 2004; Murphy & Hallinger, 1988) (Figure 1).

Although research suggests characteristics and practices of successful leaders, studies do not prescribe a "recipe" or one set of tasks a leader should follow to be effective (Marzano, Waters, & McNulty, 2005; Murphy & Hallinger, 1988). Instead, these practices should be implemented depending on district contexts and situations. Regardless, effective leadership practices, if implemented successfully, clearly relate to student achievement (Leithwood, 2012; Leithwood et al., 2004). Thus, if the goal is to support teacher development and increase students' science achievement, gaining insight into district science coordinators' roles and backgrounds may illuminate areas in which they would benefit from PD.

Purpose

Science coordinators play an important role in teaching and learning in science classrooms, yet little research examines the diversity of science coordinator roles, contexts, and backgrounds and how these relate to their PD needs and the barriers they encounter as they navigate their intermediary role between classroom science instruction and district requirements. This study

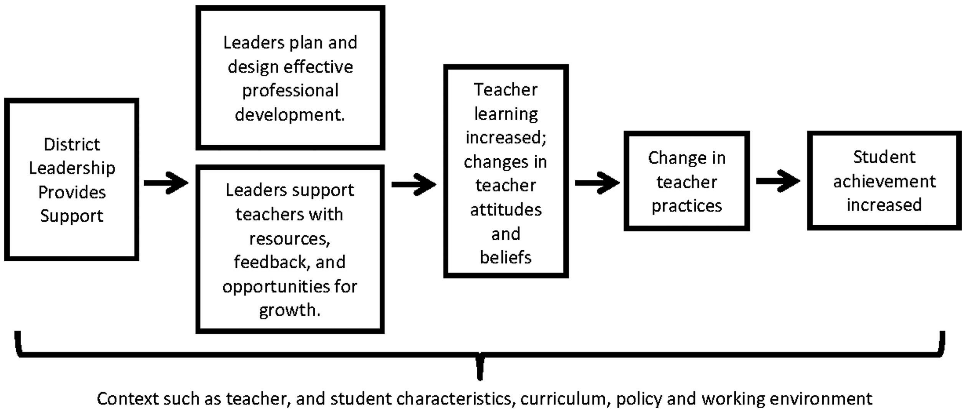

Figure 1. Model identifying the importance of studying the role of district leadership in the PD of teachers. Modified from Whitworth and Chiu (2015).

addresses this gap by characterizing the role of the district science coordinators and their perceived opportunities for PD. The following research questions guided this study:

(1) What are the backgrounds, contexts, and roles of science coordinators? How do these relate to each other?
(2) How do district science coordinators perceive and characterize opportunities to develop professionally?
(3) What barriers do district science coordinators encounter in their role?

By answering these questions, this study seeks to better understand the role of district science coordinators across the United States. This is critical to learning how we can support the improvement of science education within districts.

Methodology

Qualitative methods were adopted to answer the research questions. Data included survey responses as well as interview data. Close-ended survey responses were analyzed using descriptive and non-parametric statistics. Open-ended survey responses and interview data were analyzed using an inductive analysis approach as this was an initial phase of research and allowed for a variety of analytic units (Bogdan & Biklen, 1982). The data provide a broad perspective on the science coordinators' role, responsibilities, context, and background through the close-ended survey data, and a richer, more in-depth perspective, including the barriers coordinators encountered, from examination of the open-ended responses and interview data.

Participants

Science coordinators who were members of the National Science Education Leadership Association (NSELA) were solicited to complete surveys (described in the data sources section below). NSELA is a National Organization committed to "communicate the principles and practices of effective science education leadership, build a community of science education leaders, and influence science education policies and practices" (Triangle Coalition, 2013). Members of NSELA include over 600 science department chairpersons, science coordinators, science supervisors, science education faculty, and science lead teachers from across the country. Of these, 206 members self-identified as science coordinators as part of their NSELA registration.

The NSELA membership was selected as a nationwide sample of science coordinators because this organization includes a known membership and contact information was readily available.

To elicit participation in the study, an initial email was sent to all NSELA members that included a description of the study and a link to an informed consent agreement and the survey. This email also informed coordinators of the opportunity to win a gift card if they completed the survey. NSELA members were asked to complete the survey within a 2-week window. Seventy-six participants completed the survey within this first 2-week period. After 2 weeks, a reminder email was sent to the NSELA membership. Forty-five additional participants completed the survey. A final reminder was sent 2 weeks later. Another one participant completed the survey. Given this low response rate to the final request, we assumed at this point that no more NSELA members would complete the survey. Thus, a total of 122 out of 206 NSELA members who self-identified as science coordinators completed the survey, representing a total response rate of 59.2%. Science coordinators self-selection into membership in NSELA and their subsequent completion of the survey are limitations of this investigation. One meta-analysis of web surveys reported an average response rate of 39.6% across 68 studies (Cook, Heath, & Thompson, 2000). This issue was partly resolved by sending two follow-up reminders to solicit more responses, resulting in an overall response rate of 59.2%.

Those completing the survey included 84 females and 38 males from 29 different states. Of these, 3 (2.5%) reported their ethnicity as African American, 99 (81.1%) identified themselves as Caucasian, 1 (0.8%) was Latina/o, and 2 (1.6%) self-identified as combined ethnicities. Seventeen respondents (13.9%) declined to provide their ethnicity. The majority of participants were from Virginia (14.8%), Ohio (10.7%), and Massachusetts (9.0%).

A purposeful sample (Creswell & Plano Clark, 2011) of 16 (13.1%) survey respondents were selected based on analysis of survey responses for a follow-up interview (described in the section Science Coordinator Interview). All participants who were initially selected agreed to participate and were interviewed via phone. Criteria used to select participants for interviews included district locale (as defined by http://nces.ed.gov/ccd/commonfiles/glossary.asp), degree, responsible for only science, and desire for more science coordinator specific PD. These characteristics were selected to provide diverse perspectives across characteristics that may influence coordinator practice (Whitworth, 2014). A representative sample of participants along these criteria was selected (Table 1). Table S1 provides a description of individual participants along each of the criteria.

Data Sources

Data collection included a Science Coordinator Role Survey (Appendix S1) and a semi-structured interview (Appendix S2) with a subset of purposefully selected science coordinators. Utilizing a survey in this study was appropriate given our desire to provide a description of trends, attitudes, and opinions held by science coordinators by studying a sample of the population (Creswell, 2014). Follow-up semi-structured interviews of a subset of survey respondents provided more detailed information about the responsibilities and role of coordinators and served as a means to triangulate the survey data; thus, increasing the validity of the findings. Survey and interview instrument development are detailed below.

Science Coordinator Role Survey. In designing the survey, two researchers wrote and developed an initial set of questions. Prior to administration, the survey was reviewed by a panel of six experts in science education, evaluation, and measurement in order to establish support for face and content validity (Haynes, Richard, & Kubany, 1995; Newman & McNeil, 1998). Two rounds of review were conducted with this expert panel and recommended changes were

Table 1
Criteria representation within population and sample

Criteria Category	Criterion	Criterion Within Population % (*n*)	Criterion Within Interview Sample % (*n*)
District locale	Large city	8.2 (10)	12.5 (2)
	Medium city	13.1 (16)	6.3 (1)
	Small city	9.0 (11)	6.3 (1)
	Large suburb	36.1 (44)	31.3 (5)
	Medium suburb	2.5 (3)	6.3 (1)
	Small suburb	3.3 (4)	6.3 (1)
	Town/rural fringe	17.2 (21)	18.7 (3)
	Town/rural distant	9.8 (12)	12.5 (2)
	Town/rural remote	0.8 (1)	0 (0)
Degree in science	Yes	79.5 (97)	81.3 (13)
Content area responsibilities	Science only	50.8 (62)	56.3 (9)
Desire for PD	Yes	91.8 (112)	75 (12)

incorporated into the final version of the survey. Inter-rater agreement on the content validity, whether the item matched to the construct it was designed to measure, following the first round of review was 95.2%. For face validity, whether the item was adequately structured, inter-rater agreement was 85.4%. Following this round of review, in the professional responsibilities section, wording was clarified for two questions and additional answer choices were added for one question. For the professional growth section, one question was clarified, one question's answer choices were clarified, and two follow-up questions were added. In the demographics section, one question was clarified and two questions about their background were added.

A second round of review was conducted after completing these revisions with the same panel. The inter-rater agreement for content validity was 95.7% and for face validity was 90.4%. Following this review, two more answer choices were added to a question in the professional responsibilities section and a question about their background was added to the demographics section. The final version of the science coordinator role survey included three sections that included a total of 23 questions, 15 forced answer and eight open-ended questions, related to the following: responsibilities as a coordinator, professional growth, and demographics (Appendix S1). See Table S2 for a summary of the variables, item type, and alignment with the research questions. Development and design of the survey was informed and aligned with best practices (Dillman, Smyth, & Christian, 2014; Fowler, 2013).

Science Coordinator Interview. The 14 question, semi-structured interview protocol (Appendix S2) included questions designed to characterize the role and responsibilities enacted by a district science coordinator, how they interact with other stakeholders in their district and their peers within and across districts, the type and context of PD received, and barriers encountered in enacting their role. The interviews occurred during the academic year following the survey administration and each interview lasted between 20 and 40 minutes. Interviews occurred over the phone and were tape recorded and transcribed for analysis.

A panel of six experts in science education, evaluation, and measurement reviewed the interview protocol to establish support for face and content validity prior to use

(Haynes et al., 1995; Newman & McNeil, 1998). Two rounds of review and revision resulted in the final version of the interview protocol used in the study. After the first round of review, inter-rater agreement for content validity was 80.6% and for face validity was 76.1%. As a result, the wording of four questions were clarified and six question prompts were added including one question about PD they would like to receive and two questions focused on the barriers and rewards of their role. Following these refinements, the panel reviewed the protocol again. The second review resulted in an inter-rater agreement for content validity of 90.0% and for face validity of 86.7%. After this review, one question was clarified and one prompt was added resulting in the semi-structured protocol in Appendix S2.

Data Analysis

Results from the surveys and interviews were analyzed using descriptive and non-parametric statistics and inductive analysis. The relationship between the research questions, data sources, and analysis method is described in Table S2. Triangulation of the data sources (surveys, interviews) during the analytic process, inter-coder agreement, and revisiting data sources for evidence contributed to the trustworthiness of the findings (Creswell, 2014). Data were triangulated by examining the consistency of responses between multiple methods, identifying areas of consistency and inconsistency within data sources, and by using multiple coders to analyze the data from different perspectives as suggested by Patton (1999).

Closed-Ended Analysis. For the analysis of the close-ended survey questions, responses for questions were coded using a coding framework (Appendix S3). For example, questions were coded on desire for PD, school size, background, experience, content-area, and professional responsibilities. These questions were coded as follows: Participants' desire for PD was coded as no (0) or yes (1), district locale was coded using the urban-centric locale coding system (http://nces.ed.gov/ccd/commonfiles/glossary.asp), with the largest districts receiving a code of 1 and the smallest districts receiving a code of 12, experience was reported as years, and whether participants received a degree in science was coded as no (0) or yes (1). The total number of content-area responsibilities was summed for each participant. For example, if a participant checked that they were responsible for Science, English, Special Education, and Technology, they received a score of 4.

Means and standard deviations were calculated for all variables to answer research questions 1 and 2. Due to the categorical nature of the demographic data and the non-normality of the survey data, Spearman's correlation matrix was used to provide further information about possible relationships between the variables identified in questions 1 and 2. Correlation analysis identified any significant relationships between participants' desire for PD, school size, experience, and content-area.

Open-Ended Analysis. The open-ended survey questions and interview responses were inductively analyzed (Bogdan & Biklen, 1982) using inductively generated codes guided by the research questions, the conceptual framework, the researchers' prior knowledge, and inferences from the data. First, the data were studied holistically in order to inductively generate codes. The data set was read and re-read and initial categories were generated by two coders. The first rater developed initial categories, then the second coder coded the data using those categories and created additional categories as necessary. Next, the first and second rater determined whether categories should be retained or collapsed into other categories. This preliminary coding and discussion resulted in the final set of codes applied to the entire data set for each question. Inter-rater agreement was established to be 89.0% once final categories were developed and applied independently by the two raters. All disagreements in coding were resolved through discussion.

As an example, one rater read all of the open-ended responses regarding why coordinators wanted to attend PD with other coordinators and developed an initial set of codes for this survey question. These codes included: collaborating with others, networking, sharing PD strategies, developing ideas around NGSS and curriculum, developing ideas for state curriculum and standards, science coordinator specific focus, creating/developing a support system. The second rater then coded the data using these codes. Following this process, the raters discussed the codes and collapsed the collaborating with others and networking into one collaboration code and collapsed developing ideas around NGSS and curriculum, developing ideas for state curriculum and standards codes into one curriculum code. The raters also separated out a code for more time to collaborate with peers from the science coordinator specific focus code. Both raters then re-coded the data using the finalized codes for each question. This same approach was taken for analyzing all of the open-ended responses.

The results of the investigation, presented below by research question, embed the analyses of both data sources to provide an overarching picture of the roles, responsibilities, context, and background of science coordinators in the United States while simultaneously offering an in-depth perspective of the barriers coordinators encountered and PD desired.

Results

What Are the Backgrounds, Contexts, and Roles of District Science Coordinators?

Survey respondents identified their titles in a variety of ways (Table S3) and most reported being in their current position less than 10 years ($n = 100/122$, 82.0%) (Table S4). Of the 122 respondents, 106 (86.9%) were former science teachers and 97 (79.5%) hold a degree in a science content-area. Survey respondents reported working with various grade levels (Table 2) and content-areas (Table S5) and indicated having a wide variety of professional responsibilities.

From the survey data, around half of the participants' ($n = 62/122$, 50.8%) sole content-area responsibility was science and nearly half ($n = 54/122$, 44.3%) of the respondents reported being the only person in their district responsible for science supervision at the district level. Of the 60 (49.2%) survey respondents who had multiple content-area responsibilities, 26 (43.4%) reported having responsibilities for STEM, engineering, math, and/or technology.

All participants reported having multiple professional responsibilities that comprised their role as science coordinator (Table 3). Other responsibilities identified in the survey included leading PD for teachers, creating strategic plans for science, assisting in employment decisions and teacher evaluation, and safety/chemical hygiene.

Table 2
Participants' reported grade level responsibilities

Grade Level Responsibility	*n* (%)
All K-12	60 (49.2)
Only 9-12	10 (8.2)
Only 6-12	21 (17.2)
Only 6-8	8 (6.6)
Only K-8	7 (5.7)
Only K-5	16 (13.1)

Table 3
Participants' professional responsibilities

Professional Responsibilities	*n* (%)
Aligning curriculum with standards	114 (93.4)
Disseminating information to teachers	112 (91.8)
Working with administrators	112 (91.8)
Analyzing data to inform future work	110 (90.2)
Working with groups of teachers (including PD)	109 (89.3)
Curriculum development	109 (89.3)
Developing a strategic plan	107 (87.7)
Working with teacher leaders	101 (82.8)
Collaborating with other coordinators	100 (82.0)
Working 1-on-1 with teachers	94 (77.0)
Ordering supplies	94 (77.0)
Developing community relationships	82 (67.2)
Presenting at conferences	75 (61.5)
Monitoring budget	73 (59.8)
Administrative duties	72 (59.0)
Assisting in employment decisions	51 (41.8)
Teaching K-12 students	30 (24.6)
Working with students outside of class	19 (15.6)
Co-teaching daily	8 (6.6)
Grant writing	8 (6.6)
Safety	5 (4.1)
Evaluating teachers	4 (3.3)

Note. Coordinator responses could include multiple responses.

The open-ended analysis provided evidence to support the variety of responsibilities reported by participants in the survey. For example, the following quote from one interviewed participant described her multiple responsibilities:

> I'm the person that has all the basic communications with, about science content and curriculum and testing updates and that type of thing with grades 6 through 12. I am the person that organizes all of the PD that's specific for grades 6 through 12. And sometimes it's K-12 depending. . .. . .I'm the one that coordinates for microscopes, balances, what I'm working on now. I'm the person that deals with the safety stuff. I'm the one that makes decisions on curriculum as far as supplemental and other things that we would bring into the district. I have budgets. I have to make sure I am following grant deadlines, that I'm collecting the correct data. I have to do all the back-end paperwork for that. I go out into schools. I observe teachers. I make recommendations. I'm sure I've got others but that's a lot (SC55 Interview).

The breadth of responsibilities described by this coordinator evidence the multiple responsibilities that fall under a coordinator's purview.

Interview data also revealed a more nuanced understanding of how participants interacted and worked with groups of teachers ($n = 109/122$, 89.3%), one of the most cited responsibilities on the survey. Several interview participants ($n = 7/16$, 43.8%) indicated that working with teachers to prepare for testing and analyzing test data had become a major focus of their work over the last few years. For example, one respondent described a PD opportunity she was getting ready to provide and the reasons for it:

> I go out and I do the presentation that they [superintendents] think the staff needs to know and then I give like, right now I'm working on a presentation coming up here with a district that is really not prepared for the new testing format. They have not moved their instructional practices and they think they are just fine, and when I took the superintendents through all of our tests as well as our state next-generation science assessments, they were so blown away and said, "Oh, my gosh, we are not prepared. We have not changed our paradigm. Our teachers are not teaching what they need to teach." So, I'll come out and do that presentation based upon what they defined as a need that they saw at the meeting (SC33 Interview).

This science coordinator indicated she works with her district to help improve areas of identified weakness in teachers' instruction and tailoring her support for this group. It is also evident that preparing teachers to work with new standards and testing requirements is an important aspect of the role of science coordinators.

In summary, both survey and interview data illustrate the varied content-areas and responsibilities participants take on in their role as district science coordinators. Some science coordinators were responsible for just science while others also supported teaching and learning in other content-areas. Many different responsibilities were identified in the role of the science coordinator, but of these responsibilities, there was a focus on supporting teachers' instruction and preparation for new standards and tests.

Relationships Between Characteristics

The survey data revealed significant, moderate correlations (Cohen, 1992) between the size and type of the school district, whether participants held a degree in science, and the number of responsibilities they reported (Table 4). Participants without science degrees tended to have positions at smaller, more remote rural school districts and are likely to be responsible for multiple content-areas including science. Participants with no science degree tended to be responsible for multiple content-areas. Finally, participants in larger, urban school districts tended to have science backgrounds, more professional responsibilities, and were more focused on the science content-area than participants from smaller, rural school districts. No significant correlations existed between participants' years of experience or the desire for more PD and any other variables.

Interview data supported these findings. Interviewed participants in smaller districts indicated they took on a coordinator role in another subject area such as social studies (SC110 Interview). Conversely, individuals working in large districts tended to be responsible for fewer

Table 4
Means, Standard Deviation, and Correlations between Variables

	M	SD	1.	2.	3.	4.	5.	6.
1. District locale[a]	5.00	3.01	1.00					
2. Degree in science[b]	0.795	0.41	−0.277**	1.00				
3. Years in position	6.38	5.91	−0.071	−0.023	1.00			
4. # Content-area responsibilities	2.10	1.62	0.232*	−0.214*	−0.049	1.00		
5. Total # of Prof. responsibilities	13.02	3.33	−.137	0.236**	0.076	−0.142	1.00	
6. Desire for Prof. Ddevelopment[b]	0.62	0.49	0.136	−0.06	−0.116	0.047	0.077	1.00

Notes: *Indicates statistically significant at $p < 0.05$; **Indicates statistically significant at $p < 0.01$
[a]District locale coded 1 (largest) to 12 (smallest) according to the NCES urban-centric locale assignment system (http://nces.ed.gov/ccd/commonfiles/glossary.asp).
[b]Degree in science and Desire for PD coded as no (0) and yes (1).

grades and more schools. For example, one interview participant indicated she was the only elementary (K-5) science coordinator for 45 elementary schools (SC103 Interview), whereas another interviewed participant in a small district worked with only 10 schools PK-12, but was responsible for science and math (SC22 Interview). These interview data support the quantitative finding that district size and/or locale is related to the number and variation of content-area responsibilities for a science coordinator.

In summary, analysis suggest there exists a relationship between science coordinators' degree in science, their responsibilities, and their district locale. The implications of these relationships are elaborated on in the discussion.

How Do District Science Coordinators Perceive and Characterize Opportunities to Develop Professionally?

Main themes related to science coordinators' perceptions of PD are used to organize this section. Specifically, science coordinators reported on the types and focus of PD in which they enjoyed participating in and the PD experiences that facilitated collaboration with science coordinators in other districts.

Short PD Opportunities Were Most Desired. Survey responses showed science coordinators enjoyed participating in PD experiences in formats that included conferences, short activities, and collaborative study groups, among others (Table 5). In interviews, participants ($n = 13/16, 81.3\%$) also indicated the presence of consortia in their states that provided opportunities for them to interact with others in similar positions. For example, one participant stated in regards to the PD he preferred, "Every 6 months, we have a meeting with our state Association Science Supervisors, and it's usually basically about a 2.5 or 3-day meeting. There are sessions that we have where we talk about things" (SC3 Interview).

Science Coordinators Desired More Interactions With Colleagues. Of the 122 survey respondents, 107 (87.7%) indicated they have had opportunities to interact with other science coordinators during PD (Table S6). PD experiences that allowed for interactions between science coordinators from different districts within a given state were most prevalent ($n = 57/122, 46.7\%$). Interview analysis confirmed the majority of participants ($n = 13/16, 81.3\%$) interacted with other coordinators during state or national meetings; however, it seems these settings may not allow for the depth of connection or interaction participants desire. For example, when asked about opportunities for interactions with other coordinators, SC71 responded, "Not very often. That's

Table 5
Format of professional development preferred by science coordinators

Professional Development Format	*n* (%)
Conferences	99 (81.1)
1- to 4-day activities	62 (50.8)
Collaborative/study groups	32 (26.2)
Online courses over several weeks	17 (13.9)
Weeklong/multiple week courses/Institutes	11 (9.0)
College/University courses	11 (9.0)
School district-sponsored courses	3 (2.5)
Self-directed research	1 (0.8)
Other	1 (0.8)

Note. Participants' responses may have included multiple formats.

the unfortunate thing." Despite attending national and state meetings SC71, who was from a large suburban district still had difficulty connecting with other coordinators and learning how she could find support for her own work from others in her position.

Even though most survey participants 76 (62.2%) indicated they had adequate PD opportunities, 112 (91.8%) stated they would also like more PD opportunities to interact with other science coordinators. Their rationales for wanting more PD experiences with other science coordinators included the following: collaboration and sharing ideas, decreasing isolation, science coordinator-specific PD, sharing resources, and learning how to design PD to support NGSS, state standards, and STEM (Table 6).

For example, a representative response for the rationale for PD regarding sharing ideas and collaboration from one respondent was, "It is always important to collaborate with peers to learn and grow together in leadership and PD strategies" (SC2 Survey). Another participant discussed learning about what works in other districts, noting, "It is beneficial to collaborate with others with similar positions and professional responsibilities. I like hearing others' curriculum ideas or methods for overcoming shrinking budgets and other challenges public schools face" (SC86 Survey). Finally, 30 (24.6%) survey respondents discussed the isolated nature of their work environment and how science coordinator PD may help them overcome the feeling of isolation as a rationale for PD. One participant described this, "Very few people (including my boss and other content specialists) understand our role, workload, and responsibilities. It's nice to have a support system as well as someone to collaborate with" (SC32 Survey).

PD Coordinators Attended Emphasized Varied Topics. Analysis of open-ended survey responses revealed participants most frequently engaged in PD that emphasized: understanding student learning, learning to incorporate inquiry, learning to implement NGSS or state Standards, learning to use technology, and learning teaching and assessment strategies (Table 7). Analysis of interview responses also indicated participants perceived PD opportunities to learn about integrating literacy and to further understand the ongoing changes in state policies as important. One participant described his reasoning for attending PD opportunities to learn about literacy for his district:

> And then as our state moves toward increasing effectiveness, we've been more involved with common core standards and things, we've been more involved with things like literacy support in the content-areas and writing learning objectives and things like that for teachers to help support them in their professional growth and in students' growth in literacy components (SC63 Interview).

Table 6
Participants' rationales for professional development with other science coordinators

Rationale	*n* (%)
Collaborate, network, and share ideas with peers	82 (67.2)
Decrease isolation	30 (24.6)
Learn professional development strategies	29 (23.8)
Science coordinator-specific focus	22 (18.0)
Learn about curriculum/assessment	19 (15.6)
Share resources (e.g., funding, materials)	10 (8.2)
Need more time to collaborate with peers	7 (5.7)
Other reasons	4 (3.3)

Note. Participants' responses may have included multiple rationales.

Table 7
Topics of professional development emphasis attended by science coordinators

Professional Development Topics	*n* (%)
Understanding student learning	43 (35.2)
Learning to incorporate inquiry	40 (32.8)
Learning about/how to implement the NGSS/state standards	36 (29.5)
Learning to use technology	27 (22.1)
Learning teaching strategies	25 (20.5)
Learning to assess students	21 (17.2)
Deepening content knowledge	12 (9.8)
Learning to work with diverse learners/students with special needs	8 (6.6)
Learning leadership skills	5 (4.1)
No professional development	4 (3.3)
Learning to integrate literacy/writing	4 (3.3)
Learning about teacher evaluation	3 (2.5)
Learning about PLCs	2 (1.6)
Learning about textbook adoption	1 (0.8)

Note. Participants' responses may have included multiple topics of PD.

Similar to other interview respondents ($n = 9/16$ 56.3%), this participant, from a medium sized city district, recognized the need to understand how to support teachers in teaching literacy as a result of the changing policies within his state and across the nation. Furthermore, it is evident that as policies change, coordinators must take time out of their schedules to receive PD around these new policies and to develop a depth of understanding so that they can effectively support teachers. During this period of change, the availability of coordinators to support teachers may be diminished as they learn about these new policies and determine ways to implement them with their teachers.

In summary, participants indicated they engaged in PD that was typically short in duration and provided by state-wide leadership communities. These PD opportunities for participants varied in the topics covered, but many participants agreed interacting with other science coordinators was one of the most important reasons for engaging in PD.

What Barriers Do District Science Coordinators Encounter in Their Role?

Interview responses revealed a number of barriers that science coordinators perceived limited their effectiveness in supporting teachers. These barriers included a lack of time ($n = 16/16$, 100%), emphasis on mathematics and reading over science instruction ($n = 14/16$, 87.5%), and a lack of power to enforce policies within a district ($n = 12/16$, 75.0%). These lack of resources and limited power in the district were clear barriers to these science coordinators in being able to improve teaching and learning in their districts.

Limited Resources Reduced Science Coordinators' Ability to Handle Multiple Responsibilities. Time was especially an issue for those serving in smaller districts and/or those who were responsible for multiple content-areas. For instance, when asked about barriers in her role, SC22, who is responsible for both math and science in her district, said, "Time. Mainly time, just because I am K-12 math and science, it's just time, to be able to give all my attention to being split between the two." (Interview). The needs for time, whether to do more work, or for more PD time with teachers was echoed by all of the interviewed participants ($n = 16/16$, 100%).

Many interview participants ($n = 14/16$, 87.5%) stated they would like to have more interactions with the teachers in their district but were unable to do so due to lack of resources and time. For example, when asked about how he interacted with teachers one coordinator stated, "Again, not as much as I'd like or as we'd like" (SC117 Interview). He went on to describe that he met only twice a year with all teachers, but worked with a focus group of teachers on a monthly basis. This science coordinator was from a large city division. Other interviewed participants ($n = 5/16$, 31.3%) indicated their primary interactions with teachers occurred through email, monthly meetings, and occasional PD opportunities. Many participants ($n = 8/16$, 50.0%) stated that interactions with teachers in their district were infrequent and focused on standardized testing, and some participants ($n = 4/16$, 25.0%) explicitly identified a disconnect between what they wanted to do and what they were able to do. While working with teachers is one of the most cited responsibilities of coordinators (Table 3), survey results did not indicate the amount of time coordinators are able to devote to their varied responsibilities. Given the vast and varied number of responsibilities coordinators report holding, it is not surprising coordinators feel the need for more time and specifically more time to work with teachers.

Science Coordinators Lack Power to Make Change. Participants frequently mentioned the focus on reading and mathematics over science ($n = 14/16$, 87.5%), which they had no control over changing, as a barrier to being successful in their work. For example, one respondent stated

> One of the frustrating things for a lot of science leaders, not just in [state x] but nationally, is that the increased focus on high stakes testing has really, I think caused a shift in emphasis away from science education to math and literacy. Even with more of a national push towards STEM education, I think that its, especially at the elementary level there are a lot of places where science instruction has fallen by the wayside to make room for more literacy and mathematics. And that's an unfortunate trend (SC110 Interview).

Another participant voiced her concerns and frustration about the amount of science elementary students in her district receive:

> I think the fact that science is not a priority and neglected is infuriating. We work in a large urban district with largely high needs students, and they just flat out get denied science education. And I think that's a violation of their rights, and so that's really a challenge to me (SC117 Interview).

As evidenced by the representative quotes above, science was often neglected at the elementary level and getting buy-in from teachers and/or other district administrators was perceived as a challenge for participants.

In addition, the lack of power participants' have to enforce policies was another barrier to being effective ($n = 12/16$, 75.0%). One participant stated

> It is a "consulting position", so, you have, you want to do a lot of things, you know, and you have lots of ideas, but you have to always get the buy-in to get districts to come along with you or to get a superintendent to say, "Yeah, let's try this" or "No, this isn't for us". So, it's very frustrating that you only stand to serve and to offer and no one has to take your offerings, you know (SC33 Interview).

This participant perceived the superintendent as the gate-keeper that had to approve any new ideas before they were implemented in the school district. Another participant stated

> I don't really have the authority in my role in our district to mandate anything, so I really have to encourage and facilitate collaboration and coordination, and I really can't tell anyone they have to do anything. I guess that is somewhat a barrier in itself because you do reach a point with some teachers where unless somebody tells this person they have to do this, this classroom is always going to be out in left field on its own. That's not fair to the kids in the class (SC23 Interview).

This lack of power to enforce polices or to ask teachers to use best practices in their classrooms may trickle down, ultimately impacting the experience and learning of students. It was clear that this participant, and other interviewed participants' ultimate concern was for the impact of their work with teachers and students.

In summary, interview data revealed the barriers participants' perceived as impacting their role as a science coordinator. These barriers included having multiple content-area responsibilities, not having enough PD, lack of time, lack of emphasis on science instruction, and a lack of power to enforce policies within a district. Interviewed participants' concerns about their effectiveness as a science coordinator was focused on how they were able support teachers, but more importantly how these barriers impacted the students in their district.

Discussion

This study explored the diversity of roles and backgrounds of a national sample of science coordinators, the kinds of PD activities they seek out, and the barriers they encounter. Understanding the various characteristics of coordinators and contexts where coordinators serve provides knowledge of what may influence or shape their practice. Examining the kinds of PD activities science coordinators seek out aids the field in determining how to target support for science coordinators. Furthermore, identifying barriers encountered by district science coordinators provides understanding of how to more successfully support this important group of science educators. By investigating characteristics, challenges, and needs of science coordinators, this study provides insight into how to support these leaders in the midst of NGSS-based reforms.

Who Are Science Coordinators?

The results of the present study begin to fill the existing void in the research presently available on science education leadership by presenting a picture of the professional responsibilities of science coordinators (Luft & Hewson, 2014; PCAST, 2010).

Background. Our data suggest that science coordinators are typically a Caucasian female who holds a degree in a science content-area and is a former science teacher who has been in the coordinator role for less than 10 years. The majority of coordinators ($n = 99/122$, 81.1%) identified as Caucasian suggesting a lack of diversity for individuals serving in this position. Similar to our need for more science teachers of color, this finding may suggest we also need to increase the number of science coordinators of color (Dilworth & Coleman, 2014). If the disparity between teachers of color and enrollment of minority students continues to be a hindrance to increasing student achievement (Dilworth & Coleman, 2014), then it is likely that the lack of diversity of coordinators may also be a contributing factor or likewise may be a hindrance to supporting diverse teachers in their work with diverse populations of students.

Role. Results indicated science coordinators have multiple professional responsibilities. These results highlight the difficulty in understanding the role of the district science coordinator; they are often wearing multiple hats and carrying out multiple responsibilities. It is unclear from the data collected in the present investigation whether these individuals are well-prepared for these professional responsibilities or would benefit from PD during their first few years in the position. The research on the induction of K-12 teachers (Luft, 2001) suggests K-12 teachers experience barriers to their success and benefit from opportunities to grow and develop. The results of the present investigation suggest this trend may also exist for science coordinators; however, further investigation is needed to assess whether coordinators also benefit from opportunities to grow and develop.

Furthermore, the majority of respondents were responsible for working with students in grades PK-12. Although having responsibility for all grade levels may allow coordinators to be solely responsible for science, as indicated by 62 (50.8%) of participants, it may also stretch the abilities of coordinators beyond their expertise. Differences observed in how elementary and secondary teachers approach science instruction (Schneider & Plasman, 2011) may require coordinators who have not taught at multiple grade levels to develop new expertise in order to support their teachers. The results of the present investigation and the Whitworth (2014) study suggest districts may need to consider how to structure their administration and/or provide PD for leaders working with teachers outside of their content-area or grade level expertise. This is also supported by what we know of how expertise develops and manifests (Bransford, 2001; Bransford et al., 2006). Whether these individuals have adaptive or routine expertise may influence their ability to effectively move between different grade levels and content-areas. Therefore, identifying science coordinators' ability to hold and/or develop adaptive expertise may be critical to their serving multiple content areas or grade levels.

Coordinators identified developing curricula and aligning curricula with standards as two of their professional responsibilities. Coordinators also highlighted the importance of providing training to teachers around new testing and standards. In addition, they frequently serve as a liaison between other administrators who lack an understanding of science and teachers. In light of the introduction and adoption of the NGSS in many states, the role of coordinators in helping teachers make sense of these standards and reform efforts is critical (Domina et al., 2015). Given the findings of the present study, science coordinators appear to be the individuals most likely responsible for developing curricula aligned with NGSS and for providing PD for teachers around the implementation of NGSS within their curricula. Therefore, understanding the role of science coordinators and the support they need in doing their job is crucial to the successful adoption of NGSS across the United States.

What Support Do Science Coordinators Need?

The majority of science coordinators indicated the amount of PD opportunities available to them were sufficient; however, almost all participants desired more PD. We found no correlation between years in position and the desire for PD. Thus, science coordinators may recognize their need for continual growth and PD and seek out these opportunities throughout their careers. In addition, the desire for more PD was not significantly correlated with participants' responsibilities, district size, or degree in science. Regardless of participants' district size, background, or varied responsibilities, all appeared to want more PD opportunities.

Previous research suggests PD of short duration is ineffective in changing science teacher's reform-based practices and understandings (Desimone, 2009; Desimone et al., 2002), and yet science coordinators most enjoyed conference and 1- to 4-day activity PD formats. Typically, we see teacher PD of significant duration grouped as whole weeks in the summer with multiple follow-up sessions during the academic year. Given the difference in teacher and science coordinator roles, it is possible that effective PD for science coordinators could look much different than it does for teachers. It may be that PD designed for coordinators should incorporate multiple PD sessions of short duration over an extended period of time (e.g., 1 day session/month over 12 months). As coordinators have many demands on their time—evidenced by their multiple stated responsibilities—and PD of short duration are easiest to fit into their schedules, considering different approaches to designing and delivering PD is important. Understanding science coordinator PD and how it impacts this group of leaders is a largely unexplored area of research in need of further development. Alternatively, science coordinators may not be aware of what they need to develop professionally, and creating opportunities for science coordinators that are of sufficient duration and enticing to coordinators is an important consideration for professional developers. We propose science educators, those serving as state science supervisors, and individuals serving in high levels of national organizations (e.g., NSELA, National Science Teachers Association, National Association for Research in Science Teaching) should focus on developing PD targeted to science coordinators.

Results also indicated there were a variety of foci of the PD attended by science coordinators and the majority of science coordinators indicated they have opportunities to interact with colleagues. However, results indicated only a small percentage of these opportunities were specifically designed and intended for science coordinators. Rather, the majority of opportunities for interacting with other science coordinators occurred during regional or state leader and teacher meetings and almost all coordinators indicated they would like more PD opportunities to interact specifically with science coordinators. Taken together, these results indicate that despite ample opportunities for science coordinators to attend PD and interact with other science coordinators, there is a strong desire for more science coordinator-specific opportunities.

Most science coordinators also indicated that PD should provide opportunities to collaborate, network, and share ideas with peers. It is likely that current PD opportunities for science coordinators do not provide this type of engagement. Many coordinators indicated interactions with peers allowed them to learn from each other and develop as leaders without reinventing the wheel. Peer interaction may facilitate more efficient and effective science coordinator development into the science leaders districts require to be successful.

Results of the present study suggested relationships between school district type and size, content-area responsibilities, and whether or not a science coordinator had a science degree existed. The individuals responsible for science in small districts are typically generalists who may actually be responsible for all curriculum and instruction within their district, while science coordinators with a degree in science are more likely to be employed in urban districts and have more professional responsibilities. Similar to Whitworth (2014), the results of the present investigation suggest coordinators in smaller districts may need more content-specific PD to provide the best support for science teachers and students, while science coordinators in large districts might need more administrative-specific PD.

Furthermore, regardless of the responsibilities, science coordinators appear to be stretched thin. Research on K-12 teachers suggest teacher practices develops over a prolonged period of time (e.g., Luft, 2001). While science coordinator "effectiveness" was not measured in this study, it may be important to understand how science coordinators develop over time and how, if at all, their "effectiveness" changes over time spent in the position. Should more seasoned science coordinators be more effective, high-level district administrators should find ways to retain science coordinators in their positions.

What Barriers Do Science Coordinators Encounter?

Comparable to other areas of science teacher education research (e.g., Anderson, 2002; Jorgenson, MacDougall, & Llewellyn, 2003; Keys & Bryan, 2001), the participants in this study experienced barriers as a result of reduced emphasis on science education in the classroom. In fact, 27% of elementary schools across the United States reported having insufficient time to teach science (Banilower et al., 2013). The effects of state-mandated testing at the elementary level appears to have an effect on the amount of time teachers devote to science instruction (Anderson, 2002; Keys & Bryan, 2001), and this clearly shaped science coordinators perceptions of their ability to support teachers in their science instruction in the present study. Given this, science coordinators may need more PD around how to think creatively about addressing science standards through the integration of science with other subject areas.

Science coordinators are tasked with learning about new policies, reforms (e.g., NGSS), and testing requirements and passing this information along to the teachers and administrators in the form of PD. This takes substantial time, yet science coordinators indicated a lack of time was a barrier to their effectiveness. A lack of time may indicate a position, such as that of a science coordinator, carries more responsibility than is realistic for a single person. This suggests the need for more resources (e.g., funding, PD) to be devoted to the responsibilities of the science coordinator position. If we want to see teachers supported as they adopt NGSS and other new reform efforts, it is critical that science coordinators have the resources and time needed to effectively do so.

Finally, participants noted another barrier was a lack of power; they had very little influence over whether or not principals and/or teachers implemented their suggestions in the classroom. These findings further our understanding of the science coordinator role, but also suggest science coordinators' effectiveness within a district may be hindered by contextual factors. Decisions made by these district leaders may have less impact on improving teaching and learning than previously thought. We suggest researchers examine the dynamics between administration, specifically superintendents and science coordinators, to better understand the change process within a school district. It may be that PD for science coordinators may not be sufficient to overcome systematic barriers to improving teaching and learning.

Implications

As a result of this study, we are beginning to concretely grasp the current role and responsibilities of science coordinators. Science coordinators are often a primary support for teachers who teach science and make many of the decisions surrounding the implementation and design of science curricula. Given this crucial role, coordinators should be seen as integral in the adoption, interpretation, and implementation of any new policies or standards (e.g., NGSS) within a district. Future research should investigate the influence coordinators have on the adoption and translation of standards into the classroom. Researchers should also incorporate the perspective of science coordinators as they investigate how and if NGSS and/or new policies are being implemented and translated into the classroom. Practically, if science coordinators do not have a robust, in-depth understanding of new policies and standards, it is difficult to imagine how teachers would then be able to develop these understandings on their own and/or deviate from what they have learned from PD with the coordinator. Thus, it is essential we ensure coordinators receive the training necessary to effectively communicate and translate new policies to their teachers.

In addition, it is evident individuals serving in this position are not racially diverse. Similar to the need to increase the diversity of the science teaching population, we may also need to find ways to increase the diversity of those serving in the science coordinator role. The integral role coordinators play in supporting teachers as they implement curricula and deliver instruction may be impacted by this lack of diversity in those serving in this role. Additional research should be conducted to determine if teachers are impacted by the diversity of coordinators similar to the way students are impacted by the diversity of teachers.

Furthermore, this study has illuminated areas where coordinators may need professional growth opportunities and identified the need for more science coordinator-specific opportunities. A more in-depth study of how coordinators divide their time among leadership responsibilities may provide insight about topics and/or areas where coordinators need the most PD. Other areas of future research should include whether PD designed specifically for coordinators is more effective for them than attending PD intended generally for science teachers, and if opportunities for coordinators to interact with others in similar positions provides any benefit to those in this role. Given the often isolated nature of this role and the lack of time these individuals indicate they have, it may be necessary to creatively design and deliver PD through different modes than typically provided.

Results of the current study confirm that the majority of science coordinators plan and provide PD to teachers. Future research should now investigate how coordinators go about planning and providing PD, if the PD they provide is effective, and if it brings about positive changes in teacher practice and student achievement. Research in this area has the potential to provide insight into the needs of science coordinator-specific PD, as well as implications for policy decisions. If, in fact, science coordinators positively impact teacher practice, then providing more resources and time for these individuals to work as well as ensuring all districts employ a science coordinator may be of critical importance for our nation to see growth in science achievement.

This survey-designed investigation was based on the self-report data of participants. Thus, one limitation that must be taken into consideration when interpreting the results is the self-selection of the sample. Furthermore, because the data were self-reported by participants, the findings of this study are accurate to the extent that the self-reported information is accurate. The results of self-reported data in educational research have mixed outcomes regarding the accuracy of self-report data (e.g., Jeff & Julie, 1991; Maxey & Ormsby, 1971; Smith & McCann, 1998; Traub & Weiss, 1982). However, this investigation also incorporated interviews with a subset of participants in order to triangulate the data and increase the reliability of the findings. Future research should also explore the roles and responsibilities of science coordinators through methodologies such as ethnography and case study.

Conclusion

The findings of the present study provide insight into the current role of a science coordinator and further define the responsibilities coordinators hold in this era of NGSS-based reform against the backdrop of accountability and high-stakes testing. Based on the results of this investigation, we propose districts should explicitly define the roles and responsibilities for science coordinators with all stakeholders. Articulating specific roles and responsibilities of a science coordinator has the potential to make expectations explicit for all stakeholders.

This study serves as a foundation for developing PD designed specifically to support science coordinators. Our findings suggest science coordinators desired more PD opportunities to interact with other science coordinators and that few of these opportunities presently exist. In addition, coordinators serving in smaller districts, across larger grade spans, or without a science degree may need more content-specific PD to assist them in their support of teachers and students. Continuing to design PD opportunities for science coordinators, who have an influential role in the improvement of schools and teacher growth, is critical to improving student learning and achievement in science.

Many parallels exist between what we know to be effective K-12 science teacher PD and the PD opportunities science coordinators in the present investigation desired (e.g., opportunities for collaboration). However, given the different responsibilities of K-12 teachers and those of science coordinators, and the areas in which science coordinators in the present investigation reported the need for more support (e.g., developing budgets, finding and disseminating curriculum, etc.) and the many time pressures they reported, it is possible that effective science coordinator PD will look markedly different from PD for K-12 teachers. Given our findings, PD consisting of short but frequent meetings over a significant time span (e.g., a school year), with colleagues in similar positions and contexts, and emphasizing the specific needs of the coordinators (i.e., NGSS, content, strategic plans) may be a place to start.

References

Anderson, R. D. (2002). Reforming science teaching: What research says about inquiry. Journal of Science Teacher Education, 13, 1–12.

Banilower, E. R., Smith, P. S., Weiss, I. R., Malzahn, K. A., Campbell, K. M., & Weis, A. M. (2013). Report of the 2012 National Survey of Science and Mathematics Education. Chapel Hill, NC: Horizon Research, Inc.

Birman, B., Le Floch, K. C., Klekotka, A., Ludwig, M., Taylor, J., Walters, K., . . . Yoon, K. (2007). State and local implementation of the No Child Left Behind Act: Vol. 2. Teacher quality under NCLB: Interim report. Washington, DC: U.S. Department of Education; Office of Planning, Evaluation and Policy Development; Policy and Program Studies Service.

Bogdan, R. C., & Biklen, S. K. (1982). Qualitative research for education. Boston: Allyn & Bacon.

Bransford, J. D. (2001). Thoughts on adaptive expertise. Retrieved from http://www.vanth.org/docs/AdaptiveExpertise.pdf

Bransford, J. D., Barron, B. J. S., Pea, R., Meltzoff, A., Kuhn, P., Bell, P., . . . Sabelli, N. (2006). Foundations and opportunities for an interdisciplinary science of learning. New York, NY: Cambridge University Press.

Cohen, J. (1992). A power primer. Psychological bulletin, 112(1), 155.

Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web- or internet-based surveys. Educational and Psychological Measurement, 60, 821–836.

Corcoran, T., Fuhrman, S. H., & Belcher, C. L. (2001). The district role in instructional improvement. The Phi Delta Kappan, 83(1), 78–84.

Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). Thousand Oaks, CA: Sage.

Creswell, J. W., & Plano Clark, V. L. (2011). Designing and conducting mixed methods research (2nd ed.). Thousand Oaks, CA: Sage.

Desimone, L. M. (2009). Improving impact studies of teachers' professional development: Toward better conceptualizations and measures. Educational Researcher, 38, 181–199.

Desimone, L. M., Porter, A. C., Birman, B. F., Garet, M. S., & Yoon, K. S. (2002). How do district management and implementation strategies relate to the quality of the professional development that districts provide to teachers? Teachers College Record, 104, 1265–1312.

Desimone, L. M., Smith, T. M., & Phillips, K. J. R. (2007). Does policy influence mathematics and science teachers' participation in professional development? Teachers College Record, 109, 1086–1122.

Dillman, D. A., Smyth, J. D., & Christian, L. M. (2014). Internet, phone, mail, and mixed-mode surveys: The tailored design method. Hoboken, NJ: John Wiley & Sons.

Dilworth, M. E., & Coleman, M. J. (2014). Time for a change: Diversity in teaching revisited. Washington, DC: National Education Association Report.

Domina, T., Lewis, R., Agarwal, P., & Hanselman, P. (2015). Professional sense-makers instructional specialists in contemporary schooling. Educational Researcher, 44, 359–364.

Edmondson, M. E., Sterling, D., & Reid, V. (2012). Investigating the impact of a new science coordinator/liaison academy. Paper presented at the Annual meeting of the National Association of Research in Science Teaching, Indianapolis, IN, 2012.

Firestone, W. A., Mangin, M. M., Martinez, M. C., & Plovsky, T. (2005). Leading coherent professional development: A comparison of three districts. Educational Administration Quarterly, 41, 413–448.

Fowler, F. J. (2013). Survey research methods. Thousand Oaks, CA: Sage Publications.

Fowles, J., Butler, J. S., Cowen, J. M., Streams, M. E., & Toma, E. F. (2014). Public employee quality in a geographic context a study of rural teachers. The American Review of Public Administration, 44, 503–521.

Garet, M. S., Porter, A. C., Desimone, L., Birman, B., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. American Educational Research Journal, 38, 915–945.

Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. Psychological Assessment, 7, 238.

Heller, J. I., Daehler, K. R., Wong, N., Shinohara, M., & Miratrix, L. W. (2012). Differential effects of three professional development models on teacher knowledge and student achievement in elementary science. Journal of Research in Science Teaching, 49, 333–362.

Hewson, P. W. (2007). Teacher professional development in science. In S. K. Abell & N.G. Lederman (Eds.), Handbook of research on science education. London: Lawrence Erlbaum & Associates, Publishers.

Higgins, T. E. (2008). Through the eyes of the professional developers: Understanding the design of learning experiences for science teachers (Doctoral Dissertation).

Jeanpierre, B., Oberhauser, K., & Freeman, C. (2005). Characteristics of professional development that effect change in secondary science teacher's classroom practices. Journal of Research in Science Teaching, 42, 668–690.

Jeff, S., & Julie, N. (1991). Accuracy of self-reported course work and grade information of high school sophomores (Report No. ACT-RR-91-6). American College Testing Report Series.

Jorgenson, O., MacDougall, G., & Llewellyn, D. (2003). Science leadership in an era of accountability: A call for collaboration. Science Educator, 12(1), 59–64.

Keys, C. W., & Bryan, L. A. (2001). Co-constructing inquiry-based science with teachers: Essential research for lasting reform. Journal of Research in Science Teaching, 38, 631–645.

Lee, V. R., Leary, H. M., Sellers, L., & Recker, M. (2014). The role of school district science coordinators in the district-wide appropriation of an online resource discovery and sharing tool for teachers. Journal of Science Education and Technology, 23, 309–323. doi: 10.1007/s10956-013-9465-5

Leithwood, K., Seashore-Louis, K., Anderson, S., & Wahlstrom, K. (2004). How leadership influences student learning. Minneapolis, MN: University of Minnesota, Center for Applied Research and Educational Improvement.

Leithwood, K. (2012). Core practices: The four essential components of the leader's repertoire. In K. Leithwood & K. Seashore-Louis (Eds.), Linking leadership to student learning (pp. 57–67). San Francisco, CA: John Wiley & Sons, Inc.

Loucks-Horsley, S., & Matsumoto, C. (1999). Research on professional development for teachers of mathematics and science: The state of the scene. School Science and Mathematics, 99, 258–271.

Luft, J. A. (2001). Changing inquiry practices and beliefs: The impact of an inquiry-based professional development programme on beginning and experienced secondary science teachers. International Journal of Science Education, 23, 517–534.

Luft, J. A., & Hewson, P. W. (2014). Research on teacher professional development programs in science. In S. K. Abell & N. G. Lederman (Eds.), Handbook of research on science education (Second Edition). London: Lawrence Erlbaum & Associates, Publishers.

Madrazo, G. M., & Hounshell, P. B. (1987). Science supervisor: Results of research in science supervision. Science Education, 71(1), 9–14.

Marsh, J. A. (2002). How districts relate to states, schools, and communities. In A. Hightower, M. S. Knapp, J. A. Marsh, & M. W. McLaughlin (Eds.), School districts and instructional renewal (pp. 25–40). New York: Teachers College Press.

Marzano, R. J., Waters, T., & McNulty, B. A. (2005). School leadership that works: From research to results. Denver, CO: Mid-continent Research for Education and Learning.

Maxey, E. J., & Ormsby, V. J. (1971). The accuracy of self-report information collected on the ACT Test Battery: High school grades and items of nonacademic achievement (Report No. ACT-RR-45). Research and Development Division, The American College Testing Program.

Murphy, J., & Hallinger, P. (1988). Characteristics of instructionally effective school districts. The Journal of Educational Research, 81, 175–181.

Newman, I., & McNeil, K. A. (1998). Conducting survey research in the social sciences. Lanham, MD: University Press of America.

NGSS Lead States. (2013). Next generation science standards: For states, by states. Washington, DC: The National Academies Press.

Ogawa, R., & Bossert, R. (1995). Leadership as an organizational quality. Educational Administration Quarterly, 31, 224–244.

Patton, M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. HSR: Health Services Research., 34, 1189–1208.

Perrine, W. G. (1984). Teacher and supervisory perceptions of elementary science supervisors. Science Edcuation, 68, 3–9.

Pianta, R. C. (2011). Teaching children well: New evidence based approaches to teacher professional development and training. Center for American Progress, 11, 1–36.

President's Council of Advisors on Science and Technology [PCAST]. (2010). Prepare and Inspire: K-12 Education in Science, Technology, Engineering, and Math (STEM) for America's Future. Retrieved from http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast-stem-ed-final.pdf

Purzer, S., Moore, T., Baker, D., & Berland, L. (2014). Supporting the implementation of the next generation science standards (NGSS) through research: Engineering. Retrieved from https://narst.org/ngsspapers/engineering.cfm

Roseman, J. E., Fortus, D., Krajcik, J., & Reiser, B. J. (2015). Curriculum materials for Next Generation Science Standards: What the science education research community can do. Symposium paper. Presented at the 2015 NARST Annual International Conference, April 11–14, Chicago, IL, p. 34.

Roth, K., Garnier, H., Chen, C., Lemmens, M., Schwille, K., & Wickler, N. (2011). Videobased lesson analysis: Effective science PD for teacher and student learning. Journal of Research in Science Teaching, 48, 117–148.

Schneider, R. M., & Plasman, K. (2011). Science teacher learning progressions a review of science teachers' pedagogical content knowledge development. Review of Educational Research, 81, 530–565.

Smith, K. M., & McCann, C. W. (1998). The validity of students' self-reported family incomes. Paper presented at the Annual Forum of the Association for Institutional Research (38th), Minneapolis, MN, 1998.

Spillane, J. P. (2002). Local theories of teacher change: The pedagogy of district policies and programs. Teachers College Record, 104, 377–420.

Traub, R. E., & Weiss, J. (1982). The accuracy of teachers' self-reports: Evidence from an observational study of open education. Paper presented at the Annual Meeting of the American Educational Research Association, New York, NY, 1982.

Triangle Coalition. (2013). Our members and partners. Retrieved from http://www.trianglecoalition.org/members/nsela

Whitworth, B. A. (2014). Exploring the critical role of a district science coordinator (Doctoral Dissertation). University of Virginia: Charlottesville, Virginia.

Whitworth, B. A., & Chiu, J. L. (2015). Professional development and teacher change: The missing leadership link. Journal of Science Teacher Education, 26, 121–137. doi: 10.1007/s10972-014-9411-2

Supporting Information

Additional Supporting Information may be found in the online version of this article.