Critical Factors Impacting the Role of a District Science Coordinator

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Abstract

This convergent parallel mixed-methods study explored the professional responsibilities of district science coordinators, their professional development, and the relationship between their role, responsibilities, district context, and background. The national sample that completed the validated Science Coordinator Role Survey included 122 members of the National Science Education Leadership Association self-identified as science coordinators. The survey included demographic questions and questions about their responsibilities and professional growth. Participants' responses were analyzed using descriptive and correlational statistics. Open-ended responses were analyzed using a constant-comparative approach. 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. Most (92%) reported wanting additional science coordinator-focused professional development. Additionally, correlations indicated respondents without science degrees held positions at smaller, remote rural school districts and were also likely to be responsible for multiple content areas including science. Alternatively, respondents working in larger, urban school districts tended to have science backgrounds, had more professional responsibilities, and were less likely to be responsible for multiple content areas. In interviews, science coordinators reported on the variety of barriers they encountered in supporting teachers and the difficulty they experienced in their positions. The results of this investigation further define the professional responsibilities of coordinators, provide insight into the role of a science coordinator, and specify the prevalent types and focus of professional development desired by science coordinators.

Introduction

School districts, the primary providers of teacher professional development in the United States, spend billions of dollars on professional development for their teachers each year (Birman et al., 2007; Pianta, 2011; Spillane, 2002) and play a major role in improving teaching and learning (Corcoran, Fuhrman & Belcher, 2001). School districts implement a variety of professional development for teachers including: administrator and curriculum coordinator-directed professional development, engaging teachers to share, employing outside companies, creating professional learning communities for teachers, and partnering with universities and organizations. District leaders (i.e. staff developers, mentor teachers, science coordinators, math coordinators, testing coordinators, etc.) are closely tied to a district's effectiveness in improving teaching and learning (Firestone, Mangin, Martinez & Plovsky, 2005; Leithwood, Seashore-Louis, Anderson & Wahlstrom, 2004; Marsh, 2002) and help shape the leadership a district provides (Ogawa & Bossert, 1995). However, little research examines the roles of these district

leaders or how to support and educate leaders who provide professional development to teachers under their supervision (Higgins, 2008; Luft & Hewson, 2013). The present investigation seeks to address this gap by describing the role of school district leadership, specifically understanding the professional responsibilities of science coordinators and how they currently take advantage of opportunities to develop professionally.

School Leadership

Research describes characteristics of effective district leadership and suggests a set of practices of successful districts (Leithwood et al., 2004; Marzano, Waters, & McNulty, 2005; Murphy & Hallinger, 1988). For example, Desimone, Porter, Birman, Garet, and Yoon (2002) conducted a three-year longitudinal study using a national sample of district professional development coordinators (N = 363). The study examined the link between federal policies and the strategies districts implemented to offer high-quality professional development to teachers. The authors found school districts that were aligned with standards were more likely to engage in continuous improvement efforts and were more successful in carrying out professional development plans.

Districts can have a strong influence on teaching and learning through high quality professional development. For example, Firestone et al. (2005) compared three urban school systems in New Jersey through action-based research. The authors found that district decisions related to vision, professional development activities, and human resources influenced the coherence and content-focus of the professional development programs. The district with the most coherent and content-focused professional development had the greatest teacher-reported influence on teaching practice. These findings highlight the key role that administrators play in decisions made about professional development.

While there is extensive research in this area, all seem to agree that there is not a "recipe" or one set of tasks a leader should follow to be effective (Marzano et al., 2005; Murphy & Hallinger, 1988). However, it is clear effective leadership practices are associated with student achievement (Leithwood et al., 2004). It is also evident district leadership is most effective when district leaders collaborate and work together to support teacher instruction and student learning (Leithwood et al., 2004; Murphy & Hallinger, 1988).

Despite these findings, district-offered professional development for teachers is often ineffective and delivered in the form of short in-service workshops with little or no follow-up (Loucks-Horseley & 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 professional develpment and what is actually implemented by district leaders suggests a need for further research to understand how the individuals who design and conduct professional development are educated and supported (e.g., Luft & Hewson, 2013).

District Science Coordinators

District leadership in science includes subject-area supervisors and district science coordinators. In the present study, a district science coordinator is defined as an individual responsible for science curriculum and instruction within a district (e.g. Edmondson, Sterling, & Reid, 2012). 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 professional development and the science curriculum. However, there may be many titles for those who serve

in this role within a district. The present study focuses on research pertaining to the district science supervisor, science supervisor, and science coordinator roles (e.g. McComas, 1993).

Little research exists on science coordinators and the existing research is decades old. In one study, Perrine (1984) investigated how elementary teachers and science coordinators perceived the science supervisor position and its' practices. In his study, a sample of 29 coordinators and a random sample of 470 elementary teachers were surveyed in the state of New Jersey. Results indicated teachers and coordinators felt the present 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 science coordinator role needed to be more clearly defined so all district stakeholders (e.g. principals, teachers, district administrators) held 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 indicated the importance of continuing to research the science coordinator role and endeavoring to define the role more clearly for all stakeholders.

Together, the results of these two investigations suggest district science coordinators play a role in supporting teacher instruction. They also indicate the importance of continuing to define and study the science coordinator role (Madrazo & Hounshell, 1987; Perrine, 1984). However, there is still much we need to understand about district science coordinators, how they can support teachers and student learning, and how they themselves are supported.

Core Leadership Practices

Leithwood's (2012) core leadership practices for teachers and principals served as the conceptual framework for this study. Leithwood (2012) developed these categories based on reviews of qualitative case studies and other empirical research of leadership practices in educational contexts. The categories of core leadership practices include: setting directions, developing people, redesigning the organization, and improving the instructional program. Each of these categories is characterized further by specific leadership practices (Table 1). This study builds on Leithwood's (2012) study by extending the framework to science coordinators. This study leverages the core leadership practices to characterize various professional responsibilities and activities coordinators engage in to develop professionally.

Table 1
Overview of Core Leadership Categories and Practices

Category	Practices
Setting Directions	• Building a shared vision • Fostering acceptance of group goals • Creating high expectation • Communicating the direction
Developing People	• Providing individualized support and consideration • Providing intellectual stimulation • Modeling appropriate values and practices
Redesigning the Organization	• Building collaborative cultures • Restructuring the organization to support collaboration • Building productive relationships with families and communities • Connecting to the wider community
Improving the Instructional Program	• Staffing the program • Providing instructional support • Monitoring school activity • Buffering staff from distractions • Aligning resources

Note. Adapted from "Core practices: The four essential components of the leader's repertoire," by K. Leithwood, 2012, in K. Leithwood & K. Seashore-Louis (Eds.), *Linking leadership to student learning* (pp. 57-67). Copyright 2012 John Wiley & Sons, Inc.

Purpose

The purpose of this study is to investigate the role of the district science coordinator and their perceived opportunities for professional development. The research questions addressed in this study are:

1. What are the professional responsibilities of district science coordinators?
2. How do district science coordinators perceive and characterize opportunities to develop professionally?
3. How are the role, responsibilities, context, and backgrounds of science coordinators related?

This study seeks to better understand the critical role of a district science coordinator across the United States. Understanding this role more clearly may illuminate areas in which district science coordinators need professional development or pursue professional growth independently. Gaining this knowledge is critical to learning how we can support the improvement of science education within districts.

Methods

A convergent parallel mixed-methods design (Creswell, 2014) was adopted to explore the role of science coordinators. Within this design, quantitative and qualitative data were collected simultaneously, analyzed separately, and then results are compared to confirm or disconfirm the findings (Figure 1). The findings embed both the quantitative and qualitative data. This design was chosen in order to compare different perspectives by drawing on both the qualitative and quantitative date.

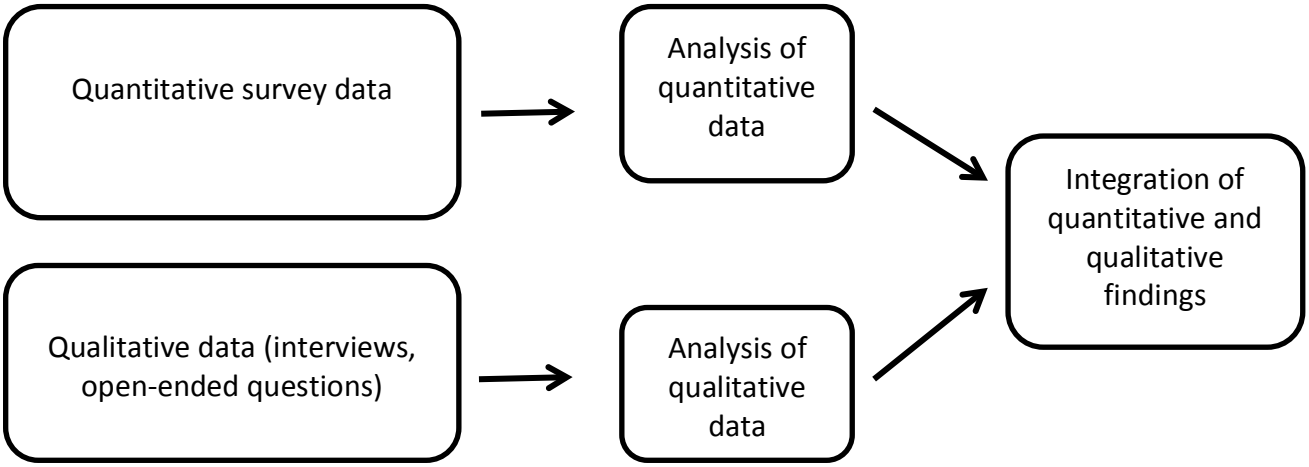

Figure 1. Convergent parallel mixed-methods design used in this study.

Participants

Science coordinators who are members of the National Science Education Leadership Association (NSELA) were solicited to complete surveys. 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 identify themselves as science coordinators, as defined for the present investigation. The NSELA membership was selected as a representative nationwide sample of science coordinators because this organization includes a known membership and contact information was readily available.

An initial email eliciting participation that included a description of the study and a link to an informed consent agreement and the survey was sent to NSELA members. This email also informed coordinators of the opportunity to win a gift card if they completed the survey. Science coordinators self-selection into membership in NSELA and their subsequent completion of the survey are limitations of this investigation.

Data Collection

Data sources included a Science Coordinator Role Survey and a semi-structured interview with science coordinators.

Science Coordinator Role Survey. The science coordinator role survey included three sections: responsibilities as a coordinator, professional growth, and demographics (Appendix A). The responsibilities section included seven questions regarding the science coordinators' content-area and professional responsibilities and was informed by the conceptual framework (Leithwood, 2012). The professional growth section included five questions designed to elicit the types of professional development science coordinators engage in and benefit. Finally, the demographic section included eight questions about the participant and information about the district in which he or she served.

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 and recommended changes were incorporated into the final version of the survey. Then the survey was piloted with a selected group of science coordinators. Modifications to the survey were made to any questions that needed further clarification.

NSELA members were asked to complete the survey within a two-week window. Seventy six participants completed the survey within this first two-week period. After two 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 identified themselves as science coordinators completed the survey, representing a total response rate of 59.2%.

Science Coordinator Interview. A purposeful stratified sample of 16 (13.1%) participants were selected for a follow-up interview based on analysis of survey responses. Selection was stratified across district size, urbanicity, degree, and described role. The 14 question, semi-structured interview protocol (Appendix B) 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 professional development received, and barriers encountered in enacting their role. Each interview lasted between 15 and 30 minutes 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 used in the study.

Data Analysis

Results from the surveys and interviews were analyzed using qualitative and quantitative methods. For the quantitative analysis, responses for questions on desire for professional development, school size, background, experience, and content-area and professional responsibilities were coded. Participants' desire for professional development was coded as no (0) or yes (1). School size was coded using the urban-centric locale coding system (http://nces.ed.gov/ccd/ commonfiles/glossary.asp), with the largest schools receiving a code of 1 and the smallest schools 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. Similarly, the total number of professional responsibilities was summed for each participant. The types of professional responsibilities were then aligned with the four Core Leadership Practices categories (Appendix C). For example, developing and working toward a strategic plan for science in the district, aligning curriculum with state or national standards, and evaluating teachers were grouped into the *Setting Directions* category of Core Leadership Practices. Thus, there were three possible types of professional responsibilities in the *Setting Directions* category. After aligning the responsibilities with the leadership categories, the number of responsibility types each participant indicated was converted to a percentage of the possible responsibilities for each leadership category. For example, if a

participant checked two of the three responsibility types in the *Setting Directions* category, they would receive a 67% score for that category.

Means and standard deviations were calculated for all variables. A correlation matrix identified significant relationships between participants' desire for professional development, school size, experience, and content-area and professional responsibilities. Multicolinearity was tested, and no variables were highly correlated (Lewis-Beck, 1980). These results helped identify the interview participants, as described above.

A constant-comparative approach (Glaser & Strauss, 1967; Lincoln & Guba, 1985) was used to inductively analyze the interview and open-ended survey questions. Responses were open-coded using inductively-generated codes guided by the research questions, Leithwood's (2012) core leadership practices, 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 reliability was established to be 89.0 % once final categories were developed and applied independently to open-ended questions by the two raters.

Results

The purpose of this mixed-methods investigation was to explore science coordinators' role, responsibilities, and professional development opportunities. We also explored the relationship between participants' role, responsibilities, context, and backgrounds. Specifically, we ascertained the relationship between district size and participants' professional responsibilities, participants' teaching experience and desire for professional development, and participants' responsibilities and their desire for professional development.

Who Are Science Coordinators?

Survey respondents included 84 females and 38 males from 29 different states. The majority of participants were from Virginia (14.8%), Ohio (10.7%), and Massachusetts (9.0%). 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 respondents (82%) reported being in their current position less than 10 years (Table 2). Of the respondents, 106 (86.9%) were former science teachers and 97 (79.5%) hold a degree in a science content-area. Respondents identified their titles in a variety of ways (Table 3).

Table 2
Years in Position

Years in Position	n (%)
0-3	45 (36.9%)
4-6	29 (23.8%)
7-9	26 (21.3%)
10-12	11 (9.0%)
13-20	7 (5.7%)
21+	4 (3.3%)

Table 3
Respondent Title

Title	n (%)
Science Supervisor/Coordinator	53 (43.4%)
Science Specialist	27 (22.1%)
Science Lead Teacher	10 (8.2%)
General Curr./Inst. Supervisor/Coordinator	9 (7.4%)
General Specialist	6 (4.9%)
Science Teacher	5 (4.1%)
Other	5 (4.1%)
Science Consultant	4 (3.3%)
Science Dept. Chair	3 (2.5%)

Responsibilities of Science Coordinators

Science coordinators reported working with various grade levels and content-areas and indicated having a wide variety of professional responsibilities. Most participants, (n=59, 48.4%) worked with students in grades PK-12; however, some participants reported working with only K-5 students (13.1%), only middle school students in grades 6-8 (6.6%), or only high school students in grades 9-12 (8.2%). Others reported working with K-8 students (5.7%), and another group worked only with 6-12 students (17.2%). One participant reported working with adult students.

Table 4
Participants' Reported Content-area Responsibilities

Area of Responsibility	n (%)
Science	115 (94.3%)
Other (Administrative)	24 (19.7%)
Math	19 (15.6%)
Engineering	17 (13.9%)
Technology	14 (11.5%)
English/Language Arts	13 (10.7%)
Social Studies	13 (10.7%)
Heath/PE	13 (10.7%)
Family/Consumer Science	6 (4.9%)
STEM	3 (2.5%)
Gifted Education	3 (2.5%)
Art	3 (2.5%)
Other	3 (2.5%)
Special Education	2 (1.6%)
ELL	1 (0.8%)

Note. Coordinators could select multiple content responsibilities.

Most participants' (n=62, 50.8%) sole responsibility was science and 54 (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%) who had multiple responsibilities, 43.4% (n=26) reported

having responsibilities for STEM, engineering, math, and/or technology (Table 4). In smaller districts, science coordinators often took on a coordinator role in another subject area such as social studies (SC110 Interview). As might be expected, individuals working in large districts tended to be responsible for fewer grades and more schools. For example, one participant indicated she was the only elementary (K-5) science coordinator for 45 elementary schools (SC103 Interview), whereas another coordinator in a small district worked with only 10 schools PK-12, but was responsible for science and math (SC22 Interview).

All participants reported having multiple responsibilities that fell under their role as science coordinator. These included curriculum alignment and development, disseminating information to teachers, teaching students and co-teaching, working individually and in small groups with teachers and administrators, and analyzing data to inform their work. Other responsibilities included leading professional development for teachers, creating strategic plans for science, assisting in employment decisions and teacher evaluation, and safety/chemical hygiene (Table 5).

Table 5
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.

Most interviewed participants indicated their primary interactions with teachers occurred through email, monthly meetings, and occasional professional development opportunities (SC3 Interview, SC23 Interview, SC111 Interview). Several participants indicated that working with teachers to analyze benchmark test data had become a major focus of their work over the last few

years (SC33 Interview). Many participants 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, one coordinator stated, "Again, not as much as I'd like or as we'd like", when asked about how he interacted with teachers (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 description is typical of the responses received from other participants.

Professional Development Opportunities for Science Coordinators

In addition to describing their professional responsibilities, science coordinators also described the types and focus of professional development in which they enjoy participating and professional development experiences in which they participate that facilitated collaboration with science coordinators in other districts. Of survey respondents, 76 (62.3%) indicated they had adequate opportunities to participate in professional development as a science coordinator. Respondents reported they enjoyed participating in professional development experiences in formats that included conferences, short activities, and collaborative study groups, among others (Table 6). In interviews, participants also indicated the presence of consortia in their states that provided opportunities for them to interact with others in similar positions (SC3 Interview, SC111 Interview).

Table 6
Format of Professional Development Enjoyed by Science Coordinators

Professional Development Format	n (%)
Conferences	99 (81.1%)
One-to four-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.

Of respondents, 107 (87.7%) indicated they have had opportunities to interact with other science coordinators during professional development. Professional development experiences that allowed for interactions between science coordinators from different districts within a given state were most prevalent. For example, participants reported interacting with other science coordinators most often during state/regional science leader meetings (46.7%) or state science teacher meetings (24.6%). National science leader meetings (18.0%), national science teacher meetings (20.5%), general professional development experiences (23.0%) also provided opportunities for science coordinators to interact with each other. Science coordinator professional development (8.2%), working with state department of education (11.0%), and reaching out to other science coordinators (12.0%) appeared to provide less opportunity for science coordinator interaction. Interview analysis confirmed the majority of participants interacted with other coordinators during state or national meetings (SC33 Interview, SC71 Interview, SC110 Interview); 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 the unfortunate thing." Despite attending national and state meetings SC71 still had difficulty connecting with other coordinators and learning how she could find support for her own work from others in her position.

Analysis of open-ended survey responses revealed the most prevalent topics of professional development in which respondents participated emphasized understanding student learning, learning to incorporate inquiry, learning to implement the Next Generation Science Standards (NGSS) or state Standards, learning to use technology, and learning teaching and assessment strategies (Table 7). Interview analysis also indicated the importance of professional development opportunities to learn about integrating literacy and to further understand the ongoing changes in state policies.

Table 7
Topics of Professional Development for 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

Similarly, 62% of science coordinators indicated they had adequate professional development opportunities, but 112 (91.8%) stated they would also like more professional development opportunities to interact with other science coordinators. Their rationales for wanting more professional development experiences with other science coordinators included the following: collaboration and sharing ideas, decreasing isolation, science coordinator-specific professional development, sharing resources, and learning how to design PD to support NGSS, state standards, and STEM (Table 8).

For example, a representative response 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 professional development 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%) of respondents discussed the isolated nature of their work

environment and how science coordinator professional development may help them overcome the feeling of isolation. 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).

Table 8
Participants' Rationales for Professional Development with other Science Coordinators

Rationale	n (%)
Collaborate, network, and share ideas with peers	82 (67.2%)
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%)
Decrease isolation	8 (6.6%)
Need more time to collaborate with peers	7 (5.7%)
Other reasons	4 (3.3%)

Note. Participants' responses may have included multiple rationales.

Role, Responsibilities, Professional Development, Context, and Background

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 9). Specifically, a significant negative correlation existed between participant's degree in science and district locale. A significant positive correlation was noted between participants' district locale and number of content area responsibilities. These correlations indicated 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. A significant positive correlation between total number of professional responsibilities and degree in science and a negative correlation between degree in science and number of content area responsibilities confirmed participants with no science degree tended to be responsible for multiple content areas. 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 professional development and any other variables.

Table 9
Means, Standard Deviation, and Correlations Between Variables

	M	*SD*	1.	2.	3.	4.	5.	6.
1. District Locale[1]	5.00	3.01	1.00					
2. Degree in Science[2]	.795	.41	-.269**	1.00				
3. Years in Position	6.38	5.91	-.107	.016	1.00			
4. # Content-Area Responsibilities	2.10	1.62	.199*	-.271**	-.020	1.00		
5. Total # of Prof. Responsibilities	13.02	3.33	-.176	.230*	-.083	-.132	1.00	
6. Desire for Prof. Development[2]	.62	.49	.109	-.06	.063	.047	.077	1.00

Notes: * Indicates statistically significant at $p<0.05$. [1] 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). [2] Degree in science and Desire for PD coded as no (0) and yes (1).

Overall, participants' responsibilities focused on the Core Leadership Categories of *Redesigning the Organization* (77.05%) and *Setting Directions* (61.48%) (Table 10). *Redesigning the Organization* included responsibilities such as collaborating with other school leaders in their district and working to communicate with the community and other science coordinators. The lowest percentage of science coordinators' perceived responsibilities (42.62%) fell into the *Developing People* category of the Core Leadership Practices. These responsibilities focused on working directly with teachers and students.

Table 10
Percentage of Participant Professional Responsibilities Organized by Core Leadership Practices

Category (number of possible prof. responsibilities)	All % (n=122)	Science degree % (n=97)	No Science degree % (n=25)
Setting Directions (3)	61.48	63.58*	53.33
Developing People (5)	42.62	44.12	36.80
Redesigning the Organization (5)	77.05	78.56	71.20
Improving the Instructional Program (9)	57.74	59.68*	50.22

Note: * Indicates statistically significant to $p<0.05$

A significant positive correlation existed for some variables when the types of professional responsibilities were classified under the four Core Leadership Practices categories (i.e. Setting Directions, Developing People, Redesigning the Organization, and Improving the Instructional Program) and compared with other variables. Specifically, a significant positive correlation existed between *Setting Directions* and degree in science (r=.228), and between *Improving Instructional Programs* and degree in science (r=.197). A post-hoc t-test determined whether significant differences between the types of responsibilities for participants with and without a degree in science existed. Levine's test was violated for three of the four categories, therefore equal variance could not be assumed. Thus, a more conservative t-statistic was used. Participants with science degrees reported significantly more responsibilities aligned with *Setting Directions* and *Improving the Instructional Program*. These two categories focus on teacher evaluation, alignment with *Standards,* and curriculum development.

Barriers

In interviews participants identified several barriers that they perceived limited their effectiveness in their role. These barriers included a lack of time, lack of emphasis on science instruction, and a lack of power to enforce policies within a district. 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 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. It's just time" (Interview). The needs for time, whether to do more work, or for more professional development time with teachers was echoed by a majority of the participants.

Another participant voiced her concerns 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)

Participants frequently mentioned the focus on reading and mathematics as a barrier to being successful in their work. As evidenced by the quote above, science is often neglected at the elementary level and getting buy-in from teachers and/or other district administrators was difficult.

In addition, the lack of power participants' have to enforce policies was another barrier to being effective. 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)

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. These coordinators' ultimate concern is for the impact on students.

Discussion

This study investigated the role of the district science coordinator and their perceived opportunities for professional development and growth. The results of this survey study suggest most science coordinators desired additional science coordinator-focused professional development. Additionally, science coordinators without science degrees had positions at smaller, remote rural school districts and were also likely to be responsible for multiple content areas in addition to science. Respondents working in larger, urban school districts tended to have science backgrounds, more professional responsibilities, and were less likely to be responsible for multiple content areas. Participants with science degrees had more responsibilities focused on teacher evaluation, alignment with standards, and curriculum development. Finally, participants reported a lack of time, de-emphasis on science, and insufficient administrative power as barriers to doing their jobs effectively.

Characteristics of Science Coordinators

The majority of respondents identified themselves as Caucasian, female, and had served in their position for less than 10 years. In addition, the typical science coordinator holds a degree in a science content-area and is a former science teacher. Most respondents held the title of Science Supervisor, Science Coordinator, or Science Specialist. This variety substantiates and updates previous research indicating a diversity of titles and corresponding responsibilities for this position across the United States (McComas, 1993). Currently, no defining title or national standards for individuals in the science coordinator position exist. In some states, a science supervisor may be the individual responsible for science at the state level, while in other states the same title may used be a district level supervisor. Whether or not this ambiguity contributes

to different perceptions and expectations of individuals in this position has not been studied, but may be an important factor for researchers to consider (Madrazo & Hounshell, 1987).

Responsibilities of 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). The majority of science coordinators who responded to the survey 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 50.8% of participants, it may stretch the abilities of coordinators beyond their expertise. In a recent case study of three science coordinators Whitworth (2014) found that the coordinator with an elementary teaching background, responsible for students in grades PK-12, perceived she was less effective when working with secondary teachers. However, the two coordinators with secondary teaching backgrounds and more science content expertise were perceived by teachers as effective across grade levels. Taken together, 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 professional development for leaders working with teachers outside of their content area or grade level expertise.

Results indicated science coordinators have multiple professional responsibilities and that there was no relationship between years in position and total number of responsibilities. Thus, when science coordinators enter their role as a coordinator they are expected to immediately take on all of these professional responsibilities. It is not clear from the data collected in the present investigation whether these individuals are prepared for these professional responsibilities or would benefit from professional development during their first few years in the position. However, given that 91.8% of respondents reported a desire for more science coordinator-specific professional development, it is possible that they do not feel adequately prepared to undertake all of the responsibilities required in the position. Further, 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.

Participants' professional responsibilities were also analyzed through the lens of Leithwood's (2012) categories of Core Leadership Practices, adding to the literature on leadership practices. Results indicated science coordinators with science degrees took on science-specific coordinator roles with leadership practices focused on the science curriculum, while participants without science degrees roles and responsibilities varied more. This suggests that science coordinators' expertise in science may play a role in the types of leadership responsibilities they take on within their district.

Professional Growth Opportunities

The majority of science coordinators indicate the amount of professional development opportunities available to them were sufficient; however, almost all participants desired more professional development. We found no correlation between years in position and the desire for professional development. Thus, science coordinators may recognize their need for continual growth and professional development and seek out these opportunities throughout their careers. Further, the desire for more professional development was not significantly correlated with

participants' responsibilities, district locale, or degree in science. Regardless of participants' district locale, background, or varied responsibilities, all appeared to want more professional development opportunities.

Science coordinators most enjoyed conference and one-to four-day activity professional development formats. By definition these two formats are of short duration. This is of concern as previous research suggests professional development of short duration is ineffective in changing science teacher's reform-based practices and understandings (Desimone, 2009; Desimone et al., 2002). It is likely that such professional development is also ineffective at changing science coordinators' practices and understandings. It may be that coordinators prefer these types of opportunities as they have many demands on their time and those of short duration are easiest to fit into their schedules. Developing opportunities for science coordinators that are of sufficient duration and enticing to coordinators is an important consideration for professional developers.

Results also indicated there were a variety of foci of the professional development attended in the last two years by science coordinators. While 87.7% of the participants indicated they have opportunities to interact with other science coordinators during professional development, only 8.2% indicated that these opportunities were specifically designed and intended for science coordinators. 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 professional development opportunities to interact specifically with science coordinators. Taken together, these results indicate that despite there being ample opportunities for science coordinators to attend professional development and interact with science coordinators, there is a strong desire for more science coordinator-specific opportunities.

The majority of science coordinators indicated their desire for these opportunities was to collaborate, network, and share ideas with peers. It is likely that the conferences and one-to-four day activities most coordinators attend do not provide the time or opportunity for these types of peer interactions. Many coordinators indicated interactions with peers allowed them to learn from each other and develop as leaders without reinventing the wheel. By providing opportunities for coordinators to interact with their peers, they may develop more effectively and efficiently into the science leaders districts require to be successful. One such professional development opportunity specifically designed for science coordinators is the Virginia Initiative for Science Teaching and Achievement (VISTA) New Science Coordinator Academy (NSCA). Through a year-long experience with 2 days of meetings in the fall and 3 days of meetings in the spring, the VISTA NSCA intentionally provides science coordinators the opportunity to collaborate and interact with peers in meaningful ways (for details and specifics of the program, see Whitworth, 2014). Preliminary evidence suggests the NSCA was effective in facilitating coordinators' understanding of how to design and implement a strategic plan and how to develop effective professional development for teachers around science inquiry. Results indicated the NSCA also helped science coordinators build and maintain sustained relationships with peers across the state (Whitworth, 2014). The results of the present investigation suggest an approach such as the VISTA NSCA may meet the professional development needs of science coordinators. Further, the format of the NSCA may entice science coordinators to participate because the time burden is spread throughout the year instead of concentrated.

Context and Background

Results of the present study suggested relationships between school district type and size and content-area responsibilities and whether or not a science coordinator had a science degree

existed. It is likely the individuals responsible for science in small districts are generalists and are, in actuality, responsible for all curriculum and instruction within their district. It is possible that smaller districts lack the resources to employ a dedicated science coordinator. Science coordinators with a degree in science are more likely to have more professional responsibilities and less likely to have more content area responsibilities. It may be that science coordinators with a degree in science tend to be responsible for more science-specific professional responsibilities. So regardless of the responsibilities, whether breadth or depth, science coordinators appear to be stretched thin. Whitworth (2014) found that science coordinators in smaller districts experienced barriers in finding the time and resources to support their teachers in improving science instruction. Taken together with the results of the present investigation, coordinators in smaller districts may need more content-specific professional development to provide the best support for science teachers and students, while science coordinators in large districts might need more administrative-specific professional development.

Barriers

Comparable to other areas of science teacher education research (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 there is 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. Given this, science coordinators may need more professional development around how to think creatively about addressing science standards through the integration of science with other subject areas.

Science coordinators also indicated lack of time was a barrier to being effective in their role. A lack of time may be indicative of the position carrying more responsibility than is realistic. This suggests the need for more resources to be devoted to the responsibilities of this position. Furthermore, participants noted another barrier was a lack of power, indicating 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.

Limitations

This survey-designed investigation is based on the self-report data of participants. Thus, one of the limitations of the study is the self-selection of the sample; not all individuals sent the survey responded. 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 52.9%. Another limitation of this investigation is the self-reported nature of the data provided by the participants. The findings of this study are accurate to the extent that the self-reported information is accurate. Self-reported data in educational research has been researched for decades and the results of these studies 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. This

survey-designed approach provides first steps to broadly investigate the roles and responsibilities of science coordinators.

Implications

The findings of the present study provide insight into the role of a science coordinator and further defined the responsibilities coordinators hold. Science coordinators' demographic characteristics, professional responsibilities, and opportunities for professional growth were elucidated. Given the ambiguity of position titles and corresponding responsibilities, it may be helpful to develop accepted definitions and corresponding responsibilities for those serving in the science coordinator position. Doing so has the potential to make expectations explicit for all stakeholders involved in work with science coordinators.

The professional development opportunities coordinators reported participating in, preferring, and desire for the future while serving in this role were also characterized. Our findings suggest science coordinators desired more professional development 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 professional development to assist them in their support of teachers and students. Continuing to design professional development 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.

Over the past 25 years, little research has been conducted on science coordinators' role, responsibilities, and professional development. Thus, this investigation serves as a foundation to begin to understand the role of science coordinators in supporting the teaching and learning of science. It provides vital information about those persons responsible for the day-to-day professional growth and support of science teachers.

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Appendix A.
Science Coordinator Role Survey

By clicking the check box and submitting your survey, you are indicating that you have read and understood the information provided to you about your participation in this study. You may print out a copy of this for your records.

1. I have read and agree to participate in research activities including surveys and interviews.
2. I do not accept.

Professional Responsibilities

1. What is the job title for your current position?

2. Approximately how long have you been in your current position? (Years, Months)

3. Are you the only person responsible for science instruction and/or curriculum in your district?
    1. Yes
    2. No
4. Is science your only area of responsibility in your district?
    1. Yes
    2. No
5. If you answered no to the previous question: Is science your only area of responsibility in your district?What other areas are you responsible for? Check all that apply.
    1. Engineering
    2. English/Language Arts
    3. English Language Learners
    4. Gifted Program
    5. Math
    6. Social Studies
    7. Technology
    8. Other responsibilities not listed are _____
6. What grade levels are you responsible for science in your district? Check all that apply.
    1. K
    2. 1
    3. 2
    4. 3
    5. 4
    6. 5
    7. 6
    8. 7
    9. 8
    10. 9
    11. 10
    12. 11
    13. 12
    14. Other _____

7. What are your responsibilities as a science coordinator? Check all that apply.
    1. Teaching K-12 students
    2. Working with students outside of the classroom
    3. Co-teaching with teachers on a daily basis
    4. Working with teachers one-on-one
    5. Working with teachers in groups (i.e. professional development)
    6. Working with teacher leaders
    7. Working with administrators
    8. Analyzing data to inform future work
    9. Developing and working towards a strategic plan for science in the district
    10. Aligning curriculum with state or national standards
    11. Curriculum development
    12. Administrative duties
    13. Disseminating information to teachers
    14. Collaborating with other science coordinators
    15. Developing relationships with the community
    16. Ordering science supplies
    17. Presenting at conferences
    18. Creating and monitoring budget
    19. Employment decisions for teachers and staff
    20. Other responsibilities not listed are

    _____

Professional Growth

8. I have enough professional development opportunities to attend as a science coordinator.
    1. Yes
    2. No

9. I like to participate in the following types of professional development activities (Select up to two answers).
    1. One- to four-day activities
    2. Conferences
    3. Week or multiple week courses/Institutes
    4. College/University courses
    5. Collaborative/Study groups
    6. Online courses over several weeks
    7. School district courses
    8. Online courses over a year
    9. Other _____

10. During the last two years, the primary focus of my science professional development activities have been (Select up to two answers):
    1. Learning how to use inquiry investigations in science
    2. Deepening my own content knowledge
    3. Understanding student learning and knowing
    4. Learning how to use technology
    5. Learning teaching strategies
    6. I have not received any science professional development opportunities

7. Learning how to work with diverse students or students with special needs
8. Learning how to assess students
9. Other

_____

11. I have had professional development opportunities where I have been able to interact with science coordinators from other districts.
    1. Yes
    2. No
12. If you answered yes to the previous question: I have had professional development opportunities where I have been able to interact with science coordinators from other districts. What were these professional development opportunities?

13. I would like to have more professional development opportunities where I can interact with other science coordinators.
    1. Yes
    2. No
14. If you answered yes to the previous question: I would like to have more professional development opportunities where I can interact with other science coordinators. Why would you like to have these opportunities?

Demographics

Please provide your name, phone number, and email address. This information will not be shared and contact information will only be used if you are selected to participate in a follow-up interview or as a winner of the Amazon gift cards.

First Name

Last Name

Phone

Email Address

15. I am:
    1. Male
    2. Female
16. My primary ethnicity is:
    1. African American
    2. Anglo
    3. American Indian or Alaska Native
    4. Asian
    5. Latina/o
    6. Native Hawaiian or other Pacific Islander
    7. Combined ethnicities

8. No response

17. Are you a former science teacher?
    1. Yes
    2. No
18. Do you hold a degree in a science field or in science education?
    1. Yes
    2. No
19. The state that I work in is:

20. What is the name of the school district (division/county) in which you are currently employed?

21. Total student population of the district in which you are currently employed

22. Total teacher population of the district in which you are currently employed:

23. Total science teacher population are you responsible for:

Appendix B.

Science Coordinator Interview

This interview is designed to follow up on your responses from the District Science Coordinator Role Survey. It will be tape-recorded for transcription, then blinded.

1. What is your role in science leadership in the district?
2. Describe your job responsibilities. Please provide as much detail as possible.
3. How do you feel your actual job responsibilities compare to your job description?
4. How, if at all, do you interact with science coordinators from other districts about science teaching and achievement?
    a. How often?
    b. Format?
    c. Purpose?
5. How, if at all, do you interact with principals in your district about science teaching and achievement?
    a. How often?
    b. Format?
    c. Purpose?
6. How, if at all, do you interact with teachers in your district about science teaching and achievement?
    a. How often?
    b. Format?
    c. Purpose?
7. Describe any professional development you have received since beginning your position as a science coordinator.
    a. What was the duration?
    b. What was the format?
    c. Did you seek it out or was it required by your district?
    d. Who was the target audience?
    e. What professional organizations are you involved in?
8. How could the district or state provide professional development to help you better improve science teaching and achievement for your district?
9. What supports do you think would be helpful in your position?
    a. Why do you think these supports would be helpful?
10. What professional development would you have liked to have received before you became a science coordinator?
    a. Why would you have wanted this type of professional development?
11. What barriers or limitations do you encounter in your role as a science coordinator?
    a. Why do you think you encounter these barriers?
12. What do you find most challenging about your position?
13. What do you find most rewarding about your position?
14. Is there anything else you would like me to know about your role as a science coordinator?

Appendix C.

Alignment of Responsibilities of Science Coordinators and Core Leadership Practices

Setting Directions:

- Developing and working towards a strategic plan for science in the district
- Aligning curriculum with state or national standards
- Evaluating Teachers

Developing People:

- Teaching K-12 Students
- Working with students outside of the classroom
- Co-teaching with teachers on a daily basis
- Working with teachers one-on-one
- Working with teachers in groups

Redesigning the Organization:

- Working with teacher leaders
- Working with administrators
- Collaborating with other science coordinators
- Developing relationships with the community
- Presenting at conferences

Improving the Instructional Program:

- Analyzing data to inform future work
- Curriculum development
- Administrative duties
- Disseminating information to teachers
- Ordering science supplies
- Creating and monitoring budget
- Employment decisions for teachers and staff
- Grant Writing
- Safety