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Findings from a Survey of State Science Leaders

Megan Hopkins, Ph.D.

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Executive Summary

This study reports on results of a survey of the Council of State Science Supervisors (CSSS). CSSS is a professional organization composed of supervisors of science education in State Education Agencies. The organization works to sustain and nurture a dynamic learning community that empowers its members to be effective and articulate advocates for quality science education at the local, state, and national levels. The National Center for Research in Policy and Practice, a center funded by the Institute of Education Sciences at the U.S. Department of Education, conducted the study.

The survey focused on the roles and activities that CSSS members take on and participate in as supervisors of science education, as well as on how they use research to inform state decisions related to implementation of the *Framework for K-12 Science Education*.ⁱ While State Education Agencies play key roles in supporting the implementation of standards that align with the *Framework*, with state science supervisors taking a lead role, little is known about how these individuals use research to inform their decisions.

The Council of State Science Supervisors includes both current and past state leaders, and this survey study included both these groups. A total of 61 individuals responded to the survey from 38 states. The overall response rate for the survey was 62%. On average, survey participants had five years of experience as state science leaders, and the majority of the sample was white and female.

The survey used items that were previously developed and validated via a national survey of research use conducted by the National Center for Research in Policy and Practice.ⁱⁱ Additionally, the survey team drew on prior studiesⁱⁱⁱ to author social network questions related to CSSS members' research networks. Finally, survey items pertaining to CSSS members' roles and activities were developed in collaboration with CSSS members.

Definition of Research Used in the Study

For the purposes of this study, we defined "research" as an activity in which people employ systematic, empirical methods to answer a specific question. In this sense, research is different than the practice of looking at data from the district, school, or classroom, which is more open-ended and seldom addresses specific research questions.

Roles and Activities

The survey asked respondents which roles they have assumed within the CSSS organization. CSSS members most often reported participating in their state science conference and as ad-hoc committee contributors or participants. They reported serving as CSSS officers least often, as well as organizers of their state science fairs.

Respondents were also asked to report how often they had participated in various CSSS activities in the last three years. Of the activities included on the survey, respondents reported reading information on the CSSS listserv most frequently, as well as consulting with other CSSS

members. Respondents were less likely to report visiting other states or attending CSSS meetings, such as the annual meeting, Board meetings, and committee meetings.

In addition to CSSS activities, survey respondents reported the kinds of state-level activities they engaged in over the last year. Of these state activities, respondents reported being most involved with leading state science standards development and professional development design, whereas they were less involved in curriculum selection or adoption and the allocation of federal or grant funds.

CSSS Activities that Research Supports

In addition to reporting the types of activities they engaged in as CSSS members, respondents also indicated the extent to which they learned about research or research-based tools via these activities. The majority of respondents who attended CSSS Annual Meetings and BCSE Meetings, as well as workshops or talks by researchers, reported learning about research findings and research-based tools through these activities. Conversely, the fewest number of respondents reported learning about research while visiting other states or attending CSSS board meetings.

Specific Pieces of Research CSSS Members Found Useful or Shared with Others

The survey asked CSSS members to name a specific piece of research they found useful for informing their state's decisions related to the implementation of the *Framework*, as well as a piece of research they shared with district or school leaders. Respondents reported using and sharing research that focused on instructional practices or student learning and development in science, yet few mentioned using or sharing research pertaining to particular student subgroups (e.g., African American students, English learners). The pieces of research respondents named were often research reports or policy briefs, and many of the reports were published via the National Research Council.

Sources Leaders Used to Obtain Research

The survey listed 13 different sources where CSSS members might obtain research. Of these, many respondents indicated seeking out research through CSSS or the National Science Teachers Association (NSTA), from other state colleagues, and directly from university researchers. Far fewer respondents indicated seeking out research from Regional Educational Laboratories (RELs) or the National Science Education Leadership Association (NSELA), the professional association for district leaders in science.

Effort to Acquire Research

We asked CSSS members to indicate whether they would seek out research under different conditions. Although a majority said they would look for research to inform a new problem or decision, fewer said they would contact researchers directly under these circumstances, especially researchers they do not already know.

Research Networks

The survey asked CSSS members to whom they have turned for research to inform their state's implementation of the *Framework*. While respondents could list up to 12 individuals, an average of six individuals were named. Of those, respondents turned to an average of 3 individuals for research related to assessment and curriculum, and an average of 4 individuals for research related to instruction and professional development.

In total, respondents listed 144 different individuals, including 16 current CSSS members, 6 former CSSS members, 75 university researchers, 29 individuals working for non-profit organizations, 8 members of state departments of education, and 7 local educational leaders. Although there was variability in how often each individual was named by respondents, former CSSS members were named most frequently by an average of 7 respondents.

Introduction

The core studies conducted by the National Center for Research in Policy and Practice focus on research use among school and district leaders, but leaders in state education agencies also make use of research to inform their decision making. A recent study of research use among state leaders indicated that they are highly reliant on their professional associations for both social support and research-based resources to help them do their jobs effectively.^{iv} Moreover, findings from the NCRPP national survey showed that district and school leaders are most likely to access research through their professional associations.^v Contrary to many depictions of state agencies, state education agency leaders have many social ties across departments and with external organizations, ties along which research flows.^{vi} Research use among state education agencies, however, remains a largely understudied phenomenon.

The Council of State Science Supervisors (CSSS) was the focal professional organization for this study. CSSS is a professional organization composed of science education specialists who serve at the state, territorial, or the protectorate educational agency in the United States and U.S. Territories. Its members include all current supervisors of science education in State Education Agencies, as well as former leaders of their state agency. Within their own jurisdictions, each of these supervisors plays a key role in directing efforts at improving school science and to ensure excellence and equity in science education. As a professional organization, CSSS organizes meetings, facilitates consultations between state leaders, provides learning opportunities to its members, and serves as a linkage point from outside organizations to schools and districts. Its members are knowledgeable about their states' standards, curriculum, assessment systems, and professional development providers, as well as key state-level initiatives to improve science education.

One such initiative is the recent implementation of the *Framework for K-12 Science Education*,^{vii} which calls for significant changes to science education to ensure that *all* students become proficient in science. It calls for systems to be organized around building understanding of disciplinary core ideas over time, engagement of students in the practices of science and engineering, and application of crosscutting concepts that unify science. It is based on a large body of research on how students best learn science^{viii} and on careful observations of the real work of scientists and engineers.^{ix} In the past two years, a number of states have chosen to adopt the *Next Generation Science Standards*^x or standards based on the *Framework*, an important first step to reorganizing science education to achieve the ambitious aims laid out in the *Framework*. Additional changes to curriculum, instruction, teacher preparation and professional development, and student assessment will be required.

In this context, we sought to develop an understanding of CSSS members' work, and their use of research to inform their state's decisions. We asked:

- What roles and activities do CSSS members take on and participate in as state science education leaders?
- What research findings and research-based resources do CSSS members use to inform their efforts to promote implementation of the *Framework*? What research findings and research-based resources do they share with other science education leaders?

- To whom do state science education leaders turn for research to inform their state's decisions regarding implementation of the *Framework*?

In this report, we provide information related to the study design and survey sample, as well as the roles and activities in which survey respondents reported engaging as CSSS members and state science supervisors. We also present findings related to CSSS members' research use, with respect to the sources and individuals they sought out for research to inform their state's decisions, as well as their efforts to acquire and use research. In future work, we will investigate the relationships between CSSS members' roles and activities and their uses of research.

Study Design

We surveyed a nationwide sample of CSSS members using items developed through previous NCRPP pilot studies and in collaboration with CSSS members. Below, we describe the population targeted, procedures for data collection, the content of the survey items, and the final sample achieved.

Population

The population for our study is the membership of the Council of State Science Supervisors, which is comprised of current and former state leaders in science education. Some of these members are or were employees of their state agency, while others are or were consultants. These include state science supervisors and, in some larger states, their state-level staff. The reason to limit the sample in this fashion is to focus on research use that is consequential in current state-level policy making in science. We developed a list of current and former CSSS members from the organization's website, <http://www.csss-science.org/members/>, which included a total of 98 individuals across 47 states. Former members were listed as Honorary or Associate Members.

Data Collection Procedures

We collected surveys from current and former CSSS members in two ways. First, we attended the 2016 Council of State Science Supervisors Annual Conference, and asked participants to complete a paper or online survey during the CSSS General Meeting. Second, we sent email invitations to any individuals listed as current or former CSSS members on the membership website who had not yet completed the survey. A maximum of three follow-up invitations were sent over a one-month period. All respondents opted to complete the survey via Qualtrics, an online survey administration platform. On the basis of Qualtrics data, the average respondent spent about 22 minutes completing the survey.

Survey Instrument

For each survey construct, we provide a definition, sample items, item response choices, and the total number of items for that construct. The survey instrument is available by request.

Research CSSS members found useful. Following an approach used in the national NCRPP survey, we sought to identify individual pieces of research that CSSS members found useful in informing a decision in their state related to the implementation of the *Framework*. For each study identified as useful, we asked them to identify (if they could) the title, author, year published, publisher, topic, and why they found it useful.

Research CSSS members shared. We also sought to identify individual pieces of research that CSSS members shared with state or district leaders related to their implementation of the *Framework*. For each study identified as useful, we asked them to identify (if they could) the title, author, year published, publisher topic, and with whom they shared it.

Acquisition effort. This construct refers to the extent to which an individual exerts effort to acquire research and develop relationships with researchers in order to address problems or decisions. The scale for acquisition effort was comprised of five items, which asked CSSS members to indicate how often they engaged in activities such as contacting researchers to find out more about articles they have written, or when confronted with a new problem or decision. Item response choices were: Never (1), Rarely (2), Sometimes (3), Often (4), All of the time (5).

Sources where CSSS members obtain research. These items pertain to the sources where CSSS members obtain research, and the frequency with which they consult those sources. Sources included traditional ones, such as university researchers, as well as peer networks (e.g., professional associations such as the National Science Teachers Association) and media. For each source, we asked how often individuals had sought out or acquired research in the past twelve months. Item response choices were: Never (1), Rarely (2), Sometimes (3), Often (4), All of the time (5).

CSSS activities that support research use. These items asked participants to self-report the frequency with which they have participated in association activities in the past three years, as well as the perceived value of those activities for identifying research and research-based tools. A list of activities was generated from a review of documents provided by the CSSS Board, and then reviewed by Board members. Examples of activities include: annual CSSS meeting participation, consultations with other CSSS members, participation in CSSS-sponsored webinars, and attendance at workshops/talks by researchers. For each activity, respondents were asked how often they participated in the activity, with response choices as follows: Never (1), Once (2), 2-3 times (3), 4 or more times (4). Then, for those activities in which respondents participated, they were asked to indicate whether or not they: 1) learned about research findings, 2) learned about research-based tools, and/or 3) learned about strategies for addressing issues in their state.

Research networks. These items sought to identify to whom CSSS members turned in the past 12 months for research to inform their state's efforts to implement the *Framework*. First, participants were asked to name up to 12 researchers, state science supervisors, and other colleagues, both within and outside their states. For each person listed, participants were then asked to indicate how often they turned to each person over the last year, considering all forms of communication such as face-to-face, e-mail, or telephone, with the following response options: 1-2 times per year (1), 3-4 times per year (2), Every 2 months or so (3), Monthly (4), 2-3 times per month (5), and weekly (6). Then, participants were asked what topics of research they discussed with each person among the following five options: curriculum, assessment, professional development, instruction, other.

State science leader activities. These items pertain to the activities participants engaged in as part of their work as state science supervisors. In consultation with CSSS board members, we developed a list of such activities across six broad areas: standards and curriculum (e.g., reviewing state science standards), assessments (e.g., designing state assessments), professional development (e.g., writing contracts for professional development providers),

partnerships (e.g., identifying resources to share with districts), awards (e.g., coordinating student scholarships), and other. Participants were asked to indicate how often they engaged in each activity in the last 12 months. Item response choices for each activity were: Never (1), Rarely (2), Sometimes (3), Often (4), All the time (5).

CSSS roles. Roles refer to the roles participants have taken on as CSSS members. We developed this list of roles in consultation with CSSS board members. Altogether, we identified nine different roles that CSSS members could choose from:

- President
- Secretary
- Board member
- Ad-Hoc Committee Chair
- Ad-Hoc Committee Contributor/Participant
- Presenter at this year’s CSSS conference
- Presenter at a previous CSSS conference
- Participant in state science conference
- Organizer of state science fair

Respondents could choose more than one role, and indicate “other” if necessary. When possible, we re-coded other into one of the nine categories.

Sample

Of the 98 individuals invited to complete the survey, 61 of those individuals filled out all or a portion of the survey, for an overall response rate of 62%. Of those 61 individuals, 52 completed the entire survey, for a completion rate of 85%. Of the 47 states in the study population, 38 states, or 81%, are represented in the sample. The vast majority of respondents (87% or n=53) were current CSSS members, while 13% or 8 respondents were former (i.e., Associate or Honorary) CSSS members.

While survey respondents reported holding a variety of positions in their states, nearly half (44% or n=27) reported serving as Science Specialists, Coordinators, or Directors (see Figure 1). Others reported holding positions as STEM Directors (12% or n=7), Program Managers (10% or n=6), science or general educational consultants (12% or n=7). Six respondents, or 10% of the sample, indicated that their positions focused on science assessment.

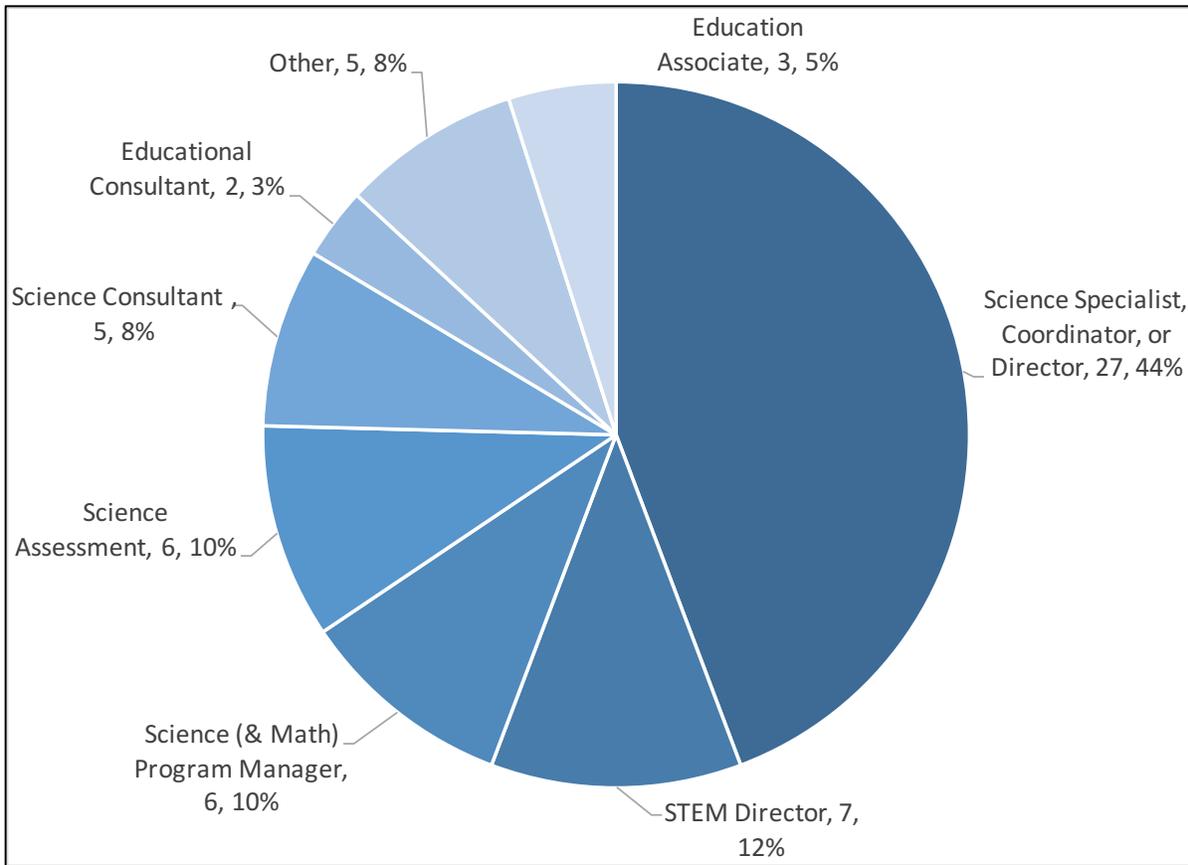


Figure 1. Job Positions of Survey Respondents (n=61)

On average, respondents reported five years of experience as state science leaders, with a range of 0 to 18 years. While 20% (n=12) had one or fewer years of experience, 15% (n=9) had more than 10 years of experience. In terms of education, 4% (n=2) reported completing an Associate’s degree, 63% (n=38) a Bachelor’s degree, 85% (n= 52) a Master’s degree, and 33% (n=20) have completed or are in the process of completing a doctoral degree.

Additionally, 38% (n= 23) reported holding a general teaching certification, 77% (n=47) a science teaching certification, and 40% (n=24) an administrator certification. Only 6%, or 3 respondents, indicated not holding any type of certification.

With respect to gender and race, 69% (n=42) of respondents are female, and 81% (n=50) indicated that they are white, with 4% (n=2) African American or Black, 2% (n=1) American Indian or Alaska Native, 2% (n=1) Asian, and 10% (n=6) two or more races.

CSSS Member Roles and Activities

Key Findings:

- Survey respondents reported frequently accessing information from the CSSS listserv, as well as consulting or collaborating with other states.
- Survey respondents were most likely to be involved in state-level activities focused on reviewing or developing state science standards, designing state science assessments, and designing or conducting professional development.

Roles CSSS Members Assume

Figure 2 shows CSSS members' responses to the question regarding the roles they have assumed within the organization. Respondents could select multiple roles. The majority of CSSS members (67% or n=41) indicated that they have participated in their state's science conference. About one-third of respondents (33% or n=20) have served as ad-hoc committee contributors or participants, and about one-quarter have served as an ad-hoc committee chair (23% or n=14) or a presenter at a CSSS conference (21% or n=13 at a previous conference, and 18% or n=11 at this year's conference). Less frequently assumed roles among respondents included organizer of state science fair (7% or n=4), as well as CSSS President (7% or n=4) and CSSS Secretary (2% or n=1).

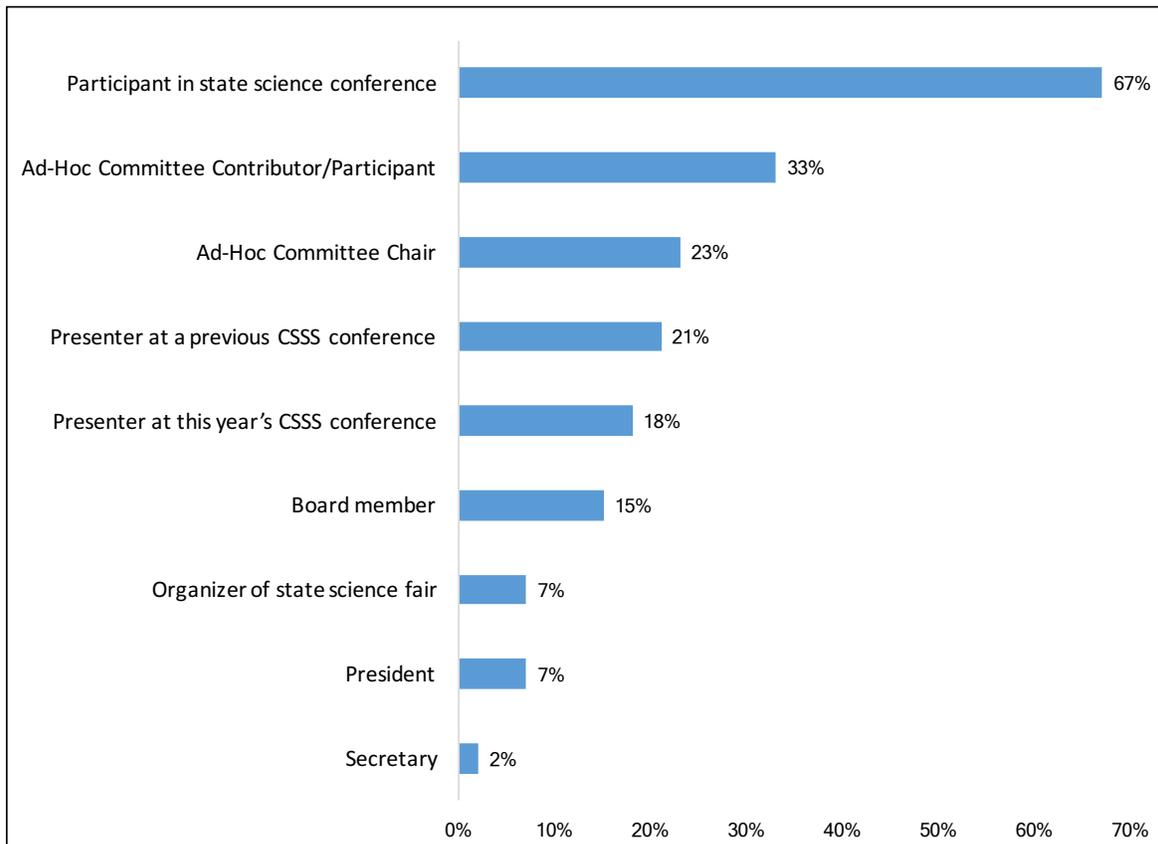


Figure 2. CSSS Roles Taken on by Survey Respondents (n=61)

CSSS Activities Members Participate In

In addition to asking about the roles within CSSS that members have assumed, we asked about the types of CSSS activities they have engaged in over the last three years, and the frequency at which they participated. Of the 51 respondents who replied to this set of questions, a full 86% (n=44) indicated reading information from the CSSS listserv four or more times in the last three years (see Figure 3). Additionally, about half of respondents reported consulting with other CSSS members at that frequency (51% or n=26), as well as attending workshops or talks by researchers (48% or n=24) and collaborating with other states (46% or n=23). About one-third of respondents also reported participating in CSSS-sponsored webinars (38% or n=19) and CSSS committee meetings (35% or n=17) four or more times, as well as reviewing drafts of the Next Generation Science Standards (33% or n=16). CSSS activities that members reported rarely engaging in included CSSS Board Meetings, presenting at the National Research Council (NRC) or other national meetings, and visiting other states, with 78% (n=40), 57% (n=29), and 62% (n=32) reporting no participation in these activities over the last three years, respectively.

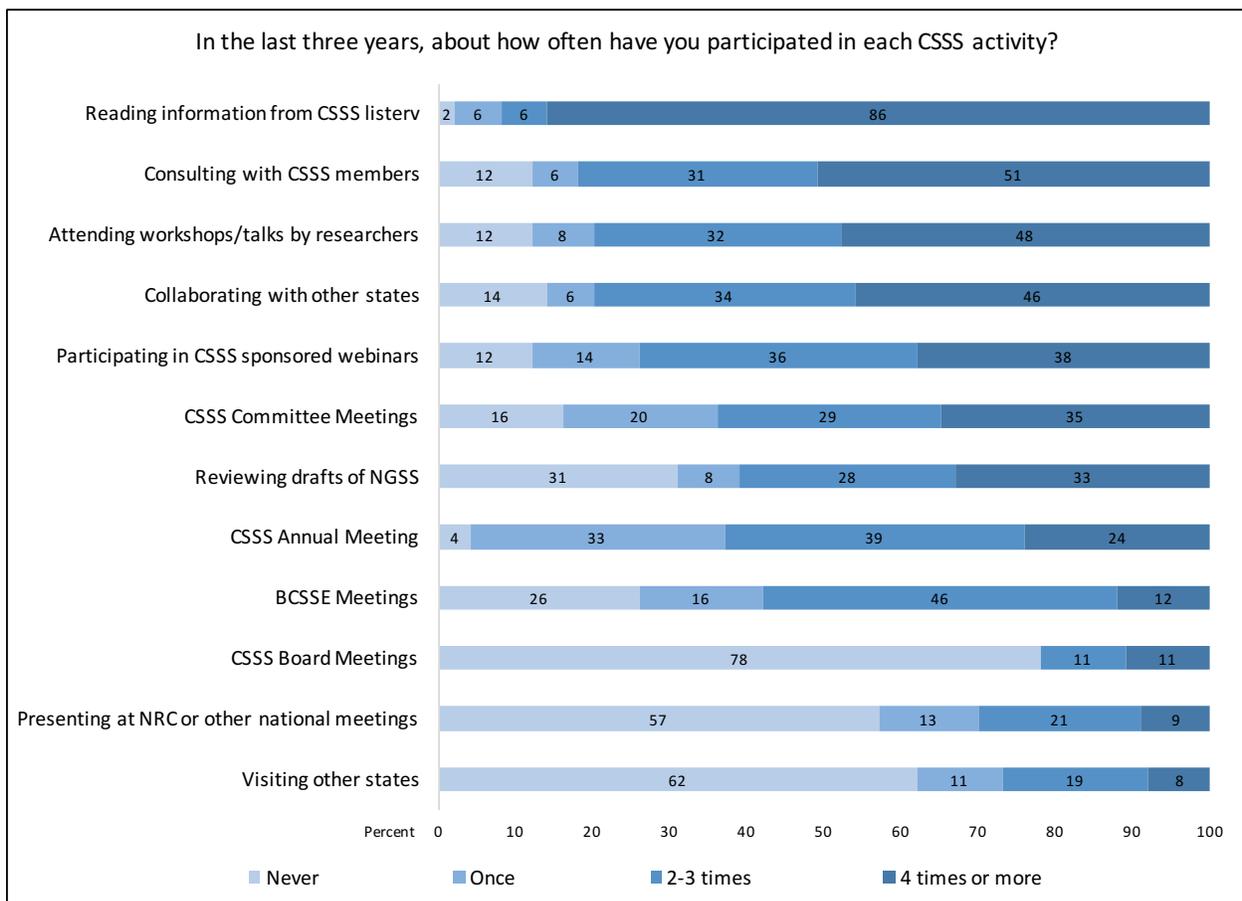


Figure 3. CSSS Activities in the Last Three Years (n=51)

State-Level Activities CSSS Members Participate In

A total of 52 respondents reported their frequency of participation in various state-level activities over the 12 months. These activities centered on five areas: (1) standards and curriculum, (2) assessment, (3) professional development, (4) partnerships, and (5) awards.

Of the activities focused on standards and curriculum, CSSS members reported the most frequent engagement in reviewing or developing state science standards, with 61% (n=32) serving in lead roles often or all the time, and 46% (n=24) serving in support roles often or all the time (see Figure 4a). On the other hand, 48% of respondents (n=25) reported never consulting with curriculum companies on products in the design phase, and a full 71% of respondents (n=37) reported never organizing state curriculum adoption in the past 12 months.

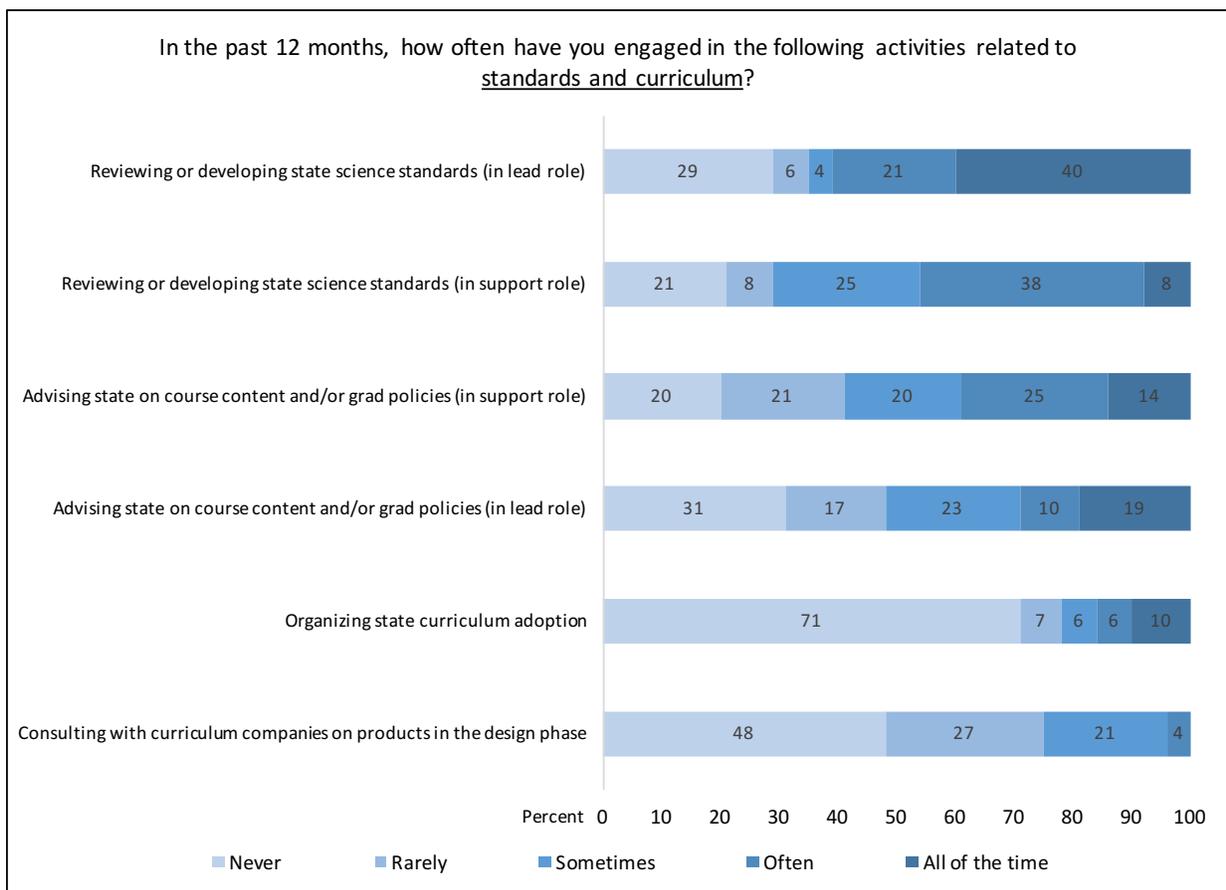


Figure 4a. State-Level Activities, Standards and Curriculum (n=52)

With respect to state-level activities related to assessment, CSSS members were more likely to report more frequent involvement in designing state assessments than selecting contractors for state assessments (see Figure 4b). Specifically, 49% of respondents (n=25) indicated that they played a support role in designing state assessments often or all the time, and 41% of respondents (n=21) reported playing a lead role in the past 12 months. Conversely, only 16% of respondents (n=8) reported selecting contractors for state assessments at that frequency.

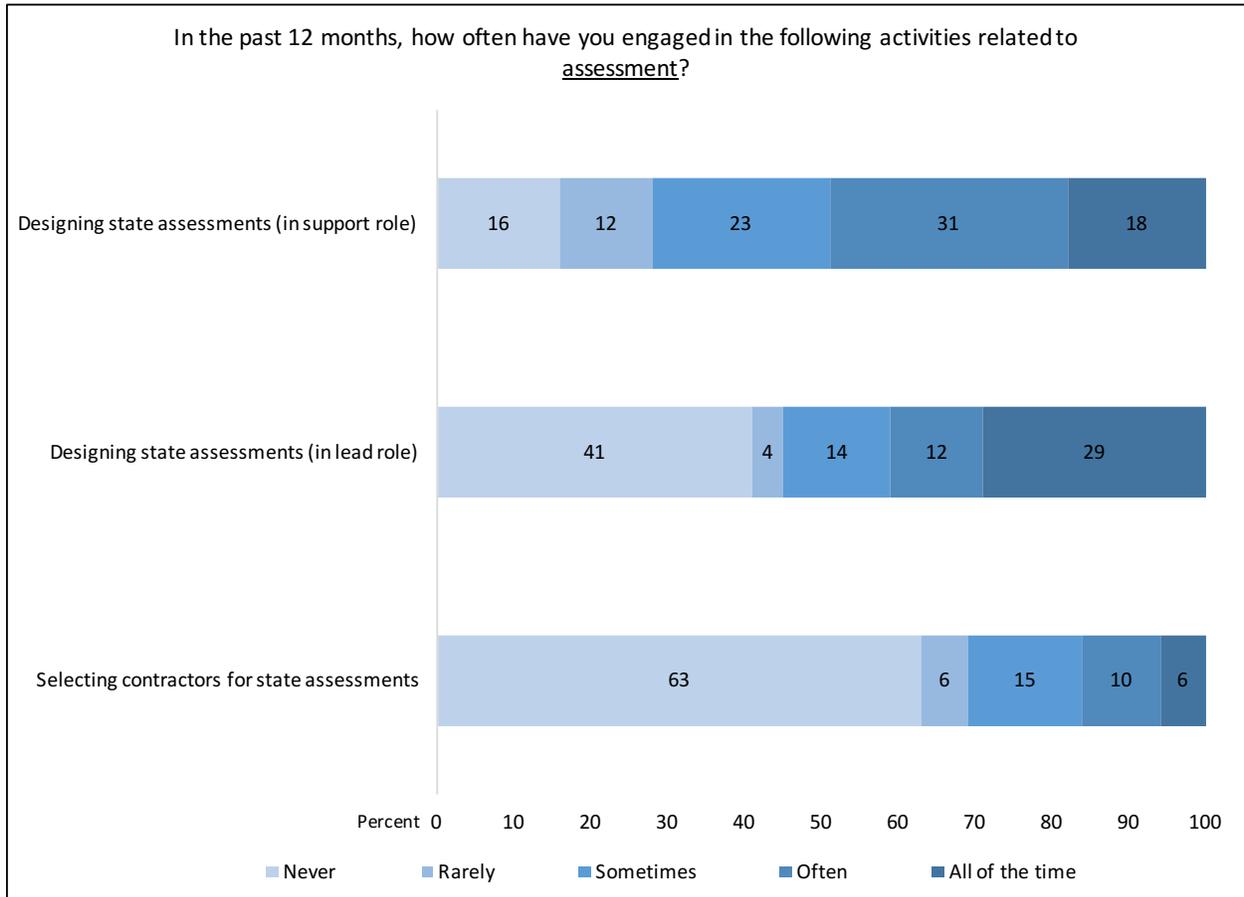


Figure 4b. State-Level Activities, Assessment (n=52)

The state-level professional development activities that CSSS members were most frequently involved in focused on designing or conducting professional development (see Figure 4c). A full 73% of respondents (n=38) indicated that they led the design of professional development often or all the time in the last 12 months, and 60% (n=31) reported playing a support role in professional development design at that frequency. With respect to conducting professional development, 65% of respondents (n=34) reported engaging in this type of activity often or all the time. On the other hand, CSSS members were much less likely to report writing contracts for professional development providers or allocating Title 2A funds at that frequency, with just 23% (n=12) and 12% (n=6) reporting involvement in these activities often or all the time.

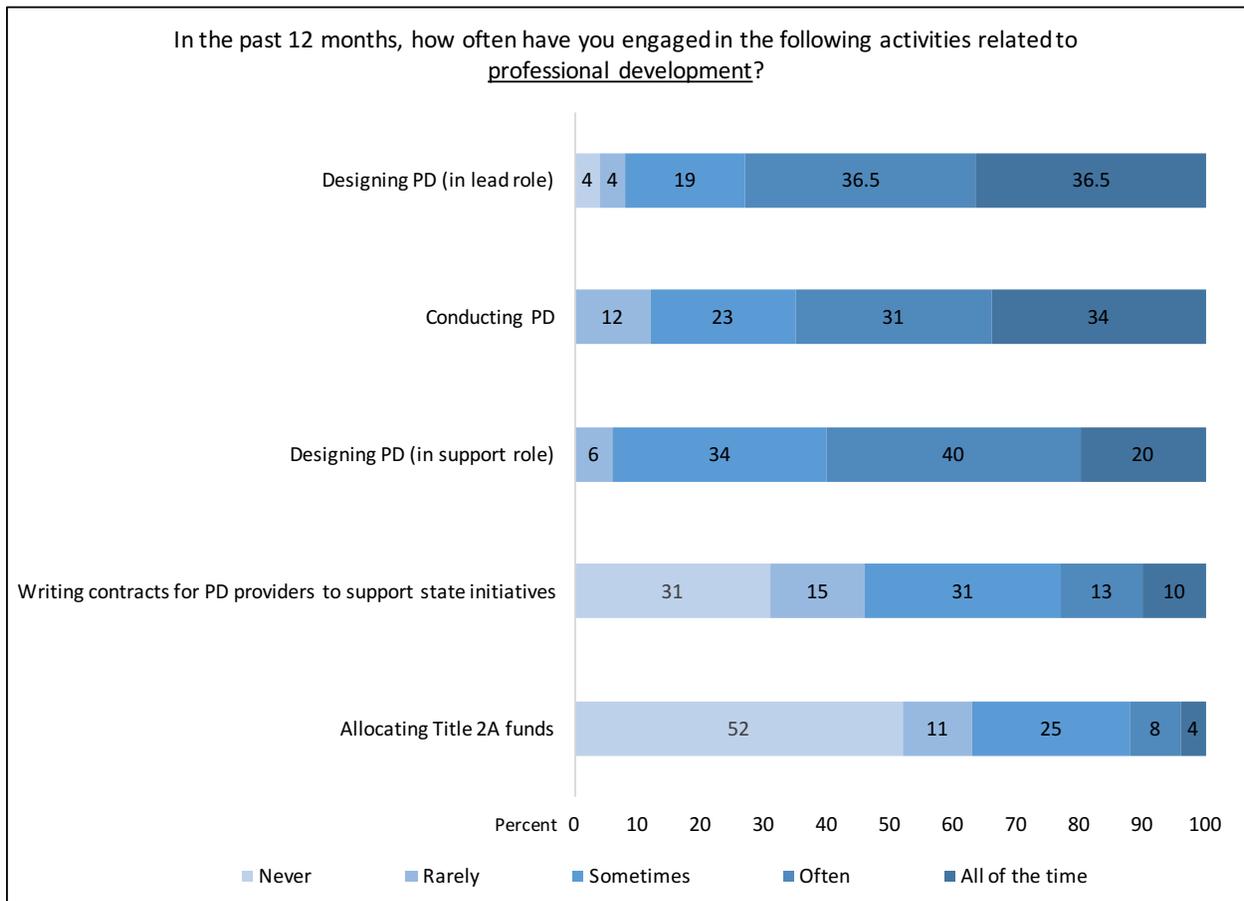


Figure 4c. State-Level Activities, Professional Development (n=52)

Compared to the other areas, CSSS members did not report much variation in their level of participation in the various partnership activities included on the survey (see Figure 4d). While 62% of respondents (n=32) reported identifying resources to share with districts often or all the time in the last 12 months, 42% (n=22) reported screening or reviewing such resources at that frequency. Additionally, 56% of respondents (n=29) reported establishing partnerships with business, industry, and non-formal groups often or all the time, and 51% (n=27) reported collaborating with their state university systems in K-16 initiatives at that frequency.

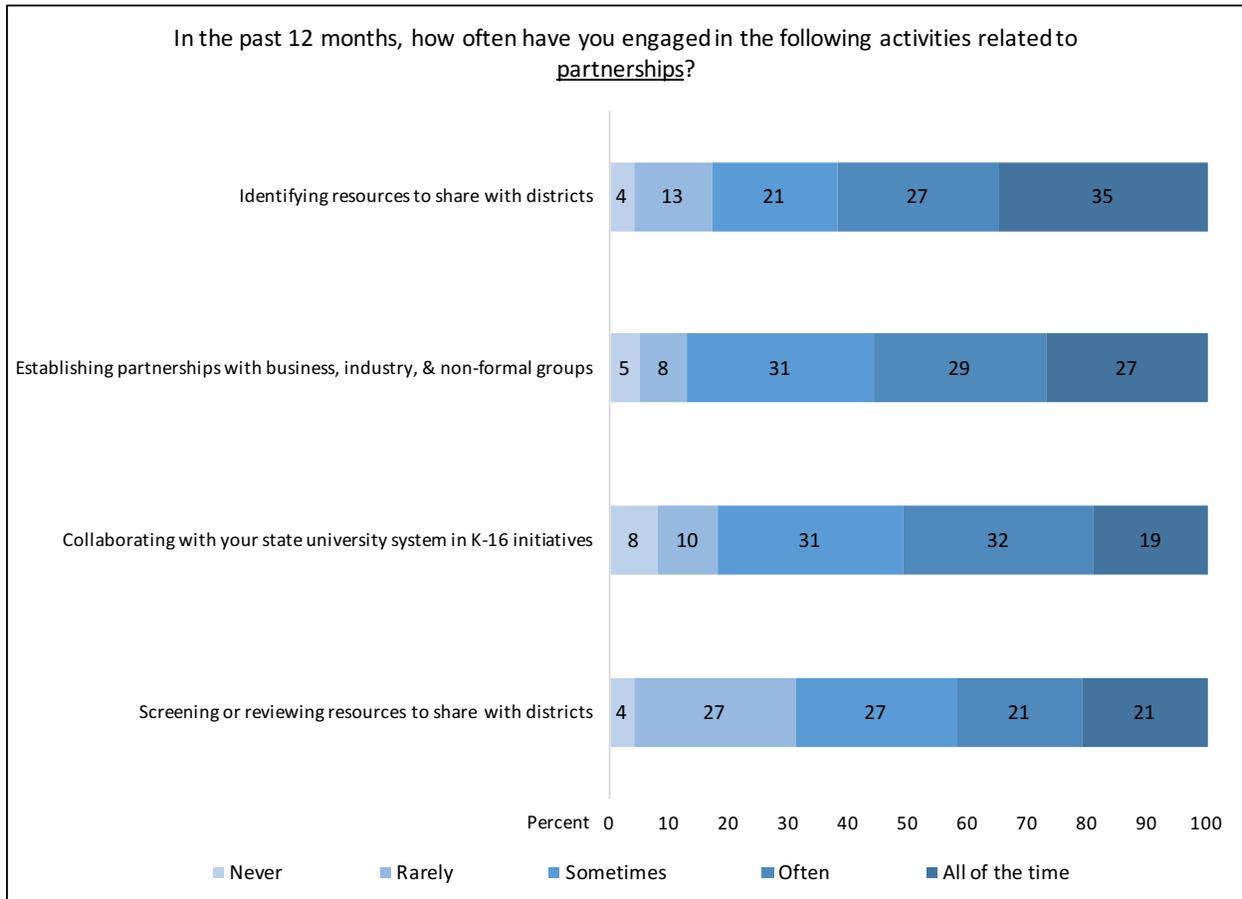


Figure 4d. State-Level Activities, Partnerships (n=52)

The final area of activities focused on awards (see Figure 4e). In general, respondents were not as frequently engaged in state-level award activities as some of the other activities noted above (e.g., reviewing or developing state standards or designing or conducting professional development). Of the award activities we asked about on the survey, 40% of respondents (n=21) reported coordinating teacher awards often or all the time over the last 12 months, compared to 31% (n=16) conducting grant competitions and 30% (n=15) coordinating student scholarships at that frequency.

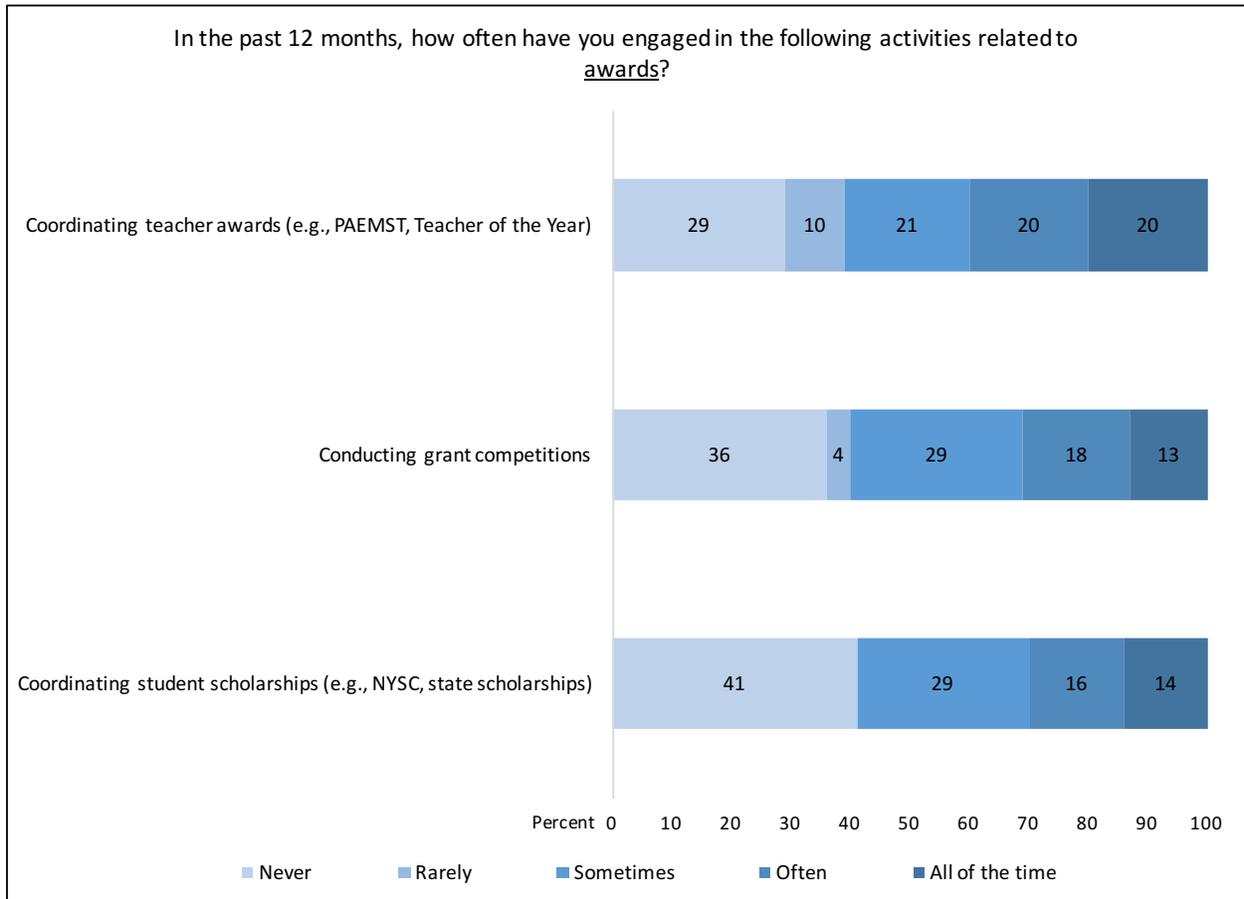


Figure 4e. State-Level Activities, Awards (n=52)

Research Use

Key Findings:

- The research CSSS members used or shared most often focused on instructional practices and student learning in science.
- Whereas CSSS members used research in a variety of forms, including research or policy reports, journal articles, books, they tended to share research in the form of reports. One of the most prominent forms of research used and shared were reports by the National Research Council.
- Few, if any, pieces of research that CSSS members used or shared focused on particular student groups (e.g., by race/ethnicity, gender, socioeconomic status, or language).
- Many respondents reported using research to inform their own professional learning, or the learning of others. They reported sharing research with a variety of leaders, at the state, district, and school levels.
- CSSS members tended to access research through their professional networks, including through CSSS, NSTA, and colleagues in state departments of education. University researchers were also prominent sources of research.
- CSSS members turn to a variety of individuals for research to inform their state's decision, including current and former CSSS members, university researchers, state department of education leaders, individuals working for educational non-profit organizations, and local educational leaders. Of these groups, former CSSS members were particularly prominent in CSSS members' research networks.

Analysis of Research CSSS Members Use and Share

We asked respondents two questions related to the specific pieces of research they refer to in their work. First, we asked them to name a piece of research they have used to inform their state's decisions related to implementation of the *Framework for K-12 Science Education*. Second, we asked respondents to name a piece of research they have shared with state or district leaders related to implementation of the *Framework*.

For the first item related to a specific piece of research used to inform state decisions, 27 unique pieces of research were listed by a total of 38 respondents, or 62% of the overall sample. Within these 27 responses, 26 provided enough information to identify the specific piece of research referenced. For the second item related to a piece of research shared with state or district leaders, 27 unique pieces of research were listed by 33 respondents, or 54% of the sample. Within these responses, 24 provided enough information to identify the specific piece of research referenced.

Below, we describe the focal topics of the research named as well as the content areas and student subgroups the pieces of research highlighted. Then, we describe the form of the research referenced by respondents and the reasons it was useful or with whom it was shared.

Focal topics of research. Of the 26 unique pieces of identifiable research listed by respondents as useful in informing state decisions, the majority (62% or n=16) focused on teachers and teaching in the classroom (see Figure 5). Among these pieces of research, 10, or 63% of this category, focused on instructional practices, including the National Research Council report, *Ready, Set, Science!*^{xi} Others focused on teacher professional learning (n=3 or 19% of this category) or curriculum and standards (2 or 13%).

Teachers and teaching in the classroom was also a prominent category among the 24 unique pieces of identifiable research listed by respondents as shared with state or district leaders. Specifically, 50%, or 12 pieces of research, focused on this area (see Figure 5). Among those, 10, or 83%, focused on instructional practices, such as the *Talk Science Primer*.^{xii} Other pieces of research in this category focused on teacher professional learning or teacher preparation (n=2 or 17%).

Research on student learning and student outcomes was another area that respondents noted was useful in informing state decisions related to the *Framework*, with 10 pieces of research (or 38%) focused in this area (see Figure 5). Within this category, the majority (n=7 or 70%) focused on learning and development (e.g., how students learn science), such as the edited volume, *Working with Big Ideas*.^{xiii} The remainder (n=3 or 30%) focused on student achievement or academic outcomes.

Results were similar for the pieces of research respondents reported sharing with state or district leaders, with 11 pieces of research (or 46%) focused on student learning and student outcomes (see Figure 5). Within this area, nearly all (n=10 or 91%) focused on learning and development, such as the National Research Council report, *A Framework for K-12 Science Education*,^{xiv} while the one remaining piece of research focused on student achievement outcomes.

A few of the pieces of research named by respondents also focused on assessment. Of those named as useful in informing state decisions related to the Framework, 2 pieces of research, or 8%, focused on either classroom assessment or standardized testing; this figure was 4, or 17%, for those pieces respondents shared with state or district leaders (see Figure 5). An example of a piece of research focused on assessment is the National Research Council report, *Developing Assessments for the Next Generation Science Standards*.^{xv}

Finally, a few respondents named pieces of research related to school or system improvement (n=4 or 15%) as something they used to inform their state's decisions, as well as something they shared with state or district leaders (n=4 or 17%), such as the National Research Council report, *Guide to Implementing the Next Generation Science Standards*.^{xvi}

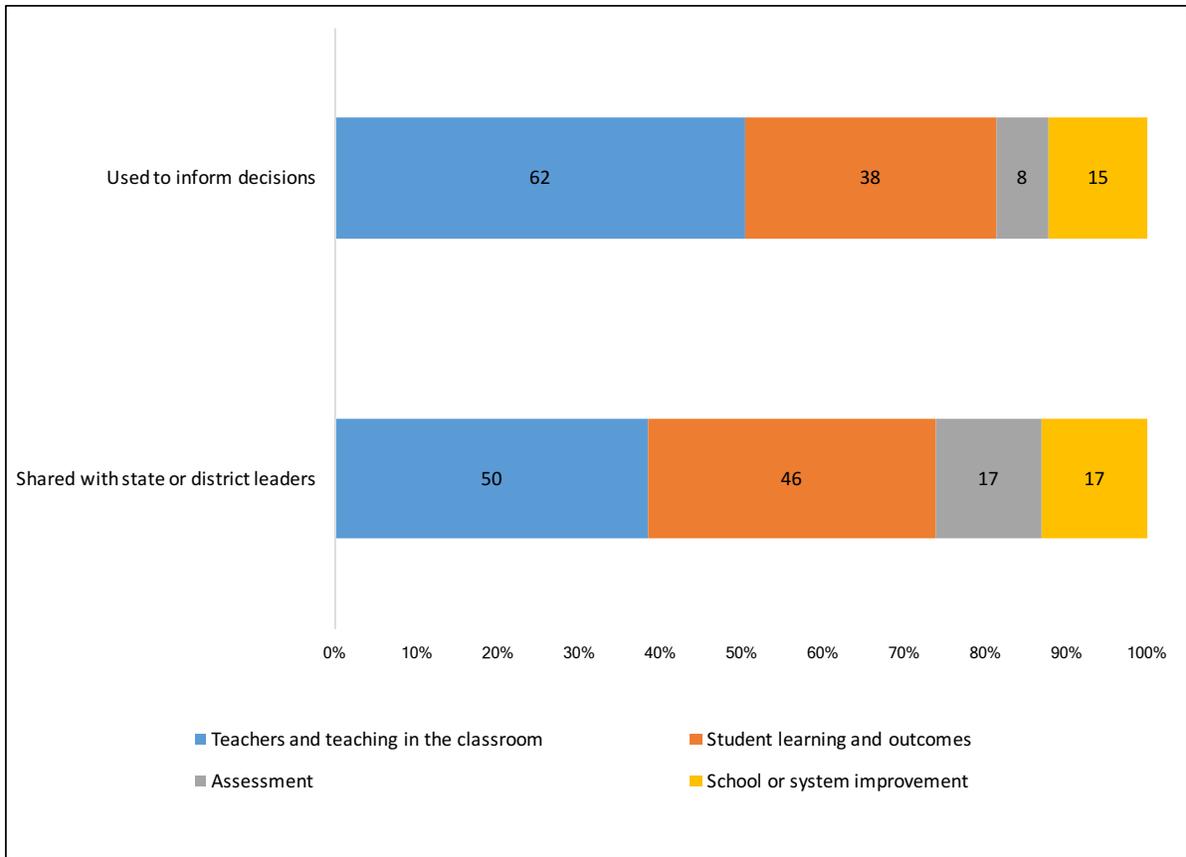


Figure 5. Focal Topics of Research Used (n=26) and Shared (n=24)

Content areas and student subgroups. Perhaps unsurprisingly, the vast majority of the pieces of research named by respondents as informing their state’s decisions related to the *Framework* focused on the content area of science (n=23 or 88%). The other 3 studies did not focus on a particular content area; instead, they focused generally on assessment development or the use of curriculum materials. The same was true for the pieces of research respondents reported sharing with state or district leaders, as nearly all (n=23 or 96%) focused on the content area of science, with only one piece of research focusing on mathematics.

With respect to student subgroups, respondents overwhelmingly named research that did not focus on a particular subgroup (n=23 or 88% of those used, and n=22 or 92% of those shared). Nonetheless, three pieces of research respondents named as useful in informing their state’s decisions focused either on several subgroups (i.e., race/ethnicity, SES/poverty) or specifically on English language learners.

Form of research. The pieces of research that respondents used to inform their state’s decisions came in a variety of formats (see Figure 6), including research reports or policy briefs (n=9 or 35%), peer-reviewed journal articles (n=7 or 27%), books (n=5 or 19%), presentations (n=2 or 8%), research-based tools (n=1 or 4%), and webinars (n=1 or 4%). Six of the research reports named, or 23%, were book-length reports published by the National Academies Press with support from the National Research Council, such as *Ready, Set, Science!*^{xvii} and *Developing Assessments for the Next Generation Science Standards.*^{xviii}

With respect to the pieces of research shared with state or district leaders, the majority were research reports or policy briefs (n=13 or 54%) (see Figure 6), with 8 (33%) published by the National Academies Press with support from the National Research Council. Of the other pieces of research respondents shared, 4 or 17% were peer-reviewed journal articles, 3 or 13% were research-based tools, 2 or 8% were books, and 2 or 8% were presentations.

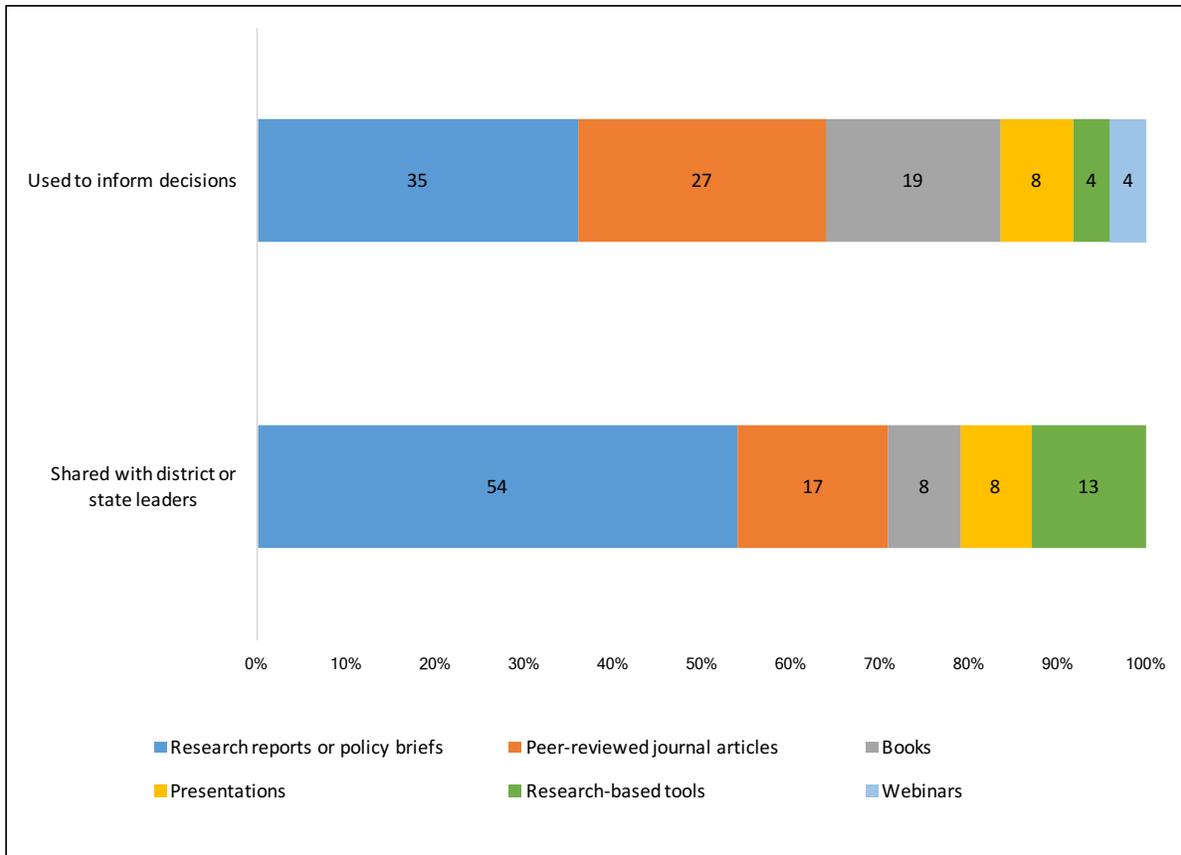


Figure 6. Form of Research Used (n=26) and Shared (n=24)

Reasons for why a piece of research was useful. For the item in which respondents listed a piece of research they use to inform their state’s decisions related to implementation of the *Framework*, we also asked respondents to answer the question, “Why was it useful?” Responses from 28 respondents provided enough information to identify reasons for the usefulness of the research. An additional 10 respondents provided no response or an answer that provided a description of the piece (e.g., “Study of formative assessment practices”) rather than a reason. These responses were excluded from the analysis.

Respondents’ reasons for using a piece of research to inform their state’s decisions related to supporting their own professional learning (n=13 or 46%); providing instructional leadership for others in their states (n=6 or 21%); designing programs or initiatives (n=7 or 25%); persuading others on programs or initiatives (n=2 or 7%), and supporting and monitoring implementation (n=1 or 4%).

Groups with whom research was shared. For the item in which respondents listed a piece of research they shared with state or district leaders, we also asked respondents to answer the question, “With whom did you share it?” Responses from 28 respondents provided enough information to identify with whom they shared it. An additional 4 respondents provided no response or an answer that provided a description of the piece (e.g., “Study of formative assessment practices”) or a reason they use it, rather than a group with whom they share it. These responses were excluded from the analysis.

Respondents reported sharing research with individuals at a variety of levels, including other state leaders (n=9 or 32%), district leaders (n=7 or 25%), school leaders (n=5 or 18%), teacher leaders (n=7 or 25%), and teachers (n=7 or 25%). Three respondents, or 11%, also indicated that they posted the piece of research on their state’s website.

Sources CSSS Members Use to Obtain Research

A set of survey questions asked respondents to report how often they had sought out or acquired research from various sources in the past 12 months (see Figure 7). Respondents showed a tendency to access research through their networks, such as via their colleagues in state department(s) of education (n=35 or 63% often or all the time), the National Science Teachers Association (NSTA) (n=31 or 56% often or all the time), and the Council of State Science Supervisors (n=31 or 55% often or all the time). Additionally, university researchers and conferences represent other prevalent sources for accessing research, with 26 and 23 respondents, or 48% and 42%, respectively, reporting seeking out or acquiring research from these sources often or all the time.

On the other hand, respondents were less likely to report accessing resources at that frequency from the National Center for Education Statistics (n=6 or 11% often or all the time), the What Works Clearinghouse (n=6 or 10% often or all the time), Regional Educational Laboratories (n=5 or 9% often or all the time), vendors (n=4 or 8% often or all the time), the National Science Education Leadership Association (n=3 or 6% often or all the time), and county offices of education (n=2 or 4% often or all the time). In fact, a majority of respondents indicated that they rarely or never acquired research from these six sources.

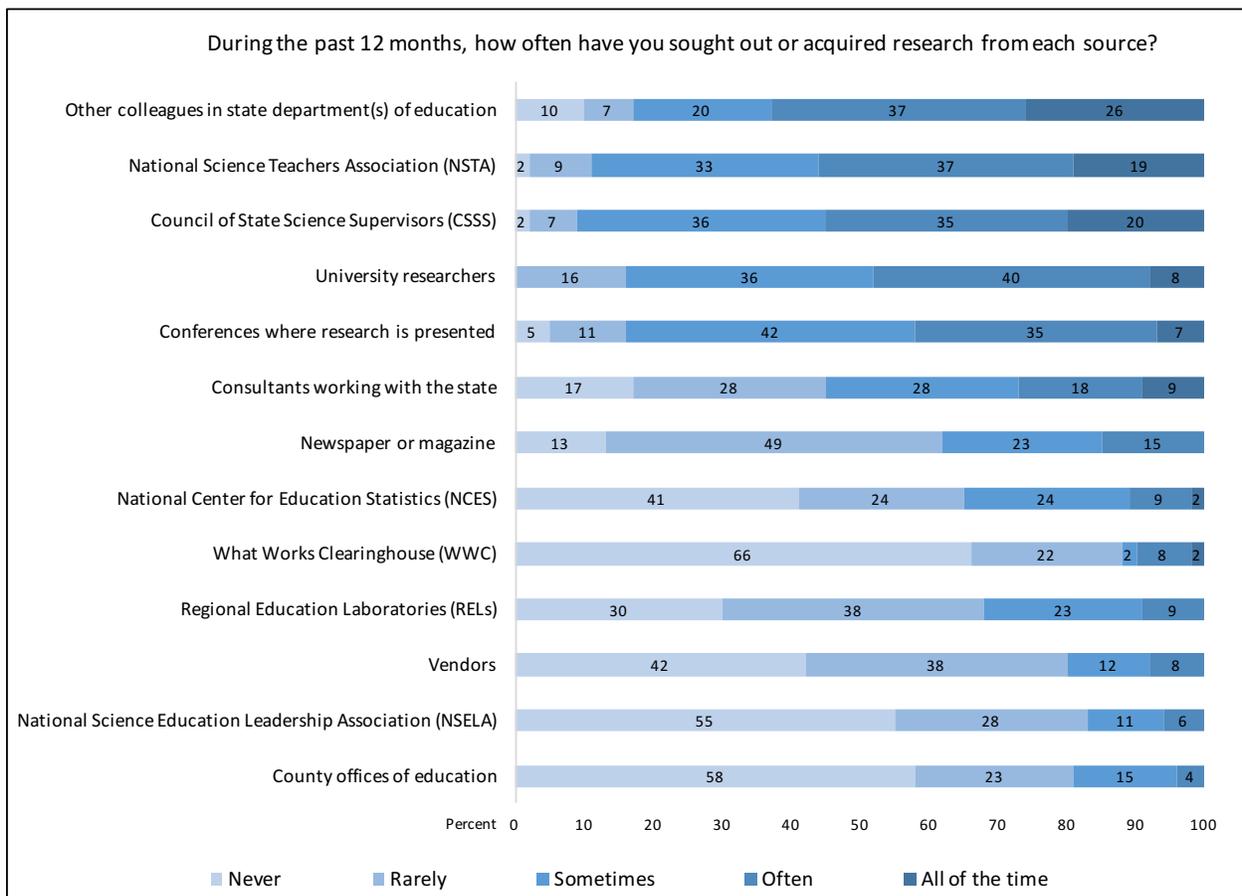


Figure 7. Sources CSSS Members Use to Access Research (n=55)

Effort to Acquire Research

We asked respondents five questions related to their efforts to acquire research and develop relationships with researchers, when confronted with new problems or decisions. The vast majority of respondents (n=46 or 75%) indicated that they find it valuable to consult educational research “often” or “all of the time” when confronted with a new problem or decision (see Figure 8). Additionally, the vast majority of respondents (n=46 or 76%) reported looking for relevant research studies “often” or “all of the time” when confronted with a new problem or decision. Although 42% of respondents (n=26) reported that they contact researchers they already know “often” or “all of the time,” few reported reaching out to researchers to find out more about a specific article (n=11 or 18%) or contacting researchers they do not know (n=3 or 5%) that frequently.

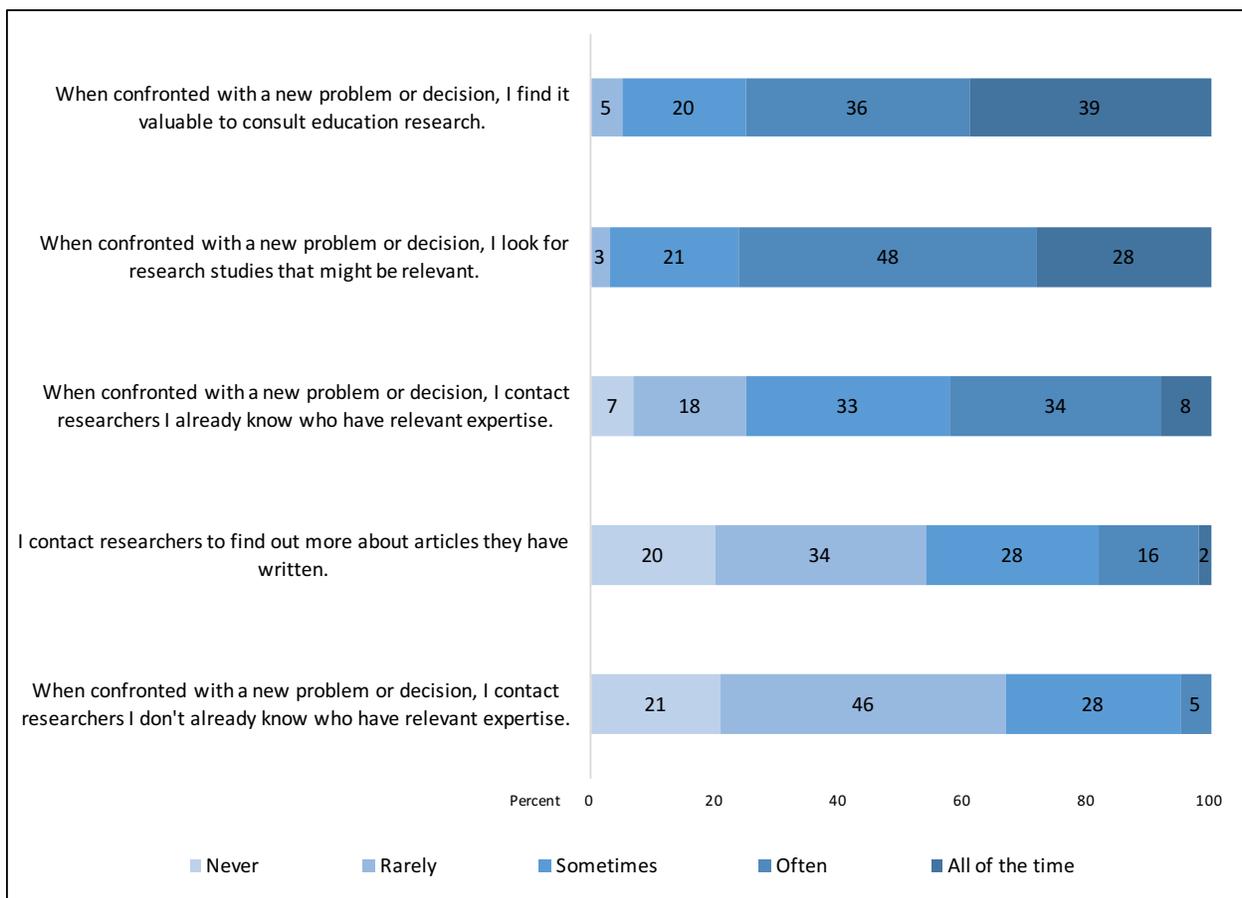


Figure 8. Effort to Acquire Research (n=61)

CSSS Activities that Research Supports

Research findings and research-based tools supported the work of state science leaders to varying degrees across the activities in which they engaged as CSSS members. The vast majority of respondents who reported attending the CSSS annual meeting or BCSE meetings, as well as workshops or talks by researchers, also reported learning about research findings and research-based tools through these activities (see Figure 9). About two-thirds of respondents who reported reading information from the CSSS listserv, participating in CSSS-sponsored webinars, and attending CSSS committee meeting also reported learning about research findings and research-based tools through these activities. Conversely, fewer respondents who reported visiting other states or attending CSSS Board meetings indicated that they learned about research findings or research-based tools during those activities.

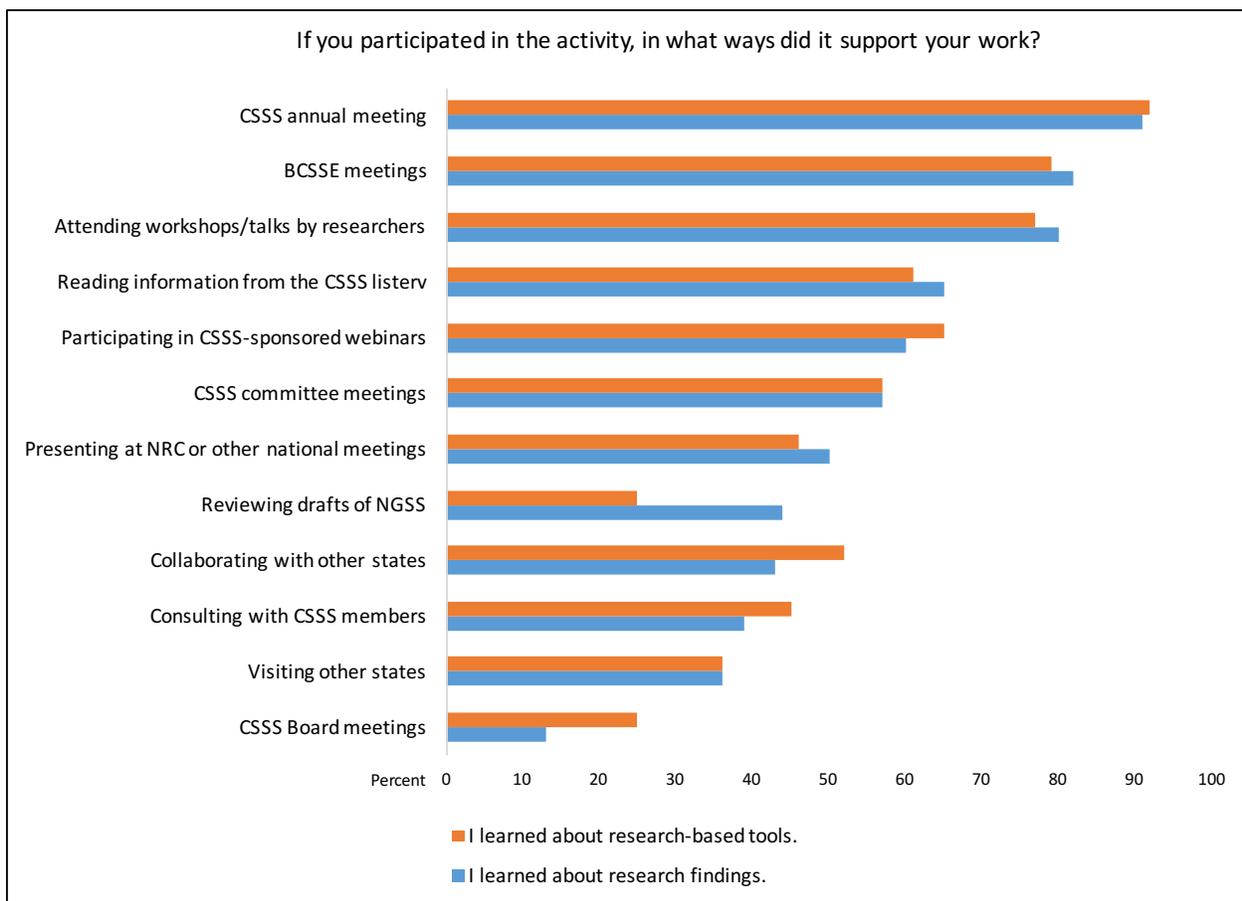


Figure 9. CSSS Activities that Research Supports (16 ≤ n ≤ 49)

Research Networks

Survey questions pertaining to research networks asked respondents to name up to 12 individuals to whom they have turned in the past 12 months for research to inform their state's efforts to implement the vision of the *Framework for K-12 Science Education*. We also asked respondents to indicate the topics of research discussed: curriculum, assessment, professional development, and/or instruction.

The 44 CSSS members (37 current, 7 former) who responded to these questions named a total of 141 individuals to whom they turned for research. We categorized these individuals into six groups, depending on their organizational affiliations:

- Current CSSS members (n=16)
- Former CSSS members (n=6)
- University researchers (n=75)
- State department of education staff (n=8)
- Individuals working in education non-profits, such as Achieve, the Exploratorium, SRI, and WestEd (n=29)
- Local educational leaders, such as school district administrators (n=7)

We analyzed these data in several ways. First, we calculated the number of individuals to whom each respondent turned for research, both overall and by research topic. In social network analysis, this number is referred to as an individual's *out-degree*. Those with higher out-degrees in this network can be interpreted to seek out more people for research to inform their state's implementation efforts. Second, we calculated the number of individuals who named each person in the network as someone they turn to for research, both overall and by topic. This number is referred to as an individual's *in-degree*. Those with higher in-degrees are often thought to have more influence in a network. In general, both out-degree and in-degree help us to get a sense of an individual's overall exposure to others in the network, and in this case to research and research-related information. We report average out-degree and in-degree below, by research focus area and organizational affiliation.

The 44 CSSS members who responded to the network questions had an average out-degree of six, indicating that they turned to an average of six individuals for research to inform their state's efforts to implement the vision of the *Framework* (see Table 1). Across the focal areas, respondents reported turning to an average of 3 individuals for research related to assessment and curriculum, and an average of 4 individuals for research related to instruction and professional development (see far left column in Table 1). Current CSSS members reported turning to at least one more individual for research related to each topic area than former CSSS members, indicating that current members are more slightly more active in seeking out research related to their state's efforts than former members.

Table 1. Average (SD) Out-Degree, or Number of Individuals to Whom Respondents Turned for Research Related to Different Topics

| Research Topic | All (n=44) | Current Member (n=37) | Former Member (n=7) |
|-----------------------------|---------------|--------------------------|------------------------|
| All | 6.2 (3.8) | 6.4 (3.7) | 5.1 (4.3) |
| Assessment | 2.8 (2.9) | 3.0 (2.9) | 2.0 (2.8) |
| Curriculum | 3.3 (2.6) | 3.5 (2.7) | 2.3 (2.0) |
| Instruction | 4.0 (3.1) | 4.3 (3.1) | 2.4 (2.6) |
| Professional Development | 4.0 (2.9) | 4.1 (3.0) | 3.3 (2.5) |

Among the 141 individuals who were named as someone a respondent turned to for research to inform their state’s efforts to implement the *Framework*, each had an average in-degree of two, indicating that they were named an average of two times by respondents (see Table 2). There was not much variation in in-degree across research areas, with in-degrees ranging from an average of 0.9 for assessment and 1.0 for curriculum, to 1.2 for instruction and professional development.

Comparing in-degree across organizational affiliation, it is notable that former CSSS members were named most frequently as someone respondents turn to for research, by an average of 7 respondents (see Table 2). Even so, there is wide variability in how often these individuals were named, as evidenced by the standard deviation of 6.8, indicating that just a few former CSSS members were named by several respondents. Thus, while former CSSS members may not be as active in seeking out research as current CSSS members (see Table 1), a few key former CSSS members are prominent sources of research in the network.

Of the other groups, current CSSS members, university researchers, and individuals from non-profit organizations were all named by an average of two respondents, with average in-degrees of 1.8, 1.9, and 1.6, respectively. State department of education staff and local leaders were both named by an average of one respondent.

Table 2. Average (SD) In-Degree, or Number of Times Respondents Named Individuals as Someone They Turn to for Research

| Research Topic | All (n=141) | Current Member (n=16) | Former Member (n=6) | University researchers (n=75) | State DOE (n=8) | Non-profit (n=29) | Local leader (n=7) |
|--------------------------|--------------|-----------------------|---------------------|-------------------------------|-----------------|-------------------|--------------------|
| All | 1.9 (2.5) | 1.8 (1.2) | 6.8 (6.8) | 1.9 (2.4) | 1.0 (0.0) | 1.6 (1.3) | 1.0 (0.0) |
| Assessment | 0.9 (1.6) | 1.1 (0.6) | 4.0 (4.4) | 0.8 (1.5) | 0.4 (0.5) | 0.6 (0.7) | 0.6 (0.5) |
| Curriculum | 1.0 (1.6) | 0.8 (0.9) | 3.5 (4.2) | 1.0 (1.6) | 0.8 (0.5) | 1.0 (1.1) | 0.7 (0.5) |
| Instruction | 1.2 (1.8) | 1.0 (1.1) | 4.2 (5.7) | 1.2 (1.5) | 0.6 (0.5) | 1.1 (1.3) | 1.0 (0.0) |
| Professional Development | 1.2 (2.0) | 1.3 (1.1) | 5.5 (6.2) | 1.1 (1.6) | 0.5 (0.5) | 1.1 (0.9) | 0.9 (0.4) |

Another way to examine the CSSS members' research network is through a visual representation of the network, called a sociogram. In addition to generating sociograms for the overall network and by focal area, we calculated two network-level measures to help us understand the levels of cohesion and connectedness in each network. The first measure is *density*, which is simply the number of interactions in the network, or ties, expressed as a proportion of the number of possible ties. Density is an indicator of cohesion, and is best interpreted when compared between networks, or between focal areas in our case. The second measure is *connectedness*, which measures the extent to which a network is connected via examining the proportion of pairs of individuals, or nodes, in the network who can reach each other via others in the network.

We first present the overall research network sociogram in Figure 10a, where each dot, or node, indicates a unique individual in the network. Organizational affiliations are indicated by color, as noted in the key. We also present the same network with nodes sized by in-degree (see Figure 10b), which helps to get a sense of which individuals are most prominent in the network.

An examination of Figure 10a reveals that CSSS members have a relatively well-connected research network, given that the vast majority of individuals in the network are connected to at least one other person, and many individuals are connected to the same people. That is, there is some overlap in who respondents turned to for research, and very few CSSS members turned to someone to whom no other members turned. Indeed, the overall connectedness for the research network is 0.819 (see Table 3), indicating that 80% of people can reach each other via others in the network.

Upon sizing the nodes by in-degree (see Figure 9b), where the larger the node indicates a higher number of respondents who named that person as someone they turn to for research, we see that a handful of individuals emerge as most central or influential in the network. Specifically, two former CSSS members (yellow nodes) have among the largest nodes in the network, followed by three or four university researchers (turquoise nodes), and two current CSSS members (red nodes).

| | | |
|-----|-----------|-------------------------------|
| Key | Red | Current CSSS member |
| | Yellow | Former CSSS Member |
| | Turquoise | University-based researcher |
| | Green | Non-Profit Organization |
| | Dark blue | State Department of Education |
| | Pink | Local educational leader |

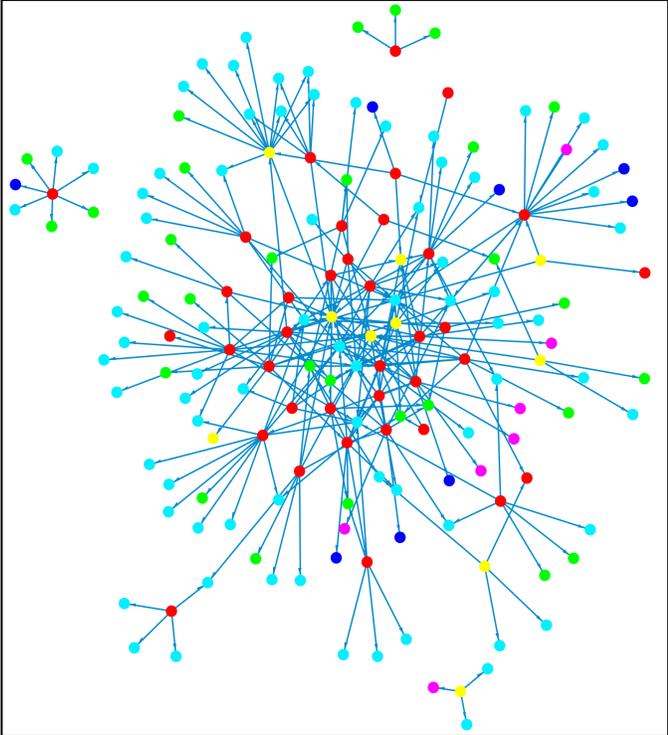


Figure 9a. Respondents' Research Network

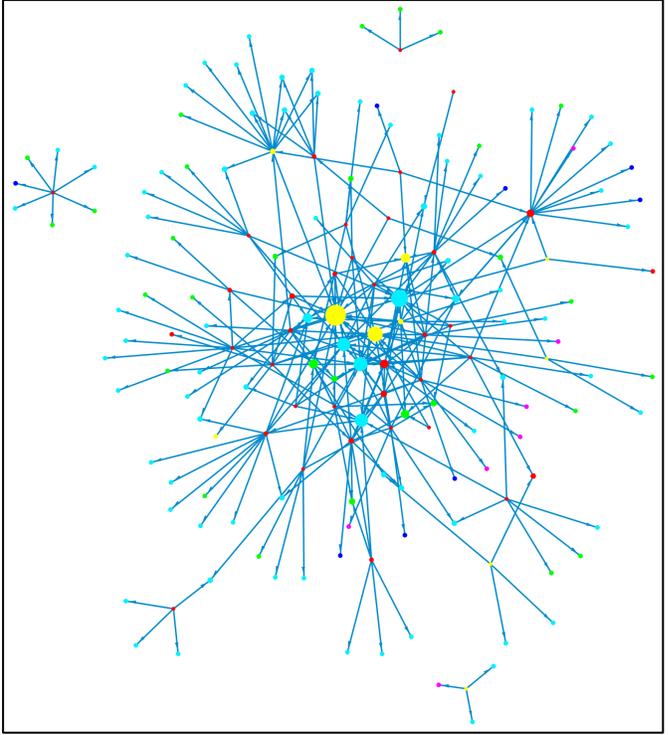


Figure 9b. Research Network by In-Degree

Considering the focal areas around which CSSS members turned to others for research, research about instruction and professional development was shared more frequently than research on assessment and curriculum. The instruction and professional development research networks were slightly denser than the assessment and curriculum networks (0.006 compared to 0.005, see Table 3), suggesting that CSSS members’ research networks in instruction and professional development are a bit more cohesive. Moreover, while about 40% of individuals in the instruction and professional development networks can reach one another via others in the network, this proportion was about 30% for the curriculum network, and 20% for the assessment network (see connectedness in Table 3). For visual representations of these four networks, see Figures 11a-11d.

Table 3. Network Density and Connectedness

| Network | Density | Connectedness |
|--------------------------|---------|---------------|
| All | 0.010 | 0.819 |
| Assessment | 0.005 | 0.226 |
| Curriculum | 0.005 | 0.315 |
| Instruction | 0.006 | 0.409 |
| Professional Development | 0.006 | 0.402 |

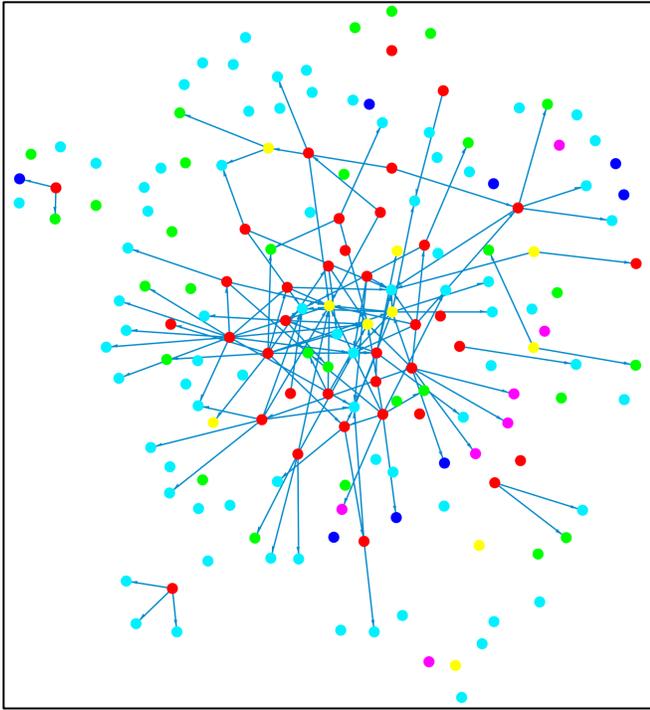


Figure 11a. Assessment

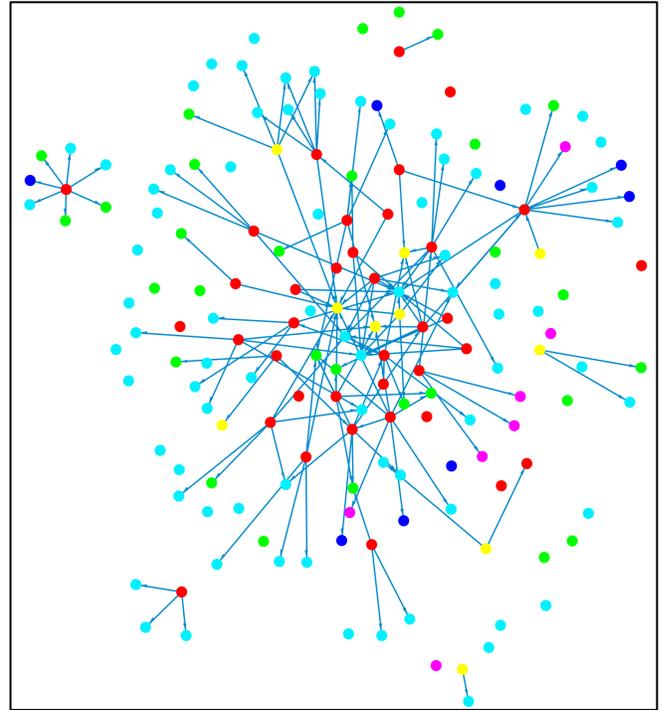


Figure 11b. Curriculum

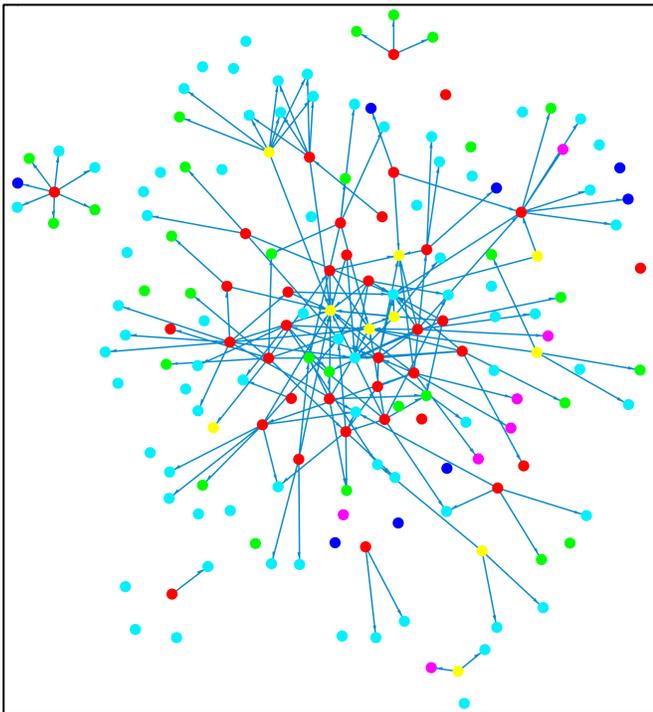


Figure 11c. Professional Development

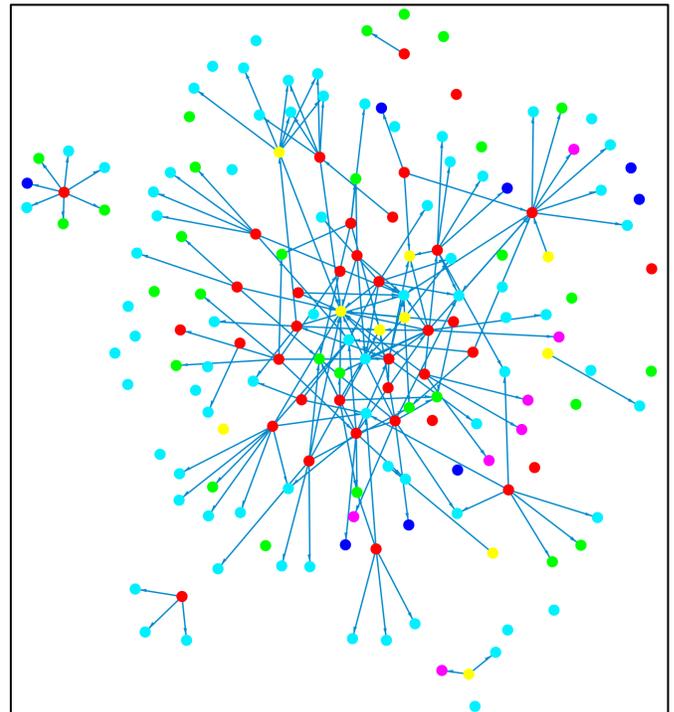


Figure 11d. Instruction

Key Conclusions and Next Steps

Findings from this study suggest that CSSS members regularly use research to inform their state's decisions related to implementation of the *Framework for K-12 Science Education*. They tend to access research through their networks, such as CSSS, NSTA, or state department of education colleagues, rather than via other research outlets such as governmental websites. Moreover, broad engagement in CSSS networks, such as through meetings and workshops, appear to facilitate the use of research more than activities like visiting or collaborating with other states. Indeed, our findings show that CSSS members have a relatively robust, well-connected research network. Within that network, former CSSS members, or Honorary and Associate Members, are key sources of research, suggesting that the inclusion of these members in the organization's activities helps to preserve institutional memory around research use.

With respect to the kinds of research that CSSS members found useful and shared with others in their states, National Research Council reports published via the National Academies Press were particularly prominent, indicating that these research syntheses are important for informing the work of state science leaders. Nonetheless, it was striking that very few, if any, of the research studies that CSSS members used or shared focused on science education as it pertains to particular student subgroups. In the context of changing demographics in states and districts across the country, it will be important to consider whether and how science education reforms are implemented equitably for students across race, gender, socioeconomic status, and language, and for research to attend to these issues.

The next steps in this work are to explore the relationships between CSSS members' roles and activities and their uses of research. This analysis will help us to understand whether particular kinds of roles or activities are associated with CSSS members' access to research, as well as their efforts to use research. We will also conduct a second round of survey data collection in spring 2017, which will allow us to examine how CSSS members' research network shifts as new leaders join the network.

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Endnotes

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- ⁱ National Research Council (2012)
- ⁱⁱ Penuel, Briggs et al. (2016)
- ⁱⁱⁱ Frank, Zhao, and Borman (2004); Penuel, Frank, Sun, Kim, and Singleton (2013); Spillane, Hopkins, and Sweet (2015)
- ^{iv} Massell, Goertz, and Barnes (2012)
- ^v Penuel, Briggs et al. (2016)
- ^{vi} Goertz, Barnes, Massell, Fink, and Francis (2013)
- ^{vii} National Research Council (2012)
- ^{viii} National Research Council (1999, 2005, 2007, 2009)
- ^{ix} See, for example, Knorr-Cetina (1999); Pickering (1995).
- ^x NGSS Lead States (2013)
- ^{xi} Michaels, Shouse, and Schweingruber (2008)
- ^{xii} Michaels and O'Connor (2012)
- ^{xiii} Harlen (2015)
- ^{xiv} National Research Council (2012)
- ^{xv} National Research Council (2014)
- ^{xvi} National Research Council (2015)
- ^{xvii} Michaels, Shouse, and Schweingruber (2008)
- ^{xviii} National Research Council (2014)