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'1-800-Help-Me-With-Open-Science-Stuff': A Qualitative Examination of Open Science Practices in Communication Sciences and Disorders

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Abstract

Purpose: The purpose of this qualitative study was to examine the perceptions of communication sciences and disorders (CSD) assistant professors in the United States related to barriers and facilitators to engaging in open science practices and identify opportunities for improving open science training and support in the field.

Method: Thirty-five assistant professors (16 from very high research activity (R1) institutions, 19 from institutions with other Carnegie classifications) participated in one 1-hour virtual focus group conducted via Zoom recording technology. The researchers used a conventional content analysis approach to analyze the focus group data and develop categories from the discussions.

Results: Five categories were developed from the focus groups: (a) a desire to learn about open science through opportunities for independent learning and learning with peers, (b) perceived benefits of engaging in open science on assistant professors' careers, the broader scientific community, and the quality of research in the field of CSD; (c) personal factors that act as barriers and/or facilitators to engaging in open science practices; (d) systemic factors that act as barriers and/or facilitators to engaging in open science practices; and (e) differences in perceptions of R1 and non-R1 assistant professors.

Conclusions: Assistant professors in CSD perceive benefits of open science for their careers, the scientific community, and the field. However, they face many barriers (e.g., time, lack of knowledge and training), which impede their engagement in open science practices. Preliminary recommendations for CSD assistant professors, academic institutions, publishers, and funding agencies are provided to reduce barriers to engagement in open science practices.

Keywords: open science; open access; assistant professors

'1-800-Help-Me-With-Open-Science-Stuff': A Qualitative Examination of Open Science Practices in Communication Sciences and Disorders

In 2021, the United Nations Educational, Scientific and Cultural Organization (UNESCO) released a recommendation on Open Science (open science; UNESCO, 2021), emphasizing principles of inclusivity, transparency, and collaboration. As the first international standard-setting instrument for open science, UNESCO aims to advance scientific research by making it more accessible and inclusive while fostering collaboration across individual, institutional, national, regional, and international levels. Since releasing these recommendations, countries, funders, and organizations have increasingly promoted open science practices. In the United States specifically, the White House Office of Science and Technology Policy (2023) initiated 2023 as the Year of Open Science, "featuring actions across the federal government to advance national open science policy, provide access to the results of taxpayer-supported research, and advance the adoption of open, equitable, and secure science." Many funders (e.g., National Institutes of Health [NIH], National Science Foundation [NSF]) and journal publishers (e.g., American Speech-Language-Hearing Association [ASHA] Journals Academy) now endorse or require more transparent research conduct and reporting practices (ASHA, n.d.a; NIH, 2020). Furthermore, the Center for Open Science (n.d.) has become a leading non-profit organization whose mission is to "increase openness, integrity, and reproducibility of research" by marshaling technological tools and resources for scientists, including Open Science Framework pre-prints and pre-registration, and Transparency and Openness Promotion guidelines (Nosek et al., 2016).

The rise of open science practices comes in response to concerns raised by the scientific community regarding the reproducibility of research findings across various fields (e.g., psychology, education, biology, and ecology; Baggerly & Coombes, 2009; Fraser et al., 2018; Makel & Plucker, 2014). Additionally, they were suggested as a tool to decrease the use of questionable research practices such as: *p-hacking*, manipulating data collection or analysis until results are significant (Fraser et al., 2018, Büttner et al., 2020); *cherry-picking*: selectively reporting data or studies that support a desired conclusion while ignoring data or studies that contradict it (Fraser et al., 2018); and *failing to report null results*: not publishing studies that do not support the researchers' hypotheses, leading to publication bias and a distorted view of evidence (Fraser et al., 2018).

Open science practices, such as preregistration, open data, gold open access, and self-archiving, are one approach to increasing transparency, rigor, and reproducibility. Applicable across disciplines (e.g., medicine, psychology, education, communication sciences and disorders [CSD]), open science practice use has several benefits (Adelson et al., 2019; Brown & Strand, 2023; Christensen et al., 2020; Kadakia et al., 2021). First, it may facilitate more transparent research processes. *Preregistration*, or pre-specifying, documenting, and timestamping hypotheses, procedures, outcomes, and statistical analysis plans, allows for increased transparency and discoverability of the entire research workflow and protects against *p*-hacking and hypothesizing after the results are known (Munafò et al., 2017). Second, it may promote collaboration and spur additional scientific discoveries. *Open data* (i.e., public availability of research data and materials) can allow research groups to combine data into larger datasets to answer research questions requiring larger samples or address new ones as part of secondary data analysis (Kathawalla et al., 2021). Third, using open science practices may help reduce the research-to-practice gap. For example, through *gold open access publishing* (i.e., making manuscripts freely available through the publisher for readers without a subscription to the journal) or *self-archiving* (i.e., making a version of the manuscript legally and freely available [green open access]), researchers have promoted dissemination and afforded clinicians – and the broader community – greater access to cutting-edge research. As preliminary evidence of this effect, Long et al. (2023) found that gold open access publishing led to significantly greater citation and altmetric counts, suggesting more significant research and online attention than when research is behind a paywall.

Despite these benefits, research on the effectiveness of these practices is limited, and it is important to hold scientific reform to the same rigorous research standards we hold for experimental studies (Devezer et al., 2021). Therefore, more studies are needed to establish the extent to which these practices are effective. Additionally, some principles inherent to open science practices could limit the applicability and implementation of these practices. For example, transparency through open data is challenging, given the confidentiality and privacy limitations of human subjects data (Guzzo et al., 2022). Additionally, the emphasis on replication might reduce the robustness of research through a focus on narrow research questions and away from exploratory research (Guzzo et al., 2022). Furthermore, implementing open science practices, such as data sharing, preregistration, and open peer review, often requires additional time and effort from researchers. These practices can increase researchers' workloads, especially those early in their careers, who may already be under pressure to publish and secure funding (Allen & Mehler, 2018). We also acknowledge that the shift towards open science requires significant changes in research culture, including altering incentive structures and evaluation processes. These changes can be difficult to implement, particularly in established institutions where traditional practices are deeply ingrained (Aguinis et al., 2020).

Open Science and CSD

Despite these potential challenges, open science practices continue to hold promise to make our research more transparent and accessible, which may increase the likelihood that clients, patients, clinicians, and students can access assessments, methods, interventions, and strategies to actualize the outcomes reported in CSD research. These benefits may explain, in part, why the open science movement is gaining ground globally and across disciplines (Christensen et al., 2020); the CSD field is no exception. For example, researchers publishing in CSD journals, such as the *Journal of Speech-Language and Hearing Research*, can earn badges for open science practices, such as preregistration or open data (ASHA, n.d.b). While CSD journals still have room for improvement in enhancing research transparency, reproducibility, and accessibility, as there are no explicit requirements for open science practices (Schroeder et al., 2023), the CSD field is organizing efforts to embrace and encourage open science. The efforts coalesce around two strands: (a) exploring current perceptions and use of open science practices and (b) identifying ways to support its uptake.

Exploring Perceptions and Use of Open Science Practices

Preliminary investigations have identified that CSD researchers generally see the benefit of open science in their daily research workflow, to the CSD field, and broader society (El Amin et al., 2023). El Amin and colleagues (2023) disseminated a survey to CSD researchers in the United States examining knowledge, implementation, and perceived benefits and barriers of four open science practices: preregistration, gold open access, self-archiving, and open data. A total of 222 CSD researchers responded, with a majority being early career researchers (38% doctoral students, 24% assistant professors) at very high research activity institutions (R1 institutions as per the Carnegie Classification of Institutions of Higher Education; Indiana University Center for Postsecondary Research, n.d.). Respondents reported low to moderate knowledge of preregistration and gold open access and limited implementation of preregistration, gold open access, and open data. Only 25% and 22% of participants reported experience with preregistering a study or publishing gold open access, respectively. In addition, only 38% of the sample had self-archived their research, and 26% had shared data openly. While the researchers included open-ended questions about the barriers and facilitators to using open science practices, the number of participants who answered these questions was minimal. Overall, El Amin and colleagues' study has been a critical first step in exploring CSD researchers’ perceptions and use of open science practices. Given that open science practices are one way to increase the rigor and reproducibility of science in CSD, we must now more deeply explore CSD researchers' perceptions to identify opportunities for improving open science training, support, and implementation in the field.

Identifying Ways To Support The Use of Open Science Practices

With CSD researchers reporting low knowledge and implementation of open science practices (El Amin et al., 2023), several efforts have been made to disseminate information about them in the field of CSD. For example, Brown & Strand (2023) provided a tutorial on preregistration for CSD researchers, providing step-by-step guidance and discussing issues with the process particularly relevant to the field. To promote self-archiving, the CSDisseminate group provides a free learning community to help CSD researchers initiate – or even maintain – their self-archiving (CSDisseminate, 2024). At the ASHA Convention in 2023, there were five presentations on open science, including self-archiving (Drown et al., 2023), preregistration (Ford et al., 2023), and code sharing (Kearney & Hirsch, 2023). To ensure we are meeting the needs of CSD researchers and tailoring training and support optimally, we need to understand what open science practices they want to learn about and elicit their training preferences.

Purpose

The purpose of the current qualitative study is to expand upon the findings of El Amin et al. (2023), utilizing focus group methodology to explore CSD researchers' attitudes and experiences related to four specific open science practices: preregistration, self-archiving, gold open access, and open data. This follow-up study seeks to: (a) explore perceptions of assistant professors about open science practices broadly; and (b) specifically compare perceptions and experiences of assistant professors at R1 and non-R1 (less research active) institutions to better understand nuances in their perceptions and experiences related to open science practices. Our decision to focus on assistant professors from R1 and non-R1 institutions is informed by El Amin et al. (2023), who identified years of research experience and Carnegie classifications as key predictors of knowledge and participation in open science practices. Recognizing that perceptions of open science vary according to research experience, career level, and institutional research intensity, we concentrate our investigation on assistant professors and focus on the contrast between those from R1 and non-R1 institutions. Through this study, we aim to better understand CSD researchers' perceived barriers and facilitators to engaging with open science practices and to identify opportunities for improving open science training and support in the field. Our research questions are the following:

1: What information related to open science practices do assistant professors in CSD report wanting to learn more about, and how would they prefer to learn more about them?

2: What potential impacts do assistant professors perceive their engagement in open science practices to have on their careers?

3: What do assistant professors in CSD perceive to be barriers and facilitators to their use of open science practices?

4: How do the perceived barriers and facilitators compare between those at R1 institutions and those at institutions with other classifications?

Method

This exploratory qualitative study was approved by the Institutional Review Board (IRB) at Towson University (#1975). The study was preregistered before data collection (https://osf.io/6yq2s), and no deviations were made from the original registration. The Standards for Reporting Qualitative Research (O'Brien et al., 2014) were used to guide the development of this manuscript.

Sampling and Recruitment

To participate in the study, participants had to be employed as an assistant professor on a tenure and/or promotion track in the field of CSD at a university in the United States. The study was limited to participants in the United States as facilitators and barriers to open science practices are expected to be influenced by country-specific factors (e.g., funding bodies in different countries have different policies regarding data sharing and making associated publications open access). First, we used stratified sampling to recruit participants for two different groups: (a) assistant professors from institutions classified as R1: Doctoral Universities-Very High Research Activity by the Carnegie Classification of Institutions of Higher Education (American Council on Education, 2024), and (b) assistant professors from institutions with other classifications (e.g., R2: Doctoral Universities-High Research Activity, Master's Colleges and Universities). This decision was made to explore the differences in perceptions and experiences between researchers at institutions with the highest amount of research expenditures and the greatest amount of resources to support researchers and those at institutions considered to have less research expenditures and are expected to have less research support. In addition, Carnegie Classification was one of the greatest predictors of knowledge and participation in open science practices in the El Amin et al. (2023) study, suggesting potential differences in experiences related to open science for those at R1 institutions compared to other institutions that are less research-intensive.

Both random and convenience sampling methods were used to identify potential participants for both participant groups. For the random sampling, we obtained a list of all universities in the United States with CSD programs (compiled in March 2021 for the study by El Amin et al., 2023). Using a random number generator, we sampled 100/314 (32%) programs and then manually searched the corresponding university websites for contact information for assistant professors. We sent a recruitment email to all identified assistant professors (n = 234). For convenience sampling, the researchers promoted the study through personal networks and social media platforms, including ASHA Special Interest Groups (SIG 1 Language Learning and Education, SIG 16 School-Based Issues), Instagram, Facebook, Twitter, and LinkedIn. All interested participants were asked to complete an electronic screener form, which included: (a) eligibility questions to ensure they were an assistant professor in CSD in the United States, (b) the Carnegie Classification of their institution; and (c) their availability to participate in a focus group. Then, the first author reviewed responses and scheduled eligible participants for a focus group depending on their institution's Carnegie classification and their availability. Participants were recruited for participation in one of four focus groups (two with R1 participants only and two with non-R1 participants only) with a minimum target of 6-8 participants per group (Krueger & Casey, 2014). This approach aligns with Hennink et al.'s (2019) recommendation to conduct two focus groups per stratum (i.e., by a specific characteristic of a population), which was the Carnegie Classification of the participants' institution in the current study. Additional participants were recruited above the target sample to allow for attrition.

Participants

Thirty-five participants consented to participate in the study: 16 from R1 institutions and 19 from non-R1 institutions. All participants were directed to a survey on Qualtrics to provide informed consent and demographic information before participating in a focus group. Demographic information is provided in Table 1. While participants in both groups had similar years of experience as an assistant professor (R1: $M = 4.36$, $SD = 2.84$; non-R1: $M = 3.01$, $SD = 1.96$), participants in the R1 group reported a greater percentage of their time being allocated to research ($M = 51.75\%$, $SD = 12.65\%$) than the non-R1 participants ($M = 31.05\%$, $SD = 12.09\%$), as anticipated. The R1 group also reported more publications ($M = 19.19$, $SD = 9.89$) than the non-R1 group ($M = 8.11$, $SD = 7.88$). Participants in both groups reported a range in familiarity and use of open science practices (see Figure 1). Participants also reported expertise in a variety of CSD research areas (see Supplemental Material). All consented participants attended the focus groups; however, one participant from the non-R1 group did not contribute to the conversation during the focus group.

Table 1.

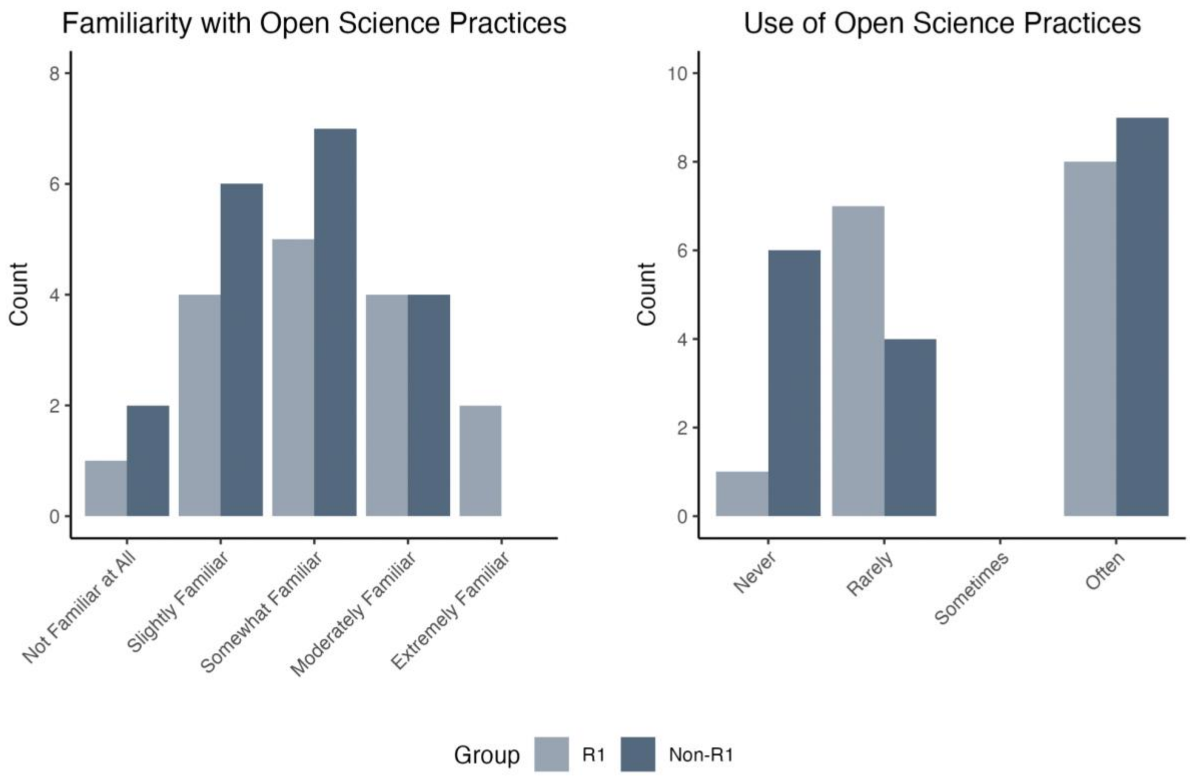
Participant Demographic Information by Group

Characteristic	R1 (*n* = 16)	Non-R1 (*n* = 19)
Gender[1]		
Man	2 (12.50)	2 (10.53)
Woman	14 (87.50)	14 (73.68)
Nonbinary	0 (0)	1 (5.26)
Prefer not to say	0 (0)	2 (10.53)
Race[1]		
White	12 (75)	17 (89.47)
Black	0 (0)	1 (5.26)
Asian	2 (12.50)	1 (5.26)
Latino or Hispanic	1 (6.25)	0 (0)
Prefer not to answer	1 (6.25)	0 (0)
Carnegie Classification of Graduate Program Institution[1]		
R1	13 (81.25)	10 (52.63)
R2	0 (0)	3 (15.79)
D/PU	0 (0)	2 (10.53)
Other	3 (18.75)	4 (21.05)
Region[1]		
Midwest	3 (18.75)	4 (21.05)
Northeast	3 (18.75)	6 (31.58)
Southeast	7 (43.75)	4 (21.05)
Southwest	2 (12.50)	2 (10.53)
West	1 (6.25)	3 (15.79)
Age[2]	38.13 (4.99)	38.12 (7.67)
Percentage research workload[2]	51.75 (12.65)	31.05 (12.09)
Percentage teaching workload[2]	34.19 (10.97)	54.74 (12.19)
Percentage service workload[2]	14.06 (5.23)	15.53 (9.99)
Total publications as assistant professor[2]	10.88 (8.17)	4.26 (4.82)
Total years employed as assistant professor[2]	4.36 (2.84)	3.01 (1.96)
Total years of research experience[2]	10.69 (2.32)	8.14 (3.55)

[1]n (%); [2] Mean (SD)

Figure 1

Participants' Familiarity With and Use of Open Science Practices Across Groups



Note. None of the participants from the Non-R1 group indicated they were 'extremely familiar' with open science practices.

Focus Groups

Each participant attended one, 1-hour focus group on Zoom. The focus group protocol and de-identified transcripts are available on the Open Science Framework (https://osf.io/tprzu/). Questions addressed three main areas: (a) past and desired open science training experiences (e.g., "What training experiences have you had, if any, about open science practices?"); (b) the potential impact of open science on their work and careers (e.g., "What impact do you think open science practices could have on your career, if any?"); and (c) perceived barriers and benefits associated with open science and specific open science practices (e.g., "What factors currently facilitate your ability to preregister your own studies? Or could facilitate your ability to preregister your own studies in the future?").

Focus groups were attended by one facilitator, one note-taker, and one undergraduate student to help with technology issues. Three different authors facilitated the focus groups. To ensure consistency across sessions, the three facilitators trained on the protocol together before facilitating the focus groups. They also met and reviewed Krueger and Casey's (2002) moderating guidelines and decided to use Guest et al.'s (2013) recommendations for managing different personalities during their individual focus groups (e.g., reminding participants what question had been asked if they wandered off topic). Similarly, three different authors acted as note-takers and were all trained by the first author to take field notes using the same template (Prentice & Loppie, 2018) before data collection began. During the sessions, audio and video were recorded via Zoom. The audio recordings were transcribed verbatim via Zoom and checked for accuracy by the first author and an undergraduate research assistant.

Data Analysis

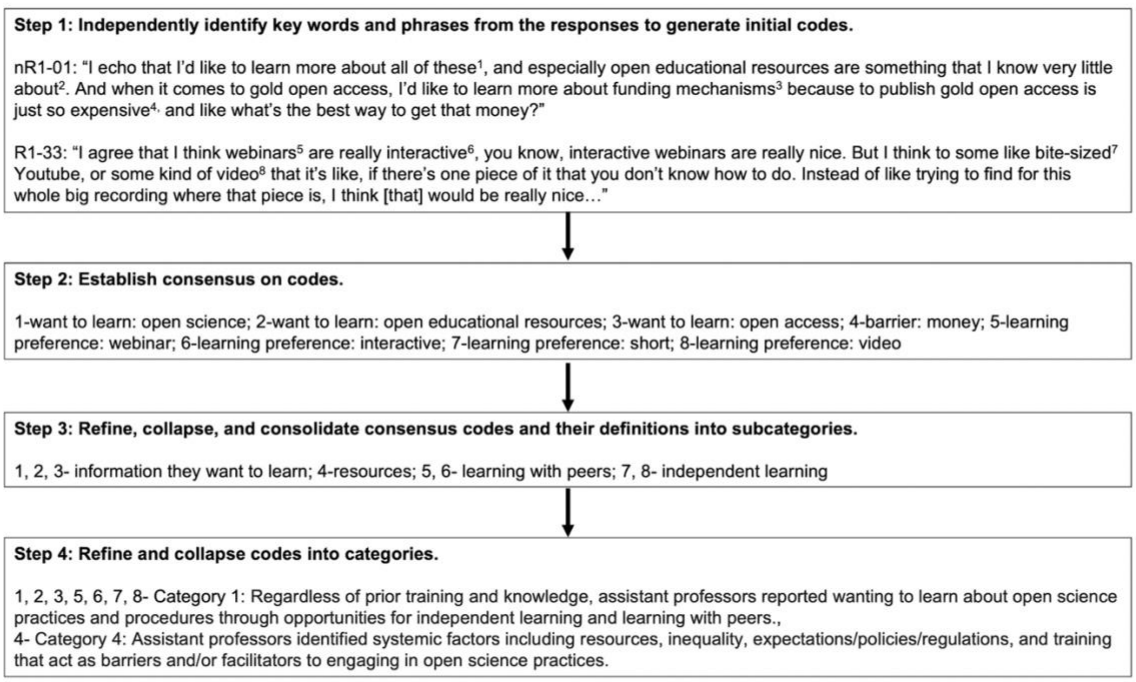
Research Questions 1-3: Conventional Content Analysis

The combined data from both groups were analyzed to answer the first three research questions. The first five authors conducted the data analysis, using a conventional content analysis approach (Hseih & Shannon, 2005). This inductive approach was selected due to the exploratory nature of this study and the ability to generate both overall qualitative categories and frequency counts of individual codes. This technique allows the data analysis process to be guided by the participants' words instead of the researchers' preconceived notions or ideas. The analysis team was led by a speech-language pathologist with a doctoral degree (first author) with expertise in qualitative analysis. The rest of the coders were CSD doctoral student researchers. Positionality statements for each coder are included in the Appendix.

The researchers used the following steps of the conventional content analysis approach (Hseih & Shannon, 2005) by engaging in emergent consensus coding (Creswell & Clark, 2017) using Microsoft Word and Excel. At the start of the coding process, the analysis team met and coded the responses to the first two questions of a non-R1 transcript together as a group to begin a codebook with code names and their definitions. They engaged in initial coding, by conducting repeated readings of each response and identifying key words and phrases related to the research questions (Figure 2, Step 1). Multiple codes were assigned to responses as appropriate.

Figure 2

Emergent Consensus Coding Process Example



Note. The top box indicates two participants' responses as sample quotes used in the development of categories 1 and 4. The first response (nR1-01) is to the question, "What open science topics would you like to learn more about?" And the second response (R1-33) is to the question, "How would you prefer to learn about open science practices?"

Then, the whole group independently coded the first three responses to the rest of the protocol questions (questions 3-15) using the same guidelines, before coming together to establish consensus as a group. Next, the group split up into three coding pairs to code the rest of the responses, with the second author participating in two coding teams. Within each coding pair, each researcher individually coded their assigned responses and then met with their coding partner to establish consensus (Figure 2, Step 2). The coding pairs all coded their assigned responses from the same transcript (e.g., the first non-R1 focus group) and met to discuss new codes that each pair had established before the whole analysis team moved on to analyzing responses from a subsequent transcript. Once the initial coding of all transcripts was complete, the coders engaged in axial coding (the process where data are sorted, synthesized, and organized) to refine, collapse, and consolidate consensus codes and their definitions into subcategories (Charmaz, 2014) (Figure 2, Step 3). Lastly, subcategories of codes were collapsed into categories (Figure 2, Step 4).

Multiple methods were used to establish rigor and trustworthiness of the findings that have been used in other qualitative studies (e.g., Pfeiffer et al., 2023). Specifically, we aimed to provide sufficient detail of the analysis for the reader to assess: (a) if participant voices guided the analysis process rather than researcher biases, (b) if the analysis process could be replicated, and (c) to determine the applicability of the findings to other contexts (Johnson et al., 2020). This was accomplished through: the use of an audit trail to keep detailed notes about the study methods, procedures, and decisions (Merriam & Tisdell, 2015); the use of multiple coders; rich descriptions providing contextual information (Merriam & Tisdell, 2015); detailed report of the research method; and presenting disconfirming evidence in the data (i.e., information that challenges our analysis; noted below in Category 2 in participants' uncertainty about the impact of engaging in open science on their careers). In addition, credibility of the categories was assessed through member checks with the participants (Merriam & Tisdell, 2015) conducted by the first author via email. Seventeen participants responded, with all reporting that the categories accurately captured the focus group discussion. One R1 participant asked that additional specificity be added to theme five to indicate the type of formatting requirements mentioned in the focus group. The authors made this revision to better capture the participants' perceptions.

Research Question 4: Frequency Counts

To answer research question four, responses from both R1 groups were combined for analysis and compared to the responses from participants in both non-R1 groups. From the coded transcripts, the participant comments and their corresponding codes were extracted from the Microsoft Word document and exported as CSV files using a custom Microsoft Word macro. The data were then imported into R version 4.3.3 (R Core Team, 2024), where the data were cleaned and summarized for group frequency comparisons using the *tidyverse* package (Wickham et al., 2019). The frequency counts for each code were calculated based on unique instances per participant. Specifically, if multiple comments from a single participant were assigned the same code, the frequency count was tallied only once for that participant. The macro and custom R script are provided at https://osf.io/tprzu/.

Results

The coders established a final codebook with 184 codes from the transcript which is provided on the Open Science Framework (https://osf.io/tprzu/). A total of 15 subcategories were generated during the analysis process. Those subcategories were combined and condensed into five overall categories (See Table 3). Categories are described in order of the research questions. Exemplar quotes illustrating responses from each group for each category were chosen by coders and systematically selected from a variety of participants to amplify several different participants' perceptions and experiences. Throughout the results, we refer to participants by their group assignment and participant ID, e.g., R1-03, nR1-22.

Table 3

Results Categories and Subcategories by Research Question

Research Question	Category	Subcategory
1. What information related to open science practices do assistant professors in CSD report wanting to learn more about, and how would they prefer to learn more about them?	1. Regardless of prior training and knowledge, assistant professors reported wanting to learn about OS practices and procedures through opportunities for independent learning and learning with peers.	Wanting to learn about OS practices and procedures Independent learning Learning with peers
2. What potential impacts do assistant professors perceive their engagement in open science practices to have on their careers?	2. Assistant professors perceived that engaging in OS practices would benefit their careers, the broader scientific community, and the quality of research in CSD.	Career benefits Broader scientific community benefits Quality of research in the field of CSD
3. What do assistant professors in CSD perceive to be barriers and facilitators to their use of open science practices?	3. Assistant professors identified personal factors that act as barriers and/or facilitators to engaging in OS practices, including their attitudes and self-perceptions, specific research methodology, knowledge, and past experiences.	Attitudes and self-perceptions Specific research methodology Knowledge Past experiences
	4. Assistant professors identified systemic factors, including resources, inequality, expectations/policies/regulations, and training that act as barriers and/or facilitators to engaging in OS practices.	Resources Inequality Expectations, policies, and regulations Training
4. How do the perceived barriers and facilitators compare between those at R1 institutions and those at institutions with other classifications?	5. While both groups perceived similar barriers and facilitators, the R1 group discussed money, extrinsic benefits, and formatting requirements more often, while the non-R1 group more frequently mentioned teaching load, uncertainties about changing study methods, and general fears about OS practices.	n/a

Note. CSD = Communication Sciences and Disorders; OS = Open Science; R1 = Very high research activity.

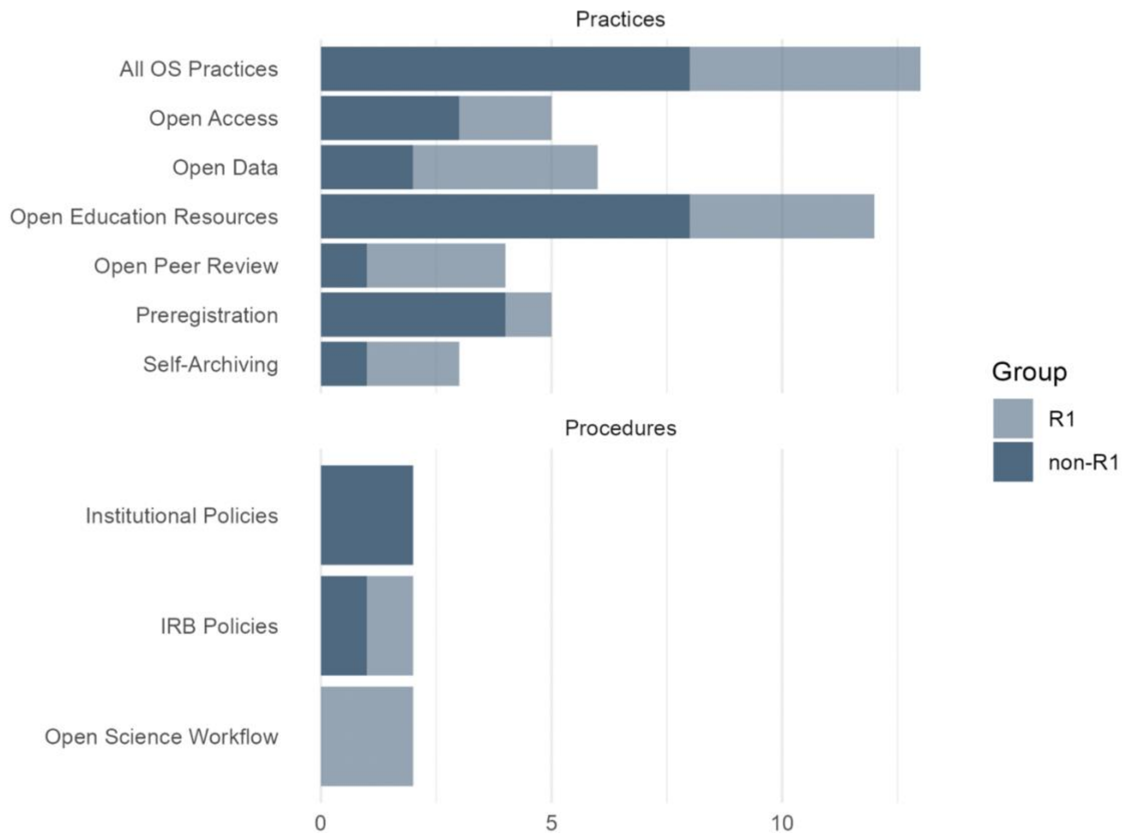
Category 1: Regardless of prior training and knowledge, assistant professors reported wanting to learn about open science practices and procedures through opportunities for independent learning and learning with peers.

Wanting to Learn About open science Practices and Procedures

Participants shared an interest in learning about open science in general, as well as specific open science practices and procedures (i.e., logistical ways to complete practices, such as through an IRB). Many participants (n = 12) wanted to learn about open educational resources that could be useful for teaching CSD classes. Participants also expressed interest in open data (n = 6), open access (n = 5), preregistration (n = 5), open peer review (n = 4), and self-archiving (n = 3); see Figure 3. Participants also described the type of information they want to learn about open science, including (a) a step-by-step procedural outline about how to complete an open science practice, (b) content such as a “flowchart where it directs you to the appropriate resources” (R1-20), (c) information directly from publishers or journals about what they are allowed or not allowed to do, and (d) their institution’s specific IRB procedures related to open science. Participants also mentioned that they would like to learn how to efficiently build open science practices into their workflow, sharing that it “feels like this extra big step…how do I even do this with everything else going on?” (R1-33).

Figure 3

Specific Open Science Practices and Procedures that Participants Wanted to Learn More About



Note. OS = open science, IRB = Institutional Review Board.

Independent Learning

Several participants wanted to learn about open science through videos, with many wanting short “bite-sized YouTube” videos (R1-33) explaining the step-by-step procedures to follow with tagged sections. Participants also wanted something accessible on their own time and pacing so they could “get [the] information when [they] need it” (nR1-10). Participants also wanted to learn about open science through resources such as “brief handouts” or “cheat sheets” (R1-29). R1-27 mentioned, “having some resources like YouTube videos or handouts would be good in training graduate students…if they cannot be at [an] interactive workshop.” Participants also expressed a desire for a central website that would be a go-to spot for open science information: “When the need pops up, and it’s really urgent…if I could go to a FAQ site, or just have that resource at my fingertips” (R1-19).

Learning with Peers

Participants discussed wanting to learn with peers through an interactive medium such as “interactive workshops” (nR1-06), webinars with “live discussion” and “good question and answer” opportunities (nR1-17), or “presentations at conferences” (nR1-04). Others discussed the importance of accountability through working groups or other cohort-style groups to discuss problems and solutions for implementing open science into their research workflow: “I need a working group where I’m [held] accountable” (nR1-02). Participants also mentioned a desire for an “open science coach” (R1-19) or “contact person [to] reach out to with a question” (nR1-06) about an open science practice when they need support. R1-19 stated, “I wish there was a hotline, like 1-800-help-me-with-open-science-stuff.” Additionally, some participants mentioned that a combination of independent learning and learning with peers would be helpful for learning about open science.

Category 2: Assistant professors perceived that engaging in open science practices would benefit their careers, the broader scientific community, and the quality of research in CSD.

Career Benefits

Participants expressed that engaging in open science practices could help them find collaborators. Participant R1-30 mentioned, “I've had a ton more collaboration since starting open science.” This sentiment was echoed by R1-22: “It gets us out of our silos, so it allows us to be more collaborative.” Several participants expressed the potential of the collaborative nature of open science to impact their teaching positively, such as “put[ting] their research data online as a teaching tool, like for case studies” or creating “a repository of lectures” to “shar[e] the teaching prep load” (nR1-03), with nR1-05 sharing that others “offer[ing] [their] materials” for use is “so wonderful.” Participants also described the advantages of specific open science practices; R1-29 specifically mentioned the career benefits of open data by stating, “[The] more access we have to larger data sets, we can ask bigger questions and make broader generalizations.” Participant nR1-13 mentioned a specific benefit to preregistration: “It really gets you set up to get [your study] ready to go.”

Participants reported that open science could “mean that you have a bigger audience” (nR1-07) reading your open access manuscripts, which could lead to more citations. R1-28 described, “Having [my papers] be easily accessible has meant that my open access papers are cited more frequently than my not-open access papers.” Several participants mentioned that engaging in open science “would make it easier for some of us to get tenure” (nR1-01) or “might help with the tenure process…if more work is open access, then more people can cite your work” (nR1-13).

While most participants agreed that open science has potential career benefits, two disconfirming cases were noted in which participants shared doubts or uncertainty about the benefits of open science. For example, R1-26 questioned the impact of engaging in open science on their career: “What effect does it have if other people publish something using your data set that they got through open science? What is the impact of it? I don't know.” Further, Participant R1-27 questioned if publishing using gold open access would enhance readership: “I just wonder, how many more people would my article actually reach if it were gold open access?”

Broader Scientific Community Benefits

Several participants expressed that engaging in open science practices could help them conduct more research, such as: “Secondary data analysis, [which] would be really helpful for me to grow as [a] professional” (nR1-06); building “technical skills” such as “Matlab skills or Python skills” (nR1-14); or helping with experimental creation by reducing “redundancy” when “getting stimuli processed…and cut[ting] out all that extra work, and allow[ing] us to focus more on doing the actual research” (nR1-12). Similarly, others remarked that open science “saves us time” (nR1-07) because there are more resources available.

Open science was mentioned as a potential mitigator to the problem of small sample sizes in CSD studies. Participants described the impact of “leverag[ing] that power” of open data (R1-29) by “combin[ing] a lot of studies together” that could potentially lead to “getting clearer answers to some of the questions that would help clinicians” (nR1-04) making it “easier to generalize your findings to clinic” (R1-27) and “increase the impact of our research” by “mak[ing] it accessible to clinicians and the community” (R1-21). R1-27 shared, “It's better for everything to be accessible to everyone,” with nR1-15 noting that open science practices could “facilitate research getting to practice more quickly as clinicians could locate things without cost.” R1-28 also noted that open science practices would allow for “having protocols available that can be implemented in clinical practice,” which would “lead to more research and more direct translation from the Academy to the clinic.” Participants shared a related benefit for students, with nR1-03 sharing that “researchers who [put their] research data online as a teaching tool” could help “reduce that research-to-practice gap because the students are practicing with real cases.” Participant nR1-17 mentioned that engaging in open science practices could show students that research “doesn't have to be this big scary process,” and reflected on their experience as a student researcher: “Data collection was really overwhelming. As well as developing methodology. So, seeing what's out there, and seeing how I can tweak it to my interests... it might have recruited more of my classmates into research”.”

Others noted that open science practices could legitimize the field of CSD by “mak[ing] people recognize this field as a scientific field of study” (nR1-07). Participants expressed that engaging in open science practices may increase community support for their work, with nR1-12 noting that open science could “potentially help people have more faith in the type of research I'm doing and view me as a stronger researcher.” Similarly, nR1-01 noted a potentially positive impact on their research participants’ support of their work, stating, “If your work is more readily accessible to the people who are directly affected by it, then that influences their perception of you, which influences their willingness to support your future research." Participants also noted the benefits they experienced as consumers of open science: "I've benefited from other people posting their things online" (R1-28), such as accessing "stimuli for experiments" (R1-27) and "being a consumer of code" which "has been really, really useful" (R1-29).

Quality of Research in the Field of CSD

Participants discussed the potential for open science to increase transparency, reproducibility, and accountability in CSD research, as well as reduce bias. Increased transparency associated with open science practices was discussed by several participants, with nR1-08 sharing, "I love the idea of transparency" and nR1-16 stating that open science practices allow researchers to "pull back the veil…on how the science is produced." nR1-10 mentioned "posting protocols and trying to publish open access when possible" to increase transparency. In addition, R1-20 noted that engaging in open science practices would "make the research more reproducible," with nR1-14 stating, "It will facilitate a lot of replication studies. You can use the same stimuli, same protocol. Everything is available." The potential to enhance accountability was discussed by nR1-08, specifically during the open peer review process for "making people accountable for some of the harmful, abusive, and uninformed things they say." R1-33 also mentioned accountability: "[open science] makes us a little bit more accountable. I mean to ourselves even, right? By knowing that people are going to look at this." Lastly, R1-30 expressed the potential for open science practices to reduce bias, as engaging in open science practices would ensure that the accessible research and resources are not "just coming from these huge well-funded labs" or "white males who've been in the field for a very long time," and instead "actually make the evidence wide-reaching."

Category 3: Assistant professors identified personal factors that act as barriers and/or facilitators to engaging in open science practices, including their attitudes and self-perceptions, specific research methodology, knowledge, and past experiences.

Attitudes and Self-Perceptions

Negative attitudes were voiced by participants who failed to see the benefit of specific practices, such as “I don't perceive a lot of benefit to myself” (nR1-12). Some participants also viewed them as a waste of resources, particularly regarding open access publishing fees. For example, R1-20 said, “Why would I pay [open access publishing fees] versus paying for a graduate student, or part of a research assistant?” Some participants stated that knowing “if there is some sort of direct benefit to me of doing this” (nR1-12) would motivate their engagement in open science practices, with another participant adding, “I think it would be really interesting to… have data on how much of a difference [these open science practices] actually make” (R1-33).

Others reported feeling nervous or fearful about engaging in specific practices. The most common fear related to self-archiving was not wanting to “get sued for sharing my own work” (nR1-03). Others described the processes of preregistration and “coming up with an analysis plan and sticking to it ahead of time” as “kind of scary” (nR1-07). Additionally, worries were expressed about the credibility of open access journals, with some describing open access journals as “scams” (R1-31) or that publications from these journals “aren't worth anything” (R1-28).

When it came to the practice of sharing data openly, participants expressed that working with their IRB to share data seemed “very daunting” (R1-33), with many participants expressing concerns about ensuring participant confidentiality, particularly when researching low-incidence populations, where “if you know where the study was conducted” then “you could potentially figure out who [the participants] are” (nR1-04). Others feared that sharing their data or code could result in other researchers misunderstanding “what the data was [collected] for” (R1-26) or that sharing their data would “give somebody else the idea to then run away with my project” (R1-28).

Another set of barriers to engaging in open science practices related to participants’ self-judgments, such as (a) a lack of organization: “It's just honestly my own organizational practices are the biggest barrier for me preregistering” (nR1-15), or (b) a lack of confidence: “I feel like my studies aren't big enough or important enough or using the right methods to preregister” (nR1-01). Other participants demonstrated self-judgment when describing their research practices, such as “I just still feel like, hey, I'm a lousy researcher.” (nR1-08) or “I've also submitted data to [a restricted shared database]… I know they're still [not open]…. but at least… it's available to a lot of researchers” (nR1-04).

Assistant professors also expressed positive attitudes toward open science practices, although fewer than their ambivalent or negative attitudes. Some participants mentioned they intended to engage in an open science practice, “[I] can't wait to do more in the future, hopefully, even better” (R1-22). Others reported feeling “motivated” (nR1-12) and “excited” (nR1-07) by open science and that they believed “open science is important” (nR1-06).

Specific Research Methodology

The most mentioned barrier related to the participants’ inability to share their data because it was identifiable (e.g., “audio recordings” [R1-29], “videos” [R1-21], “MRI data” [R1-28]), stating that they lacked permission from their IRB or their participants to share the data. When describing barriers to sharing data, one participant shared they were unsure about what their IRB would allow them to share: “From the IRB perspective, just knowing if it's okay to post the identified data publicly if I didn't explicitly write that in the IRB and in the consent form” (nR1-12). Another common concern relating to sharing materials involved the extra step of formatting the materials to be understood by others. As mentioned by R1-28, “[I have] lots of internal notes that make sense to me, but would look really ridiculous if I put them out for everyone to see.”

Regarding preregistration, many participants expressed concerns about preregistering their studies due to the belief that it would limit their ability to change methods. As stated by nR1-03, “You're not sure what you're gonna do with the stats…. You might make some statistical decision, and it's not the right one.” Others expressed concerns that the quality of their research or the type of research they do is not conducive to preregistration, such as “I do a lot of qualitative work, and your research questions can change once you have started the analysis. So, I feel like the rules become even less clear, and that makes it harder to preregister qualitative studies” (nR1-01). In another instance, R1-28 said: “We had trouble even getting our IRBs through for people with aphasia, because who can consent if you have a language disorder… will I also [ever] get an IRB [to] be approved for people with aphasia to consent to have their data open?” Finally, some participants expressed copyright concerns, stating that the materials they used in their study were copyrighted: “we use some movie clip stimuli that are copyrighted” (R1-20). One person mentioned that they are often the second or third author on their manuscripts, which requires them “to get consent from the other authors” (nR1-08) to self-archive that manuscript.

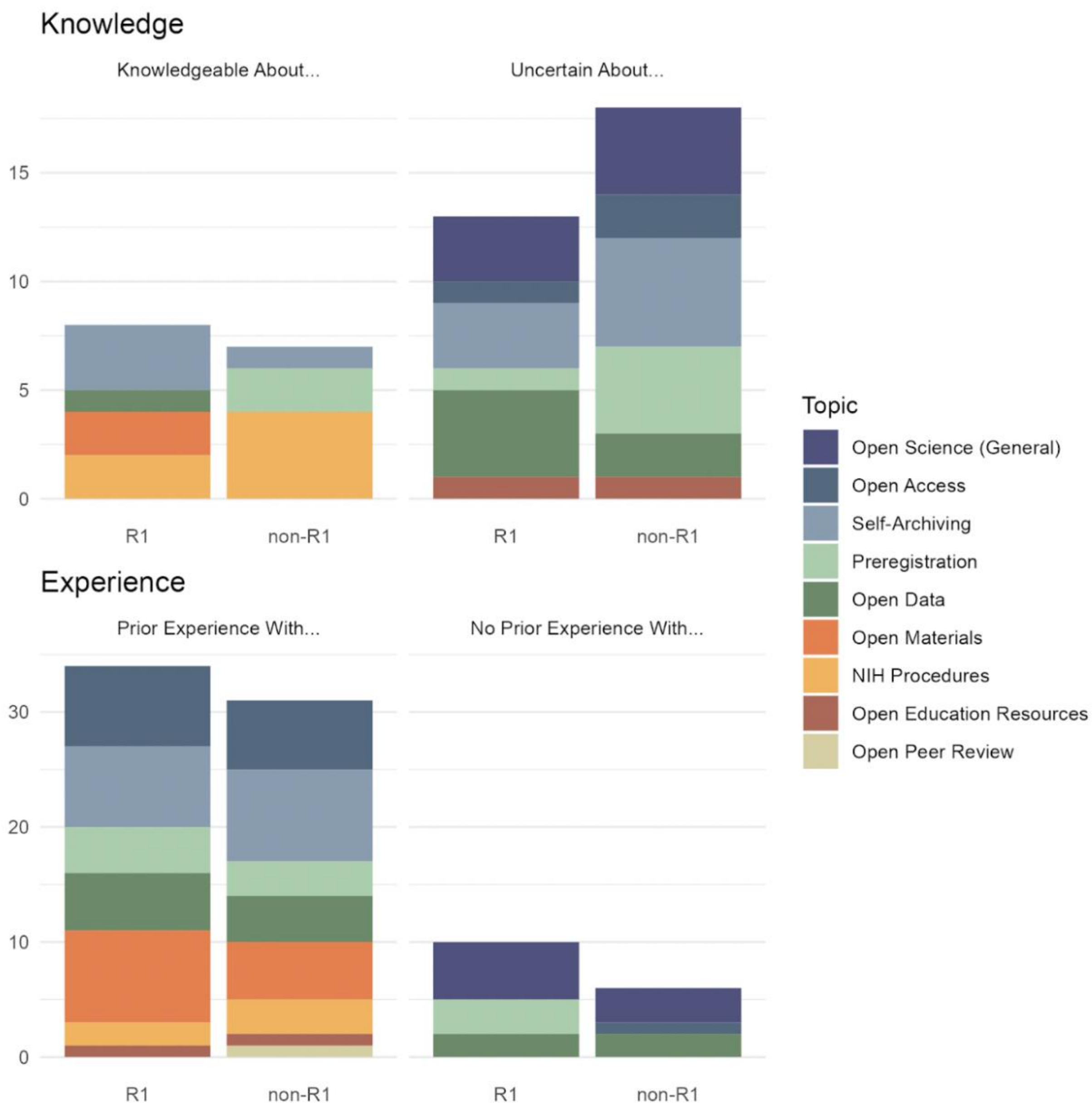
A few participants highlighted how the nature of their specific research methodology facilitated their engagement with open science practices. For instance, some participants noted that their data were inherently deidentified, making data sharing easier. For example, when discussing eye tracking data: “It's just numbers. There's nothing identifiable” (R1-28). Others mentioned that having their data collected made preregistering their study easier, as they could determine their sample size, enabling the creation of an appropriate analysis plan. For example, nR1-13 said, “I find it a good time to preregister when you’ve collected the data, but haven't analyzed it yet. So you… have a sense of… what your age group is, and how many kids... So you still have really sound research questions, hypotheses, and methods.” One participant pointed out that preregistration might be simpler when conducting research similar to past studies that the researcher has completed: “I think I'd be more likely [to preregister] if it was just really similar to something I'd done previously… having walked through the analysis, having some knowledge of what… barriers that would [arise]…” (nR1-04).

Knowledge

The frequency counts for participants mentioning being knowledgeable or uncertain about a specific open science practice are presented in the left two panes of Figure 4. While many participants demonstrated some knowledge of open science practices, several expressed uncertainty about open science in general, or about a specific practice, including (a) open access: “Are there ways to get gold open access paid for if you don't have grant support for a particular project?” (R1-20); (b) open data: “What counts as de-identifiable or not?” (nR1-07); (c) preregistration: “I don't know how to learn how to preregister things, and I feel like that's a big gap in my personal knowledge” (nR1-08); (d) self-archiving: “I don't know which articles we're allowed to share, how to share them. Things like that” (R1-31); and (e) open educational resources: “I don't even know what open educational resources means” (nR1-03). In addition, concerning self-archiving, a significant number of participants reported not knowing the specific journal policies regarding permissions to self-archive, such as “figuring out the different [rules] for different journals” (R1-24) and “What can I [self-archive]? What's mine? What's theirs?” (R1-34). Additionally, participants expressed uncertainty about where to self-archive or preregister their research. For example, participant R1-32 asked: “Is there a CSD-specific open access preprint platform?”

Figure 4

Participants' Reported Open Science Knowledge and Prior Experience



Note. The focus group prompts included a question about prior experience with open science practices, hence the larger response for this category. In response to this question, some participants mentioned having no prior experience with a specific practice. In contrast, participants were not specifically asked about their knowledge or uncertainty regarding specific practices. Therefore, the frequency counts provided reflect only those participants who spontaneously discussed their knowledge and uncertainty, which may not capture the full extent of their understanding or uncertainty of these practices.

Past Experiences

Several participants spoke about their experience engaging in an open science practice, while others reported having no prior experience with open science practices (see right two panes of Figure 4). Participants had the most experience with self-archiving and sharing materials openly and the least experience with open educational resources and preregistration.

Category 4: Assistant professors identified systemic factors, including resources, inequality, expectations/policies/regulations, and training that act as barriers and/or facilitators to engaging in open science practices.

Resources

The largest systemic factor brought up by the participants related to the presence or lack of resources. Among the resources discussed, time was identified as the largest barrier. Time was discussed in two ways: first, the challenge of "taking the time to [engage in open science] on top of everything else we have to do as faculty" (nR1-04). As put by another participant, open science practices are "just one more thing to do" (nR1-04), and "it's not clear… [if] the time that is required to do all this stuff actually helps us" (R1-27). Second, some participants described how engaging in open science practices prolongs the already long publication pipeline, as one participant described their experience of trying to preregister their study: "It didn't happen because it was taking away time from the actual manuscript" (R1-22). Another participant described wanting to "get access to shareable data [from a repository]," adding that "it took forever, just to get all the paperwork done" (R1-21). Finally, one participant summarized their experience of engaging with open science practices as a "dilemma of how much modification to make to something, just to make it freely available" (e.g., preparing code or data to share or reformatting a preprint for easy reading) and that it's a "time-effort trade-off" (R1-29).

The second largest barrier is money, particularly when paying open access publication fees. As assistant professors, money is “a huge barrier for those of us who are all early in our career, because it's like, I don't know how much I have laying around. That's $12,000 for four papers” (R1-30). Some participants recounted instances where university support did not allow for funds to pay open access fees, “I tried to write funds for [open access] publishing into my startup, and I was denied” (nR1-05) and “[Open access] fees cost more than I'm allotted for research each year” (nR1-08). However, even when other universities offered funding for covering open access publication fees, some participants pointed out logistical issues that prevent these from being helpful, with one participant saying, “Most of the publishers want the money within like two weeks of acceptance, and that is just not gonna happen with getting funds from the university that fast” (R1-30). Others reported uncertainty about how to obtain funding for open access fees, “I have no experience with grant writing, so I don't even really know how to access funding for opportunities like this” (nR1-17).

Inequality

A few participants highlighted the current inequalities that are present when it comes to open science, mainly related to paying open access publication fees. As one participant said, “I feel like the cost associated with publishing open access is pretty inequitable” and highlighted how one of the goals for open access is to bridge the research-to-practice gap, however, they described the fees as “punishing us by making us pay for something when we already don't get any monetary gain from publishing” (nR1-17). Another participant described open access fees as “ethically ambiguous” and said that they “try to just [self-archive] because [they’re] uncomfortable with the current ethics of it” (R1-30). Another critique of the open access publication fees was that they are burdensome on smaller labs run by junior investigators “who might not have big externally funded grants” (R1-19). Further, one participant noted inequity related to early career scholars not having the funds required for open access publishing:

“Some of the smaller internal and external grants that are awarded early in your career just simply don't have the budget to support that line item” (R1-19).

Inequality also came up when discussing open peer review. Many participants discussed how this practice puts junior faculty in an uncomfortable position when reviewing a more senior researcher’s work. One participant remarked, “There's just this huge power differential there. And I wouldn't be able to review for some of the people that I review for if they knew it was me reviewing for them” (nR1-08). Similarly, another participant said, “I was asked to be a reviewer on an open review, and it was for a researcher who I deeply respected, but who scared me, and I decided I did not want to do it… I just didn't want her to associate me with criticizing her work” (nR1-04).

Expectations, Policies, and Regulations

Participants often identified their institution’s policies and regulations as a barrier to engaging in open science practices. For example, with self-archiving, many identified “the lack of control of [their] university-run website” (R1-21) as a barrier as well as the universities not allowing publications to be posted on faculty members’ webpages. Others expressed a similar experience: “I can't post directly to my University website. It has to go through our IT team. So that's sometimes super efficient. And other times really not” (R1-19). Others identified challenges with working with their institutional IRBs, such as, “it's definitely a moving target with IRBs” (R1-30) and “I perceive [my IRB] as kind of like worrying about things excessively. So, if I were to share data openly, I'm worried that the IRB would shut that down at my university, or I would face backlash from them” (nR1-17).

Another limiting factor in the adoption of open science practices mentioned was the lack of expectations to do so. Specifically, many participants noted that their institution’s tenure expectations do not value open science practices. For example, R1-30 stated:

> The tenure process doesn't care, they literally don't care…. there's no incentive there whatsoever…. never have I been asked about it…. I made a specific section about [open

science in my tenure portfolio] that I've been told to cut by multiple people, which I'm not going to do… It's not incentivized terribly well.

Other participants also expressed this sentiment: “I lack the motivation to do… preregistration, because it's not something that is looked for in my promotion or tenure reviews, and it's not valued by my university” (nR1-12). Another participant described engaging in open science as a “sinking cost… in your tenure track” (R1-21). Several participants identified that “if this was valued by institutions more,” then that would “motivate people to do this more” (R1-24). In fact, one participant mentioned their tenure guidelines were recently changed to include the applicant’s use of open science practices and added, “So maybe some systemic level change there from the powers that be, who… dictate the tenure process, would be helpful in supporting people who want to spend their time [using open science practices] to demonstrate that it's worth it” (R1-27).

A handful of participants identified the NIH’s new data-sharing policy as a facilitator for sharing their data openly, “the NIH is changing to require data sharing… I think that'll be a good facilitator” (nR1-03). Another participant expressed hope that these changes in NIH policies would lead to broader change, “I think the… direction NIH is going is really going to be a benefit… I do think it's going to encourage our institutions to step up to the plate a little bit in helping to facilitate open data” (nR1-10).

Training

Another systemic barrier to engaging in open science practices is that many participants were not trained on how to do so. As put by one participant, “I did not receive any formal training in my doctoral program, my postdoc, or even onboarding as a new faculty member at my home institution” (R1-19), and another, “It wasn't really a model that was emphasized in my Ph.D. training. I didn't really see that from my PhD mentors” (nR1-12). Similarly, another participant said, “I feel like I just missed [learning about preregistration] in my doc program… I feel like that's a big gap in my personal knowledge” (nR1-08), to which another participant responded, “I don't think you missed it. I don't think it was there" (nR1-07). The few participants who recalled formal training on open science practices described this training as very brief: "It was either like one class session or one colloquium meeting, and somebody presented on open science, and was like, 'Hey, this is a good idea. We should do more of this'" (nR1-01).

In the absence of formal training, many reported having to rely on learning from one-on-one support from colleagues: "Most of my open science practice knowledge was built individually through conversations with other scientists who were working their way through the process" (nR1-15). However, most of the training received by participants came from workshops. Participants also mentioned learning about open science through various types of media, "a webinar here and there, some podcasts, and then seeing things on Twitter. People encouraging open science practices" (nR1-12).

Category 5: While both groups perceived similar barriers and facilitators, the R1 group discussed money, extrinsic benefits, and formatting requirements more often, while the non-R1 group more frequently mentioned teaching load, uncertainties about changing study methods, and general fears about open science practices.

Qualitative and quantitative (i.e., frequency counts) differences emerged between the R1 and non-R1 groups (see Table 2). Both groups discussed money as a primary barrier to engaging in open science practices, particularly for open access publication fees. However, the R1 group's concerns about money related to the allocation of funds (e.g., funding research personnel versus paying article processing charges for open science publications), while the non-R1 group discussed money in the context of challenges with securing funding for open access publication fees. Additionally, the R1 participants discussed the lack of benefits to engaging with open science more frequently (n = 7) than the non-R1 group (n = 1). Finally, the R1 group cited formatting requirements as a barrier to sharing data, code, protocols, or preregistering a study more often (n = 5) than the non-R1 group (n = 1). For example, participant R1-29 discussed the need to clean up their code to meet formatting requirements:

“My code is always a slew of comments to myself that I don't necessarily want... accessible to everyone”.

As mentioned earlier, both the R1 and non-R1 groups identified time as the primary barrier to engaging with open science practices. However, non-R1 participants often attributed their teaching load as a significant time-related obstacle, while the R1 participants were more inclined to view time as a barrier because it adds additional time to the research pipeline. Additionally, when discussing preregistrations, the non-R1 group was more concerned about the implications of needing to change their methods (n = 5), while no R1 participants expressed this concern. Finally, both groups expressed ambivalent or negative attitudes about open science or negative self-perceptions. However, the non-R1 group expressed these sentiments with a greater frequency (n = 6) than the R1 group (n = 1). For example, when discussing barriers to preregistration, nR1-10 said, "It's kind of the vulnerability of posting your ideas before you've done this study,” and when discussing self-archiving, nR1-13 stated, “I don't want to have to go to court because I did something wrong.”

Table 2

Sample Quotes from R1 and Non-R1 Participants about Perceived OS Barriers and Facilitators

Barrier and/or Facilitator	R1 Participants	Non-R1 Participants
Money	R1-20: “Why would I pay [OA publication fees] versus paying for a graduate student, or like part of a research assistant?” R1-28: “When you are almost out of your startup funds, and you’re a new faculty… [OA publication fees are] not the top priority for where that funding goes”	nR1-08: “Funding is a huge issue, specifically when you're not in an [R1] institution, right? Because we don't have research assistants. We don't have lab space. We don't have… cash to pay for an open access readership.” nR1-17: “I’m curious about like how to kind of manage the cost of publishing open access… I don't know if my university would be willing to cover that.”
Lack of Benefits	R1-24: “I'm not really sure what the benefits are of preregistering my study.” R1-27: “Prioritizing [OS practices] is questionable in my mind because it's not clear to me what the payoff is at this point for science or for my career.”	nR1-03: Open data can improve the quality of teaching by serving as “better teaching cases.” nR1-03: On the impact of open educational resources: “Sharing the teaching prep load would be very helpful, and giving me more time for research, and make my teaching more effective.” nR1-08: “Facilitat[ing] secondary data analyses which would make life a lot easier for those of us that aren’t in R1 or R2 institutions if we didn't have to collect our own data.”
Time	R1-19: “Finding the time and the bandwidth to move that item up on the priority list is always so challenging.” R1-21: “It requires a lot of time investment to get the process right.”	nR1-02: "I don't have as much time and resources, being someone with a high teaching load at a very teaching-focused university" nR1-06: "I teach a 4-4 load. I feel like I am barely keeping my head above water just teaching my classes"

Discussion

The purpose of this qualitative study was to explore assistant professors’ perceptions of open science practices as a follow-up to the El Amin et al. (2023) survey study. El Amin and colleagues (2023) found that among CSD researchers broadly, there is low knowledge and implementation of open science practices but a high desire to learn more about them. The current study confirmed many of the El Amin et al. (2023) findings, such as: barriers to engagement in open science practices, including a lack of knowledge, time, and money; negative perceptions related to paying for open access publishing; and misconceptions about open science practices that prevent authors from engaging in open science practices (e.g., the belief that preregistration prohibits authors from changing their analysis plans). By using an inductive analysis approach in the present study, we uncovered four novel findings specifically related to CSD assistant professors: (a) an interest in open educational resources; (b) positive perceptions related to potential impacts of open science practices on their careers, the broader scientific community, and the quality of research in CSD; (c) a desire for tenure and/or promotion processes to consider engagement in open science; and (d) overlapping barriers and facilitators to engagement in open science practices at R1 and non-R1 institutions, with differences in how the groups discussed barriers of money and time. We will discuss each of these findings in more detail and provide recommendations to address common barriers to engagement in open science practices.

Open Educational Resources

Participants expressed wanting to learn about all open science practices included in our focus group protocol: preregistration, self-archiving, gold open access, and open data. We intentionally chose these practices because they were the focus of the El Amin et al. (2023) study. Interestingly, however, while our focus group protocol did not include any questions about open educational resources, 12 participants (34%) voiced an interest in learning more about them, with a majority of comments coming from non-R1 participants. Open educational resources are defined as “learning, teaching, and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license that permits no-cost access, re-use, re-purpose, adaptation, and redistribution by others” (UNESCO, 2024, p. 5). Open educational resources include open software, open textbooks, and fully open classes such as Massive Open Online Courses (Gownaris et al., 2022). Participants expressed a range of prior knowledge and experience with open educational resources. Some reported not knowing anything about them, one mentioned that funding was available at their institution to create open educational resources, and another shared that they were on a task force at their institution to expand adoption of them. The discussion of open educational resources highlights the relevance of all stages of the open science life cycle to assistant professors: (a) planning (e.g., preregistration); (b) data collection (e.g., open data); (c) publication (e.g., open access); and (d) outreach (e.g., open educational resources; Gownaris et al., 2022). Conceptualizing open science from a life cycle approach may be helpful for those learning about how to integrate open science practices into their current workflows.

Potential Impacts of Open Science Practices

Assistant professors perceived that engaging in open science practices would benefit not only their careers, but also the broader scientific community and the field of CSD. Career benefits discussed by the participants included increasing collaborations through sharing materials and data sets, as well as increasing the readership of their publications by making work accessible to more people. These benefits are supported in CSD literature, including Strand and Brown’s (2023) call for sharing speech stimuli and Long et al.’s (2023) finding that manuscripts published in ASHA journals available through both green and gold open access have higher citation counts compared to closed access manuscripts. It is important to note that while the majority of comments discussed career benefits, one participant expressed uncertainty about gold open access having positive implications for their career: “I just wonder, how many more people would my article actually reach if it were gold open access?” This comment highlights that while many see potential benefits to engaging in open science practices, there is also skepticism about their measurable impacts. These impacts have yet to be documented in the early stages of the adoption of open science practices in the field of CSD.

Participants also described several benefits of engaging in open science for the broader scientific community, such as getting research into practice more quickly, increasing community support for research, and legitimizing the field to other disciplines. They also described potential benefits to the quality of research in CSD, including increased transparency, reproducibility, and researcher accountability, as well as reduced bias. One participant mentioned how open science could enhance the diversity of accessible research so it's not just from well-funded labs or "white males who have been in the field for a very long time." This sentiment acknowledges inequities in the work published in the field of CSD, and highlights the need for researchers to amplify BIPOC voices in open science practices (Girolamo et al., 2023). This can be done by diversifying participants, labs, and researchers to ensure that BIPOC are valued members of the scientific community. Assistant professors can encourage institutional change by engaging in open science practices and encouraging a shift in what is valued at their institutions, and in the field at large, in the years to come.

Promotion and Tenure Processes

Several focus group participants discussed the fact that their promotion and/or tenure processes do not value engagement in open science practices. For many, this was cited as a barrier to engaging in open science, with one participant calling the effort a "sinking cost" to their tenure track. Promotion and tenure guidelines are particularly important for assistant professors because they provide a roadmap for how they should spend their time during their initial years to meet their institution's benchmarks of success. Lack of inclusion of engagement in open science practices in promotion and/or tenure guidelines is a commonly cited barrier to early career researchers' uptake of open science practices (e.g., Fleming et al., 2021). However, participants also mentioned that engaging in open science could potentially help them earn tenure by engaging in secondary data analysis from others sharing their data or benefitting from more citations for their work from publishing open access. This highlights a potential misalignment that can occur between universities' values in their promotion and tenure guidelines (such as publishing in elite, high-impact journals with expensive article processing charges to publish open access) and early career researchers' recognition of open science as a way to enhance their research workflows, including expanding the accessibility of their work.

Banks et al. (2019) refer to engaging in open science practices and establishing an open science culture as "an obvious chicken-and-egg problem" (p. 265). That is, many researchers are cautious about the feasibility and implementation of open science practices, causing them to wait until there is a large-scale, well-established open science culture in their institution or field to engage in open science practices. For example, one of the participants expressed skepticism in the open data process: “What effect does it have if other people publish something using your data set that they got through open science? What is the impact of it? I don't know.” For many, widespread adoption is needed to ensure a return on their time investment for learning and executing open science practices. The inclusion of open science practices in promotion and tenure guidelines at R1 and non-R1 institutions may be one way to accelerate the uptake of open science practices in CSD. Without incentives to engage in open science practices, such as ‘credit’ towards promotion or tenure, many early career researchers will likely choose not to engage in open science, prioritizing other tasks that are valued in their institutions’ guidelines, such as pursuing first-author publications in well-respected, and often paywalled, journals.

Barriers and Facilitators to Engagement in Open Science Practices

Focus group discussions illustrated a complex landscape of personal and systemic factors that act as barriers and facilitators to engaging in open science practices for assistant professors. Personal factors included either positive or negative attitudes about engaging in open science practices, feeling nervous or fearful about engaging in open science practices, a lack of organization or self-confidence to use open science practices, challenges and/or limitations of a specific research methodology for engaging in open science practices, their knowledge of open science practices, and their previous experiences engaging in open science practices. Systemic factors included resources, inequality inherent in some open science practices such as gold open access, expectations/policies/regulations of their institutions, and open science training. It should be noted that some participants mentioned these factors as facilitators, while others described them as barriers. For instance, having prior open science training experiences served as a facilitator for some, while the absence of such experiences acted as a barrier for others. This highlights the variability in assistant professors’ barriers and facilitators to open science practices, which was noted not only across institution classifications but also within them.

While all personal and systemic factors were mentioned by participants in both R1 and non-R1 groups, differences emerged in the groups' discussions of money and time. The R1 participants' discussion of money as a barrier often centered around the allocation of funds needed to engage in open science practices, such as funding research personnel, while the non-R1 group's participants discussed securing funds for paying article processing charges for open access articles. In addition, while time was the primary barrier noted by participants in both groups, R1 participants discussed the additional time added to the research pipeline as a barrier, while non-R1 participants expressed needing more time to engage in open science practices due to their teaching load. These differences have important implications for developing training and support to increase engagement in open science practices that are tailored to the unique barriers and facilitators to engaging in open science practices at research-intensive versus teaching-intensive institutions. The current study confirms early career researchers' personal and systemic barriers identified in other fields (e.g., Fleming et al., 2021; Toribio-Florez et al., 2022). However, by sampling assistant professors across institution categorizations using an inductive qualitative approach, we uncovered nuances in perceptions and experiences that cannot be captured using quantitative methods.

Recommendations and Future Directions

In the following section, we will describe and discuss several recommended actions for reducing barriers to increase engagement in open science practices, explicitly aligned with the personal and systemic barriers our participants identified. We further separate these actions by the unique, yet complementary, levels of influence on CSD researchers' adoption and implementation of open science practices (Adelson et al., 2019; Durlak & DuPre, 2008; Fleming et al., 2021) that our participants highlighted: (a) themselves, as CSD assistant professors; (b) academic institutions, (c) journal publishers, and (d) funding agencies. Finally, we framed these actions using Mellor’s (2021) and Nosek’s (2019) suggestions for changing a research culture, recommending steps that make open science practice use required, rewarding, normative, easy, and/or possible. Table 4 summarizes recommended actions across these levels of influence and denotes which personal and systemic barriers it addresses.

Table 4

Preliminary Recommended Actions for Reducing Barriers to Increase Engagement in OS Practices Across Levels of Influence

Recommended Actions	Potential Personal Barrier Addressed	Potential Systemic Barrier Addressed
CSD Researchers		
• Learn about individual OS practices, such as pre-registration, registered reports, self-archiving, and code-sharing	Knowledge	Training
• Learn about and/or create OER	Knowledge	Training
• Build OS into courses (e.g., Research Methods) to further enhance personal learning	Knowledge	Time
• Create a community of practice amongst colleagues interested in OS	Self-Confidence	Training
• Train graduate students in OS workflow practices	Organization	Training
• Engage graduate students in supporting the preparation of open materials, data, and dissemination	Organization	Time
• Identify Diamond OA journals to publish in (free for authors and readers)	Attitudes & Self-Perception	Money
• Advocate for OS to be valued in tenure and promotion with committee work, task forces, and administration	Attitudes & Self-Perception	Expectations & Policies
Academic Institutions		
• Incentivize engagement in OS and development of OERs	Attitudes & Self-Perception	Expectations & Policies
• Offer university-wide OS and OER training and resources (e.g., university repositories) tailored to specific research designs, content, and career stage	Attitudes & Self-Perception; Knowledge; Specific Research Methodology	Training
• Build collaborations between librarians and faculty, staff, and students		Training

Recommended Actions	Potential Personal Barrier Addressed	Potential Systemic Barrier Addressed
• Enhance training in de-identifying and aggregating data as part of RCR training	Attitudes & Self-Perception; Knowledge; Specific Research Methodology	Training; Regulations
Journal Publishers (e.g., ASHA Journals Academy)		
• Update and/or articulate journal procedures and policies that make OS the norm and expectation, such as offering registered reports and making data sharing the default	Attitudes & Self-Perception	Expectations & Policies
• Incentivize OS by offering OS badges or reduced cost of OA publishing for early career researchers and/or small labs	Attitudes & Self-Perception	Money; Inequality
• Partner with universities to provide OA for free for faculty		Money
• Offer OS training and resources for authors, reviewers, and editors	Knowledge	Training
• Require reviewers to learn about the Peer Reviewers' Openness Initiative (https://www.opennessinitiative.org/)		Expectations & Policies
• Allow authors to post a postprint (i.e., author-formatted versions of manuscripts after peer review) in open repositories		Policies; Inequality
Associations and Funding Agencies (e.g., ASHA; NIH)		
• Update and/or articulate procedures and policies that make OS the norm and expectation	Attitudes & Self-Perception	Expectations & Policies
• Provide guidelines and resources for OS practices	Knowledge	Expectations & Policies
• Provide specific funds/grants for OA publishing if that mechanism does not already exist (e.g., PubMed)	Attitudes & Self-Perception	Money; Inequality
• Offer career development and OS training opportunities and resources tailored to issues/concerns relevant to CSD	Attitudes & Self-Perception; Knowledge; Self-Confidence; Specific	Training

Recommended Actions	Potential Personal Barrier Addressed	Potential Systemic Barrier Addressed
Research Methodology		

Note. These recommended actions are a preliminary starting point for the CSD field and represent alignment between our current participants' perspectives (i.e., assistant professors) and existing literature. We have not tested them for efficacy or gathered perspectives of other relevant groups (e.g,. associate professors, department chairs, etc.). We suggest that these recommendations continue to be refined with future work.

CSD = Communication Sciences and Disorders; NIH = National Institutes of Health; OA = Open Access; OER = Open Educational Resources; OS = Open Science; RCR = Responsible Conduct of Research.

Considerations Across Recommended Actions

As readers review Table 4, we want to first highlight several important considerations. First, Table 4 is intended to be a preliminary set of recommendations that incorporates our participants' viewpoints and existing literature aligned with them. It is not exhaustive, nor have we tested these recommendations for efficacy. Rather, the recommended strategies are meant as a starting point for future efforts to promote open science practice use within the CSD field. Future research should include multiple relevant groups' perspectives, such as associate and/or full professors and university administrators, to refine them. Second, these recommended actions are complementary and often have cascading and compounding effects. For example, if advocacy efforts for open science as part of the tenure process were successful and academic institutions were to incentivize open science practices, researchers would be justified in prioritizing learning about and implementing open science practices, potentially reducing time and negative attitudes as barriers. Moreover, by creating training resources for PhD students, assistant professors would already know how to implement open science practices when establishing their own labs. Second, these recommendations also vary along a continuum of engagement with open science practices from an initial awareness to the next step of exploration, and, finally, adoption (Adelson et al., 2019).

CSD Assistant Professors

The actions we recommend for CSD assistant professors reflect three main takeaways from our focus groups: (a) a lack of knowledge and training in open science, (b) difficulty with the time and organization needed to engage in open science, and (c) open science not being valued as part of the tenure process. Several options are freely available for researchers to build knowledge and access training. Moreover, amidst the barriers mentioned by the participants, some open science practices take minimal time to learn and implement (e.g., posting a preprint on a preprint server) and can be a starting point for those interested in building open science practices in their workflow. For individuals more novice to open science, accessing resources that build foundational knowledge and address common misconceptions about open science practices (e.g., data from qualitative studies cannot be shared) may be helpful. For example, FOSTER, a European Union-funded project to support cultural change through training and networking, offers a free introductory course to open science. As a companion, Framework for Open and Reproducible Research Training (FORRT) offers a wealth of open education information and resources to support teaching and mentoring in open science, such as lesson plans, syllabi, and an educators' corner for building connections and sharing experiences. For those looking to delve more deeply, we suggest training on individual open science practices such as preregistration, registered reports, self-archiving, open data, and code-sharing (El Amin et al., 2023; Fleming et al., 2021). Pre-recorded webinars on these topics are free from CSDisseminate and the Center for Open Science YouTube Channel. These webinars may also be complemented with resources that provide a “how-to” and step-by-step guide, such as Brown and Strand's (2023) preregistration tutorial, Cook et al.'s (2021) open science how-to guide and Stanford Psychology's GitHub guide on *Doing Open Science*. Importantly, engaging in open science practices is not an all-or-nothing venture. We suggest starting with learning about and implementing just one or two practices that are most manageable for your research workflow.

We recognize, however, that for some, independent work like readings and webinars may not be the preferred modality for adopting and implementing open science practices. In these instances, collaborative options, such as a community of practice (Mellor, 2021) or a journal club (Kathawalla et al., 2021), may be helpful. A community of practice allows researchers to interact, build relationships, co-create and exchange knowledge, and have a shared set of resources (Li et al., 2009). To reconcile uncertainties, promote accountability, and increase engagement in open science practices, creating or finding an existing community of practice can be advantageous (OpenSciency Contributors, 2023). Likewise, for researchers working with graduate students, creating a community of practice within a lab or journal club may be another option. Kathawalla et al. (2021) offer a start guide, suggesting eight practices to start immediately. For many, these collaborative options also have the added benefit of overcoming the barriers our participants indicated of time and organization.

As CSD researchers develop an understanding of open science–even if it's emerging–we recommend they advocate for open science as part of tenure and promotion and as a necessary value of the academic institution. This advocacy may involve becoming part of tenure review committees or task forces at the college or university level and directly connecting with administration, such as Offices of Research or college-level research divisions. Mellor (2021) and Nosek et al. (2015) also provide suggestions for promoting a research culture that may interest those on an advocacy path who want more than our cursory overview here.

Academic Institutions

Moving from the individual to thinking about institutions and systems in place that can foster engagement in open science, we offer several recommendations. These recommendations aim to have a wider reach (e.g., Durlak & DuPre, 2008), change the culture around open science, and address personal barriers of attitudes, self-perception, and knowledge and systemic barriers of training, money, and expectations and policies. As a first step, we reiterate recommendations by several others (e.g., Mellor, 2021) that suggest that institutions begin by incentivizing and rewarding engagement in open science. When operationalized, this incentivizing may involve covering open access publishing fees and adding language to promotion and tenure documents that encourage using open science or practices, such as preregistration, data sharing, and open access.

Beyond policies and monetary support, academic institutions can also change the culture of open science through training and encouraging interdisciplinary collaboration. With a unique knowledge of the research activities and faculty within their institution, universities can offer broad-based training or tailored training to the specific needs of their faculty. For example, training for early career researchers may look different than more senior researchers who are more established in the traditional processes and may be less favorable to some open science practices (Fleming et al., 2021). Furthermore, data privacy training can be enhanced as part of the Responsible Conduct of Research at an institutional level, including clear guidelines for researchers to engage in open science practices, such as providing specific examples of IRB language required for various open science practices (e.g., language to use to ask participants to share their data during the consent process). By highlighting methods for de-identification and aggregation with a nod to open data sharing, institutions can support researchers in ensuring that participant privacy and identities are protected (Banks et al., 2019).

Journal Publishers

Journal publishers, such as the ASHA Journals Academy, are well-positioned to promote open science practices through their procedures and policies. For example, ASHA Journals Academy offered registered reports as an article type in 2022 and currently incentivizes open science through badges for open data, open materials, and preregistration (ASHA, n.d.b). Though the ASHA Journals Academy has not gone as far as requiring specific open science practices or making them the default (e.g., sharing data), this would be the next logical step. Likewise, while these journals offer open access at a cost, we encourage them to consider cost adjustments for early career researchers with limited funds. In addition, they can offer training for reviewers and editors on open science practices. Reviewers and editors have a natural opportunity in the review process to ask for and encourage authors to share their data and materials (Mellor, 2021). For those interested, see Peer Reviewers' Openness Initiative, an initiative that sets minimum requirements in openness (e.g., data and materials publicly available) and offers steps for reviewers to take before completing their comprehensive review.

Funding Agencies

Within CSD, open science initiatives are largely the result of grass-roots efforts, such as organizations (e.g., CSDisseminate, OpenCSD) or published tutorials (e.g., Brown & Strand, 2023). To broaden this impact, open science requires endorsement and funding from associations, foundations (e.g., ASHFoundation), or federal agencies (e.g., NIH). Though several federal agencies already recognize its importance (e.g., see Public Access Policy from NIH), endorsing and dictating clear policies that make open science the norm and expectations is necessary (Adelson et al., 2019), such as the initial steps made in the NIH's 2023 Data Management and Sharing Policy. These policies might include explicitly calling for proposals or grant activities to include preregistration or data and material sharing, requiring any output to be provided openly and freely (e.g., pre-prints). Furthermore, providing training related to these policies will be necessary as researchers–some novice and some more advanced–will have varying levels of knowledge and experience.

Limitations

This study has several limitations. First, we acknowledge the potential for self-selection bias to have influenced our sample of participants. It is possible that assistant professors who are more interested in open science and see its potential advantages were more likely to sign up to participate in the study, potentially influencing the results of this study. Second, to recruit participants from various types of institutions, we decided to group participants by a R1/non-R1 designation. However, the participants' institutions represented in the non-R1 category are not homogenous, with varying research and teaching expectations. Participants from R2 institutions shared anecdotally that their experiences may align more closely with those from R1 institutions than more teaching-intensive institutions. We also chose to exclude research assistant professors in an effort to recruit a sample of participants with both research and teaching responsibilities. Future studies could consider investigating the perspectives of research assistant professors, and/or assistant professors from R1 and R2 designated institutions together, who may have more similar resources available for engaging in open science practices. The impact of receiving open science training during graduate/doctoral studies on assistant professors' engagement in open science practices could also be examined. In addition, as is true of all qualitative studies, we acknowledge that our findings are not generalizable to the lived experiences of all assistant professors in CSD, and our categories may not capture all assistant professors' perceptions of open science in the field. Further, while we extended the opportunity for all participants to provide feedback on the categories we developed summarizing their discussions, only about half of the participants responded to do so. Lastly, while we over recruited for the focus groups in the common event of attrition, in one of the non-R1 focus groups, all 11 recruited participants attended. This may have prohibited all participants from sharing their perspectives equally and may have been the reason that one participant did not make any comments.

Conclusion

In summary, assistant professors in CSD perceive benefits of engaging in open science for their careers, the broader scientific community, and the field. However, barriers such as time, lack of knowledge and training, lack of recognition of open science in tenure and promotion processes, and cost of publishing open access impede widespread uptake of these practices among researchers across institution classifications. Notably, participants from R1 and non-R1 institutions discussed barriers of money and time differently, with those from non-R1 institutions emphasizing the high APC costs for publishing open access articles more often, and identified their teaching load as a limiting factor on their time to engage in open science practices. We offered a range of recommendations to continue the discussion in CSD on promoting the adoption and use of open science practices. These recommendations were aligned with identified barriers across levels of influence, including CSD researchers, academic institutions, journal publishers, and funding agencies, and should be taken in consideration within the context of one's institutional classification.

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Data Availability Statement

The preregistration, study materials, and focus group data supporting the findings of this study are available on the Open Science Framework at https://osf.io/tprzu/.

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Appendix

Qualitative Analysis Team Positionality Statements

Danika L. Pfeiffer, PhD, CCC-SLP

Danika Pfeiffer is an Assistant Professor at Old Dominion University. Her primary research interest is in enhancing children’s early language and literacy skills through collaborative school-based partnerships. Danika is an advocate for the use of open science practices to increase transparency, reproducibility, and accessibility of research, particularly for clinicians, families, and community members. She volunteers for CSDisseminate (www.csdisseminate.com) to share information with others in the field of Communication Sciences and Disorders (CSD) about open science practices. When coding the data for this study, Danika intentionally considered the views and opinions of all participants, even those who did not align with her own beliefs or experiences. In addition, when training the other coders on the qualitative analysis process, she emphasized the importance of being as inclusive as possible of all participants' views when generating codes and categories from the transcripts and reporting quotes in the manuscript.

Austin Thompson, PhD
Austin Thompson is an Assistant Professor at the University of Houston, with a research interest in speakers with dysarthria and motor speech disorders due to neurodegenerative diseases, such as Parkinson's disease and ALS. Through this work, Austin acknowledges the potential value of open science practices, such as open data, in advancing our understanding of dysarthria in low-incidence populations. Austin believes that open science has the potential to improve scientific rigor, reproducibility, and accessibility. He actively engages in initiatives like CSDisseminate, which is a volunteer organization advocating for the widespread adoption of open science principles. Austin aimed to be mindful of his background throughout the coding process and strived to consider all of the participants' perspectives and to be mindful of the diverse perspectives held by the participants in this study.

Brittany Ciullo, MA, CCC-SLP
Brittany Ciullo is a PhD student at the University of Massachusetts Amherst whose research focuses on supporting children's language and literacy skills in the school environment. Her experience working as a school-based speech-language pathologist informs the clinically applicable and interprofessionally collaborative lens she applies to her research. Although Brittany is new to adopting open science practices in her own work, she is passionate about increasing accessibility and transparency in the research process and joined CSDisseminate as a volunteer collaborator in 2022. While participating in the qualitative coding process, she strived to be intentional and reflective about her own experiences and beliefs related to open science as well as the perspectives voiced by focus group participants.

Mariam El Amin, PhD
Mariam El Amin is a postdoctoral research scholar whose research focuses on expanding the global science of the research in communication sciences and disorders . She approaches this work as a clinician and scholar from the global south. Mariam believes in the potential of using open science practices to further diversify the study of child language development and disorders. Therefore, she has worked on several research projects on open science. Additionally, she strongly believes in the importance of providing everyone with access to the research literature academics produce regardless of their background. She co-founded an open science initiative, CSDisseminate, focused on teaching scientists in the field of communication sciences and disorders how to self-archive, which is legally and freely sharing their research openly online. Mariam was consciously aware of her own background when coding for this study and was intentional in ensuring she considers all participants' points of view.

Micah E. Hirsch
Micah Hirsch (they/them) is currently a PhD candidate at Florida State University with research interests in motor speech disorders, speech science, and metascience. Micah is a strong proponent of open science and believes that the use of open science practices has the ability to strengthen the rigor of research in Communication Science and Disorders and related fields.

Therefore, they are involved in CSDisseminate, which is a volunteer-run initiative with the goal of increasing awareness, knowledge, and use of open science practices in the CSD field. Micah strived to be aware of their own background and biases during the coding process and aimed to be reflective and considerate of the perspectives shared by the participants in the focus groups.

Supplemental Material

Participants' Reported Areas of CSD Research Expertise Across Groups