Champions of Transparency in Education: What Journal Reviewers Can Do to Encourage Open Science Practices

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Abstract

As the field of education and especially gifted education gradually moves towards open science, our research community increasingly values transparency and openness brought by open science practices. Yet, individual researchers may be reluctant to adopt open science practices due to low incentives, barriers of extra workload, or lack of support to apply these in certain areas, such as qualitative research. We encourage and give guidelines to reviewers to champion open science practices by warmly influencing authors to consider applying open science practices to quantitative, qualitative, and mixed methods research and providing ample support to produce higher-quality publications. Instead of imposing open science practices on authors, we advocate reviewers suggest small, non-threatening, specific steps to support authors without making them feel overwhelmed, judged, or punished. We believe that these small steps taken by reviewers will make a difference to create a more supportive environment for researchers to adopt more open science practices.

Keywords: open science, journal reviewer, peer review, education, research transparency

In 2018, McBee et al. issued a call for researchers of giftedness to use open science practices, such as preregistration, registered reports, making their data, code and materials available (or open), and pre-prints. Then in 2019, the co-Editors of *Gifted Child Quarterly* (*GCQ*) issued an editorial about the journal's commitment to transparency, openness, and research improvement (Adelson & Matthews). Among the changes they made were introducing both Brief Reports (with encouragement for replication) and Registered Reports as submission options, committing to meeting Level 1 or higher in all eight areas of the TOP (Transparency and Openness Promotion) Guidelines, and implementing open science badges. Now that those changes have been in place for several years, we see a need for further education of the research community on best practices for reviewing in an open science and transparency paradigm.

What is Open Science?

The open science movement has been described as a collective effort to make the scientific process and the outputs of scientific research more available, accessible, and easier to reuse for a range of audiences (UNESCO, 2021). This encompassing definition highlights the broad benefits of open science practices, namely, that in making the research lifecycle more

democratic and transparent, the scientific community can increase the integrity and rigor of research processes and products. Operationally, open science will be used to describe the philosophy and practices that contribute to creating an increasingly rigorous and transparent scientific process and products.

Contemporary research practices have been questioned due to the lack of replication attempts and that when studies are replicated inconsistencies are found (McBee et al., 2018). Some of these inconsistencies are due to statistical false positives, multiple comparisons, the sociological context of research and publication bias, *p*-hacking, and hypothesizing after results are known (HARKing) (McBee et al., 2018). Further, van der Zee et al. (2018) describe four types of problems that open science practices are trying to solve: the failure of replication, the file drawer problem, researcher positionality and degrees of freedom, and the cost of access.

Although the research community may value transparency and openness, individual researchers often lack incentives or supports to incorporate open science practices into their research and reporting (Kessler et al., 2021; Nosek et al., 2015). Peer reviewers play a unique role in the publication process and have the opportunity to influence individual authors to consider, if not incorporate, more open science practices into their research and reporting.

Open Science in Education

Multiple positive reasons entice authors to engage in open science practices that apply to education as well as to other fields. Many open science practices support trustworthiness in the research process and findings, such as when authors outline their contingency plans for when the data appear different than anticipated (e.g., are not normally distributed, sample size is too small to detect the effect size of interest, certain participants do not agree to interviews). By planning what could happen and what the researchers would do in those scenarios, the final research

product is stronger; researchers do not have to feel forced to make the data behave in an expected way and are open to multiple outcomes. Additionally, open science practices support the democratization of the research process (Arza & Fressoli, 2017). Researchers-in-training and readers of studies can now access more, whether it be through providing open data, code or protocols for adapting for further analyses, or reading versions of the final results outside of traditional, paywalled publication avenues. Finally, research methods continue to evolve and change. Qualitative and quantitative methods adapt based on innovations, including the relatively modern idea of using both qualitative and quantitative methods within mixed methods research. Open science can similarly be considered as an evolution to the research process - not a required change but rather an opportunity for integration when the research study allows.

Within education specifically, there are many reasons why authors would engage in open science practices. Resource-strained community members, such as educators and independent (non-university affiliated) authors, can increasingly access study results and research techniques. Producing and sharing evidence that matters to educational contexts can build trust between partners (Grand et al., 2012). For example, schools might be able to share data with researchers who may never before had access, and researchers may be able to share results in a faster, accessible format. Open science then might help build bridges between communities that do not have the capacity to complete the studies or integrate the latest research on their own. Many potential fears - such as sharing data that compromises student or family identities, or other researchers "scooping" research study ideas - often do not exist as issues when proper, study-specific open science practices are used (Laine, 2017; Liu & Wai, 2023).

Indeed, education researchers should identify ways to incorporate open science practices within their work when appropriate. For one, variation within and between students, classrooms,

schools, districts, states, and countries is large. Documenting research methods and decisions in various settings (e.g., through the sharing of data, code, materials and pre-registered protocols) can support replication efforts in identifying what interventions work and for whom they work well. Recent research has found that education researchers believe in using open science practices yet have not used them in their latest research projects (Nosek, 2022). Unfortunately, education researchers have even self-reported that they engage in problematic research practices that open science work tries to help solve, such as not reporting non-significant variables or studies (62%), reporting findings as complete when they were not (67%), and changing analysis type when original method did not reach statistical significance (50%; Makel et al., 2021). Thus, providing educational researchers with guidance on why to use open science practices and how to do them within an article remains important.

The Need for Peer Review

Although peer review is a standard practice for academic journals, many reviewers have different stances on the purpose of review. We take the perspective that the point of review is not to nitpick authors on tiny details or tell authors how you would have conducted the study; rather, review provides expertise (whether regarding content, methodology, or both) to provide a better quality publication that avoids potential misconduct. Reviewers also can encourage the adoption of modern research techniques, such as open science practices. Prior publications have documented best practices for gifted education researchers (Snyder, 2018) but did not include open science considerations. Open science reviewer guidelines focused on psychology research (Davis et al., 2018) have some application to education work but to date has not included open science considerations for qualitative research. Thus, education reviewers need an understanding

of how to review the research conducted within the gifted education field with a focus on open science practices.

Purpose

The goal of this article is to help educational journal reviewers understand how they can support open science practices without being overly prescriptive. We will first describe how reviewers can generally support open science through how they request open science information. Then we will briefly describe how reviewers might encourage open science practices throughout the research process - from study conceptualization, data collection, analysis, and dissemination. When relevant, we highlight differences in open science practices between quantitative, qualitative, and mixed methods approaches.

Common Open Science Practices

Because authors tend to heed reviewers' comments carefully, reviewers have the ability to increase incentives for authors to conduct open science in their own work. Choi et al. (2005) argued that scientists have 3P goals: publications, patents, and professorships. Reviewers have much influence over publications and can make a difference in authors' attitude towards open science, thus reviewers can create incentive for authors to adopt open science practices.

Reviewers could position themselves as peers who can provide constructive and respectful feedback. This means that when reviewers ask authors to consider open science, the tone should be warm and welcoming. The goal is to warmly nudge authors in the direction of best practices instead of evoking harsh feelings by threatening to reject their papers.

One example can be seen in *Journal of Youth and Adolescence*, where the editor comments on preregistration in the review letter:

> "As our journal is multidisciplinary and some fields are now moving toward encouraging preregistration, and given that we seek to have authors distinguish between confirmatory and exploratory analyses, we now encourage authors to note whether parts of their study were preregistered. If it is not, then simply ignore. If it is, then please provide the relevant link (URL, DOI, or other permanent path to a public, open-access repository) and note what was registered (the study design, hypotheses, and target analyses, and so forth)."

The editor also comments on open data:

> "We also now request a Data Sharing Declaration. The declaration is in no way intended to require authors to share their data. But, we do request that, if they are available, to let readers know."

The above comments communicate the message that the journal as well as the field is in a transition period and will move towards open science in the near future. The implicit message behind these words is that the journal does not require authors to incorporate all open science practices at the moment but may do so in the near future. For authors who did not conduct open science practices, these comments are non-threatening and low-stakes and can be ignored because they are not a required practice. However, merely asking these questions demonstrates the journal or journal reviewers' support for open science practices, which can nudge the authors to seriously consider incorporating open science in their future work.

It is important for reviewers to be aware of and support journal policies. For instance, different journals approach data sharing in different ways. Although some journals mandate data sharing to ensure authors conform with open science practices, other journals provide complementary support for authors who want to deposit data without requiring that they share data (Levesque, 2017). For instance, some journals, like *GCQ*, require open science disclosure

statements and offer open science badges. In this way, authors can obtain support from journals if they choose to follow open science suggestions, which reduces stress from authors who do not have much experience or resources to invest into these practices.

Journal mandates to share data are well-intentioned but may push authors to become incompetent sharers (see Tenopir et al., 2011) and eventually jeopardize future researchers. Journals' policies should be customized to the specific field's development. In the field of education and psychology, we are not ready to mandate open science practices. At this juncture, warmly nudging authors and offering support and guidelines is the best practice (Levesque, 2017).

Therefore, as a reviewer, you should be aware of and respect the specific journal's policy regarding disclosure statements, data sharing, material/code sharing, etc. However, once again, you can provide gentle nudges. For instance, a *GCQ* reviewer might note when reviewing the methods section that they hope the authors will consider sharing these data or that the authors consider posting their analysis syntax as a file on the Open Science Framework (OSF; http://osf.io/prereg/) or as a supplemental file in Figshare through SAGE. These suggestions support the journal rather than causing conflict among reviewers, editors, and authors when the reviewer "demands" something that the journal does not require.

The remainder of this article focuses on how reviewers might encourage open science practices at each phase of the research process as they conduct their peer review.

Study Conceptualization

Preregistration

Preregistration is a timestamped record that is created in a structured, web-based, publicly accessible registry of the planned study design, hypotheses, data collection procedures, and

analytical decisions and is one way researchers can make their decisions more transparent (Nosek et al., 2018). Preregistration helps reduce the common problem of selective reporting of results (John et al., 2012) and serves two primary purposes. First, preregistration makes the distinction clearer between confirmatory research and exploratory hypothesis generating work by documenting a priori hypotheses separate from claims created while exploring the data. Second, preregistration provides an open-source opportunity for readers to review how much research is conducted, i.e., reported in the pre-registered protocol, compared to how much gets published in a journal article or report (Nosek et al., 2015, 2018). As such, one can infer that researchers are more likely to report all results regardless of significance or novelty if the initial plan is posted to an online repository (e.g., ClinicalTrials.gov, American Economic Association RCT Registry, OSF Registry, etc.; Hardwicke & Ioannidis, 2018). Specific to the education research community, the Society for Research on Educational Effectiveness (SREE) developed the Registry of Efficacy and Effectiveness Studies (REES), an open-source repository for preregistering impact studies designed to make causal inferences about "what works" in education (Anderson et al., 2019). Preregistration, however, is not specific to experimental studies. Protocols can be pre-registered for plans to conduct archival research, field observations, correlational research, longitudinal studies, survey research, meta-analysis, etc. (Mayo-Wilson et al., 2021). Pre-registering qualitative research also helps ensure that decisions made before data analysis are maintained or that deviations are intentional but documented (L. Haven & Van Grootel, 2019).

Again, this is a place where the reviewer can inform and nudge authors. The reviewer could state in their review, "Is there a preregistration of this study? If so, please encourage the reviewer to include the registration ID in their manuscript (e.g., in the abstract or methods

section) and consider asking whether and if so how decisions made in this manuscript differ from the preregistration. Although it is too late for the authors to go back and preregister the study under review, by providing reminders about preregistration if they did it, the reviewer is planting the seed that this is a possibility and a practice the authors could consider in future publications.

Analysis Plan

An analysis plan is a detailed explanation of the methods and decisions for conducting the analysis (Gamble et al., 2017). A standalone document, the analysis plan should still be reviewed along with the pre-registered protocol and other protocols in place, such as the application to an Institutional Review Board or to the funder. The purpose of preregistering an analysis plan is to detail how analysis decisions changed over time, thus improving the understanding and credibility of findings. In addition, protocols and analysis plans made public to readers allow users to consider whether findings are consistent with the totality of the study's evidence (Chan et al., 2013). For quantitative researchers, a comprehensive "statistical analysis plan" (or SAP): (1) Lists all research objectives and hypotheses; (2) Identifies datasets; (3) Lists both the inclusion and exclusion criteria; (4) States the planned covariates, confidence intervals, and alpha values; (5) Reports the software planned for statistical analysis; and (6) Identifies methods, formulas and algorithms planned to populate the tables, figures, and listings illustrating the study's findings (Gamble et al., 2017). Researchers who conduct qualitative analyses can also preregister an analysis plan for sharing in an ethically and legally appropriate way various forms of data, such as photos, audio recordings, interview transcripts, and field notes (Antonio et al., 2020).

Since different analysis methods have the potential to produce different findings and deviations from planned methods can introduce bias, the nature, timing, and rationale for

deviations from planned methods should be documented and reported. Preregistration and preregistering an analysis plan support this effort and are transparency practices that facilitate one another. In other words, preregistering an analysis plan is easier if researchers are already preregistering the study design (Mayo-Wilson et al., 2021).

A prospective registry is posted before data are collected and analyzed, and can increase transparency and reduce bias in how research is conducted and reported. Retrospective registration occurs after data are analyzed or a project is completed and is better than nonregistration because any form of registration can help researchers identify previous trials and link multiple reports about trials (Altman et al., 2014; Cybulski et al., 2016).

Preregistration is still in its infancy, though it is becoming more common in recent years (Gennetian et al., 2020). Preregistration takes time and can be confusing. However, there are opportunities to provide practice and accelerate such skill building. For example, decision tools such as Declare Design (http://declaredesign.org/) offer structured workflows designed to help researchers anticipate common decisions and provide guidance for documenting and reporting those decisions (Nosek et al., 2019).

Again, this is a place where reviewers can be champions of open science and plant seeds. They might suggest to the author retrospective registration of their analysis plan or nudge them by asking if the analysis plan is preregistered, and if so, how the analysis differed from the plan.

Registered Reports

Although the majority of manuscripts that require review are published using the standard publishing model, it is possible that a reviewer might be asked to review a Registered Report submission, especially for journals like *GCQ* that offer them as a submission option. Registered Reports describe a publishing model that is designed to combat publication bias and questionable

research practices by focusing on the research questions and the quality of the methodology (Nosek & Lakens, 2014). This is accomplished through a two-stage review process, with the first stage of review being conducted before data collection occurs.

Registered Reports and preregistrations share similarities but differ in a number of key ways. Registered Reports and preregistrations both act as time-stamped research plans that are created before a study is conducted. However, although a preregistration is submitted to a public registry and does not necessarily garner feedback from peers, a Stage 1 Registered Report undergoes active review, which can influence a study's methods. Registered Reports also carry the added benefit of combatting publication bias, in which studies with statistically significant findings are published more frequently than studies with non-statistically significant or inconclusive findings (Rosenthal, 1979). In fact, Scheel et al (2021) found that 96% of the first hypothesis of articles published by the standard method had positive results while only 44% of the first hypothesis of articles published through Registered Reports had positive results. By accepting the manuscript in-principle before data collection and analyses have been conducted, journals commit to publishing results of a research study regardless of the primary outcomes (although failing pre-defined quality assurance measures could be grounds for rejection at Stage 2).

In the Registered Reports model, authors submit a Stage 1 manuscript to the journal, which includes an Introduction section, a Methods section, and any pilot experiments that may have been conducted already. Reviewers then assess the submission, offering feedback on methods and study design. They also may recommend quality control measures at this step, such as checks for floor or ceiling effects or positive controls to demonstrate that the methods were conducted correctly. Just like with the regular review process, this Stage 1 manuscript may go

through one or more rounds of revision before being accepted. Once approved, the journal can offer the authors in-principle acceptance (IPA). By offering IPA, the journal agrees to publish the results of the study if the study is conducted as outlined in the Stage 1 protocol. After receiving IPA, the authors conduct the proposed study and submit a Stage 2 manuscript with the final results. Results can include the outcomes of the preregistered analysis plan as well as any clearly identified exploratory analyses that were conducted. After a second round review of the Stage 2 manuscript, in which reviewers assess whether or not the conclusions are justified by the data, the manuscript is published (Center for Open Science, 2022).

As a reviewer, considerations for a Stage 1 manuscript submission may include the importance of the research question, the reasoning behind the hypotheses, the quality of the methods and analyses (potentially including statistical power), and the inclusion of sufficient outcome-neutral tests to ensure a proper test of the hypotheses. At Stage 2, reviewers should evaluate the manuscript based on if the data collected appropriately test the original hypotheses, the introductory materials and hypotheses are in line with the Stage 1 manuscript, adherence to the pre-stated experimental procedures has been followed, unregistered analyses conducted are appropriate, and conclusions are justified by the collected data (adapted from https://osf.io/pukzy).

Data Collection

Thick Descriptions

Within qualitative research, thick descriptions are used to provide the reader with enough detail of the context, participants, and the analytical process. These descriptions, such as participants' body language when answering certain interview questions, can provide important details beyond what is simply stated (Mill & Ogilvie, 2003). Although journals often have page

or word limitations, these thick descriptions could be added to an online repository rather than always added within the text. For example, *GCQ* accepts supplemental materials. Those can be posted independently on a service that provides a DOI (such as through OSF) or can be included with the manuscript submission to be posted on Figshare through SAGE (which also provides a DOI). Reviewers could ask authors to provide more thick descriptions when there are situations that are culture-specific and unknown to the reviewer, although this should be balanced with the need to not unintentionally identify participants or settings. We encourage reviewers to acknowledge that space limitations may be a concern and to recommend what could be provided in a supplemental document instead when appropriate.

Data Sharing

Data sharing may seem like a challenging open science practice, but scholars have argued that there are many longstanding examples of this practice in our discipline (van der Zee & Reich, 2018), such as the data shared by the National Center for Education Statistics (NCES, 2022) and the data associated with many large-scale assessments (see Bailey et al., 2022). Although there are a range of ways educational data can be shared, there is evidence that making data available upon request is not effective in practice (Tedersoo et al., 2021; Wicherts et al., 2006).

Sharing data has several benefits. For one, it allows other researchers to use the time and effort you put forth to advance knowledge in other ways. For another, it allows others to verify your work, building trust in the process. In addition, most recognized data repositories (e.g., the OSF) provide persistent identifiers (DOIs) for shared data, thus encouraging widespread citation of shared research components, not just articles (Gennetian et al., 2020).

When sharing data of any kind, we suggest the following strategies:

- *Sharing in a stable location.* Although sharing data on one's individual website is a positive step, we suggest that researchers share data in a stable location that commits to hosting the data for a substantial period of time. OSF and institutional repositories are likely better choices than personal websites or even many commercial options (e.g., Google Drive).
- *Respecting privacy.* Sharing data does not mean that the individuals represented by the data should have their privacy compromised. Instead, we suggest that researchers respect individuals' privacy, considering the importance of data sharing in the context of this imperative (Lundberg et al., 2019). In practice, this means that datasets may need to be carefully anonymized or shared in partial form. (Authors also should check with their Institutional Review Board in making decisions about what can and cannot be shared.)
- *Documenting the dataset.* Last, we suggest that researchers include a codebook with, at a minimum, the names of the variables and a brief description of them.

We note that for qualitative data, public sharing data may be more difficult given the smaller sample size and thus the increased likelihood for identification of subjects, but sharing data directly with participants (e.g., copies of their responses, confirmation of quotes to be used) or in a graded fashion (i.e., only some data to some people) can provide more confidence to the community of focus (Humphreys et al., 2021; Steltenpohl et al., 2022). Additionally, not all data needs to be shared; considering qualitative data often includes audio and video recordings, transcripts, interview protocols, memos, documents, and more, balancing the sharing of certain kinds of data remains critical for honoring and protecting participants.

Again, reviewers play an important role in making this a more normative practice in educational research. They may suggest or nudge authors to consider making their data available. When reviewing quantitative research, they could suggest that if the data are not able to be made publicly available that the authors at least provide a variance-covariance matrix with *n*'s, which would allow some of the analyses to be replicated even without the raw data. Reviewers of qualitative research may request access to the data, certain components of the data (e.g., the responses to a particular interview question, the number of people responding a particular way to a question) or ask follow-up questions about the data to the author to help promote trustworthy findings that do not require full open data sharing.

Code Sharing

Code sharing can apply to both quantitative and qualitative analyses. We address both below given there are different concerns with each.

Quantitative analysis code. Like data sharing, sharing the analytic code for quantitative analyses has several benefits. But, first, what is meant by analytic code? We use this term to refer to the syntax (i.e., SPSS syntax) or analytic code (i.e., the code that is used to carry out analyses using the statistical software and programming language R).

One benefit of sharing analytic code of any kind is the facilitation of transparency: When code is shared, the decisions made by researchers are made clear. For example, readers can see which models were specified and how they were specified with a greater level of detail than is possible to include in the method section of a manuscript. Also, sharing analytic code builds the capacity of the wider field: If other researchers can see the code needed to reproduce a complex analysis, it makes the process of carrying out that analysis much more tractable for other researchers. A final benefit of this kind of sharing is that it increases that chance that the analyses

can be reproduced. In practice, the audience that is the most likely to need to reproduce an analysis is the research team itself. Consider a common scenario of submitting a manuscript, receiving reviews several months later, and needing to make a change to the analysis. If one has left one's SPSS or R code in a state of disorder, it may be challenging—or even impossible—to reproduce an analysis. But, if one has shared one's code at the time one submits a manuscript, it is far easier to open the files and start where one left off.

A good set of strategies for sharing code also support sharing data (discussed above). The code that is shared in whichever software was used should—if at all possible—begin the analysis with the original, raw data source, and all of the key outputs of the analysis should be able to be reproduced in the code. In practice, this may be a difficult aim to achieve: some data collection or processing steps may have taken place with another tool (e.g., Microsoft Excel), and this should not inhibit the sharing of the code. Instead, in such cases, we recommend sharing the code that uses whichever dataset is necessary to reproduce the key outputs of the analyses, with the steps that took place in ways that are not included in the code (e.g., preparing the data in Microsoft Excel) documented in the manuscript or an appendix, with the orienting aim being to inform readers and analysts of the steps that you took so that they (or you!) can reproduce the steps undertaken in the future.

Reviewers play important roles in requesting for analytic code to be available. Simply asking in a review *whether* the analytic code can be shared in a repository (e.g., OSF or a GitHub repository or as a supplemental file) can prompt reviewers to address this remark by sharing the code. Additionally, reviewers might consider requesting to view the code as part of their review so that they can provide a more thorough review of the model, assumptions, and more.

This being said, we acknowledge the potential burden of requiring reviewers not only to view and ensure code is available as stated but also to re-run the code. There are several potential considerations. First, editors need to be sure to be clear about what the expectations are of reviewers (e.g., making sure there is a link to code versus checking to be sure it is truly available versus doing a verification check/re-running the code). Reviewers should know that some journals have someone on staff who does verification checks. Understanding what checks already are completed from staff would reduce the reviewers' workload. Second, if journals choose to do verification (e.g., running the code and providing reviewer feedback on the analyses), they could potentially have separate reviewers for providing feedback on code and analysis. However, this might limit the pool of reviewers when it already is difficult to recruit and maintain reviewers. Finally, reviewers also can consider the verification process on a case-by-case basis. If they already are recommending that the authors change their model, they should not check the code. If there are suspicions of errors, they can check or ask the editor if other reviewers or staff could complete this before final publication. Reviewers may not feel comfortable running code for models or programs they do not know, which is understandable. Reviewers then can communicate these needs to the editorial team and allow the editors to make the decision. By understanding and limiting roles, editors and reviewers could ensure that reviewers that do agree do not get burnt out by adding reviewing tasks to their existing duties.

Qualitative coding scheme. Big data and computer assisted analytic approaches no longer are only part of quantitative research. Natural language processing and other forms of machine learning combined with human-centered analysis have opened up a broad array of analytic approaches in qualitative research in recent years (e.g., Anderson et al., 2020; Baumer et al., 2017; Nelson, 2020). These computer-assisted analytic approaches do involve code through

traditional statistical programming languages such as R or Python that potentially can be shared in a very similar manner to code shared for quantitative analysis. However, in addition to this type of computer code sharing, there also arguably should be sharing of non-computer assisted coding schemes from more traditional forms of qualitative research. However, this will differ based upon a range of factors.

Qualitative coding schemes differ based on the methodology and aim of the study and are dependent on a variety of process decisions that occur throughout the iterative coding process. Some scholars in qualitative research have outlined high-quality elements recommended for reporting in qualitative research, of which code and theme development is a recommended reporting element (e.g., Tong et al., 2007). These coding process decisions easily could be shared through supplemental files or within the manuscript itself. However, some qualitative researchers have argued that the quality elements recommended by Tong et al. (2007) are too prescriptive and founded on questionable theoretical principles themselves, missing the wider variation that underlies qualitative research (Buus & Perron, 2020). In more recent years, other scholars have worked to improve the rigor and reasoning of reporting standards in qualitative research (O'Brien et al., 2014). Yet, in spite of these advancements, having a universally acceptable one-size-fits-all standard for sharing and reporting is arguably difficult in qualitative research due to the complex and diverse array of methodologies and analytic approaches that fall under the umbrella of qualitative research.

Rather, what underlies all these best practice recommendations for reporting and code sharing in qualitative research must be a foundation whereby reviewers are able to think critically and identify what elements can and should, or should not, be shared, reported, or made open. These decisions must be based on the study aim, methodology, and qualitative analytic

approach. Reviewers must be able to think beyond the checklist of recommendations. This may seem like an easy statement to have reviewers knowledgeable in the methodology of the study. However, too often, qualitative research is assigned to reviewers who do not encompass the necessary expertise. This already should be an imperative in the review process but will become even more important as reviewers must decipher not only the rigor of the study design and methods but also must identify what components should be expected to be shared and those not appropriate for open sharing because there cannot be a one size fits all approach across all qualitative research. Therefore, we encourage peer reviewers of qualitative research to consider if they can comment on what components of the code could be shared, and if they do not have the expertise to make that recommendation to recommend someone who could.

Materials Sharing

Another method for researchers to follow transparent practices is by sharing their research materials (e.g., survey instruments, structured interview plan, outcome measures, intervention manuals). Like sharing data and code, sharing research materials helps (for example) protect against making inadvertent mistakes that could lead to reporting incorrect results, enables reuse, and facilitates potential reproduction or replication (Mayo-Wilson et al., 2021). Qualitative researchers can also share materials, such as detailed memos, codebooks, and information on inter-rater reliability (Lorenz & Holland, 2020). Taking into consideration any legal, ethical, and/or proprietary constraints, researchers can share materials in archiving repositories such as GitHub, Dataverse, Dryad, Vivli, and the Interuniversity Consortium for Political and Social Research (Christensen et al., 2019). Alternatively, materials can be included in a supplemental online document when submitting articles for review in an academic journal. Registered protocols and/or published reports or articles should also ideally state whether some

or all the research materials are available for purchase, freely available in a named public repository, freely available on a website, available through a third party, and/or available by contacting the authors.

Once again, this is where the reviewer can step up as a champion of open science. Especially if the materials were developed for the purpose of the study under review, reviewers may ask to see the materials so that they may evaluate them in terms of their appropriateness for answering the research questions and the validity of conclusions based on them. They also may nudge authors to consider making their materials openly accessible with some positively worded suggestions.

Citing Secondary Data Sources

GCQ as well as some other journals require authors to appropriately cite "all data, program, and other methods or content drawn from existing sources" (https://journals.sagepub.com/pb-assets/cmscontent/GCQ/GCQ_Author_Submission_Guidelines.pdf). The *Publication Manual of the American Psychological Association*, 7th edition, provides guidance on how to cite these (see pages 337-338). If a reviewer notices that authors have used a secondary data source, secondary program code, or other methods or content from existing sources, they should constructively point out that the authors need to include citations for those (as well as references). The references should include a DOI or other persistent identifier if available.

Data Analyses

Authors can provide transparency regarding their analyses in many ways. However, this transparency differs for quantitative research compared to qualitative research.

For both quantitative and qualitative research, prior to being transparent about their analyses, authors must be transparent about their subjects, providing enough detail so that reviewers understand to whom the study could be generalized or whom the data describe. In the field of gifted education, it is imperative that this includes transparency about how giftedness is determined or operationalized. If the authors are not transparent about their sample, reviewers should inquire.

For quantitative research, analytic transparency often largely centers around reproducibility. Specifically, it examines whether the code and analytic processes are documented well enough to be conducted by an outside researcher and reproduce the same results. At a minimum, authors should include their equations or a graphic depiction of their models so that reviewers know exactly what variables were included and what associations were analyzed. Additionally, they need to be transparent about how they handled missing data. One resource for reviewers regarding what best practices are in reporting for different quantitative methods is *The Reviewer's Guide to Quantitative Methods in the Social Sciences,* 2nd edition, edited by Hancock, Stapleton, and Mueller (2018).

For qualitative research, due to the complexity of analytic processes relevant to different methodologies in qualitative research, analytic transparency extends beyond, and often may not include, the replication of analytic processes or code. Although conversations are only beginning in this area of replication in qualitative research, there are some common premises that have emerged in the literature that include writing analytic memos and keeping a documentation trail for auditing purposes (more below).

Hypotheses

Such practices as HARKing (hypothesizing after the results are known), *p*-hacking (repeated analysis of data in search of statistically significant results), and the failure to report studies (publication bias) can lead to overestimated effects and indicate stronger evidence than what really exists (Anderson et al., 2019). As McBee and colleagues (2018) discuss in their article on replication in gifted education, "...journals seek to publish work that is exciting and new; that tells a compelling, straightforward story; and above all, that finds statistically significant evidence supporting the article's central claims" (p. 376), and thus reviewers must stay vigilant to determine if there are issues related to these present in a study.

Exploratory vs. Confirmatory Analyses. Confirmatory analyses examine claims that were based on a priori hypotheses, and exploratory analyses examine claims created while exploring the data (Nosek et al., 2015). In other words, researchers use exploratory analyses to generate hypotheses and confirmatory analysis to test a priori hypotheses. For instance, a researcher might test their hypotheses, find that the data do not support the hypotheses, and then decide to test some alternative hypotheses with the same data. When this is done, it should be clear what analyses are confirmatory and what analyses are exploratory. What should not be done is writing the manuscript, including literature review and hypotheses around those post hoc hypotheses as if they were confirmatory, a practice known as HARKing (McBee et al., 2018). As noted earlier, preregistering the hypotheses and the analysis plan is one way to establish what analyses are confirmatory vs. exploratory.

When reviewing a manuscript, reviewers should look for hypotheses to be clearly identified and that researchers make clear what hypotheses are confirmatory and what hypotheses are exploratory. If it is unclear, reviewers should inquire about the nature of the hypotheses. Additionally, reviewers might inquire at what stage in the process the researchers

developed their hypotheses. Although exploratory vs. confirmatory analyses are specifically about whether hypotheses were developed before or after the results were known, it also is important to know if hypotheses were developed before or after data were collected.

***p*-Hacking.** There are multiple practices that fall under the term *p*-Hacking but essentially the term relates to practices that turn nonsignificant results into results that have statistically significant *p* values. Initial hypotheses, therefore, can be instrumental in understanding how or if the researchers added or changed the models to be run, added or deleted variables, removed outliers or missing data, or conducted multiple analyses to inflate the Type I error rate.

Although *p*-hacking and HARKing have primarily been associated with quantitative research, theoretically there are arguably similar occurrences in qualitative research. In recent literature, some scholars have argued that 'empirical veracity', "to what extent textual evidence supports theoretical claims", is rarely questioned in qualitative research (Moravcsik, 2013, p. 50). For example, authors may either cherry-pick textual evidence to support the theoretical hypothesis or only cite theoretical publications that support the textual evidence after it has been analyzed. These practices, in which authors create an image that they are supporting original hypotheses rather than grappling with the differences between theory and results, has resulted in highly debated publications whereby authors have been found to utilize only selected publications that support existing biases versus an authentic representation of current literature (Moravcsick, 2013). One potential solution to ensure reviewers have easy access not only to textual data and support for findings/results in the qualitative study through supplemental files (e.g., codes and associated quotes) but also to all of the citations referenced in the literature. Providing quick access to the literature can occur through having all references hyperlinked and

it also requires ensuring reviewers have access to databases where articles are available. Some reviewers and researchers may take this for granted, but access to databases of scholarly articles is becoming highly varied across universities let alone across different countries and locations. We need a diverse array of reviewers, and with this comes a pressing need to ensure access to the tools needed for a high-quality review.

Another key pathway to minimize the potential for confirmation biases and selective findings in qualitative research, and also arguably quantitative research, is through clearly documented reasoning for analytic and methodological decisions. These documented decisions must demonstrate support for the reasoning from current scholarly literature and best practices. Recent literature has identified that clearly identified qualitative methods are often missing from research reports, particularly in mixed methods designs and practice-focused research (Raskind et al., 2018). This lack of clear detail leaves high potential for what can be equated to the *p*-hacking of qualitative research. Reviewers may ask for a supplemental document that detailed these decisions in a qualitative study just like they might for a table or list of various quantitative models that were run.

Positionality/Reflexivity Statements

Positionality statements are sections, often within the method section, to provide information about the researchers' backgrounds and how these backgrounds might influence the study such as through potential power imbalances between researcher and participant (Merriam et al., 2001; Patton, 2014). These statements often detail how the researchers engaged in considering their role as an instrument of the research throughout the entire research process, from which research questions to ask to data collection, analysis, and interpretation ("reflexivity"; Guillemin & Gillam, 2004). For example, in a meta-analysis examining the role of

interventions and student characteristics (e.g., race, ethnicity, socioeconomic status) on phonemic awareness (Rehfeld et al., 2022), the researchers described their experience within giving and receiving disability interventions (or not) along with their backgrounds. This helped provide context for the reader so the reader could help understand why and how the researchers came to conclusions they did; all had worked in schools before and thus knew nuances in practice that could impact the validity and reliability of these reading assessments, but many of them were white and therefore did not have personal experiences regarding racial and ethnic discrimination within disability identification. Reviewers must keep in mind that these positionality statements must not be written or shared in the same way by all authors, however, as to not compel groups with hidden identities (e.g., sexual or gender identity, disability status) to "out" themselves (Secules et al., 2021).

Reviewers might ask authors to consider adding a positionality statement. In doing so, they should consider sharing questions that have come up in reading the study that would be answered by knowing the authors' backgrounds to help guide the authors both in understanding the value of a positionality statement and in seeing what aspects of their background may have influenced the study.

Dissemination

Pre-Prints

A pre-print is a version of an article prior to having undergone review. There are several advantages of pre-prints. First, pre-prints allow broad dissemination of research. Second, pre-prints allow authors to get feedback before (or simultaneously to) submitting to a journal, which could ultimately improve the final product. Typically, pre-prints are shared through a pre-print server such as the OSF platform for pre-prints. Other popular pre-print servers include PsyArXiv

and EdArXiv. A pre-print does not need to be anything special: many are created by saving a document in Microsoft Word as a PDF; some use the typesetting language LaTeX through a tool such as Overleaf to create a document that appears more polished, but this is not at all necessary. Many authors add a note to their pre-print indicating that the article is a pre-print that has not yet undergone review. When submitting the pre-print, authors are asked to answer several questions, including the names and contact information of all the authors. Some pre-print servers moderate submissions so that papers submitted are not approved for several hours or days, whereas others share the articles immediately upon submission. Most journals allow pre-prints to be submitted (and kept online during the review process), although some may request that the pre-print be anonymized while the review process is being conducted. Pre-prints typically are kept online as a pre-print when the article is published in a journal, though a citation in reference to the published article is typically included.

Knowledge of a pre-print is not problematic for single-blind peer review where the authors do not know who the reviewers are but the reviewers know who the authors are. pre-prints, however, present more of a challenge for journals that conduct double-blind peer reviews. If the journal, such as *GCQ*, conducts masked reviews in which the reviewers are not supposed to know the authors, reviewers should not seek out a pre-print to determine the authors. Given the growing interest in publishing pre-prints, reviewers searching the Internet for information about an article could compromise the anonymity of the authors (though we do not think reviewers should go out of their way to avoid diving deeply into an article under review, its contents, and its provenance). If reviewers have already read a pre-print of the article that has the authors identified, this is a situation similar to having heard a researcher present on the study at a conference prior to reviewing the manuscript - the reviewer should contact the editor to let them

know they have prior knowledge of this work and know the author and honestly disclose whether that introduces a particular bias into their review. Note that some editors may choose to remove a reviewer who knows an author's identity regardless of whether the reviewer discloses a particular bias to avoid implicit bias. For instance, although we are unaware of research specifically on bias in journal reviews, implicit bias has been found in reviews of NIH grant peer review based on gender (Magua et al., 2017).

As champions of open science, reviewers might mention in their review that they hope the authors have posted the manuscript as a pre-print so that others may read it now instead of waiting for the review process to be completed and for the article to be published. And if so, reviewers can encourage authors to make note of the pre-print in their manuscript by citing the pre-print source (e.g., OSF) and the DOI assigned to the pre-print. Again, this is a gentle way to let authors know that sharing a pre-print is an option for promoting open access to research.

Post-Prints

A post-print is a version of an article that is accepted for publication but not copyedited or typeset. Often, post-prints are confused with pre-prints, but they are distinct and, at least in principle, are governed by different policies. Although most journals allow pre-prints to be submitted for review (and eventually published), not all allow post-prints to be published; the putative reasoning is that these articles have benefited from (and been revised through) the review process. Some authors update the pre-prints they posted with the post-print version when the article is accepted; still other authors share a post-print that has not been published as a pre-print on a pre-print server.

Our recommendation to both authors and reviewers is to consult journal's policies on their webpage or through the Sherpa Romeo[8] site. The role of reviewers is lessened for the practice of sharing pre-prints and post-prints (relative to the other open science practices we have discussed). Especially when a manuscript is nearing the end of the review process and likely to be accepted, reviewers can suggest that authors share whichever version of the work they are allowed to under the journal's terms upon publication in order to enhance the availability of the research, especially for individuals who do not have access to an institution with a library subscription to the journal. And depending on the journal policies, for those that do allow pre- and/or post-prints, reviewers should ensure authors report the DOIs for all versions shared in the public domain so that readers can identify previous research and link multiple reports about specific research studies (Altman et al., 2014).

Open Access

Many research funders have policies requiring authors to make their published work available open access. For example, the Institute of Education Sciences (IES) has a policy that all grantees and contractors must submit the electronic version of their final manuscripts to ERIC upon acceptance for publication in a peer-reviewed journal or as a final deliverable by the Department. This public access requirement has applied to most peer-reviewed publications supported through IES research and training program grants and contracts since FY 2012, including paywalled research papers. We note, however, that though open access is a central part of open science particularly given the trend of funders requiring open access papers (van der Zee & Reich, 2018), it is a part of open science that is relatively beyond the realm of what reviewers can impact through peer review. Still, there is a step reviewers can take (in addition to suggesting

[8] Sherpa Romeo https://v2.sherpa.ac.uk/romeo/

that authors share pre-prints and/or post-prints and report DOIs associated with all research products). In cases where open access is not a funding requirement, we suggest to reviewers to encourage authors to consider open access opportunities with the publisher so that a wider audience can read research studies. In the context of aforementioned benefits of sharing pre-prints and post-prints, this step may be especially important for research fields–like education–that aim to share findings with educational leaders and educators in such a way that the findings can have a bearing on what happens in practice.

Discussion

In this article, we discussed a number of common open science practices for which reviewers can be champions. When thinking about the study conceptualization, they can advocate for preregistration of the study, preregistration of analysis plan, and future use of Registered Reports. When thinking about the data collection for the study, they can advocate for the use of thick descriptions for qualitative research and advocate for data sharing, code sharing, and materials sharing for quantitative, qualitative, and mixed methods research. If a manuscript is reporting a study using secondary data sources, reviewers should ensure that the data sources have been appropriately cited. When reviewing the data analyses, they should consider exploratory vs. confirmatory analyses and the possibility of *p*-hacking when reviewing the hypotheses and should advocate for positionality/reflexivity statements as appropriate. Finally, reviewers also can advocate for pre-prints and post-prints to aid dissemination of the research. For a summary and overview of our recommendations, see Table 1.

[Insert Table 1 about here]

We have made several suggestions specific to *Gifted Child Quarterly* practices (such as accepting Registered Reports, offering Open Science badges, and allowing supplemental

materials through SAGE's Figshare) throughout the text, but we note that as both the field's acceptance and use of open science practices evolve and as editorial teams change, journal practices will and do change. One resource for reviewers (and authors) to understand a journal's level of commitment and practice of open science and transparency practices beyond looking up the journal's submission guidelines is the TOP Factor (https://topfactor.org/). For instance, at the time of this submission, *Gifted Child Quarterly* and *Exceptional Children*, both offer Open Science badges, require data citation, and articulate design transparency standards, whereas *Journal for the Education of the Gifted* and *Journal of Advanced Academics* do not mention any of those practices. Although all four of those journals accept Registered Reports and encourage replication studies at the time of this present publication, *High Ability Studies* does not.

Gifted Child Quarterly has been at the forefront of implementing transparency and open science practices. Some gifted education researchers have already incorporated many of these practices into their research and into their reporting of their research, as seen by the increase in the number of badges being awarded. Although the field is already doing many good things, there are some things that we could do better, especially in increasing our use of preregistration and Registered Reports, our posting of pre-prints and post-prints, and being transparent in our data collection and data analyses. One way in which the field can move forward with these efforts is through reviewers acting as open science champions.

Being an open science champion does not mean requiring that all researchers incorporate all open science practices at all times. Instead, reviewers should use gentle nudges both to inform and to encourage authors to incorporate more open science practices. Additionally, they should be critical of the manuscripts they review for transparency in their methods to help promote the

trustworthiness of results. This article offers several concrete suggestions for reviewers in providing such constructive criticism.

At the same time that we encourage reviewers to gently nudge authors through their feedback to authors, we note that in no way do we mean to suggest that reviewers bear the sole responsibility for advancing open science practices. Rather, our perspective is that reviewers' work can serve as an important lever (among others) that can help authors and the wider field to take up open science practices to a greater degree. At the same time that we take this perspective, we recognize that other changes in the gifted education and wider education fields are not necessary for open science to become more widespread–especially as the recommendations we make to reviewers can add additional time for reviewers and authors alike. Thus, we think academic institutions and leaders of professional societies and disciplines also have a responsibility for both encouraging and supporting open science practices to a greater degree–and, our work joins others (e.g., Kessler et al., 2021; Kessler et al., 2021; Nosek et al., 2015) in this call for a paradigmatic shift in the value placed on conducting research in an open science manner.

Thus, our advice to reviewers is to start with small steps. You do not need to encourage authors to incorporate every open science practice into every manuscript you review. You can start with the practices you feel most comfortable with or pick 2-3 practices that seem most appropriate and non-threatening for the manuscript you are reviewing. We encourage small steps not only for the sake of you as a reviewer but also for the sake of authors. If a reviewer makes a dozen recommendations for incorporating open science practices, the author is likely to feel overwhelmed and may opt not to do any of them.

Our other piece of advice is to remember that “pretty good” practices can make a difference. If an author is making efforts to incorporate open science practices, even if they are not executing it at the “great” level, take the time to give positive recognition for their efforts. Be accepting of those “pretty good” practices, and do not hold a tight line that it has to be the strongest execution of the practice or not done at all.

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