SREE panel submission
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Organizer:
Elizabeth Stuart, Johns Hopkins Bloomberg School of Public Health, estuart@jhu.edu

Title: Getting down to brass tacks: What does pre-registration of studies actually look like in practice?

Symposium Justification:
This panel discussion will discuss the pre-registration of studies in education research, with a focus on the issues and opportunities that come up in practice. As the field of education research takes steps towards pre-registration (e.g., through the IES-funded registry or the Center for Open Science pre-registration challenge), it is important to share stories and lessons learned about what works, and what doesn't work. This panel will build on last year's panel on pre-registration by providing different perspectives on pre-registration and the considerations for its use in practice in education research. Dr. Spybrook will discuss the IES-funded Registry of Efficacy and Effectiveness Studies. Dr. Ochsendorf will provide a funder's perspective, and Dr. Gehlbach will provide a researcher's perspective, as someone who has submitted studies for pre-registration. Dr. Stuart will moderate the discussion, including questions from a journal editor's perspective. Each participant will give a short (5-10 minute) overview of their experience with pre-registration, followed by a moderated discussion (with pre-determined prompts) for approximately 30 minutes, followed by 30 minutes for open discussion with the audience.

Panelists:
Jessaca Spybrook, Associate Professor, Western Michigan University; co-PI, Registry of Efficacy and Effectiveness Studies; jessaca.spybrook@wmich.edu

Rob Ochsendorf, Program Director, National Science Foundation; rochsend@nsf.gov

Hunter Gehlbach, Associate Professor, University of California, Santa Barbara; Researcher; gehlbach@ucsb.edu

Moderator:
Elizabeth Stuart, Professor, Johns Hopkins Bloomberg School of Public Health; Methods Editor, Journal of Research on Educational Effectiveness

Abstract #1: Jessaca Spybrook

The Registry of Efficacy and Effectiveness Studies (REES)

In an effort to increase research transparency and quality, the Institute of Education Sciences (IES) awarded a grant to the Society for Research on Educational Effectiveness (SREE) to create a registry of impact studies in education and the broader social sciences. The development of the beta version of the registry occurred during the past two year. We plan to launch the registry, known as the Registry of Efficacy and Effectiveness Studies (REES) https://www.sree.org/pages/registry.php. in early 2018.

The Mechanics of REES

REES is an interactive website. An important goal underlying the design of REES was to make it quick and easy to create a registry entry. Any designated study administrator can enter study data into REES and make updates at any time in the future. A designated collaborator can view the entry while the study data are entered but cannot make changes to the entry. All updates to the study data will be described and time stamped. Registry entries can be started and stopped at any time and a pdf of a partially complete or fully complete entry can be saved, downloaded, and printed at any point. A study with a detailed proposal, such as an IES-funded goal 3, efficacy and replication project, should take less than 60 minutes to enter into REES. Entries within REES are searchable and can be exported in excel.

REES collects basic study information as well as details related to the design and analysis of the study. A complete REES entry includes eight sections:

- Section 1: General Study Information
- Section 2: Description of Study
- Section 3: Research Questions
- Section 4: Study Design
- Section 5: Sample Characteristics
- Section 6: Outcomes
- Section 7: Analysis Plan
- Section 8: Additional Materials

To the extent possible, the information is collected through questions with discrete response categories (see Figure 1 and 2 for examples). This promotes consistency in language across REES entries and allows users to more easily search the database for study qualities like design, topic, or grade level. The REES database of studies will make it easier for researchers, funders, policymakers, and the public to keep track of topics that have been or are currently under investigation, thereby allowing them to better gauge the current and projected gaps in research. As we move towards the completion of the beta version of REES, we aim to mobilize the research community to register their studies. Toward this end, we have attempted to create efficient systems for registering, updating, and retrieving studies. In this presentation, we share our strategies for launching and marketing REES as well as for increasing the efficiencies associate with registering in REES with the goal of encouraging feedback. Among the proposed strategies we will discuss are the following:

Launch and Marketing

- Preloading the registry with completed impact studies that have been reviewed by the WWC as well as ongoing studies easily identifiable through public sources such

as the IES and NSF websites so that it serves as a comprehensive database of impact studies in education;

- Convening funders discuss the benefits of registration and to enlist their guidance and support in promoting registration (e.g., including requiring, encouraging, and/or rewarding registration of studies they support);

- Meeting with journal editors to discuss promote the benefits of routinely include registration information on all relevant publications and to consider instituting explicit policies regarding expectations about pre-registration;

- Working with funders to encourage development of a plan encouraging and supporting research drawing on REES to conduct replication studies and methodological work focused on issues such as the frequency, nature and implications of design adaptations and/or deviations and the implications for study relevance and rigor.

Increasing Efficiencies

- Pre-populating registry records with information from structured abstracts for newly funded projects such as IES Efficacy Studies to minimize additional work for PIs.

We seek audience feedback about the potential of these strategies for engaging the community in pre-registering studies in REES.

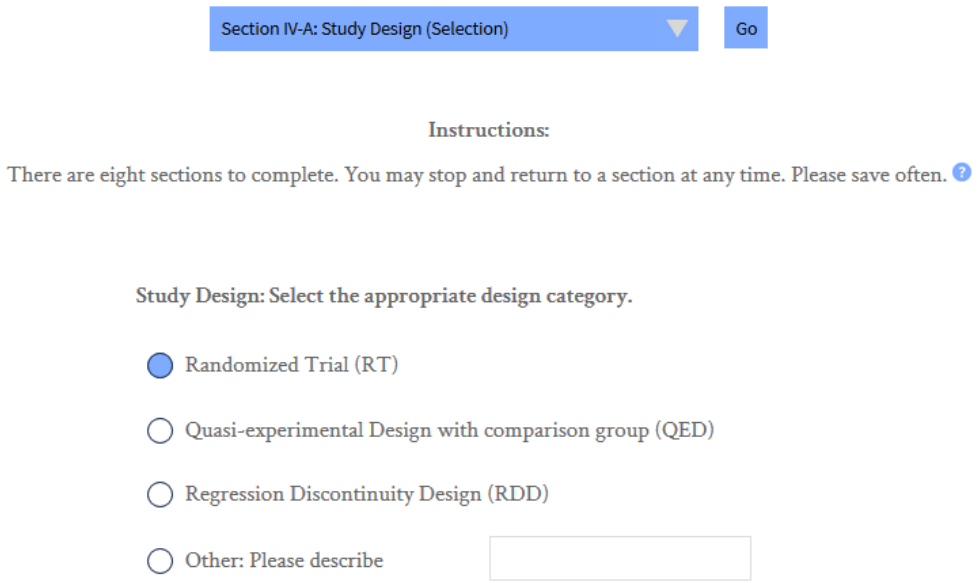

Figure 1. First question to identify study design. Subsequent questions depend on the response to this opening question.

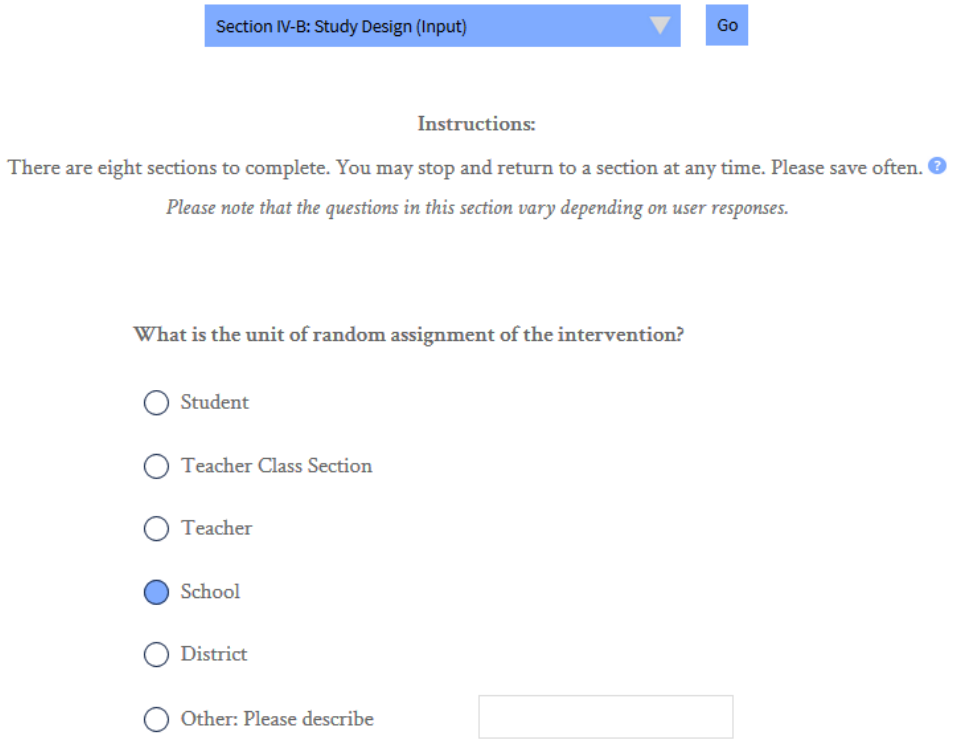

Figure 2. First question once a user selected randomized trial as the design. Subsequent questions depend on the response to this question.

Abstract #2: Rob Ochsendorf

A Funding Agency Perspective on Pre-Registration in Education

The National Science Foundation has considered issues related to data sharing and research transparency in the social sciences since the 1980's. In recent years, data sharing, replication, and pre-registration have garnered significant attention. In fact, the federal government, the public, and researchers themselves have become interested in building more robust bodies of evidence in education research with the goal of influencing practice and understanding the applicability of research findings in new settings and with new groups of participants. In the biomedical field in particular, pre-registration has played a vital role in helping to promote transparency by ensuring that published studies align with and adhere to the original intent of the research (Hudson, Lauer, & Collins, 2016). Registration requirements have also been instrumental in ensuring that the results of trials are made readily available to the public, practitioners, policymakers, intervention developers, and other researchers.

In general, a commitment to data sharing and replication can foster more rigorous peer-reviewed research that will form the foundation for evidence and high-quality science. The NSF is committed to understanding the challenges and opportunities in making STEM education research as open and as transparent as possible. NSF has developed a plan that is grounded in the realization that clear and open communication of research results is central to promoting the progress of science. The NSF has been encouraging leaders in education research to make incremental but steady progress by grappling with some of the more pressing challenges, including privacy concerns, training researchers on data sharing, effectively rewarding those who take on replication research, and the critical role that journals and publications play in this process.

Pre-Registration as Open Science

The Transparency and Openness Promotion (TOP) Guidelines, developed by the Center for Open Science, have been increasingly adopted by fields in the natural and social sciences as a means of encouraging research communities to adopt open science practices. The TOP Guidelines include eight standards that are intended to promote transparency and be adopted by journals, societies, and funders. Two of the eight standards focus on pre-registration by encouraging scientists to pre-register studies as well as data analytic plans. In July of 2017, the NSF supported AERA in convening journal editors and society leaders from the education research community to begin to think about what short and long-term steps might be possible to move toward greater openness and transparency, including consideration of the TOP Guidelines. There was general support for the principles and ideas put forth in the TOP Guidelines and a sense of commitment to work incrementally toward those standards, including pre-registration. While the NSF has not specifically adopted or endorsed the TOP Guidelines, many of the policies and procedures enacted with respect to data management are consistent with the philosophy of the TOP Guidelines.

Pre-Registration, Then What?

Despite recent efforts and renewed commitments to open science and transparency, reporting problems persist (Chen et al., 2016). Even with stronger requirements for pre-registration, recent analyses have shown that over half of NIH-funded intervention trials do not publish results within 30 months of completion (Ross et al., 2012). Thus, the threat of

publication bias is significant and real even with a robust and complete registry of ongoing and completed trials. So, as the field of education moves toward pre-registration of intervention and observational studies, it is critical that we acknowledge the challenges faced in other fields even with a strong tradition of pre-registration.

Conclusions

During this presentation, perspectives on open science will be shared by the National Science Foundation. With ongoing pre-registration initiatives in the field of education, some potential promises and pitfalls will be discussed along with general perspectives on open science initiatives including data sharing, reproducibility, and replication.

REFERENCES

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Abstract #3: Hunter Gelbach

Mitigating Performance-Enhanced Data through Pre-Registration in Education

Hunter Gehlbach (University of California, Santa Barbara)
&
Carly Robinson (Harvard Graduate School of Education)

Reminiscent of the problems of performance-enhancing drugs that have plagued many sports, illusory results in education cause problems not only within the academy but for policy-makers and practitioners as well. Because other disciplines have wrestled with the issue of these "results on steroids," education researchers can build upon a promising solution developed by natural- and social-scientists: the norm of pre-registering studies. Despite the unusual breadth of methodological and philosophical approaches to doing research within education, scholars in this field can learn from the mistakes experienced by other disciplines and capitalize on their best practices. We aim to spark a vigorous discussion around how education might develop a norm to systematically enact pre-registrations to improve the scientific process, while accounting for the unique challenges of the field.

What Problem does Pre-Registration Solve and Why Do We Need It?

During the study design, analytic, and reporting phases of research scholars can generate more or fewer decision points in their study—how many variables to collect, how to construct composite variables, which sub-group analyses to report, and so forth. As researchers make decisions, they walk through a "garden of forking paths" (Gelman & Loken, 2014). As scholars explore these options, they enhance their odds of finding something scientifically interesting and potentially publishable. Because these decisions are not always transparent to readers, colleagues in the scientific community will inevitably struggle to disambiguate real findings from chance occurrences (Simmons, Nelson, & Simonsohn, 2011). Even when multiple replication studies occur—a rarity in education (Makel & Plucker, 2014)—detecting which particular findings are illusory and which are real remains a nearly impossible task.

Pre-registration mitigates the likelihood that thorough, well-intentioned researchers unwittingly generating illusory results via *p*-hacking or by taking advantage of "researcher degrees of freedom" (Simmons et al., 2011). A pre-registration plan describes researchers' exact plans with respect to study design and analysis. The plan is then posted to public repository before the study is conducted or before the data are analyzed. By specifying the details of the study ahead of time, the reporting of a portion of the findings becomes largely straight-forward (i.e., report on the research questions and hypotheses as described in the pre-registration using the pre-specified analytic approach). Fortunately, the act of pre-specifying certain hypotheses does not prohibit researchers from fully exploring their data and discovering other interesting, albeit "exploratory" or "hypothesis generating" findings.

Philosophically, two key tenets drive the logic behind pre-registrations. First, preregistrations should facilitate researcher transparency with respect to study design, data analysis, and reporting choices. Second, pre-registering studies should remove researchers' degrees of freedom. In other words, pre-registration combats the natural human inclination to craft a post-hoc story and, *a priori,* charts an unambigious course through the garden of forking paths. This procedure serves to sharply distinguish pre-specified findings (which others should have relatively robust faith in) from exploratory findings (which might prove promising but have resulted from inadvertent *p*-hacking).

Pre-registration in the Messy Real World

While the procedure of pre-registering studies seems relatively straight-forward at first, the details are often tricky to navigate. To establish pre-registration as a norm within the field of education will require getting these details right for a diverse array of methodologies and research approaches. To surface some of these challenges, we will briefly describe our first attempt at pre-registration (Gehlbach et al., 2016), our ensuing challenges in replicating the core findings, and reflect upon what we learned about the pre-registration process as a result. Next, we will present a more recent study (Gehlbach, Robinson, Finefter, Benshoof, & Schneider, online July 25, 2017) as a contrasting case of pre-registration.

Preliminary Ideas for Pre-Registration Norms in Education

From these two learning experiences, we will broaden the discussion to speak more generally about how to instantiate pre-registration as a norm in education. Specifically, we will present some preliminary guidelines that the research community can experiment with to see whether a set of new norms can improve the efficacy of educational research (see Table 1 for examples). To spark a lively discussion, we plan to pose important questions ranging from whether qualitative and/or correlational studies should be pre-registered to how pre-registration might dovetail with other emerging research norms such as study registries, registered reports, and changing conventions around statistical reporting.

Conclusions

Within and beyond the academy, the consequences of illusory results can be immensely demotivating. Even for scholars who publish only work of unimpeachable integrity, some portion of their knowledge base comes from other scientists. Likewise, when practitioners and policy-makers cannot disentangle genuine findings from fake, they may rely on bad research or their gut intuition guide their decision-making. Instituting a norm of pre-registering studies in education could mitigate these problems substantially. As leaders in methodological rigor within education, the scholars at SREE are ideally positioned to begin adopting and modeling this new norm for the rest of the field.

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Table 1. Guidelines and Practices for Pre-Registration in Education

For individual researchers	Pre-register hypothesis-testing studies
	Determine if the research is hypothesis-testing or exploratory. If at least part of the research can be categorized as having a falsifiable hypothesis, pre-register the study in a public, online repository such as Open Science Framework (https://osf.io/), AsPredicted (https://aspredicted.org/) or at the Society for Research on Educational Effectiveness (https://www.sree.org/pages/registry.php).
	Be transparent in describing the study design
	Provide enough transparency and detail with regards to the study design for any other researcher to collect identical data and make identical decisions.
	Leave only one path (or process) per hypothesis.
	Pre-specify all hypotheses that are to be tested. Provide all the information for another researcher to replicate the data cleaning and analytic procedures, including equations and pre-specified covariates. When it is not possible to pre-specify all decision-forks, researchers can pre-specify the decision-making processes to leave only one path per hypothesis.
	Split up the results section
	Do not limit the amount of data collected in a study for fear of having to report it all; do not avoid publishing exploratory analyses. Instead, clearly signal the difference between pre-specified and exploratory findings in the results section.
For the field	Encourage pre-registration
	Education journals can have entire issues or sections dedicated to pre-registered studies.
	Borrow liberally from other disciplines and fields
	Because other disciplines have begun to develop practices and approaches to pre-registering studies, and because education is an interdisciplinary field, we are well-positioned to learn from the mistakes of others and adopt their best practices.
	Allow for iterations in the pre-registration process
	Allow scholars to amend original pre-registrations to account for the inevitable messiness of conducting studies in "real-world" education settings (e.g., unanticipated violations of procedures). However, ensure that all amendments are posted prior to any examinations of data.