Overlooked, Underlying: Understanding tacit criteria of proposal reviewing during a mock panel review

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Abstract

This research paper study was situated within a peer review mentoring program in which novice reviewers were paired with mentors who are former National Science Foundation (NSF) program directors with experience running discipline-based education research (DBER) panels. Whether it be a manuscript or grant proposal, the outcome of peer review can greatly influence academic careers and the impact of research on a field. Yet the criteria upon which reviewers base their recommendations and the processes they follow as they review are poorly understood. Mentees reviewed three previously submitted proposals to the NSF and drafted pre-panel reviews regarding the proposals' intellectual merit and broader impacts, strengths, and weaknesses relative to solicitation-specific criteria. After participation in one mock review panel, mentees could then revise their pre-review evaluations based on the panel discussion. Using a lens of transformative learning theory, this study sought to answer the following research questions: 1) What are the tacit criteria used to inform recommendations for grant proposal reviews among scholars new to the review process? 2) To what extent are there changes in these tacit criteria and subsequent recommendations for grant proposal reviews after participation in a mock panel review? Using a single case study approach to explore one mock review panel, we conducted document analyses of six mentees' reviews completed before and after their participation in the mock review panel. Findings from this study suggest that reviewers primarily focus on the positive broader impacts proposed by a study and the level of detail within a submitted proposal. Although mentees made few changes to their reviews after the mock panel discussion, changes which were present illustrate that reviewers more deeply considered the broader impacts of the proposed studies. These results can inform review panel practices as well as approaches to training to support new reviewers in DBER fields.

Keywords: Peer Review, Transformative Learning Theory, Grant Proposal Review, Case Study

Introduction

The successful funding of grant proposals can be imperative to an academic researcher's career. The outcome of these highly competitive proposal submissions can affect the productivity and interests of researchers at all career stages from graduate students to tenured department heads. Beyond the individual factors, funded proposals can influence the direction and growth of each discipline and general scientific knowledge and priorities based on the tendency for funded research to be published in highly ranked journals and to be highly cited [1]. The outcome of these grant proposal submissions is typically reliant on peer review. However, reviewers often receive minimal training on best practices of peer review, and the criteria upon which reviewers make their recommendations are poorly understood [2].

These issues are likely in part to blame for the continued inequities in grant funding due to race, gender, and institution prestige, even in redacted reviews [3]–[5]. Prior literature shows that reviewers have implicit biases and personal epistemologies that influence their reviews [6]–[8]. Additionally, previous studies by our group have investigated these issues in the manuscript peer

review process for engineering education research (EER) and found discipline background, cultural expectations, and level of experience to all be highly influential upon how reviewers conduct their evaluations and what they specifically mention in their summaries to editors and authors [9], [10]. The evaluation considerations for proposals are likely even more complex due to the use of review panels by many major funding agencies. While manuscript reviews are typically done individually, review panels can turn the evaluation process into more of a discussion, sometimes a negotiation, among researchers.

In such a discussion, the individuals involved may change their opinions due to changes in their previously formed perceptions (also known as schema) [11]. In the reconfiguration of one's schema, an individual begins with a previously formed idea about a person or event, assimilates new knowledge, and then accommodates their previous understanding to fit this new information [12]. Similar to schema development, transformative learning occurs in phases beginning with disjunction from a set expectation, an assessment of one's self, recognition that some change is needed, making this change, and then reorienting the change into one's life [13], [14]. Much of this learning is done by self-reflection of the content, process, or context where schema reorientation is required and can lead to a better understanding of diverse perspectives and new ideals. By promoting self-reflection and transformative learning, individuals can find themselves with broader perspectives and open themselves to the promotion of systemic changes. Similarly, transformative learning may also take place through a collaborative or team-oriented process such as proposal review panels, particularly where senior reviewers are able to reorient expectations in younger reviewers [11].

Using a lens of transformative learning theory, this research paper seeks to answer the following research questions: 1) What are the tacit criteria used to inform recommendations for grant proposal reviews among scholars new to the reviewer process? 2) To what extent are there changes in these tacit criteria and subsequent recommendations for grant proposal reviews after participation in a mock panel review? To our knowledge, no study has evaluated how researchers develop the skills to conduct proposal reviews and how the process itself could allow for the development of more inclusive and constructive peer review practices.

Literature Review

A consistent critique of the peer review process is its lack of reliability, where variability in reviewer feedback can often make it seem like the "luck of the draw" for funding decisions [15]. For instance, in an analysis of grant reviews conducted by the Australian Research Council, Marsh et al. (2008) found that North American reviewers tended to give much more lenient reviews that had little inter-rater reliability [16]. In contrast, Australian reviewers were much harsher and evidenced greater convergence in their ratings. Within this same study, researchers also found that reviewing higher numbers of grant proposals led reviewers to more consistent recommendations. Additionally, what defines *quality* and *value* in a manuscript or grant proposal review is not well studied or understood and may vary by discipline [10], [17]

Considering all of these factors, it can be extremely difficult to find not only well-qualified but also willing peer reviewers. Some authors have identified that while some issues in acquiring reviewers are due to compensation, many are due to barriers caused by lack of training and

confidence on the part of potential reviewers [18]. More than 70% of researchers decline invitations to be a peer reviewer, citing a lack of technical knowledge, time, and training as reasons [19]. Warne (2016) estimates that 39% of peer reviewers have never participated in any training or mentorship. Among the 61% of reviewers who have received training or mentorship, less than one third had received formal training, with the remaining majority following either journal guidelines or being advised by a colleague or supervisor [2].

Recently, several journals in various fields have begun offering formal training in peer review through mentored reviewer programs [20]–[24]. Results from these programs include higher quality reviews and increased confidence of novice reviewers to conduct reviews in their field [9], [10], [25]. To our knowledge, similar programs have not yet been formed for grant proposal peer review beyond workshops. Mentored review programs allow novice reviewers to develop a schema for reviewing scholarship in their field [9]. Through the pairing of senior peer reviewers with novice peer reviewers, novice peer reviewers are likely to engage in transformative learning through the reflection, reorientation, and realignment of their own reviewing criteria into their new reviewing habits. In the context of this study, we seek to understand if participants alter their implicit and explicit reviewing criteria through this mentoring process. Findings will allow for more transparency in the peer review process and allow for the formation of evidence-based practices that can be used for training purposes to produce higher quality reviews that are less prone to implicit biases and a lack of reliability.

Background and Methods

Overview of Study

This study was an instrumental, single case study analysis from one mock review panel conducted during a proposal peer review education program [26]. Data were collected from six participants situated within a larger proposal peer review program. Participants in the program (n= 24; 6 mentors and 18 mentees) were formed into six quads (one mentor and three mentees), each of which were assigned three proposals to read and review. Three mock review panels were held with one mentee from each quad (Figure 1). Mentors from the quads acted as program directors during the mock review panels. Program activities are briefly summarized here, with more detail on logistics and evaluation explained in [redacted]. Data collected for this project include: individual pre and post review summaries, panel summary statements, panel observations, focus group recordings, and exit surveys. All data were collected and analyzed in accordance with [redacted] IRB [redacted].

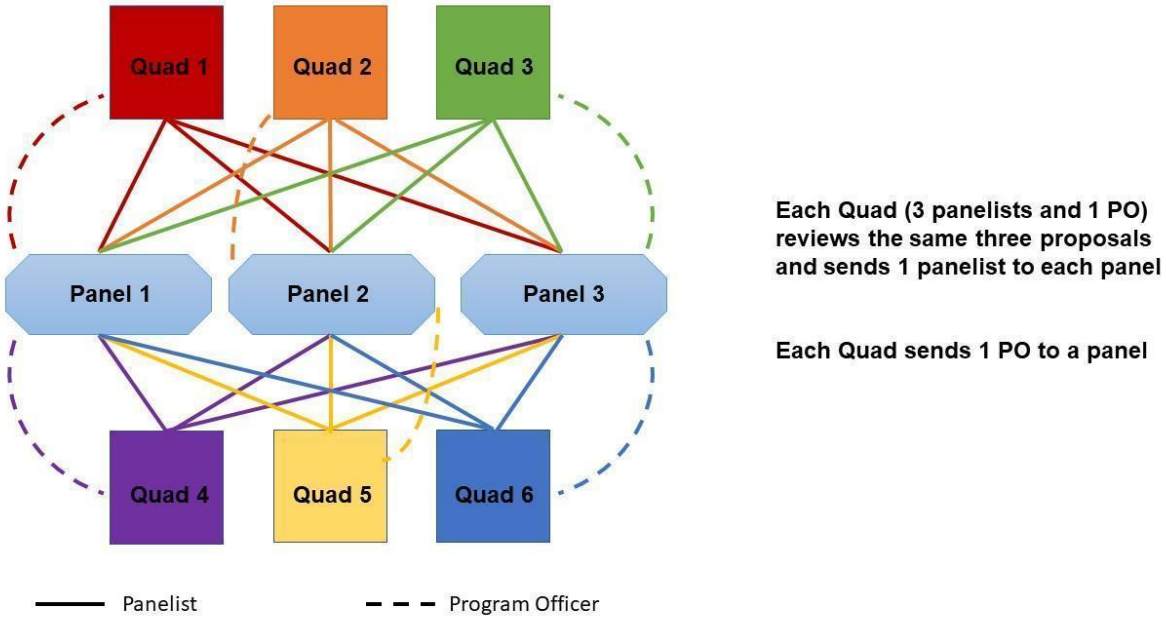

Figure 1: Mock review panel structure for the proposal review panel. One panel was used as the basis for this study.

Participant Selection and Background

The 18 mentees in the cohort were selected through a competitive, online application process that collected contact information, demographic information, and professional background, specifically about their Ph.D. concentration and year of degree, current position, relevant EER experience (e.g., publications, presentations, and reviewing history), confidence reviewing EER manuscripts, and the number of EER colleagues with whom they regularly interact. Special consideration was given to individuals deemed "lone wolves" who were not well-connected to an EER network and diverse participants who may not have been previously connected to the EER community [27]. Mentors were invited to participate based on their experience in EER, prior experience being NSF program directors and their desire to help advance EER through peer review. Participants' experience levels included graduate students, postdoctoral researchers, and faculty. Mentees had varied backgrounds in social sciences, engineering, and engineering education.

Data Collection

Data collection in this study focuses on one mock review panel. All mentees in the review panel (n=6) were asked to review three previously submitted NSF engineering education proposals and complete a Google Form with their final ratings, a statement about the intellectual merit and broader impacts of each proposal, and a summary statement (Table 1). Mentees then discussed these proposals amongst their review panels before making final edits to their previously written summary statements. Pre- and post-panel individual summary statements from one mock review panel (n=18 pre- and post- statements) were used as the focal data in this study.

Table 1: Prompts for writing the proposal review summaries (modeled after the National Science Foundation's Fastlane system). The results in this study focus on responses to 5. Summary Statement.

Proposal Review Summary
1. Overall Rating (5=poor - 1=excellent)
2. What is the intellectual merit of the proposed activity?
3. What are the broader impacts of the proposed activity?
4. (Optional) Solicitation specific review criteria
5. Summary Statement
6. (Optional) Conflicts of Interest

Code Development

Open coding was conducted on summary statements to develop a set of initial codes. After the initial codes were created, inter-rater reliability (IRR) testing was performed and codes were refined between two coders and organized into four themes with potential sub codes of positive, negative, or suggestion (Table 2). Once IRR reached at least 70%, fourteen set codes were established and all documents were coded by one of the two coders [28].

Data Analysis

Coded statements were further analyzed to conduct frequency counts to further inform the analysis (Table 2), specifically with respect to RQ 2 (the extent to which criteria and recommendations changed after the mock review panel). All coded statements were analyzed to determine relevant aspects of proposals that reviewers evaluated in their pre- summary statements. Summary statements which changed pre- to post- were evaluated individually for themes in changes.

Table 2: Codebook organized by major themes found during the open coding process. Codes with an asterisk* indicate the potential for negative, positive, and suggestion subcodes. The frequency count for each code is reported as a percentage of total codes assigned.

Major Themes	Code Label	Code Name	Definition	Pre-Frequency Counts (%)
Proposal Style Quality	PQ3*	Details	Evaluates the overall details or description of the proposal	23.1
Overview	O2	Summarizes Project	Summarizes the project	20.5
Major Outcomes	MO1*	Broader Impacts	Evaluates societal impacts resulting from the proposal	17.9
Proposal Components	PC2*	Methods	Evaluates the methods being proposed	6.4
Overview	O1	Final Recommendation	References the reviewers' final recommendation	6.4
Overview	O3*	Project Feasibility	Evaluates the ability of the project to be implemented	6.4
Proposal Components	PC1*	Team Members	Evaluates the overall qualifications of the research team	5.1
Major Outcomes	MO2*	Intellectual Merit	Evaluates the intellectual merit of the proposal	3.8
Proposal Style Quality	PQ1*	Layout	Evaluates the layout of the proposal	3.8
Overview	O5	Personal Feelings	References their personal feelings on the project or how it could potentially impact their lives	2.6
Proposal Style Quality	PQ2*	Writing Quality	Evaluates the quality of the writing for the proposal	2.6
Overview	O4*	Solicitation Specific Criteria	Evaluates the proposal in terms of the solicitation	1.3

Results

Summary statements typically restated proposal contents.
Exactly half of all summary statements contained an objective summary of the proposal (this was also 20.5% of the total number of codes applied; refer to Table 2), with many statements only summarizing the proposal without any evaluation statements. These summaries often included specific details about the proposals and restated research questions or goals within the proposal.

Reviewers often positively cite broader impacts.
When evaluation statements were given, these were primarily focused on the broader implications given by proposals. These included impacts to specific communities or populations, systemic changes, and broad changes to the field of engineering. Most mentions of broader impacts were highlighted positively, as 85.8% of MO1 codes were positive comments. One participant shares their evaluation on a proposal's broad impacts:

> *Furthermore, the research planned in the proposal begins to help individuals understand hidden curricula mechanisms via mentoring, social support programs, and reflective/culturally relevant academic and social integration models in engineering.*

As shown by this quote, positive impacts of broader impacts are often highlighted, but not explicitly evaluated in summary statements. Across summary statements, reviewers differed in their focus on breadth versus longevity of these broader impacts. In contrast to reviewers' frequent comments about broader impacts, they rarely mentioned intellectual merit (3.9% of total codes assigned). When intellectual merit was mentioned, it was vaguely evaluated as "good," "acceptable," or "poor."

Reviewers made the most negative comments and suggestions about project design.
The highest frequency of coded sections were in evaluations of the detail of the proposal (PQ3; 23.1% of total all codes). Evaluations on the detail of the proposal typically focused on the methods, purpose, and prior research outlined in the proposal. These were almost always negative and followed by an improvement suggestion. One participant suggests:

> *The risk-management plan is an apt addition, it stands well on its own but could be strengthened by expanding on how to mitigate risks in the Interpretation and Implementation phases of the project.*

Pre- to post- changes focused on adding more descriptive evaluative comments.
Only three summary statements (out of 18) contained content changes from before to after the mock review panels (two of these statements were from the same individual). In all three statements, negative language was removed and replaced with more positive statements or suggestions. While the pre- statements mainly contained summaries of the proposals, the post- statements gave more explicit evaluations and details. Two post- statements added evidence from the proposal to support their final ratings and recommendations. One post- statement expanded on the reviewer's summary to include elements from the proposal's intellectual merit and broader impacts (changes indicated in bold):

Pre: *Though I think the project is interesting, there was some disconnect with what the proposal claimed to accomplish and what it described the plan to do that would be. Additional information would help better explain what collaboration with other organizations would look like, and what interventions could be developed.*

Post: *Though I think the project is interesting, there were, i****n some parts****, disconnects with what the proposal claimed to accomplish and what it described the plan to do that would be.* ***However, the plans for the instrument development were strong as described in phases 1 and 2 of the project.*** *Additional information would help better explain what collaboration with other organizations would look like, and what interventions could be developed,* ***but despite this weakness I still believe the plan is worth funding****.*

Discussion

This study sought to answer the following research questions on outcomes of a mentored proposal review program through analysis of reviewer summary statements: 1) What are the tacit criteria used to inform recommendations for grant proposal reviews among scholars new to the review process? 2) To what extent are there changes in these tacit criteria and subsequent recommendations for grant proposal reviews after participation in a mock panel review?

From our analysis of reviewer summary statements we identified three main focuses of summary statements: 1) Restatement of the proposal's main objectives/purpose, 2) Positive evaluations of broader impacts in the proposal, 3) Negative evaluations on the level of detail within the proposal. These results suggest that these reviewers focused heavily on the potential broad impacts outlined in a proposal and how they positively relate to the broader community or systemic changes. Additionally, because most statements on broader impacts were positive, reviewers likely focused on the potential of these impacts rather than how they could be expanded on or improved. Reviewers also highlighted deficiencies in the details contained in reviewed grant proposals. These focused on multiple elements of proposals from proposed methods to prior research conducted by team members and the principal investigator. In these cases, reviewers almost always provided suggestions for improvement. Although broad impacts are an explicit reviewing criteria deemed by NSF, the reviewers' highly positive evaluations and their focus on breadth of impact provides insight into the tacit criteria used by reviewers. Because the amount of detail provided for each section of an NSF proposal is not well-specified in a call for proposals, the evaluation of details by reviewers is more tacit in nature as well. These findings give an overall greater depth of insight into what criteria beyond that specified by NSF reviewers use to evaluate proposals.

Due to our small sample size, we could not quantitatively evaluate the relationship between positive and negative reviewer comments (indicative of reviewing criteria) versus the overall proposal ratings. Future research should further investigate the relationship between positive and negative evaluations and overall proposal ratings using quantitative measures.

In both the case of broader impacts and details, reviewers gave brief evaluations on *what* was positive or negative, but not *how* this impacted their overall recommendation of the proposal. Our data showed few (three out of 18) reviewers changed their reviews from pre- to post- mock panel review. In all of these reviews, statements initially consisted of only summaries. However, after being edited post-panel discussion, all reviewers added explanations on their final ratings including evaluations of the intellectual merit and broader impacts. To further explore potential changes in review criteria before and after mock review panels, additional components of the proposal review summary including the broader impacts, intellectual merits, and solicitation specific criteria sections (and the summary statements from the two additional panels in the mock review program) will be analyzed in the future. These data could reinforce our initial findings and provide additional insights to our research questions.

Implications for the Proposal Review

Findings from this study suggest that novice peer reviewers in a mentored proposal reviewer program focused primarily on both broad impacts suggested by proposals and the amount of detail (depth and breadth) contained in the proposal, but did not draw clear connections between these criteria and their final recommendations. However, in summary statements that the reviewers edited after the mock review panel, explicit connections were drawn between evaluations and final recommendations. Although changes between the pre- statement and post-statement only occurred in three of the 18 statements, there is some evidence to suggest that reviewers may have gained a clearer understanding of the reasoning behind their recommendations after reviewing with their panels. This evidence is derived from the deeper explanations written within the summary statements themselves such as stating how their final recommendations were impacted by specific proposal components. These suggestions would align with later stages of transformative learning where individuals begin to identify changes that may be needed and re-orient themselves to implement these changes [14], [29]. Similarly, previous literature on schema development in team settings has found that individuals are able to make clearer and deeper connections when engaged in discourse with others [30]. While more research is needed to solidify this conclusion, and why this may occur, there are potential implications to the benefits of participating in a proposal review panel and the collective thinking that occurs within. Implications such as these could potentially lead to a deeper understanding of one's own implicit biases as they review and what truly contributes to their final rating of a proposal.

Interestingly, outside of broader impacts, very few other critical aspects of submitted proposals were deeply evaluated by the novice reviewers in their summary statements. Of particular note was their lack of evaluation on the intellectual merit and quality of methods within the proposed studies. Other studies on manuscript review have noted that reviewers rarely comment on elements of manuscripts that they may be less familiar with or are uncomfortable giving feedback on [31]. It is possible that this could also be the case in proposal review, particularly for

novice reviewers. Although our results do not provide evidence as to how or why this occurs, this may highlight a potential area of focus for future proposal review professional development initiatives. These results also have the potential to inform future iterations of mentoring and training programs. Through specifying particular areas of focus in these programs, mentors can promote transformative learning for their mentees, leading towards more detailed and inclusive proposal reviews.

Limitations

All participants in this study were novice proposal reviewers who had minimal experience with grant writing and little to no experience with reviewing. Therefore, interpretations of our findings should be limited to those new to proposal reviewing, and would likely differ in experienced reviewers. Additionally, all proposals included in this study were used for demonstration purposes and were already accepted and funded NSF projects, which may have limited the depth of reviewers' evaluations of the proposals. These proposals were also submitted for a variety of calls, requiring reviewers to keep multiple calls in mind during mock review panels. In a true NSF proposal review panel, submitted projects would likely have a wider variety of quality (i.e., both competitive and not competitive proposals) and more adherence to the call for proposals.

Future Directions

This research study is the first phase of a larger project on peer reviewing processes for grant proposal reviewing. Plans for future work include analysis of two additional panel reviewer summary statements, written documentation from panelists outlining explicit strengths and weaknesses of broader impacts, intellectual merit, and solicitation specific criteria,and observations of interactions between the participants (novice reviewers with each other and their mentors) during the mock review panel. In future iterations of the program, we also hope to investigate experienced proposal reviewers (our mentors/previous NSF program officers) to better understand their perspectives on reviewing criteria. From a combination of this research study and future projects, we hope to gain a better understanding of what novice and experienced reviewers focus on during the review process, why they focus on specific elements, how proposal reviewers develop their schema for reviewing, and what convergence (if any) that there is between novice and experienced reviewers through peer review professional development .

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