Let's Write About Impact!: Creating Persuasive Impact Statements to Disseminate and Propagate RED Research

Dr. Julia M. Williams, Rose-Hulman Institute of Technology

Dr. Julia M. Williams is Professor of English at Rose-Hulman Institute of Technology. Her research areas include technical communication, assessment, accreditation, and the development of change management strategies for faculty and staff. Her articles have appeared in the Journal of Engineering Education, International Journal of Engineering Education, IEEE Transactions on Professional Communication, and Technical Communication Quarterly, among others.

Dr. Cara Margherio, University of Washington

Cara Margherio is the Assistant Director of the UW Center for Evaluation & Research for STEM Equity (CERSE). Cara's work examines the social mechanisms which may transform the production of inequalities within STEM higher education. Her research is grounded in critical race and feminist theories, and her research interests include community cultural wealth, counterspaces, intersectionality, and institutional change.

Dr. Eva Andrijcic, Rose-Hulman Institute of Technology

Eva Andrijcic serves as an Associate Professor of Engineering Management at Rose-Hulman Institute of Technology. She received her Ph.D. and M.S. in Systems and Information Engineering from University of Virginia, where she worked at the Center for Risk Management of Engineering Systems. She received a B.S. in mathematics from Randolph-Macon Woman's College. Her major interests are in the areas of risk analysis and management, critical infrastructure management and protection, interdisciplinary engineering education, and risk education.

Dr. Elizabeth Litzler, University of Washington

Elizabeth Litzler, Ph.D., is the director of the University of Washington Center for Evaluation and Research for STEM Equity (UW CERSE) and an affiliate assistant professor of sociology. She has been at UW working on STEM Equity issues for more than 17 years. Dr. Litzler is a member of ASEE, 2020-2021 chair of the ASEE Commission on Diversity, Equity, and Inclusion, and a former board member of the Women in Engineering ProActive Network (WEPAN). Her research interests include the educational climate for students, faculty, and staff in science and engineering, assets based approaches to STEM equity, and gender and race stratification in education and the workforce. She was awarded the 2020 WEPAN Founders Award.

Dr. Sriram Mohan, Rose-Hulman Institute of Technology

Sriram Mohan is a Professor of Computer Science and Software Engineering at Rose-Hulman institute of Technology. Sriram received a B.E degree in Computer Science and Engineering from the University of Madras and M.S and Ph.D. degrees in Computer Science from Indiana University. During his time at Rose-Hulman, Sriram has served as a consultant in Hadoop and NoSQL systems and has helped a variety of clients in the Media, Insurance, and Telecommunication sectors. In addition to his industrial consulting activities, Sriram maintains an active research profile in data science and education research that has led to over 30 publications or presentations. At Rose-Hulman, Sriram has focused on incorporating reflection, and problem based learning activities in the Software Engineering curriculum. Sriram has been fundamental to the revamp of the entire software engineering program at Rose-Hulman. Sriram is a founding member of the Engineering Design program and continues to serve on the leadership team that has developed innovative ways to integrate Humanities, Science, Math, and Engineering curriculum into a studio based education model. In 2015, Sriram was selected as the Outstanding Young Alumni of the year by the School of Informatics and Computing at Indiana University. Sriram serves as a facilitator for MACH, a unique faculty development experience, aimed at helping faculty and administrator develop a change agent tool box

Let's Write About Impact!: Creating Persuasive Impact Statements to Disseminate and Propagate RED Research

Principal investigators (PIs) and project teams funded by the National Science Foundation are familiar with the requirement to discuss the impact of their research. Whether the discussion appears in a new proposal, or as part of annual or final reporting, describing the impacts of a project is key to demonstrating the value of the work itself. PIs and project teams typically do not, however, consider the ways in which their reporting on impacts can help them disseminate their work to stakeholders and propagate their innovations to other researchers. The difficulty stems in part from what we mean by "impact." London noted the lack of "frameworks" that could "help provide a shared language and understanding of impact as researchers communicate among themselves and share impact insights with those outside the community. However, within the context of engineering education, there is no shared vocabulary for discussing the impact of research or a framework that characterizes the impact of federal investments in undergraduate engineering education research [1]." Brewer also cites the lack of shared definitions, particularly related to who is impacted by the research [2]. For these reasons, our work to improve impact statements started with a focus on meanings and language in impact statements. Specifically, impact statements can be useful to National Science Foundation (NSF) program officers who are often in the position of informing about and advocating for the projects under their management. These impact descriptions form the foundation for teams to persuasively disseminate their work.

As part of our work to support the NSF Revolutionizing Engineering Departments (RED) program, we have developed a tutorial on the topic of impacts. The tutorial was designed to help proposal and report writers capture what is impactful about their projects and communicate that impact to multiple audiences (e.g., the NSF program officer, stakeholders for the project, etc.). We piloted the tutorial during the 2019 RED Consortium Meeting to the 21 RED teams in attendance. In this paper, we present the contents of the tutorial and suggest ways in which it can be used by others (not just RED team members) to improve impact statements for the purposes of dissemination and propagation.

Tutorial Context

The authors of this paper work together on the RED Participatory Action Research (REDPAR) project, a practice-research project that provides faculty development support in change leadership to teams funded through the National Science Foundation RED program. One element of our work with RED teams is organizing the annual RED Consortium Meeting where all RED teams meet, exchange ideas, and engage with the change leadership curriculum developed for them. In advance of the November 2019 consortium meeting, the program officer

overseeing both the RED and REDPAR projects sought our advice regarding an opportunity he saw within the RED program, namely the need for more effective impact reporting in annual and final reports. Improving impact reporting could, he believed, facilitate more effective dissemination of RED project achievements throughout NSF. In collaboration with the officer, we developed the impacts tutorial and deployed it at the 2019 meeting of the consortium.

During a plenary session involving members of 21 RED teams, we introduced the tutorial objectives with the following set of learning outcomes:

As a result of this session, participants will be able to:
- identify the components of effective impacts reporting in samples from NSF RED reports,
- draft impacts responses to specific questions that serves the needs of stakeholders,
- develop a process for identifying and communicating "nuggets" from their RED projects.

The "nuggets" referred to here are brief (roughly 150 words) reports on RED project activities, collected quarterly by the REDPAR team members, and then shared with the NSF program officer. The program officer requested that our tutorial include directions for writing "nuggets," a practice that he wished to encourage among the RED teams. "Nuggets" were introduced for the first time at the 2019 Consortium meeting, so we spent time during the session explaining "nuggets," how they should be composed, and how frequently they should be shared. A more detailed explanation of "nuggets" is included in a later section of this paper.

In addition to the session goals stated at the start of the tutorial, we also included the NSF specifications about impacts reporting that is required in Annual Reports for grant recipients. As the NSF Proposal and Award Policies and Procedures Guide (PAPPG) states,

Program officers at NSF use Annual Reports to understand:
- progress toward the goals of a project,
- activities executed as part of the project, and
- outcomes and impact of the project.

Our plenary session at the RED Consortium Meeting also included informal suggestions from the current NSF Program Officer for the RED program. As a result of these suggestions, we hoped to encourage attendees to consider impacts from a new perspective:

Impacts are the ways in which the project and its activities have **changed how we think about, perform, interpret, or disseminate research**. The Impacts section ***should not* be a list of activities, goals, or objectives.** The Impacts section should include a ***synthesis of the meaning and value* of the activities, goals, or objectives**. (Emphasis added)

Attendees were asked to reflect on answering questions about impact, questions such as: 1) What can we do now that we previously could not do? and 2) What is different about our ability to do research, educate students, engage with policy makers, etc. as a result of this work?

Tutorial Activities

After orienting attendees to the tutorial objectives, we formed groups made up of representatives from different RED teams. These groups were charged to work together on a series of activities that would help them think and write about impact. The design of the workbook was key to helping these groups understand their tasks (see Figure 1 for an example page from the workbook).

Currently there are six questions about impact included in the Annual Report template. At the RED Consortium session, we presented each question in the workbook on a separate page, and for each question, we provided a sample response submitted by a RED team. In order to help each attendee understand the nature of the example response, we provided a comment or "gloss"; the gloss was intended to highlight the response's specific features and strengths that made it a model of impacts reporting (in Figure 1, the gloss is provided in the callout box next to the response). In addition to the glossed example, additional information and suggestions from the program officer were provided at the bottom of the workbook page and were meant to provide further guidance.

Equipped with the workbook, each group was instructed to read and discuss the impact question, the sample response, the gloss, and the informal suggestions. Based on the provided information, we asked each group to write a draft response to the question using one of the RED projects represented at the table as the basis for their draft. The work of each group was then shared during a concluding discussion, with time provided for questions. Following the discussion, individuals returned to their RED teams and discussed how they could improve their impact statements in future annual reports using the impacts template and associated information as a guide.

Models of Impacts Reporting

Report Question 1: What is the impact on the development of the principal discipline(s) of the project?

From the UNM Annual Report

The principal disciplines of this work include (1) **engineering education research and pedagogy**, especially within the technical domain of chemical engineering and related to professional engineering identity development, including for diverse students;(2) **organizational change management**, especially related to changing faculty beliefs and practices to align to an asset-based approach

> The authors define what the discipline(s) are and specify related themes. They then use these categories to organize the rest of the section.

Our research has resulted in local impacts, both through conducting the research process, and because the peer-review process provides convincing validation of our approach, reinforcing the change process.

We have changed the beliefs CBE faculty hold about our students, and **many have changed the ways they teach**. For instance, because we found that teams that included rural students argued for economically-viable solutions, we changed our teaching; specifically, we now explicitly position rural and low-income students as having relevant expertise when introducing design challenges that address rural communities. Since beginning to do this, we have had very few (3 across five semesters) teams propose high-cost solutions.

> The authors explain what has been impacted and how, using specific examples to illustrate the change.

Informal suggestions from Ed: focus on the importance and utility of a new method you have developed, a new/improved theoretical framework, or the genesis of new research questions that could stimulate further research.

Figure 1: Impacts reporting, question 1, from the session workbook. Gloss comment in the box on the right.

Developing "Nuggets"

In addition to asking attendees to draft impact statements, we introduced a template for writing "nuggets." The nuggets are brief, 150 word reports on RED activities that could be used by the program officer in his efforts to inform stakeholders within NSF about progress and achievements of RED projects. As part of the tutorial, we introduced RED team members to a new process for collecting "nuggets" quarterly via a Google form. Once compiled, REDPAR would share the information with the program officer for his use. In addition to the introduction to the form that "nuggets" should take, we allowed time for RED team members to do an initial brainstorming session on possible topics for their first "nuggets" (see Figure 2).

"Nuggets" Brainstorming

In order to facilitate communication between RED teams and NSF, we are developing a process whereby "nuggets" are collected regularly. "Nuggets" represent items of interest that emerge from your RED project and can be used to communicate the vitality of the RED program to stakeholders (e.g., NSF, other departments on your campus, external stakeholders, etc.). In each cell below, take a moment to brainstorm a "nugget" that relates to the suggested topic. For example, you might consider a specific change that has led to an improvement in student learning or faculty teaching. **Try not to pre-judge the "nugget" as too minor or insignificant!**

Nugget = RED activity + RED stakeholders + statement of impact

> **Faculty Development**
>
> Our faculty PD workshops targeted mid-career faculty teaching in the UG program, introduced them to active learning strategies, and as a result 75% of our 2nd and 3rd year courses now use active learning routinely (with all the consequent benefits to students related to active learning…).

Figure 2: Introduction to "Nuggets" Brainstorming (from the session workbook)

Conclusion

As of 2021, RED teams have submitted their 2020 annual reports, while a few of the teams have completed their grants and submitted final reports. At this time, we have not assessed the impact of the tutorial session on these reports. We have, however, collected 74"nuggets" that were contributed by 11 RED teams. REDPAR has also contributed "nuggets" that discuss the impacts that our work is having on the RED teams we collaborate with. These brief impact reports will, we hope, provide stakeholders with a clear sense of the ways in which RED and REDPAR contribute to the transformation of undergraduate engineering education.

References

[1] London, J. A content analysis of how STEM education researchers discuss the impact of their publicly-supported research. *International Journal of Engineering Education*, *34*(3), 1120-1137, 2018.

[2] Brewer, J.D. The impact of impact. *Research Evaluation*, 20(3), 255–256. 2011. DOI: 10.3152/095820211X12941371876869.