**2023 Annual Conference & Exposition**
Baltimore Convention Center, MD | June 25 - 28, 2023

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Paper ID #37960

# Board 333: Lessons Learned Doing Secondary Data Analysis in EER

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Jennifer Case is Head and Professor in the Department of Engineering Education at Virginia Tech, with an honorary position at the University of Cape Town. Her research on the student experience of learning in engineering education has been widely published.

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Dr. Holly Matusovich is the Associate Dean for Graduate and Professional Studies in the College of Engineering at Virginia Tech and a Professor in the Department of Engineering Education where she has also served in key leadership positions. Dr. Matusovich is recognized for her research and leadership related to graduate student mentoring and faculty development. She won the Hokie Supervisor Spotlight Award in 2014, received the College of Engineering Graduate Student Mentor Award in 2018, and was inducted into the Virginia Tech Academy of Faculty Leadership in 2020. Dr. Matusovich has been a PI/Co-PI on 19 funded research projects including the NSF CAREER Award, with her share of funding being nearly $3 million. She has co-authored 2 book chapters, 34 journal publications, and more than 80 conference papers. She is recognized for her research and teaching, including Dean's Awards for Outstanding New Faculty, Outstanding Teacher Award, and a Faculty Fellow. Dr. Matusovich has served the Educational Research and Methods (ERM) division of ASEE in many capacities over the past 10+ years including serving as Chair from 2017-2019. Dr. Matusovich is currently the Editor-in-Chief of the journal, Advances in Engineering Education and she serves on the ASEE committee for Scholarly Publications.

**Dr. Marie C. Paretti, Virginia Tech**

Marie C. Paretti is a Professor of Engineering Education at Virginia Tech, where she directs the Virginia Tech Engineering Communications Center (VTECC). Her research focuses on communication, collaboration, and identity in engineering.

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Lisa Benson is a Professor of Engineering and Science Education at Clemson University, and the past editor of the Journal of Engineering Education. Her research focuses on the interactions between student motivation and their learning experiences. Her projects include studies of student perceptions, beliefs and attitudes towards becoming engineers and scientists, and their development of problem-solving skills, self-regulated learning practices, and epistemic beliefs. Other projects in the Benson group involve students' navigational capital, and researchers' schema development through the peer review process. Dr. Benson is an American Society for Engineering Education (ASEE) Fellow, and a member of the European Society for Engineering Education (SEFI), American Educational Research Association (AERA) and Tau Beta Pi. She earned a B.S. in Bioengineering (1978) from the University of Vermont, and M.S. (1986) and Ph.D. (2002) in Bioengineering from Clemson University.

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Susan Lord is Professor and Chair of Integrated Engineering at the University of San Diego. She received a BS from Cornell University in Materials Science and Electrical Engineering (EE) and MS and PhD in EE from Stanford University. Her research focuses on the study and promotion of equity in engineering including student pathways and inclusive teaching. She has won best paper awards from the Journal of Engineering Education, IEEE Transactions on Education, and Education Sciences. Dr. Lord is a Fellow of the IEEE and ASEE and received the 2018 IEEE Undergraduate Teaching Award. She is a coauthor of The Borderlands of Education: Latinas in Engineering. She is a co-Director of the National Effective Teaching Institute (NETI).

**Rhonda Papp, University of San Diego**
**Edward Tyler Young, The Ohio State University**

Edward "Tyler" Young is a graduate student at The Ohio State University currently pursuing a Master of Science in Aerospace Engineering and a Ph.D. in Engineering Education. He graduated summa cum laude from Case Western Reserve University with a Bachelor of Science in Aerospace Engineering before embarking on a career in STEM education.

**Dr. Yevgeniya V. Zastavker, Olin College of Engineering**

Yevgeniya V. Zastavker, Ph.D., is a Professor of Physics and Education at Olin College of Engineering and a recent Director of the Research Institute for Experiential Learning Science at Northeastern University. She earned her B.S. degree in Physics from Yale University and holds a Ph.D. in biological physics from MIT.

Dr. Zastavker's research interests lie in the field of STEM education with specific emphasis on innovative pedagogical and curricular practices at the intersection with the issues of gender and diversity. Dr. Zastavker is currently involved in an NSF-supported project to understand students' motivational attitudes in a variety of educational environments with the goal of improving learning opportunities for students and equipping faculty with the knowledge and skills necessary to create such opportunities. This work is integrated with Dr. Zastavker's efforts to understand the ways in which such environments may be supported by critically reflective practices and how these environments serve to induct engineering students into educational careers.

One of the founding faculty at Olin College, Dr. Zastavker has been engaged in development and implementation of project-based experiences in fields ranging from science to engineering and design to social sciences.

# Lessons Learned doing Secondary Data Analysis
# in Engineering Education Research (EER)

**Abstract**

This paper reports on a project funded through the Engineering Education and Centers (EEC) Division of the National Science Foundation. The project is aimed towards building understanding in the engineering education research (EER) community about the potential value of secondary data analysis (SDA) as well as developing guidelines for using this research approach. Changing the paradigm of single-use data collection will require actionable, proven practices for effective, ethical data sharing, coupled with sufficient incentives to both share and use existing data. To that end, this project drew together a team of experts and emerging researchers to develop a shared understanding of SDA, and to conduct two intentional projects using this approach. Significant insights from this work included (i.) deeper insights about the ethical implications of SDA as well specific approaches to address these; (ii.) the need for collaborative relationships between those who collected the data and those who are conducting the SDA; and (iii) the value of ongoing reflective practice by the entire team. We also solicited views from a larger workshop group at the NSF EEC Grantees conference in 2022 which surfaced ongoing concerns expressed by those who are new to this approach and confirmed the need for the engagements with the broader community that have been central to this project.

**Introduction**

This project has drawn together a team of researchers aiming to explore ways to overcome perceived obstacles for conducting secondary data analysis (SDA) in engineering education research (EER). The project scope sought to address these activities:
- Sharing data both informally and formally,
- Putting datasets in the public domain,
- Creating combined datasets,
- Performing secondary analyses of both qualitative and quantitative data,
- Publishing and disseminating these analyses,
- Securing funding to support this work,
- Valuing and validating this work within the field.

The work accomplished in the first year of the project drew together a broad team of participants and scoped out areas for consideration. The focus for the second year was working with this broader team to identify a smaller group who were keen to take on actual mini-projects conducting secondary data analysis over the summer. This work kicked off in a virtual workshop in February 2022. Following the workshop, two mini-projects were scoped out and these researchers (Zastavker and Kajfez on one project and Delaine, Jordan, and Young on another), together with the project team (Case, Paretti and Matusovich) and other expert researchers (Benson and Lord) came together in-person for two days in May 2022 to plan out the mini-project work, as well as emerging collaborative outputs. The project work and article write-up took place over the Summer 2022, and was reported out at a check-in meeting in September 2022. During January 2023, the researchers met in-person to focus on writing up findings and insights, including a draft editorial to be submitted for consideration to key engineering education journals including *Advances in Engineering*, the *Journal of Engineering Education*, and *Studies in Engineering Education*.

The project also has an ongoing objective to disseminate its findings more broadly, and to this end a workshop was conducted at the 2022 NSF Grantees' conference which generated a lively discussion. A workshop will take place at the 2023 ASEE Annual Conference and a further workshop has been proposed to the 2023 SEFI conference. A comprehensive overview of the findings of this project can be found in the article we contributed to a special issue of the *Australasian Journal of Engineering Education* on "Building Capacity in Engineering Education Research through Collaborative Secondary Data Analysis" [1].

**The Mini-Projects**

*Secondary Data Analysis as a Mechanism for New Insights and Future Researcher Preparation*

The first project aims to explore the potential of SDA for training of newer researchers to the field. The data originator is an experienced researcher with a large dataset resulting from a completed NSF funded project. While the original project had delivered on its goals, there was scope for further analysis of the interviews that had been conducted with undergraduate engineering students. Our project involves a researcher from another undergraduate-focused institution, who wanted her undergraduate researchers to get experience doing qualitative research on an already existing dataset. These two researchers navigated IRB approvals to allow the second researcher and her students to work on the dataset, and they then embarked on an intentional process allowing for regular check-ins with the first researcher to make sure the analysis remained contextually grounded. A key finding of this project was an unanticipated benefit for the undergraduate researchers, who derived personal as well as professional growth from conducting this work.

*Diné Sovereignty*

The second project also involves a researcher who had completed an NSF funded project with a rich dataset. Here the specific challenge that we aimed to explore was around conducting SDA on a dataset that had involved the participation of marginalized populations, in this case American Indian engineers. When participants are citizens of sovereign Native nations, particular care must be exercised to acknowledge their sovereignty and handle the data in accordance with the laws of that nation. Navigating the approval process of tribal institutional review boards, though, is a necessarily slow and careful process that may be accompanied by potentially cumbersome logistical challenges, and thus SDA offers an appealing avenue towards increasing research output and the associated evidence-based knowledge that can support American Indians in engineering education. However, this creates a number of new ethical and logistical questions that should be addressed prior to such an undertaking, and the project intentionally focused on these. A graduate student from another institution, working under the supervision of his doctoral advisor, joined this project as additional researcher. This student's dissertation will study American Indian populations in an engineering education context, therefore this project serves as a pilot analysis that will inform his dissertation design. Another researcher, who is a member of *Diné* community and graduated with her Bachelor's degree in May 2022—also joined this project. Both are working in conjunction with the first researcher, who provided them with the dataset from the original study after de-identifying it. This project offers significant guidelines for conducting SDA with marginalized populations, and engages deeply with emerging ethical questions, such as those involved when choosing to return to

participants for further consent.  The research design of the SDA project was presented at the American Indian Science and Engineering Society (AISES) National Conference [2].  The importance of positionality of the researchers is further explored in [3].

**Lessons from the Mini-Projects**

Overall, three significant results have emerged from the work to date:

1.  Ethical considerations

Neither original research study was designed with SDA in mind, leading to extended negotiations with university review boards. Ideally, researchers could plan for SDA prior to data collection, first carefully considering whether the planned data could and should be available for SDA and, then, as appropriate, defining the project scope and subsequent documentation (consent forms, participant information sheets, etc.) with potential SDA work in mind. Participants should be aware of how their data both will and may be used, as well as when and why they might be re-contacted. As exemplified by the second mini-project, such considerations are of heightened importance for research with marginalized communities, and researchers must balance the power of SDA as a learning opportunity with the risks and benefits to the community. Given the variation in human subjects review within and across national boundaries, there may be no single "best practice" or "standard form" researchers around the world can use, but ethically, such considerations should be at the forefront of any SDA work.

2.  Sharing contextual information

Second, in our capacity-building SDA projects, engagement with the original researcher(s) was essential in helping emerging scholars learn the complexity and nuances of data collection and analysis in context. The emerging researchers in these projects particularly needed periodic dialogue with the original researchers to understand how the data was collected and constructed, and how those processes shape subsequent analyses. Qualitative data is shaped by tacit knowledge, and emerging researchers – even graduate students trained in EER - benefit when that tacit knowledge becomes explicit. Such engagement certainly mitigates researchers' ethical concerns about how their data might be (mis)used in SDA, but equally importantly, in these cases, even with experienced EER scholars from the project team as local mentors, the emerging researchers learned extensively from the original researchers. This engagement, of course, increases the costs of SDA for the original researcher, making mutual benefits key.

This point also undergirds questions of trust between researchers. While "trust" can cover a range of issues, these projects highlight two: 1) the need to trust the new researcher to bring the same level of respect not just to the data, but to the participants whom they have not met, and 2) the need to trust the new researchers with the potential flaws or gaps in the data – metaphorically, SDA is like having a houseguest who sees all the dust under the furniture. Qualitative data is often highly personal for participants and researchers, and researchers who share the data are unavoidably making themselves and their work vulnerable.

3. Reflective practice in SDA

Third, in capacity building SDA, reflective practice for those learning EER is key. Beyond the memoing qualitative researchers typically engage in during data analysis, both projects established structured reflection guidelines about the learning process enabling the emerging scholars to identify questions about the research process and about themselves as researchers that elicited learning moments throughout the team discussions. Moreover, for undergraduate researchers, engaging in reflective SDA in EER transformed their personal and professional identities.

**NSF EEC Grantees Conference Workshop Discussion**

The workshop in September 2022 opened by asking participants to share the reasons they chose to attend. Some wanted to know what SDA was and some were keen to find out about the opportunities. Others had already experienced some of the barriers to SDA and wanted to think further about whether these could be overcome.

A panel discussion of researchers experienced with SDA including members of the project team then took up the discussion further and the audience added questions and contributions. Key issues that surfaced included:
- Major concerns about working with vulnerable populations – what is our duty to participants? What does it mean to "do no harm"? We were able to share the approaches we used in the second mini-project described above.
- Issues were raised on data quality – for example if collected by masters' students – and whether one would want to share these. Could this create vulnerability for the new researchers who had collected these original data?
- A panelist shared how some of these challenges are common to quantitative data – what happens if researchers not familiar with the context of your project do things with the data that you don't agree with?
- One panelist shared the experience of working on an international project where posting de-identified data to a repository was a requirement of the funders. De-identification is time consuming work but if you outsource it to someone not familiar with the context it can be hard for them to tell what details need to be stripped from the data.
- One participant raised the issue that reviewers for journals do not seem to like secondary data analysis. Also, this may not be popular with Ph.D. dissertations. There can be challenges if the researchers cannot answer questions that require familiarity with the context – our approach aims to mitigate this with the close connection to the original researchers.

Finally, the workshop asked participants to think about how they are thinking about future use of SDA in their research. Participants remained concerned about whether reviewers would be open to this approach. There was interest in learning how to plan upfront for SDA when designing a research proposal. The question was posed as to whether one can get a DOI for a public dataset. Some participants noted that there could be significant changes ahead if funding practices change.

## Conclusion

As the second year of this project comes close to an end, we are working on sharing insights with the wider community including a workshop for the ASEE 2023 conference and an editorial for several engineering education journals including guiding principles for undertaking SDA in EER. This paper has juxtaposed the learnings from the project participants with feedback obtained at a conference workshop. Our mini-projects have demonstrated the tremendous value of using approaches which involve collaboration between the original collectors of the data and those aiming to do secondary analysis on the same dataset. This is time intensive but has significant strengths for supporting capacity development in the broader EER community, for generating genuinely fresh insights, and for honoring the efforts of the participants who gave of their time for the original data. At this stage we remain concerned about the implications of posting qualitative data, particularly that with vulnerable populations, in (somewhat) de-identified form to public repositories. The feedback from the conference participants has confirmed that these are concerns. At the same time, with careful use, it is clear that SDA has strong potential for strengthening our research capacity and the quality of our work.

## References
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[2] E. T. Young, R. Papp, D. A. Delaine, and S. S. Jordan, "Engineering for nation building: Piloting a framework for operationalizing tribal sovereignty in engineering education research," Poster presentation at the *2022 American Indian Science and Engineering Society National Conference & Exposition,* Palm Springs, CA, October 2022.

[3] E. T. Young, D. Delaine, S. S. Jordan, R. Papp, and S. M. Lord, "Pursuing equity and quality within research 'at a distance' through centering positionality, to be presented at the *2023 ASEE Annual Conference & Exposition*, Baltimore, MD, June 2023.