Mapping Trajectories of Researcher Development with Qualitative Longitudinal Analysis: An Executive Summary

Mrs. Renee Rigrish Pelan, Ohio State University

Renee Rigrish Pelan is an Engineering Education graduate student at The Ohio State University. She is working on the AISL grant as a Graduate Research Associate under Dr. Rachel Louis Kajfez. She holds an M.S. degree in Industrial & Human Factors Engineering and a B.S. in Industrial & Systems Engineering from Wright State University. Her research interests include diversity in engineering, teaching methods, and informal learning environments.

Dr. Renee Desing, Ohio State University

Renee Desing is a postdoctoral scholar at the Ohio State University in the Department of Engineering Education. Dr. Desing recently graduated from Ohio State with her Ph.D. in Engineering Education. Her research interests include motivation and identity in engineering and diversity and inclusion in the workplace. Dr. Desing also holds a B.S. in Industrial Engineering from the Georgia Institute of Technology and a M.S. in Industrial Engineering and Operations Research from the Pennsylvania State University.

Dr. Rachel Louis Kajfez, Ohio State University

Dr. Rachel Louis Kajfez is an Assistant Professor in the Department of Engineering Education at The Ohio State University. She earned her B.S. and M.S. degrees in Civil Engineering from Ohio State and earned her Ph.D. in Engineering Education from Virginia Tech. Her research interests focus on the intersection between motivation and identity of undergraduate and graduate students, first-year engineering programs, mixed methods research, and innovative approaches to teaching. She is the faculty lead for the Research on Identity and Motivation in Engineering (RIME) Collaborative.

Amber Dyche, Ohio State University

I am a third-year studying industrial systems engineering and a minor in organization and performance. Along with being an undergraduate research assistant in the department of engineering education, I am very involved in the Society of Women Engineers. During my college career, I have been an active member and held the position of Education Director.
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Introduction
The concern for communicating scientific findings to the public audience has been a persistent issue in the research community[1], [2]. While science, technology, engineering, art, and mathematics (STEM) researchers usually communicate their findings to others in the research community, there are also opportunities for researchers to present and connect with local communities through a variety of events, improving STEM literacy broadly. With the need to increase public engagements and the ability to communicate findings with members of our local community [3], we created a program which connects university faculty members from divergent disciplines with opportunities to present to the public at various informal community based events.

For this program, we recruited faculty participants from a range of STEM disciplines to give individual presentations on their research as well as present as a group around a convergent theme. Each cohort of faculty were assigned a unique theme, which were Energy, Movement, Space, and Elements. Faculty members presented at local venues in Columbus, OH including COSI After Dark (an adult focused evening at a local science center) [4], The STEAM Factory at Franklinton Friday (an informal lecture styled talk in the community) [5], and HSI/O [6] (a high school hackathon). Recently, as a result of the COVID-19 pandemic, these events transitioned to online programming.

One objective of this program and the focus of this paper is to understand the identity development and motivation of faculty members who participate. Our guiding research question is, “In what ways do faculty researchers’ motivation to communicate with the public and identities as researchers further develop as professionals after collaborative experiences?” This executive summary and accompanying poster focus on the longitudinal coding and results of the pilot cohort, Energy.

Theoretical Framing
In order to investigate the impact of the program on faculty identity and motivation, we employed the Longitudinal Model of Motivation and Identity (LMMI) to frame our research [8]. The LMMI combines Self-Determination Theory [9] and Possible Selves Theory [10] to study motivation and identity development during an experience. This model gives us the capability to observe how the program has made an impact on individual faculty members as well as seeing the impact of the program holistically across the participants.

The LMMI has previously been used to study graduate teaching assistants’ motivation and identity development as teachers [8]. For that work, one data collection measure included having graduate teaching assistants reflect on their teaching through journal entries. Similarly, we have asked our faculty member participants to reflect on their presentations and experience with the program. Using the LMMI as our theoretical lens will help us further understand the identity development of faculty members as researchers and their motivation to present to the public.
Qualitative Data Collection & Findings
While this program involves multiple sources of data from the faculty members and the public audiences, for this paper we will be focusing on the data from interviews and reflective surveys and the analysis from the faculty members who participated in the pilot cohort. Other data sets include surveys administered to the public audiences and event observations. All data collection methods were IRB and participants were given pseudonyms.

Initial Coding
The interview data was collected from a one-hour entrance interview at the beginning of the program, five-minute pre- and post- interviews at each of the presentations, and another one-hour exit interview at the end of the experience. All interviews were semi-structured. The reflective surveys were administered approximately one week after each presentation and included only open-ended items for the pilot cohort. Interviews were transcribed, and the research team coded each interview and the reflective surveys in Dedoose using an initial coding approach as described by Saldaña [11]. While using this approach, the research team kept the research question in mind and particularly noted statements about motivation, identity, collaboration, increased or decreased interest in collaboration, engaging the community, and communication techniques in presentation. Once all the data was coded, the researchers synthesized and merged similar codes to create a codebook of primary and secondary codes to be used for coding future cohort data sets [11]. From these codes, we were able to generate categories of codes that occurred within the cohort. For example, from the pilot cohort, some larger categories that emerged included the impact of training, interdisciplinary collaboration, and an identity as an educator or mentor (more information about the initial coding process can be found here [12]).

Longitudinal Coding & Results
Once the initial coding was complete, the research team used longitudinal coding as a method to track the trajectory of each participants’ growth within each major theme. Longitudinal coding was chosen as a method as it compares the qualitative data across time, in this case over the course of the program [11]. To analyze the data, the research team created a matrix for each participant with a column for each interview and a row for each category. The research team extracted the quotes coded during the initial coding and placed them in the appropriate cells in the matrix. Once all of the quotes were extracted, the team examined the quotes in each cell and wrote a summary. The summaries were also compared to the summaries for the previous interviews to note any changes or similarities as the participant progressed through the program. After all the summaries and comparisons were completed, the research team developed a statement to describe the trajectory for each code for each participant. An example of these trajectory descriptions is shown in Table 1 for the identity category.
Table 1: Example of Summaries of Identity Trajectory for Each Participant

<table>
<thead>
<tr>
<th>Category</th>
<th>Jack</th>
<th>Alena</th>
<th>Kacey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identity</td>
<td>Jack maintained a very strong research identity throughout the process. There was a growth in how comfortable he felt presenting to the public, however, there is a disconnect in how he views his own abilities. Jack can see himself as a researcher who participates in more interdisciplinary collaborations in the future.</td>
<td>Alena's teaching and research identities started strong and have grown stronger through this process. Her first priority in her academic job is to be an educator, while research is her second priority. However, she wants to develop a research group that is interdisciplinary, dedicated, and where the students are having fun. She believes that if the students are enjoying the work, then they will produce more work. These informal events have helped her understand other ways she can present her research and do outreach at the same time.</td>
<td>Kacey maintains a strong identity as a clinical researcher that grows throughout the process. She wants to be a researcher who not only maintains a high quality of research but also makes an impact in the community. While she maintains her clinical research identity, she acknowledged other roles that helped her in her presentations to the public (teaching identity). As a clinical researcher, she can see herself moving outside of her field to explore opportunities to collaborate outside of her own field of research.</td>
</tr>
</tbody>
</table>

For the category of identity, two of that participants recognized a clear growth in their own identity development. Alena and Kacey both started with a strong identity as a researcher while acknowledging that their teaching identity helps them present to the public. Alena has prioritized her teaching identity, but through this experience, she sees growth in how her teaching identity can intertwine with her research identity to help her find new ways to present her research to the public. Similarly, Kacey acknowledges that her teaching identity is also what helps her communicate her research to the public. Jack differs from both Alena and Kacey where the longitudinal analysis demonstrated Jack’s growth over the course of the program, but he personally does not recognize any growth.

We have chosen to highlight Jack’s unique trajectory in this executive summary. When we first interviewed Jack at the beginning of the program, he stated that he was very new to presenting his research to audiences outside of his discipline. Jack was facing new challenges when it came to being a publicly engaged researcher, and in the quote below, he acknowledged needing to use new terminology that is accessible to the public, which was also his motivation for participating in our program:

\[ \text{It was really hard actually to talk about what I was doing because I don't have this broad story that is accessible to the public at all. So, being able to take some part of what I'm doing and make it attractive, or whatever, to the layman and things would be cool.} \]

Throughout the process, Jack learned techniques to communicate his research to the public through the interactions he experienced with the audience members. He stated,

\[ \text{I would say I'm, like, continuously learning how to briefly and concisely but coherently communicate, especially to people wide audiences involved in 12 different things around} \]
campus and talk to parents and relatives and things like that. Constantly want to know what I'm up to in two minutes.

This quote shows how Jack is continuing to work on his communication skills outside of his area of study and that he is also improving his techniques. However, while we saw a new identity of someone who involves themselves outside of their own research community, Jack actually rejected the idea when directly asked about it:

*I would say it was kinda hard. And as far as like prioritizing time and stuff, it may have discouraged me a bit from doing anything with the public. More comfortable talking to geeks like me.*

While Jack decided he will not continue with outreach events to engage the public, we saw growth in how he communicates with people outside his field, as well as a desire to continue collaboration with disparate disciplines. When asked, Jack continued to perceive himself as the same kind of researcher he was at the beginning of the process, but the members of the research team noted that Jack had evolved in the way he talks about interdisciplinary collaborations and his experience talking to audience members from the public based on the data. Fig. 1 is a visual representation of the growth that we saw as the research team, versus the growth that Jack perceived. We’ve included some additional quotes from jack to further illustrate his development.

**Conclusion and Future Work**

This program seeks to understand how experiences of faculty members from disparate disciplines coming together to convergently present to the public impacts faculty motivations to engage with the public and their identity as researchers. The stories that are emerging from the longitudinal data, such as Jack’s, are being use to explore faculty development while evaluating
the impact of the program more broadly. Future work will include initial coding the data from
the other cohorts and completing the longitudinal coding for each faculty participant. Based on
the findings, we hope to learn more about how faculty continue to develop their identity as
researchers and their motivation to participate in public outreach events. Overall, we hope to
improve STEAM research communication holistically and advance STEAM literacy in our local
community.

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