Investigating Researchers' Motivations and Identities through Convergent Learning from Divergent Perspectives

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Abstract— **This Research Work-in-Progress paper explores how motivation and identity can evolve when faculty from different disciplines (arts, engineering, medicine, etc.) collaborate to present on a central theme or topic (e.g. color) across multiple community settings. Sharing research findings beyond the academic community is essential for systemic change and wide spread enhancements to our everyday lives. Through this work, we explore how faculty researchers' motivations to share their work and their identities as researchers develop through collaborative experiences with other faculty that aim at sharing research findings with the public. In this study, faculty from divergent academic fields are working together to present convergent presentations as one coherent theme across three different informal learning sessions as well as a control setting. These presentations intend to increase public engagement with scientific research and broaden the scope of Science, Technology, Engineering, and Math (STEM) learning by approaching the themes through the faculty's different academic backgrounds. Through collaboration and engagement with the public, we will track how faculty's identities as researchers and motivations to share their work develop over this experience through the use of the Longitudinal Model of Motivation and Identity (LMMI). Over the course of this study, we hope to see gains in faculty motivation and researcher identities who engage with the public through this experience. For this paper, we focus on framing the overall study and provide initial findings from our recruitment survey.**

Keywords—motivation, identity, public engagement, informal learning

I. INTRODUCTION

Studies have shown that interdisciplinary interactions or collaborations can spark creativity and innovation [1]. In particular, cognitive dissonance theory has shown that when individuals are presented with conflicting or divergent perspectives on a single topic, new innovations or problem-solving ideas emerge [2],[3]. These creative skills can help contribute to the communication of new knowledge and ideas. For this work, we aim to connect faculty members with the public and encourage public engagement. Although interactions with other researchers and students are also important for faculty development, [4] learning how to communicate your research to the public in an informal setting can help engage the public in cutting-edge research. This promotes lifelong learning for the public as well as promoting creativity in faculty members [5].

The National Science Foundation (NSF) Advancing Informal STEM Learning (AISL) solicitation promotes understanding the developments in STEM learning for the public in informal settings [6]. The purpose of this study, which is funded under AISL, brings faculty from divergent fields and perspectives together to present on a single convergent theme. This program aims to engage these faculty researchers in sharing their scholarly work to the community in various informal settings to improve how they share their research. Through collaboration and communicating with the public, we want to examine how their motivation to participate in interdisciplinary collaborations and community engagement develops as well as their identity development as researchers. Throughout this study, faculty will be interviewed about their experiences and their data will be analyzed by using the Longitudinal Model of Motivation and Identity (LMMI) as a theoretical lens [7]. Our overarching research question is: *In what ways do faculty researchers' motivation to communicate with the public and identities as researchers further develop as professionals as a result of collaborative experiences?*

II. BACKGROUND

A. Motivation, Identity, and Engaging with the Public

While faculty may struggle with work-life balance when involved in public engagement [8], one study found that some faculty members do not set out to pursue outreach or engagement opportunities as a career, but instead, come to these opportunities accidently [9]. These accidental encounters could include exposure to someone else performing outreach, the outreach event, or encouragement from mentors. When they do participate in these events, faculty will often speak about the extra work public engagement requires on top of their other job expectations [8]. While juggling public engagement as another faculty duty within a work-life balance can be a challenge, faculty are motivated to participate in public engagement because they will also create deep collaborations with public stakeholders in the process [8]. Faculty members are also driven by their personal identity as an engaged faculty member to incorporate public engagement into their teaching and research [8].

When faculty work in interdisciplinary teams, new identities can emerge. For example, lecturers from the STEM field may have a "science/engineering-based" identity, especially those

who have worked in applied science and engineering fields [10]. However, one study [10] found that when having these science and engineering lecturers work in an interdisciplinary team of academic developers from 'other' disciplines such as education and language/linguistics, an alternate identity emerged. Enright and Facer [10] found this new identity of a "professional educator" demonstrated a shift in mindset that occurred in this interdisciplinary work. The collaborative experience was found to be valuable to all team members as it also reshaped how academic developers and science/engineering lecturers constructed their roles and identities in higher education [10].

Another study [11] identifies four different identities which may become apparent and play a role in faculty interdisciplinary work: "Worker Bees" communicate reflexivity and can negotiate with the research team, "Disciplinarians" set the agenda and understand task priority, "Freelancers" motivates the team to new challenges, and the "Social Activist" combines practical and academic knowledge to contribute to the public. These identities also contributed towards the attitude of interdisciplinary work where "Disciplinarians" saw interdisciplinary work as a distraction and "Freelancers" would thrive by exploring other disciplines [11].

Overall, there are several motivating factors that lead faculty to participate in public engagement. In addition, when participating in inter-disciplinary teams faculty can develop new identities in regards their roles as educators and as a research team member.

B. Theoretical Lens

To better understand the researchers' development throughout this process, we will use the Longitudinal Model of Motivation and Identity (LMMI) [7] as our theoretical lens.

The LMMI is used to examine identity development and motivation holistically by incorporating the strengths of Possible Selves Theory [12] and Self-Determination Theory [13]. Possible Selves Theory acts as the foundations of LMMI by allowing individuals to set goals and reflect on their future possible self; this could include who they aspire to be as well as possible selves to avoid in the future [12]. This leads into Self-Determination Theory where individuals explore their competence, autonomy, and relatedness during an experience [13]. This portion of the LMMI can lead to increased motivations and identity development. Once explored, the researcher will return to possible-selves theory to reevaluate their future selves [12]. After an experience, the research may or may not have achieved their future self, but regardless, they will have developed or changed in some capacity.

In the scope of this study, this combined theory suggests that the faculty that go through this experience will reflect on their current research areas, why they wanted to participate in this experience, and what they hope to gain from this experience. After the collaborative experience, LMMI suggests that they will reevaluate these items to assess their current motivations to participate in community outreach and interdisciplinary work, and identity development as a researcher.

C. Study Sites

Over the course of this study, faculty will be presenting on a convergent theme in different treatments at three different locations. There will be a pilot cohort and at least three separate cohorts that go through this experience. Each cohort will give informal presentations will be given to the public at COSI After Dark, the STEAM Factory, and HS I/O. COSI After Dark is held at the Center of Science and Industry (COSI) in Columbus, OH and is a science center that focuses on informal STEM learning [14]. Specifically, the COSI After Dark event invites adults, 21 and up, to visit the science center after hours and has different themes such as "Ice and Fire", "Galaxy Far Far Away" and "Whodunit Murder Mystery" which aim to engage the public around a theme in an informal space [14]. The STEAM Factory is a venue which provides space for scholars to engage with the broader Columbus community through a series of research-based, informal outreach programs [15]. Specifically for this work, the STEAM Factory participates in Franklinton Fridays, a monthly local public art festival, which includes opportunities for faculty to give micro-lecturers on their research. The third informal setting is a hackathon called High School I/O for high school students to provide an opportunity to learn about computer science and foster informal, peer and team based learning [16]. Students are also mentored and judged by volunteer faculty and alumni and can attend workshops given at the event by faculty and alumni [16].

For our work, each faculty member will be giving presentation with different treatments in all three of these informal settings Treatment Level 2 involves having all faculty present on a central theme with individual presentations. Faculty do not collaborate during this treatment. In Treatment Level 1, faculty prepare a collaborative presentation on the convergent theme. As stated before, both of these treatments will be presented at all informal settings. Table 1 details the combinations of treatments and sites that all faculty will be participating in.

Table 1: Treatment and Setting Combinations

	Franklinton Friday	OHI/O Program	COSI After Dark
Treatment Level 2	Multiple Presenters and No Collaboration: Informal Learning Environment	Multiple Presenters and No Collaboration: Semi-Structured Learning Environment	Multiple Presenters and No Collaboration: Traditional Informal Learning Environment
Treatment Level 1	Multiple Presenters and Collaboration: Informal Learning Environment	Multiple Presenters and Collaboration: Semi-Structured Learning Environment	Multiple Presenters and Collaboration: Traditional Informal Learning Environment

During these experiences, faculty will be interviewed in a pre and post format so we can better understand the impact of the experience on motivation and identity. In addition, the public listening and participating in these presentations are also

participants in the AISL grant, but outside the scope of this paper.

III. METHODS

A. Participant Selection

To select participants, we first distributed a survey to university faculty to gauge interest and collect baseline data on attitudes towards research. A section of the survey was developed based on a pre-existing instrument by the FINS/RIESS project team [17]. The original instrument was used to examine how post-PhD researchers view themselves as researchers as well as their feelings towards research and the research community [17]. Based on this instrument, questions were adapted to apply to faculty members and their research.

Within the survey, we also asked demographic questions and surveyed their interest in various themes. Themes were defined as a broad topic that intersects the specific research areas in unique ways. Examples were given as well to help communicate how a theme could be applied to a field. For example, the theme color could include presentations on an ophthalmologist's research on color blindness, a food scientist's research on natural food pigments and a chemist's innovative technology approach to develop new paints. We also asked questions about their engagement with research and their current research community. Questions about their engagement with research and their research community were scored on a 7-point Likert-style scale. These questions relate back to the motivation development portion of Self-Determination Theory from the LMMI. Examples of these questions included rating statements such as:

- "When I conduct research, I feel that I am bursting with energy"
- "I am inspired by my research topic"
- "I can openly discuss problems related to my research with my community."

There were also open-ended questions to allow faculty members to elaborate more about the challenges they have faced in research, their research focus, and how they view themselves as a researcher. These questions relate back to the identity development portion of Possible Selves Theory from the LMMI. The questions included:

- "What is your research area?"
- "Briefly describe yourself as a researcher (i.e., what kind of researcher are you?)"
- "Briefly describe a time you struggled as a researcher. What happened and why?"

Five faculty members were selected for this pilot cohort. In addition to the pilot, there will be 3 additional full cohorts consisting of 4-5 faculty for a total of 15 faculty. Faculty were selected based on their common interest in themes and through analysis of their responses using descriptive statistics and categorization. Descriptive statistics included the demographic characteristics, averages of Likert-style scale responses to constructs, and distribution of interest in different themes.

Out of these five faculty members who were selected for the pilot cohort, three consented to participate in the program and

this research study. Once faculty agreed to participate in the program, the researchers coordinated a time to obtain consent for their participation in the research study following approved IRB procedures. While the program and the research study are happening simultaneously, the faculty member may choose to just participate in the program and not the research.

IV. RECRUITMENT SURVEY RESULTS

A total of 71 people started the survey, and 51 of those surveys had completed all survey questions. Table 2 presents the demographics of the respondents who completed the survey. The demographic portion of the survey asked for faculty to indicate their position at the university, tenure status, gender, age, and racial/ethnic group.

Table II: Demographics of Respondents

Item	Count	Item	Count
Position at University		Age	
Associate Professor	9	26-34	17
Assistant Professor	27	35-44	24
Faculty	5	45-54	8
		55-64	1
Tenure Status		Prefer not to say	1
Tenured	14		
Tenure-track, but not tenured	37	Racial Ethnic Group	
		Caucasian or White	29
		East Asian	11
Gender		Hispanic or Latinx	2
Female	17	South Asian	5
Male	33	Other Asian	1
Prefer not to say	1	African-American or Black	3
		Prefer Not to Identify	2

The survey also had respondents indicate which themes they would be interested in. Respondents could also choose more than one theme and were given the option to enter another theme that was not listed if needed. Figure 1 illustrates the frequency of each theme response.
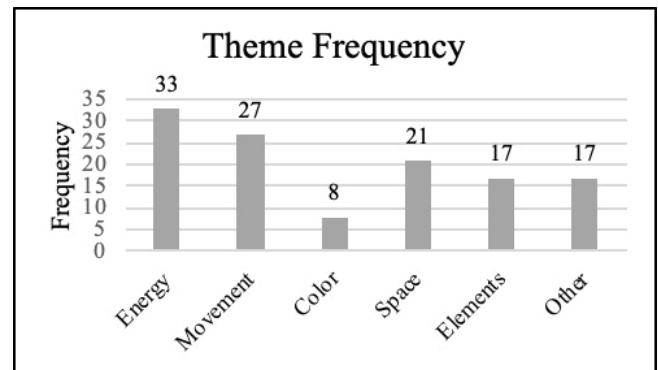

Fig. 1. Frequency of Themes Selected from Survey Submission

A 7-point Likert-type scale was used to ask faculty about their engagement in research, interest in participating in this program, and their research community and supervision. Cronbach's Alpha was used to test the internal validity of each construct and is shown in Table 3. An average for each construct across all questions and all faculty was calculated in Table 3.

Table III. Likert Scale Question Averages and Internal Consistency

Question Topic	Average	Cronbach's Alpha
Engagement	6.29	0.85
Interest in Program	6.65	0.81
Community & Supervision	5.88	0.8

In addition, an average for each question topic was calculated in Table 4 in regard to Position at University, Tenure Status, and Gender. Within each category, the averages are similar across all questions to the overall averages calculated in Table 3.

Table IV. Likert Scale Question Averages by Demographic Categories

Category	Engagement	Interest in Program	Community & Supervision
Position at University			
Associate Professor	6.57	6.68	6.22
Assistant Professor	6.16	6.23	5.82
Faculty	6.6	6.71	5.65
Tenure Status			
Tenure	6.29	6.60	6.03
Tenure Track	6.29	6.66	5.85
Gender			
Female	6.25	6.56	5.87
Male	6.30	6.68	5.90

V. NEXT STEPS

All faculty who participate in this component of this work will participate in a series of interviews to answer the research questions. Interviews will be administered in two forms. The first form will be traditional pre and post interviews. Pre interviews will be conducted before any training or public presentations to establish a baseline for each faculty member to understand how they view themselves as researchers and what motivates them to share their research with the public. Post interviews will take place one month after the end of all presentation to understand what elements of the experience resonated more with them and to better understand their development. These interviews will be grounded in possible selves theory aspect of the LMMI.

Pre-Interviews were conducted before the faculty presented at one of the informal settings. This interview asked the following questions:

1. What is/are your area(s) of study?
2. Why did you agree to participate in this project?
3. Who are you as a researcher?
4. Who do you want to be as a researcher?
5. What is your biggest challenge as a researcher?
6. How do you typically communicate your research findings?
7. What do you hope to get out of this experience?

In addition to these questions, we also asked questions which were based off of their recruitment survey data from the participant selection process. We looked at their responses from the open-ended questions to help formulate these custom question. An example being one faculty member spoke about how they describe their team as interdisciplinary consisting of engineers and medical professional. Custom questions about how working in an interdisciplinary group challenged them as a researcher and what skills and lessons they have learned while working in an interdisciplinary team were added to reflect the response from the survey.

Following the pre-interviews, faculty will present in the informal settings and control treatment. faculty will present in different treatments at COSI After Dark, the STEAM Factory, and HS I/O. The next form of interviews will be short 5-10 minute verbal interactions immediately before and after their presentation in all settings and treatments. This allows us to gather real time information about the impact of these events on their motivations. Questions about their experiences such as, "What was the best part of your presentation" and "What is one thing that you would change about your presentation" will be asked in the moment as well. These interviews will be grounded in the self-determination theory portion of LMMI.

Additionally, a week after each presentation, faculty will be emailed an online post-reflection survey which are tailored to their previous presentation, interview, and the LMMI. These post-reflection surveys will have 3-4 open-ended prompts. Possible prompts include, "What has been the most challenging part of this experience to date?" and "What are you currently considering related to the way you present research?" These written reflections will help us understand how the faculty have processed and internalized their experiences in regard to motivation and identity.

After interview data is collected, interviews will be transcribed and coded using an initial coding approach [18] to discover themes that emerge from the data. During this initial coding, analytic memos will be written to track theme ideas and trends in the data. This process will Once initial coding has concluded, the research team will determine a secondary coding method to determine the themes connected to motivation and identity development.

Over the course of this study, we hope to see growth in the researchers' motivation to participate in interdisciplinary collaborations as well as sharing their research with the community. We will also track their identity development of how they view themselves as researchers in the present, and how they see their future selves. We also hope to see and improvement in how they communicate their research.

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