Relevance of Servingness Framework to Engineering Education Research Graduate Program Recruitment Process

Dr. Cheryl A Bodnar, Rowan University

Dr. Bodnar is an Associate Professor in the Experiential Engineering Education Department at Rowan University. Her research interests relate to the incorporation of active learning techniques such as game-based learning in undergraduate classes as well as innovation and entrepreneurship.

Dr. Holly M Matusovich, Virginia Polytechnic Institute and State University

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.

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Abstract

Sixteen engineering education programs across the United States came together in Fall 2023 to offer a virtual multi-institutional graduate program showcase for prospective graduate students. The purpose of the showcase was to provide an opportunity for potential graduate students to learn about the breadth of available programs, and through understanding programmatic offerings potentially identify programs that would align with their goals and interests. Although not originally situated in a servingness framework, we were inspired by current conversations and literature regarding inclusiveness to consider what it could look like to make this framework central to our recruiting work. Thus, our study aimed to understand how the materials developed as part of the multi-institutional graduate program showcase might reflect elements of servingness. The multidimensional conceptual framework of servingness includes both indicators of serving and structures for serving. Specifically, we asked (1) how relevant is the servingness framework to materials designed for a graduate program recruitment process; and (2) what adaptations may be necessary to allow for this framework's application to the graduate program recruitment process context? We employed framework analysis to identify which, if any, elements of the servingness framework were represented in the showcase presentation. After completing content analysis of the institutional slides and thematic analysis of the program presentations, we conducted focus groups with graduate program leaders to receive their feedback on our emergent findings and to discuss applicability of servingness as a lens to thinking about the graduate program recruitment process context. Our results revealed that the framework was a useful lens as we saw some common elements of the framework across all programs that were also supported in the feedback from program directors when we asked them to specifically consider this perspective. However, it was clear that adaptations would be needed for the framework to be fully applicable. Thus, graduate programs can use servingness to prompt a focus on the student experience as part of their recruitment materials while ensuring that the underlying intent of the servingness framework is preserved.

Problem Statement

Sixteen engineering education programs across the United States came together in Fall 2023 to offer a virtual multi-institutional graduate program showcase for prospective graduate students. The purpose of the showcase was to provide an opportunity for potential graduate students to learn about the breadth of engineering education graduate programs available to them. The goal of exposure to the different programs was to enable the students to identify programs that would align better with their desired goals and interests for a graduate degree. To expand use of the servingness framework within engineering education, we considered the idea of how graduate programs could be designed to serve their students by facilitating appropriate matches between faculty and students and ensuring appropriate graduate skill development to meet targeted career

goals. As a starting point in this analysis, we sought to determine whether the servingness framework developed by Garcia, Nunez, and Sansone [1] could be a lens to evaluate the graduate program presentations provided as part of the multi-institutional graduate program showcase. Specifically, we asked (1) how relevant is the servingness framework to materials designed for a graduate multi-institutional program showcase designed without a specific focus on servingness; and (2) what changes may be necessary to the servingness framework to allow for its application to this graduate program recruitment process context? Because the programs selves and the showcase event were not originally designed with the Servingness Framework in mind, we employed framework analysis [2], [3], [4] to identify which, if any, elements of the servingness framework were represented in engineering education graduate program recruitment slides as part of the multi-institutional graduate program showcase.

Background

This section provides an overview of the concept of servingness and how it has been applied within the literature. We also give additional background on the multi-institutional graduate program showcase including its intended goals and an overview of the instructions provided to graduate programs about how to prepare their respective presentations that are the subject of analysis for this study.

Servingness

The concept of servingness was developed by Garcia, Nunez, and Sansone [1] to describe how Hispanic Serving Institutions (HSIs) would move beyond just enrolling Latinx students towards actually serving them. Within this framework, it is important that an institution serves Latinx students in a manner that reflects their goals/values as well as the context in which they operate, which means there is not a single definition for servingness. The multidimensional conceptual framework of servingness in HSIs includes both indicators of serving and structures for serving. Indicators of serving were related to elements that could in fact be measured and would often provide an understanding of whether the interventions were benefiting the Latinx population. These indicators included academic (elements like GPA, graduation rates, retention) and non-academic outcomes (self-concept, agency, identity, and leadership development). The other main indicator of servingness was observed to be student and non-student experiences. These experiences would provide an understanding of campus climate, student community, and presence of supportive faculty and staff that understand student needs. Structures for serving were related to elements of the organization that would most often be targeted for changes in order to provide a better experience for the Latinx population. These structures included organizational dimensions such as leadership and decision making (practices and policies developed around serving students), culturally relevant pedagogy and curriculum, and culturally relevant programs. Finally, the multidimensional conceptual framework of servingness in HSIs advocated for the inclusion of external forces as this portion of the framework would capture

policies and factors at the state and federal level that might impact how the institutions is able to serves its students [1].

It is important to note that the multidimensional conceptual framework of servingness in HSIs was designed specifically for the HSI context as it was meant to help address the lack of clarity in how HSIs "serve" Latinx students [5]. Although the framework has been discussed in studies that document the experiences of Latinx students [6], [7] and used to capture how servingness is employed in different HSI contexts [5], [8], [9] it has not yet been applied outside the HSI context. Our intention herein is to credit and respect the origins of the framework while expanding understanding of what it means to be student-centered in all aspects of graduate education.

Multi-Institutional Graduate Program Showcase
The multi-institutional graduate program showcase was designed to address identified issues with recruiting prospective graduate students into engineering education programs. Specifically, the lack of understanding of engineering education research and the need to help prospective graduate students to find the engineering education program that aligned most closely with their interests and needs for their targeted career paths. A detailed description of the multi-institutional graduate program showcase and the student feedback from the event is available in Bodnar et al. [10].

As part of the multi-institutional graduate program showcase, engineering education graduate programs were instructed to develop a single PowerPoint slide and prepare a short oral presentation, 2-3 minutes in duration, that would describe their program and the unique identifying features of it to prospective graduate students. In particular, the programs were guided to address the following elements in their presentation (slide and oral presentation): (1) focus research areas (unique fields of study) in comparison to other programs; (2) student experience – cohorts or info on type of community; (3) unique / differentiating features of the program (e.g. include online grad coursework, professional development training, etc.); and (4) types of fellowships (fully funded; partially funded; for how long?). The determination of what session content was included was driven by pragmatics (e.g., what program leaders collectively determined students need to know based on experience) rather than as a function of a social science or educational theory or conceptual framework.

Methods
The following section covers the methodology associated with framework analysis as well as detailed information on the data collection and analysis process followed for this study.

Overall approach: Framework Analysis
Our analysis approach was inspired by framework analysis methods [2], [3], [4]. Framework analysis is a structured approach that emerged from policy and health sciences research where there are often large volumes of qualitative data to be analyzed that may or may not have started with an initial conceptual framework as defined in typical social science research. This approach provides a way to make sense of the data. Our study followed the general approach followed by Gale et al. [4] with a primary modification of including additional and intentionally designed data collection (focus groups) to enrich the data and better articulate themes. Gale et al. [4] suggest five stages of data analysis: 1) transcription, 2) familiarization with the interview, 3) Coding, 4) Development of a working analytical framework, and 5) applying the analytical framework. The last phase is where we made the modification. In lieu of additional coding, we sought input from participants on how the outcomes of our framework analysis resonated. We chose this approach because our data were limited in depth and the framework has never been applied in this way so the construct definitions needed further development.

With a goal of understanding how the materials developed as part of the multi-institutional graduate program showcase might reflect elements of servingness, we first analyzed the materials which included the slide created by each school for the showcase as well as the transcript from the showcase where the graduate program was described. We completed a content analysis of the institutional slides and thematic analysis of the program presentations. The resulting product was the type of grid typically associated with framework analysis that includes rows and columns associated with constructs and cases respectively. Each program is considered a case, and we had multiple participants from some programs. Using the grid, we conducted focus groups with graduate program leaders to receive their feedback on our emergent findings and to discuss applicability of servingness as a lens to thinking about the graduate program recruitment process context. We used this focus group setting to refine our grid by better articulating the alignment of themes with the framework and identifying potential changes needed for the framework to work in this context.

Multi-Institutional Graduate Program Showcase Data Collection and Analysis
The two-hour showcase event was held on September 26, 2023. Representatives from 16 programs in engineering education participated in the event. The programs are mostly located in the eastern United States though two are from more central locations and two from western locations. The participating programs ranged in terms of number of years in existence including new programs (just admitting first cohort this academic year) to programs in existence for 20 years. Program sizes ranged from serving fewer than 10 graduate students to more than 50. Programs identified as schools, departments, or discipline-based models. The primary data for the initial analysis included the slides and the recordings from the session presentations. Appropriate human subjects' approval was obtained prior to the conduct of the study.

Framework analysis is amenable to both inductive and deductive coding approaches [4]. In this application, we used deductive coding for analysis of the slides and recordings with initial codes based on concepts from the Servingness framework by Garcia, Nunez, and Sansone [1]. Sub-themes emerged under each construct relevant to the context of the multi-institution graduate program showcase (Table 1).

Table 1. Codebook Including Sub-Themes Associated with Servingness Framework

Framework Concepts	Sub-Theme	Definition
Outcomes	Academic	Includes relevant academic measures such as GPA, graduation rates, retention, course enrollment, course completion
	Non-Academic	Includes outcomes relevant to the individual such as self-concept, social agency, racial/ethnic identity, and leadership development
Experiences	Student	Interactions with peers, presence of supportive faculty and staff, presence of cultural heritage on campus
	Non-Student	Describes experiences had by faculty, staff, and administrators pertaining to campus climate
Organizational Dimensions	Leadership and Decision Making	Focuses on practices and policies made by the institution that would influence servingness.
	Culturally Relevant Pedagogy and Curriculum	Includes curriculum and teaching approaches as part of degree program that consider the racial and cultural backgrounds of students from minoritized backgrounds.
	Culturally Relevant Programs	Institution offers programs that allow students to develop knowledge and language skills that are relevant to their cultural identity
External Forces		Elements external to the institution such as policies at the state and federal level that may impact the institution's ability to serve their students.

We analyzed outcomes by program separately for the slide and the transcript and then combined those two elements for an overall comparison. Consistent with framework analysis approaches the output yielded a grid format similar to Table 2 where an "X" indicates that the idea was present in the data for that school.

Table 2. Example Output Format

Framework Concepts	Sub-Theme	School 1	School 2	School 3
Outcomes	Academic	X		
	Non-Academic		X	
Experiences	Student	X		X
	Non-Student		X	
Organizational Dimensions	Leadership and Decision Making	X		
	Culturally Relevant Pedagogy and Curriculum			
	Culturally Relevant Programs			
External Forces				X

To enhance the quality of our analysis we tested our interpretation of the slides and transcripts and solicited richer descriptions through focus groups with program representatives.

Follow-up Focus Groups with Program Representative Showcase Participants
The authors hosted three one hour focus groups over a period of one week with three, two, and three participants respectively. All program representatives that participated in the showcase and completed a feedback survey were invited to participate in focus groups. Of the original 16 programs that participated in the showcase event, six participated in the focus groups with two programs having two different representatives that participated in different focus groups. The lead author served as the primary focus group leader with the second author supporting with notetaking and follow-up questions.

In the days before the focus groups, we sent out a slide deck of the slides presented during the multi-institution showcase to focus group participants so that they could review in advance if they had time but we also indicated that we would leave 10 minutes to look through content as part of the focus group session. At the start of each focus group we started the recording and consented participants for participation in research. We then asked participants and facilitators to introduce themselves.

We gave participants time to review the slides and when they were ready we asked the following questions:
- What patterns or observations did you have as you looked across all of the program slides?

- Would you change the way that your institutional slide is laid out now that you have had the chance to review the other program slides in more detail? If so, what changes would you make and why?

We then introduced the concept of servingness and why we were interested in exploring it for this analysis. We then shared the outcomes of our analysis in applying the Servingness Framework for their respective programs before asking:
- With the servingness framework in mind, review the table shown here (includes listing of servingness framework elements identified for their institutions) and share whether you believe this is an accurate representation of your program's servingness of the graduate student population? Why or why not?
- Considering this idea of servingness would you consider changing your institutional slide? If so, what changes would you make and why?

Before closing, we gave participants an opportunity to ask us questions or share anything they wanted us to know that we had not asked about. We used Zoom to record the focus groups and generate transcripts. The Zoom based transcripts were cleaned and de-identified prior to any analysis being performed. As part of this process, each of the faculty members were assigned a numerical number that will be used to represent them in the results section of this work.

To answer our research questions, we focused our analysis on the questions that related to the Servingness Framework. We looked for themes in how participants evaluated our application of the framework and how well they thought the framework worked. Having not asked participants to self-identify pseudonyms and not wanting to disrespect identities through our choice of potential pseudonyms, we opted for using a numbering system to identify faculty participants.

Results & Discussion
This section provides a detailed description of the results associated with our posed research questions and how they relate to other literature that has applied the servingness framework.

Research Question 1
In answer to our first research question, *how relevant is the servingness framework to materials created for a graduate multi-institutional program showcase designed without a specific focus on servingness* we found that none of the program's slides and presentations captured all the elements of the servingness framework. However, the most common categories from the servingness framework that were evident in the institutional slides were student experiences (13/16), academic outcomes (10/16), and non-academic outcomes (12/16). Student experiences were highlighted often through the description of the graduate student community and opportunities for student interaction. One slide shared "*Small program feel in a large university*" while another shared "*Supportive Community - We offer a diverse work environment with*

frequent interactions through small research groups and events". Programs would often add more context to student experiences within their presentation sharing elements like:

> *We pride ourselves on having a very student centered culture, a culture that's supportive and collaborative. We consider our students to be our future colleagues, and so we treat them as such. They're our partners in just about everything that goes on from governance to teaching to mentoring new students. Our students are our partners in all of that.* [Faculty 695]

Less frequently, programs would share the flexibility of their course offerings and the option to select personalized course work as part of the student's program.

In terms of academic outcomes, program slides typically highlighted program alumni, employment rates upon graduation, length of time for degree completion, and use of portfolios for showcasing student work.

Non-academic outcomes focused upon opportunities provided to the students to advance their professional development. These included teaching experiences, near-peer mentoring, focus on research to practice, immersive learning experiences, community engagement and the focus on Discipline-Based Education Research (DBER). Some institutions offered many of these components as shown here:

> *So there's a big experiential learning element of our program where you engage in something that's related to your goals. Once you leave your Ph.D. or master's program that includes serving as instructor [of] record, working for some kind of nonprofit, working in industry, whatever is aligned with your goals, you'll do that for a semester for about 250 to 300 hours.* [Faculty 300]

The inclusion of indicators of servingness within the graduate program slides and presentations is not surprising as they are denoted as measurable ways that institutions can determine how well their efforts may be supporting their targeted student population [11]. Interestingly, it was noted that within the HSI context studies documenting the impacts of programs on non-academic outcomes were less common than those related to academic outcomes [1]. This observation may be due to difficulties associated with measuring these complex constructs, whereas in this study we were not focused on the measurement of the constructs but rather if program elements existed that would create the foundation for developing them.

A few institutions included elements that mapped to organizational dimensions with leadership and decision-making being the most common (4/16). These elements were not typically represented on the program slides but rather in the program presentations where they highlighted their institutional type, i.e. Hispanic Serving Institution, or the integration of diversity and inclusion efforts at a policy level. Garcia, Nunez, and Sansone [1] conceptualized these organizational dimensions as addressing the changes that an institution would need to make in order to better serve the Latinx population. In the graduate program recruitment context, the

graduate programs themselves only have limited abilities to control or influence change at an institutional level so it would make sense that these elements of the framework would not have been prevalent in the graduate program slides and presentations.

Faculty in the focus group mentioned that they were specifically selecting to add elements to their slides that would distinguish their programs from the others participating which may have led to the exclusion of some of the elements that were listed in the framework. One particular faculty member mentioned that academic outcomes would be similar across many of the programs so that was not an emphasis they had wanted to make with their slide, but rather they were more interested in highlighting the student experience:

> *Everybody's academics are the same right? They are. Roughly, you could wash them all out and they're basically the same…and so focusing on these other aspects of student life of you know how we approach advising, how we approach cohorting our students, how we feel about the student graduate community, right? What are we doing to foster that.*
> [Faculty 665]

To answer the research question posed, we believe that these results suggest that the servingness framework does hold some relevance to the graduate multi-institutional program showcase designed without a specific focus on servingness. Particularly, concepts related to student experience and program outcomes (both academic and non-academic) were the most frequently emphasized in the showcase materials. While the entirety of the servingness framework was not evident in the showcase materials, it is likely that elements of this framework could be present in other similar contexts if the focus was intentionally leveraged. These results bring into light the tension that exists in a multi-institutional graduate program showcase as defined within this study, where programs are trying to highlight their unique features in order to attract students to their graduate program.

Research Question 2
Our second research question *what changes may be necessary to the framework to allow for its application to the graduate program recruitment process context* provided the researchers with an opportunity to gain perspectives on what elements of the servingness framework were not in alignment with the graduate student context or would need alteration if this framework were to be further employed within this context.

We observed that we had difficulty in distinguishing academic and non-academic outcomes within the graduate program educational context. Many institutions felt that elements like being able to personalize their graduate program experience or an emphasis on Discipline-Based Educational Research (DBER) were representative of academic outcomes although they were coded as non-academic outcomes by the researchers in this study. This may be indicative that there is not a clear separation between these two sub-themes for the graduate student context. Specifically, one faculty member shared in the focus group *"Yeah, I guess that is interesting.*

Like with, is there anything that's non-academic like in graduate academia land like academic and non-academic feel like one thing for better, for worse" Faculty 779. For this reason, we believe that it could be beneficial to combine the sub-themes associated with outcomes into a single category that accounts for both academic and non-academic outcomes. As the original intent of Garcia, Nunez, and Sansone [1] was to capture outcomes that were associated with serving Latinx students in the HSI context, it may not be necessary to explicitly distinguish these elements in other applications of the framework.

Additionally, there were concerns that were raised about portions of the structures for servingness component of the framework. Specifically, it was noted that for a graduate program context it would be difficult to develop and implement culturally relevant pedagogy and curriculum as the graduate student population is very diverse and includes a number of backgrounds and ethnicities. It was also referenced that we would not want the students to join the graduate programs believing that they would specifically have these opportunities if the provision of these experiences are outside the purview of the recruiting department. One focus group participant mentioned that although programs may strive for these options to be available to their students it is not necessarily under their control:

> *And then we can talk about like we strive to make our curriculum culturally responsive. But then it's also like. I don't know some teach it like they could. I feel like I don't have enough control over those 2 pieces to make a claim.* [Faculty 261]

Instead, focus group participants mentioned how changing the Organizational Dimension sub-themes from culturally relevant pedagogy and curriculum and culturally relevant programs to student-centered pedagogy and curriculum and student-centered programs would yield better alignment with the goals and outcomes of doctoral engineering education programs. The multidimensional conceptual framework of servingness in HSIs sought to employ the categories of culturally relevant curriculum and pedagogy as well as culturally relevant programs to consist of programs that were taking into account the knowing and learning of students from the minoritized backgrounds they were seeking to serve [1]. In this manner, perhaps since one of the goals of doctoral engineering education programs is to help students with a passion and desire to study and teach using student-centered pedagogies, this shift in framing makes sense and aligns with the original intention of the framework.

Finally, one participant expressed concerns with the appropriateness of using this framework for this analysis or even as a way of thinking about the showcase more broadly. The participant argued that programs were not designed with the framework in mind so it is not an appropriate way to present them in a showcase. Though not discussed in other focus groups in this way, another participant did mention that it is hard to think about servingness for newer programs which need time to develop and understand a student profile. Both perspectives are particularly important to think about for future research and practice relative to the showcase.

Based on the feedback from various faculty members, it is evident that there is a preference to make adjustments to the framework to be more suitable to this context. When graduate program faculty representatives were asked to review the suitability of this framework based upon their experiences with the multi-institutional graduate program showcase, they suggest combining academic and non-academic outcomes together into a single theme. Additionally, faculty suggested modifying the culturally relevant pedagogy and curriculum and culturally relevant program's sub-themes to reflect student-centered pedagogy. The faculty believe that these changes would allow for the framework to have greater alignment with the graduate student recruitment context.

Conclusions

We employed framework analysis to determine the suitability of the multidimensional conceptual framework of servingness in HSIs for identifying elements of servingness captured in doctoral engineering education multi-institutional graduate program showcase slides and presentations. We observed that many of the indicators of servingness were present within the presentation (academic outcomes, non-academic outcomes, and student experiences), but fewer components related to structures of servingness were evident. Some faculty also expressed wanting to combine certain themes in the framework to be more meaningful in evaluating the work in the graduate program recruitment process context. Overall, we believe that the servingness framework does provide valuable insights to the evaluation of graduate program recruitment materials for prospective students. Future work could include a focus on testing if the adapting the recruitment materials to leverage a servingness framework will yield more inclusive approaches to recruitment as hoped.

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