Qualitative Analysis of Boundary Spanning Implications within Interviews of Engagement Stakeholders

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Interviews conducted with community engagement stakeholders are qualitatively analyzed to provide contextual understanding for boundary spanning within the STEM community. Community engagement refers to relationships between the university and external educational entities such as K12 institutions, libraries, and community centers, to mutually improve social, civic, and ethical problems around educational outcomes. Boundary Spanners, or individuals who act as knowledge and power brokers to help establish reciprocal relationships between a university and community, are fundamental for providing pathways for collaboration between the academy and society. Stakeholders from University, Government, K12, Industry and Non-profit organizations were interviewed to determine how boundary spanners can be best utilized to facilitate and improve engagement outcomes. Purposeful and snowball sampling was used to identify interview subjects resulting in N = 30 interviews; 16 of which represent the university and 14 represent the stakeholders external to the university. A thematic analysis of the interviews was conducted using the constant comparative method and qualitative research software to reveal insight into the engagement landscape and boundary spanning. This evaluation is useful to provide context within a systematic framework for improvements of engagement practices and outcomes through the use of boundary spanners. Amongst emergent outcomes of the interview data, empathy is utilized as an example for illustrating contextual findings within the engagement system. Outcomes of this research, which are directed at STEM and Engineering Education, will allow policy makers and practitioners to be better informed on what boundary spanning policies to implement, and in what contexts they are applicable. The findings provide transferable research and knowledge about boundary spanning as a method of strengthening pathways for broadening participation in STEM through community engagement.

Introduction:

Academic engagement is the process of connecting university resources (knowledge, infrastructure, and individuals) to non-university partners (non-profit or government organizations, industry representatives, and K12 schools and students) to mutually improve social, civic, and ethical problems around educational outcomes [1,2,3]. Community engagement refers to relationships between the university and external educational groups such as K12 institutions, libraries, and community centers [4]. Ideally, these relationships should be established to provide mutual benefits through exchange and implementation, where researchers and participants develop shared solutions to problems of mutual interest [5].

Community engagement can positively impact citizenship and provide a larger sense of mission and clarity to those who participate [1]. These efforts are important to offset the increasingly business-oriented approach of higher education and to minimize the isolation of the "ivory tower" [5]. In the science, technology, engineering, and mathematics (STEM) fields, a lack of connection between education and society's needs is limiting interest and enrollment [6], minimizing creative outcomes and real world

connection, and inhibiting increased STEM literacy. An institutionalized and sustained commitment to engagement is a necessity and must be prioritized if higher education is to continue its important societal role [7]. The goal is to create platforms "in which the academic and civic cultures communicate more continuously and more creatively with one another helping to enlarge the universe of human discourse and enriching the quality of life for all of us" [1].

Boundary spanners, or individuals who act as knowledge and power brokers to help establish reciprocal relationships between a university and community, are fundamental for providing pathways for collaboration between the academy and society [8,9]. Boundary spanners effectively used to facilitate engagement can minimize the challenges inhibiting widespread university/community engagement and enhance pathways in which students from all backgrounds are actively invited to pursue a STEM education. Boundary spanners are critical for the balance and success of engagement interactions and to effectively unite society's needs and education. They work with all stakeholders within engagement relationships to plan, organize, implement, and evaluate initiatives [9,11]. Several characteristics lead to success for Boundary Spanners: listening skills, a service ethic, competence in power management, and neutrality [8]. An effective combination of these characteristics can be utilized to overcome the barriers for reciprocal, long-term engagement relationships.

Boundary spanning can impact engagement activities in several ways. Generally, it can be used to establish new or supplement existing engagement initiatives through direction, facilitation, and/or evaluation. Contradictory to a one-way expert model of delivering knowledge, effective engagement is performed in a two-way interactive relationship which allows both the university and targeted community to express needs and desires [8]. Boundary spanners hold the potential to systematically expand the university network and relationships to broaden the impact of engagement initiatives through utilizing concepts of inter-organizational dynamics to inform inter-stakeholder relationships.

Through this ongoing research project, the authors are seeking to inform boundary spanning and engagement practices by answering the following research questions:

1. How can the barriers to university/community, two-way engagement be minimized/overcome through a boundary spanner intervention?
2. What are the mechanisms which provide for boundary spanner success in mobilizing engagement outcomes?
3. What aspects of the boundary spanning intervention are effective for increasing engagement outcomes within the local context and can be transferred to other settings?

The performed interviews are directed towards the goal of understanding the interdependencies between the stakeholders in engagement relationships and to identify how these can be optimized for mutual benefit. The work here compliments previous efforts by Delaine, where a framework has been developed for the strategic deployment of boundary spanners to systemize a rigorous improvement of engagement processes, relationships, and outcomes [9]. The interview phase of this research seeks to contribute to this research by completing the following objectives:

1) Provide contextual understanding of the community engagement activities, including barriers, enablers, goals, and outcomes within the project area
2) Localize ongoing engagement initiatives, build a social network, and identify potential case study initiatives
3) Determine the linking mechanisms and boundary spanner potential to optimize engagement initiatives around stakeholder needs
4) Build knowledge towards the development of a holistic understanding of university/community engagement

This paper discusses the research method, data, and coding used throughout the analysis of this project. The coding categories are presented alongside excerpts illustrating the benefits of conducting interviews within the efforts of a boundary spanner. This is followed by a more thorough analysis of "Empathy" as an emergent outcome of the interviews. A discussion on interview excerpts highlighting empathy's role in engagement are presented alongside a review of empathy within engineering education to facilitate understanding. The outcomes are useful in informing engagement and boundary spanning practices.

Research Method:

This work is performed using qualitative research methods [13,14]. A semi-structured interview protocol was developed based on previously established evaluations of barriers and enablers to university engagement, indicators of campus commitment to engagement, and indicators for evaluating broadening participation [9]. Interview subjects were selected using purposive and snowball sampling [15,16]. The interviews were conducted in the Portuguese language. All interviewees were asked their thoughts on engagement and its role within academics. Questions examined the extent to which interview subjects participated in outreach, reasons for or against participation, the impact the outreach has had on participants and themselves, and the ways in which the interdependencies of the stakeholders can be optimized. The interviews varied in length between 30 – 100 minutes, were audiotaped, and then transcribed by a local professional for analysis. All information is maintained in de-identified form.

Utilizing the qualitative data analysis tool NVivo and the constant comparison method, the data was analyzed using an iterative analysis process as described in [17]. The coding was performed in two stages, topic coding, followed by interpretive coding. Initially a set of predetermined codes, developed from the existing literature and the authors' previous experience and understanding, were used to begin coding and was continuously updated through the evaluation process. The codes themselves are structured in categories and subordinate clusters. The primary focus of the data analysis was based around the research questions and objectives as listed above. The data is analyzed in Portuguese and the author translated the excerpts with assistance of local experts to verify the accuracy of the translations.

Data Sources and Participants:

Interviews were conducted with representatives from the various stakeholder groups as seen in Table 1.

Interview Overview	
Industry	2
University	15
Non Profit	3
K12	9
Government	1
TOTAL	**30**

Table #1: Interview Categorization

Representation from across the stakeholder groups was pursued within the sample set. All interview subjects are a part of the local educational landscape. A majority of the interview subjects had participated in or been aware of different engagement activities. They had been identified as appropriate subjects through the recommendation of other interview subjects, as in snowball sampling.

Results Part I – Coding and Categories of Interview Data:

In this section, the coding categories are presented as they have emerged from the interview data. The four main category trees, which are reviewed here, include: Engagement Overview and Global Perspective, Engagement Barriers, Engagement Enablers, and Outcomes. The categories are presented alongside excerpts to provide for deeper contextual understanding.

Engagement Overview and Global Perspective: Under this coding category nodes represent the overarching or global level thoughts on participation and experience in/with engagement, as articulated by the participants. One node is used to represent initiative types and possibilities, where examples of existing or ideal outreach and engagement programs are presented. Another node groups discussion on initiative and program descriptors, where any of the characteristics or programming details of engagement activities are collected. Lastly, global perspectives that discuss or define engagement's role within higher education, engineering, and society are coded.

An excerpt from an interview conducted with an educational non-profit representative shows the type of global level perspectives on engagement coded within this category:

"[A cultural difference] distances the community a little. Because the community has other interests and other ways of acting. I think that the big link between these two places is university engagement. To get closer to peoples needs… because today, I see that the community, the general population, they view the university like something really distant and really inaccessible. It is difficult in [local] culture, for a regular person, who has a question or a need, to be able to speak to somebody at a university. The people impose barriers on these types of things. So I believe the easiest way is engagement, and in one way, to popularize

the university, because I believe a barrier has been created between scientists and the general public. This wall needs to be transposed. I believe that these engagement activities are a good way to accomplish this."

In this case, the interview subject is reflecting on several important topics within the engagement ecosystem. Local communities and universities have different cultures, and have different needs [18]. To most effectively engage the community this gap must be bridged. Here we can see the potential for statements to elucidate a global contextual understanding around engagement and bridge building between communities, as well as a local contextual understanding for the site of this study. Additionally it should be noted that an educational NGO representative is well positioned to see the gap between the needs of a community and university as well as speak on the intersections between social and educational issues.

Engagement Barriers: In this category the perspectives and positions that inhibit the practice or participation in engagement activities are coded. There are three barrier categories - Lack of engagement Savvy, Leveraging Resources, University Culture and Structures - which each contain subcategories as illustrated in the table below.

Lack of Engagement Savvy
Confusion on what is engagement
Difficult Engagement Characteristics
Engineering Characteristics
Limited indicators/definition
Forming Managing Relationships
Communication
Power Imbalances
One way expert model
Unanticipated Difficulties

Leveraging Resources
Limited Resources
Communication

University Culture and Structures
Being seen as an outsider
Conservatism
Elitism
Disconnect with mission
Institutional Culture
Limited Driving Factors
Limited Engagement Structure
Bureaucracy
Reward Structures
Variable Interest
Career impingement
Empathy
Member workload

Table #2: Engagement Barrier Categories and Subcategories

A more complete discussion on what each barrier category and subcategory represents can be found in [12]. An excerpt from a university professor accurately represents some of the challenges from the university perspective:

"[Engagement] activities normally are very piecewise, that is, they occur from time to time. Institutionally, they have little value. Everybody thinks they are good, but in evaluations they don't count much, so they end up being marginalized."

This brief excerpts reflects on institutional culture where engagement efforts are not deeply valued. Additionally, due to lack of institutional value, the events happen in a piecewise manner which can also adversely affect outcomes and prevents engagement from becoming a university priority. Statements similar to these are appropriate for building a thorough understanding of the inhibitors to engagement from all stakeholder perspectives.

Engagement Enablers: The factors that serve to facilitate organization, participation, and other engagement characteristics are coded within the Enabler category.

> "One thing I find interesting about our school, is that the we…the teachers try to develop within the students, as much as possible, autonomy. With student clubs, we learn to deal with the students, to coordinate, and showcase them in one way or another. We go on to develop maturity, which many here, when they entered the school on the first year did not have. Knowing how to deal with a project, knowing how to deal with a student like that, teenager with teenager, to say "so, you can do this, you cant do that." For us to develop a project and have to present it to the whole school…in a lot of places that doesn't happen, you know. And the coolest part is when we develop a project and the teachers say "yea lets do it," you know, to have the help of our director and she says "go ahead, this project will be successful".

This brief excerpt contains many powerful enablers from a student perspective on how students can be prepared for participation and leadership roles within engagement activities. Additionally, it shows how important mentorship and support of these initiatives are to student success.

Engagement Outcomes: Within this categories the various outcomes from engagement activities are included. Outcomes can be direct physical resources or educational benefits, new relationships, information or progress towards participating in outreach, among others.

> "I think if opportunities [for engagement] were created within a course of study, no doubt that people would participate more, be more interested in the course, have higher academic achievement than they have today, have more interest in lessons. For me at least it was like this, if you look at my transcript from my first to third year, I totally changed, my academic performance improved 80%. I started to really improve in my classes, I began to get good grades, after I started to participate in engagement projects. I became a student ... in fact, a student that goes to class to resolve my doubts, to pursue the teacher for deeper understanding, to ask questions, and to bring matters to class "

This excerpt taken from a student perspective, illustrates how engagement can be effectively used to ignite passion within engineering leading to deeper overall educational outcomes within the engineering curriculum. A professors understanding of the outcomes of engagement shows a more broad perspective on how students participation in engagement leads to deeper development of social skillset:

> "Increasing [engagement] would give our students social development that they are currently not receiving here. A peripheral development that includes the virtues of social responsibility, an environmental awareness."

And lastly, an excerpt from an interview with university leadership shows the engagement outcomes on a societal scale at large:

> "[A shift in culture towards engagement] is positive not just for USP but for society at large because it encompasses the quality of life, a reduction of social conflict, and the creation of opportunity. It is very positive."

The additional excerpts in this section are included to help illustrate the benefit of parallel stakeholders views on engagement activities from differing perspectives, in this case,

providing three hierarchically staggered perspectives. Each perspective is important and must be unified within mutual-beneficial, engagement partnerships.

Together, the excerpts show how a holistic and multi-stakeholder interview phase can contextualize the boundary-spanning researcher within the engagement ecosystem. Analysis across the various categories and nodes provides for deeper thematic understanding of the engagement ecosystem. Performing interviews on the various stakeholders within the engagement ecosystem is important for contextualizing research efforts. Every system has its own particularities: differing reward structures, channels and methods of communication, structures and norms of the educational system, and priorities and opinions towards engagement. Recognizing these characteristics is essential towards successfully applying boundary-spanning practices within the system.

Within the interview phase of this research several overarching ideas that can facilitate the ability of a boundary spanner to improve engagement outcomes have emerged. The emergent areas during the ongoing research efforts include empathy, innate understanding of engagement system yet an inability to maneuver within it, and engagement as a dissociated part of university culture. Empathy is an important factor and interlinking mechanism within the engagement eco-system. In the following sections, a deeper analysis of empathy within engagement for engineering education is presented.

Results Part II - Empathy within Engagement:

One emergent theme from the conducted interviews is the role that empathy plays within the engagement ecosystem. In this section, we will use the interview data to richly contextualize empathy to more deeply illustrate how interviews can inform a boundary spanning intervention and the understanding around empathy in engagement as it has emerged from the data.

Throughout the interview data, empathy has been shown as a mechanism for motivating and encouraging participants to start engagement practices, as a factor that provides for success within engagement activities, and as a method which provides for continual and long-term engagement participation and outcomes. A brief literature review of empathy within the engineering is presented to facilitate understanding.

- **Empathy in the Engineering Literature**

Various definitions of empathy are found within different disciplines [19-21]. Psychology defines empathy as "the capacity to think and feel oneself into the inner life of another person [19]." The discipline of Relationship formation – defines it as "a specific skill designed to facilitate communication [20]." Another widely accepted definition of empathy is "being able to understand the experience of others [21]".

A previous literature review performed from an engineering perspective by Hess et. al.[22], yielded a list of alternative words found to be used as synonyms for empathy and

care within the field of engineering. The synonyms include: build trust, compassion, helping profession, humanitarian, humanized, safety, solidarity, community involvement and users' need [22].

Three essential qualities of empathy have been presented to include a cognitive component – knowing what another person is feeling, an emotional component – feeling what another person is feeling, and a responding component – responding with compassion to another person's experience [23]. Additional ideas encompassed within empathy include: affective sharing, self-awareness, mental flexibility and perspective taking, and emotion regulation [24]. Empathy, is understood to include cognitive and affective components of "perspective taking"[25].

The concept of empathy is contained within a set of skills called Emotional Intelligence (EQ), a parallel concept to intelligence quotient (IQ). EQ covers a range of skills, including self-awareness, self-regulation, motivation, empathy and social skills [26]. EQ impacts learning, communication skills, intercultural awareness, as well as the learning abilities of students, and serves as an enhancer of work skills and employment opportunities. On the other hand, declining EQ skills can affect student performance and may lead to higher drop out rates [26]. The development of the skills within EQ can be referred to as Social-Emotional Learning (SEL) [27].

The review performed by Hess led to three primary findings on empathy and care within engineering: Empathy, as well as care, are terms which are not well represented in engineering literature, while the synonyms are found more often. Empathy is present in engineering practice and education in slightly different perspectives, of which teamwork is a common factor. Empathy needs to be further defined and developed within engineering [22]. Continued evolution of the concept of empathy creates opportunities to further ground educational efforts to enhance empathy in professional communication, and provides the measured enhancement of empathic skills as a potential educational outcome [28]. Currently, a systematic consideration of empathy/care in engineering is not part of the culture of academic engineering [22].

Walther et. al. derive a definition from within engineering education, as well as review its impact within this field [28]. In this work, the authors define empathy as "perspectives enable engineering students to develop a nuanced, critical understanding of the multiple perspectives which characterize contemporary engineering problems".

Promoting, empathy, EQ and other soft skills has been referred to as holistic engineering education [29]. As these skills are essential to workforce success [26], play an important role in augmenting communication skills in engineering students [30, 31], and are important to help engineers consider the impact of their work on society [32], finding ways in which holistic engineering education can be achieved is important, yet challenging. Engineering has historically had a masculine image [33], which is "associated with keeping emotions to oneself or actively hiding feelings in order to be perceived as objective, impartial, analytical, and not weak [34]." Integrating these concepts will face some challenges within this masculine image of engineering currently

in place. This culture can inhibit the acceptance of empathy and EQ pushing towards strict technical curriculum instead.

In order for the successful integration of EQ into a curriculum, the concepts must be systematically embedded within an organizational system [35]. Some basic recommendations have been made as to how EQ skills can be incorporated into engineering education. Isolating the principles into one course or module has been shown less effective than incorporating EQ across the curriculum [26]. Engineering can naturally help to develop empathy through group work and collaborative processes [22]. On the other hand, studies indicate that a single person with a low EQ can lower the collective IQ of an entire group [15]. Experiential approaches, which include engagement, provide excellent opportunities for the development of EQ based on student involvement in in the actual experience of communication, with opportunities for debriefing and re-application, provide opportunities for the development of self-awareness [26, 28].

Within focus groups performed in [22] participants only suggested positive outcomes through the increased promotion of empathy in engineering education: engineers who are empathetic are better in teams; engineers who care about the consequences of their design decisions are more valuable employees; engineers who empathize with their clients are simply better engineers than those who do not; engineering as a profession might become more gender diverse; teachers who empathize with and care about their students have a positive impact on engineering students; teachers who show that they care provide students with a more positive educational experience.

The National Academy of Engineering (NAE) has recognized this need in promoting the development of "habits of mind" which include systems thinking, creativity, optimism, collaboration, communication, and attention to ethical considerations [7]. The promotion of these characteristics are intended to shift perceptions of engineers from object-oriented individual workers to those who display a "strong work ethic (in collaborations and communications), are ethically responsible (globally, socially, intellectually, and technologically), are able to adapt to new trends, are innovative, and are entrepreneurial [7]."

Hess found four themes of empathy within engineering: empathy/care are present and necessary in collegial collaboration and team exercises, engineers may be perceived to be empathetic/caring towards society by providing solutions that benefit mankind, empathy and care hold a presence in teacher-student interactions, and while empathy and care may be present in academic and industrial pursuits, they are not openly promoted or encouraged in the fields of engineering or engineering education [22].

The established literature on empathy in engineering provides important foundation. We will now take a deeper look into empathy within community engagement. By way of the interview data, empathy is explored across the three areas in which it is proposed to impact community engagement: initial motivation, success during, and continued success.

- **Empathy as a motivation for community engagement:**

In motivating participation in engagement, empathy serves to provide for a direct connection to initiatives, participants, and outcomes.

> "[I participate in engagement] because I like it […] I don't like to see children in the streets, people going hungry, people selling candies at the traffic lights. I don't like to see this reality. I don't like seeing it. So then, what is my objective? It is to train these people, so much so that, that child can go to school, and when they have a little time, they can help their mom doing some things, creating some kinds of artisanal crafts. And because in my reality, I don't like seeing that poverty… so If I can help to take these people out of their misery, people in the street of which I can help contribute, I am going to do my part."

In this excerpt the interview subject repeatedly states how she/he does not like to see suffering in fellow citizens. The excerpt shows a deep empathic connection to these challenges and struggles, which in turn serve as a driving force to act on this suffering. The excerpt not only shows how empathy is a motivating force to participate in engagement, but also shows a deeper connection to potential outcomes, in this case a connection to entrepreneurship and local economic development as additional outcomes within engagement activities [36].

Empathy also serves to help create a selfless individual able to participate in engagement. Community engagement is often a secondary priority within the academic value structures [12], yet participating academics and stakeholders dedicate substantial energy to their students/mentees, and engagement efforts. This selflessness is illustrated in the following excerpt:

> "I do not think much of [my personal benefit in performing engagement], in fact. I think that my gain is the success of my students, because I could interfere at some point so that they could progress. […] For me it is pleasant to have this, I have students who are taking [up] the idea [of performing research]. Are picking up the idea [of STEM participation], are moving forward and are achieving. I get sad when one [student] arrives at a point and stops ... not that, I think everyone has to choose what you want and such, but you see that the person has a good potential, and he stops, it does not will. […] So for me it is pleasurable and then ... The works published, of course, are important, because with published work I can get money. Have money I can get more people, I can support more people. So I try to pursue projects that I will publish, but it is ... the discoveries, things to work with people, I think much more ... me ... is what I get. Now that's a gain, I really think so."

Throughout the interview data, it is common that those who participate most often share a selfless outlook and display high levels of empathy. The engagement outcomes aren't always tangible or directly related to career objectives, and those who perform engagement activities from both inside and outside of academia are generally overburdened. High levels of empathy provides for participants to look past academic/institutional value structures and compassionately connect and act upon students' needs. Upon deeper reflection, the speaker in this excerpt also conveys the fact that while it is not a primary goal, obtaining career progress (via publishing and research) through her/his engagement activities is possible, and that these outcomes can be utilized to continue performing engagement.

- **Empathy towards successful interactions during engagement:**

Students are apt at recognizing which professors and mentors have their best interests in mind and are attracted to these types of mentors. Working under such guidance within engagement activities can amplify successes [37]. In promoting the success of engagement activities, empathy helps by acting as a driving force in effective and sustained mentorship:

"Even in motivation or in close collaboration, having someone close to you, telling you, "you can achieve, you can do it." I think everyone needs a person who is on their side, giving them support and positive energy, while there may be people or even yourself who thinks you can't achieve. If you have that thought, you wont get anywhere. If someone you know shows that they believe in you, you, for sure, with that support and the support of other people, you will achieve."

This excerpt from a student shows how close contact and motivation can potentially turn disenfranchised students into interested and engaged learners. Others have studied the role of faculty and peer support in relation to a student's sense of belonging and persistence [37, 38]. Participation in non-academic communities, such as community engagement, provides opportunities for students to meet their sense of belonging and safety needs, which reduce anxiety and stress. Such personal relationships with faculty and fellow students correlate to students' sense of belonging in their major which leads to deeper connection between students and their education [39]. Student engagement has been shown to be influenced by faculty behaviors [40], which also suggests that faculty can support students' ability to learn not just through their own teaching, but also through supporting opportunities to build community and belonging, from class to class [41]. The evidence found in the interviews would indicate that community engagement can develop similar empathic connections providing for belonging similarly, if not better than, class work. This can help to broaden participation as community involvement is identified as one of the essential characteristics of programs that attract women and minorities to engineering and science [42].

- **Empathy towards stimulating continuity of engagement activities:**

To help stimulate the continuity of engagement activities an understanding of where empathy comes from and how it can be developed and fostered is important to provide for continued engagement success. EQ and empathy can be stimulated, more readily through experiential learning and a constructivist approaches rather than lectures or standalone modules [26]. Insight into theses concepts is contained within the data:

"Some are born with a sense of justice, but it is learned through experience. People who have their lives transformed by social support generally want to do the same… give back the same good. But I think that social awareness is developed on macro-scale and it has to do with citizenship, environmental responsibility, etc."

Performing in engagement activities helps stimulate empathy and empathy helps motivate individuals to start community engagement, creating a sustainable cycle. Walther et al. looked at fostering empathy in instruction through the design and implementation of a series of course modules within an environmental engineering

design studio. The modules include "efforts to enhance, deepen, and learn to apply empathy in practice [20]." Their modules are "designed to enhance perspective taking (cognitive and affective), self-other awareness, compassion in problem-solving, and is grounded in an understanding of peoples' reciprocal relationship to systems [28]." The important characteristics of the developed modules, which include authentic personal interactions, group reflection, communication skills building, role-play, and authentic stakeholder scenarios [28] are readily offered through community engagement activities. It is noted, that while the cognitive component of empathy may be developed more naturally in a class, the emotional aspects are perhaps more significant and usually not acknowledged in standard approaches to engineering education [43,44]. These challenges associated with teaching the emotional aspects of empathy within a classroom can potentially be circumvented or complemented through teaching empathy via community engagement.

Insight into whether or not empathy can be developed through engagement activities, is seen in the data:

> "Yes [empathy can be developed]. When one is not as closed [minded], yes, but I feel certain barriers at the university. Sometimes we even want to do some things with a partner there, it is quite difficult. On the other hand, with others, is very easy. But a lot of people there are difficult […] Those who are afraid, it's easy [convince them]. Try it once. Work with one student, spend all this problem. For me, can fall into sentimentality, to me is not no, to me is passion. If you are passionate about what you do, you like to spend it to the other, you like to make this work, to uncover, to help, to work together. I think it's passion, if people have passion, anything she does with pleasure, it radiates. You can pass it."

In this passage it is made clear that some are willing to participate more so than others, and empathy may be a defining component in this decision. However, those who show less empathy can develop increased levels of empathy through participation. Empathy is socialized, conditioned, learned [27], as illustrated by the following quote from a professor:

> "I think that it is part of the development to be better person. Because I believe that the best people are those who have less prejudice, which has more acceptance with each other, which sees more in the other person. Knowing how to put yourself in the another's shoes, I believe that these are better people. If you live in a bubble of people like you, who think like you, you can not develop this ability, you develop less. "

Additionally, as part of engagement is often to visit communities that are not necessarily those in which you belong, providing experiential learning, cultural understanding and other components of empathy. Taking on the role of different stakeholders or the community can enhance students' capacity for perspective taking and could serve to enhance their compassion, how they think about solving or addressing problems, and can further cement their experiential understanding of systems [28]. As such, engagement can be seen cyclical mechanism for creating and enhancing empathy. This cyclical nature can be utilized to sustain engagement activities, where empathy can be developed through activities and then leveraged as a motivating force for those to continue participation.

- **Empathy to empower boundary spanners**

The consideration of empathy as a defining trait within the community engagement eco-system has several implications on boundary spanning efforts to improve outcomes. Concepts reflecting on effective boundary spanning characteristics are displayed within empathy as well.

"I do not have the slightest problem to be like this, to be as equals. I'm teaching my students and at the same time learning. "

Here is shown a statement that recognizes the concepts of mutual outcomes and power management to serve as effective boundary spanners. Neutrality, effective power, and listening management are cited amongst the most important boundary spanning characteristics [45]. These concepts fit well within the constructs of EQ and empathy and a consideration of empathy in those who act as boundary spanners, as well as those who the boundary spanner chooses as partners in collaboration can perhaps lead to increased success.

Conclusion:

Interviews within the engagement ecosystem are valuable to provide contextual understanding and frame research and boundary-spanning outcomes. In contextualizing the engagement eco-system an understanding of the local challenges can provide avenues upon which improvements can be approached. Purposeful interviews and snowball sampling are appropriate for methods for identifying interview subjects. The semi-structured protocol was successful in the interviews, establishing conversational rhythms, and allowing for narrative type responsive provided thicker descriptions leading to deeper insights. Thick description are helpful to complement the developed framework [12] and provide insight into the specific mechanisms that can lead to success within boundary spanning efforts. Analyzing engagement interviews through the constant comparative method and coding of the qualitative data is useful in elucidating the knowledge of the engagement system within the various stakeholder groups.

Empathy, one of the domains of emotional intelligence, has been shown to be important within community engagement in motivating participation, providing success within initiatives, and establishing continuity into the future. The importance of empathy an EQ cannot be overlooked and have been identified as more important for success in life and work that IQ [46]. Empathy is not only a motivational component, but also is shown to be a necessary skill for workforce success, collaboration and other things. The interview subjects who have performed engagement at an exceptional level show high levels of empathy within the transcriptions. Boundary spanners can utilize empathy as a key characteristic to identify allies and collaborators. Engagement appears to be an affective way to not only display empathy, but develop and inspire it in a cyclical, lifelong learning kind of way. More work needs to be done, but initial implications show that these two concepts are intertwined and lead to increased merit in performing engagement activities.

A fusion of core and non-core engineering skills will provide for the development of holistic engineers. As the challenges faced by engineers become increasingly complex, socio-technical problems increased empathy and EQ will prove a valuable educational outcome. Community engagement has links to empathy within engineers on various levels. Empathy can serve as a motivational factor for starting participation in engagement. Empathy can provide for increased success through improved mentorship of professionals and perspective taking of students. Lastly, engagement can be an effective way to improve empathy skills. Empathy is important to characteristic for those serving within boundary spanning roles providing for increased power management and neutrality.

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