

Developing Teacher Empathy - A Journey of Three Engineering Faculty Members  
Implementing Empathetic Actions in their Classroom

by

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## ABSTRACT

In higher education, teacher empathy is a term that refers to the empathetic skills of teachers and has been researched since the 1980s. Multiple studies in fields such as medicine, nursing and psychology have shown that teacher empathy has reduced teacher burnout, improved teacher satisfaction and student performance. Within engineering education, there is increased research on empathy in recent years, but primarily aimed at introducing and improving empathetic skills of engineering students. There is little research on teacher empathy within engineering education. In my current study, I explored the potential longitudinal impact in perception of teacher empathy among three engineering faculty members as they utilized empathetic actions while teaching a second-year engineering course. I also explored the motivations and challenges that could arise in teacher empathy implementation. I used the Model of Empathy Framework developed by Walther and colleagues to define the complex attributes of empathy in an engineering context. I chose Teacher Action Research (TAR) methodology to provide agency to my three participants and research with them instead of on them. TAR allowed the participants to choose the empathetic actions they want to implement and to iterate when they feel appropriate. I found that all three participants had positive outcomes in their classrooms. Reduced teacher burnout, improved teacher satisfaction, and better student performance were some of the major benefits of teacher empathy that aligned with prior research. Improved confidence in their empathetic skills was observed for two participants as they showed positive evolution of their perception about teacher empathy. The other participant did not have any significant longitudinal impact in perception but was able to increase the number of empathetic approaches he could use in his classroom.

External situations such as classroom technology malfunctions, having meetings or classes immediately before a class and balancing between being empathetic and being tough were some of the major challenges. Findings indicate that similar positive benefits as found in other disciplines can be realized within engineering education. The outcome of this study could be used by Learning and Teaching Centers Department Heads and University Deans to expand the implementation of teacher empathy within a college or university setting.

## DEDICATION

I would like to dedicate this work to all the teachers and engineering faculty members who were a part of my life helping me to grow and mature to be the person I am.

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I thank my family for being incredibly supportive in every stage of my doctoral journey. I was able to overcome the challenges, both emotional and mental, through numerous late night and early morning conversations. I also thank my friends, peers and faculty members in my Engineering Education Systems and Design program who created a home away from home in the United States for me as an International Student. Every member of the EESD program helped me to grow significantly as a researcher and successfully complete my doctoral journey.

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## CHAPTER 1

### INTRODUCTION

Just like the hundreds of thousands of high school students who aimed to enter the top three engineering colleges in my state in India to learn engineering, I spent day and night preparing for the state exam. I was one among the thousands of students who got into the top three colleges in various engineering departments. I entered the Production Engineering department with so many dreams and a yearning to learn from the subject expert faculty members and become one of the top engineers in the state. To my utmost shock, I felt that none of the engineering faculty members cared for our learning. No faculty was willing to try to understand the difficulties that we, as first year students, were going through to learn complex topics. When I reached out, I was not supported or given any guidance to understand. I felt ignored, pushed aside, and neglected by the very people who were supposed to be providing a wealth of knowledge and support. All I ended up with was a lot of self-learning, homework, assignments, and hard test questions.

This interaction, or the lack of interaction, with the faculty members almost suppressed my passion for learning, let alone my passion to be an engineer. Fortunately, I had a chance to interact with a faculty from another engineering department who listened to me and my fellow classmates and answered many of our doubts and concerns. His patience, support and just a minimal effort to listen to our doubts and concerns helped me feel like I belonged in engineering and helped reignite my passion for learning and to become an engineer. I had a similar experience in my master's program, with the only difference being that I had a supporting faculty as my research advisor. All these experiences made one thing clear to me as a student, a student's passion for learning can

be sustained, increased, or destroyed by the way the faculty interacts and behaves in a classroom. My negative experience as an engineering student combined with my innate interest in sharing knowledge motivated me to become an engineering faculty who cares for my students and their learning while also helping them learn complex engineering topics.

When I became a faculty member in India, I became a supportive faculty member to my students and assessed how being supportive might positively benefit student learning experiences. I embodied the engineering faculty I wanted when I was a student. I was an immediate success. Almost every student came to me and reached out to me for help and support. Because I was a recent engineering graduate myself, I had less expertise in many of the engineering subjects than other faculty. However, the students felt that my guidance was more meaningful than the actual subject experts. In my teaching, I listened to the students, helped them search for the answers and learned with them. I let my experience guide them in becoming better learners of anything they wanted to learn. I enjoyed being a faculty member and the long hours of work and the extra meetings with the students did not feel heavy or tiring. The students shared with me that they enjoyed learning and felt more satisfied with their engineering program. The students' course average in my subjects also increased.

My experience as an engineering faculty and the students' reactions to my teaching motivated me to pursue this dissertation research when I joined the Engineering Education Systems and Design (EESD) PhD program. My motivation is to aid other faculty who wish to have a similar meaningful and fulfilling career as an engineering faculty. Through my initial conversations with EESD faculty members, I found that I was

referring to the empathetic skills of a faculty – Teacher Empathy. My working definition of Teacher Empathy is the willingness of a faculty to put themselves in the shoes of the students, understand their current state and help them grow from their current level to a higher level, and to provide support as needed and when possible. This working definition is evolving as I continue to experience my PhD journey, engage in literature, and conduct my dissertation research project.

Engineering education is one of the fields of higher education just like nursing, medicine, psychology. If we compare engineering education with other fields purely from a teaching and learning perspective, explicit research on Teacher Empathy is lacking in engineering education (Araya & Martin, 2022) while there are decades of research in other fields, dating as early as 1977 (Bochner & Yerby, 1977; Coffman, 1981a; Waxman, 1983a). Multiple studies have demonstrated that Teacher Empathy is beneficial to both teachers (Arghode et al., 2013a; Dahri et al., 2018; McLeod, 1995; Muhammad & Jaafar, 2015) and students (Meyers et al., 2019; Mikkonen et al., 2015a). Some of the benefits include reduced stress and teacher burnout (Jennings & Greenberg, 2009), promotion of culturally relevant pedagogy and student-centered instruction (Warren, 2018), improved student learning and student academic performance (Bozkurt & Ozden, 2010), and the development of student empathy as a skill through role modeling (Shapiro, 2002).

While there has been a need for all the benefits mentioned in engineering education, the use of Teacher Empathy as a potential method to achieve those benefits is yet to be explored out of my own explorations (Sundaram & Kellam, 2022). The need for reduced stress and teacher burnout and better learning environments for the students is even more critical now because of the increased focus on mental health after the COVID

pandemic and social movements such as Black Lives Matter (De Souza et al., 2021). It is critical to teach empathy skills to engineering students and one of the best ways to impart empathy is to embody empathy, teach through example, and be a role model as an empathetic professional educator (Walther et al., 2012a). I am doing this important, critical research to understand the effect of Teacher Empathy in the context of engineering education. In this dissertation, I want to explore the journey of Teacher Empathy implementation by engineering faculty and understand the progressive longitudinal impact in the faculty's perception of Teacher Empathy over the course of one semester. I also want to explore the daily experiences of the faculty that becomes either a motivation or a challenge in being an empathetic teacher. The following research questions guide my research:

RQ1: What is the longitudinal impact of engineering faculty's perception of Teacher Empathy while implementing empathetic actions in engineering courses?

RQ2: What motivations and challenges are experienced by faculty while implementing empathetic actions in an engineering course?

### **Structure of the Dissertation**

In chapter one, I provided an introduction to this dissertation which included my personal motivation for pursuing this research interest. In chapter two, I will provide a literature review that demonstrates the extensive research on teacher empathy in higher education and the need for exploring teacher empathy research in engineering education. In chapter three, I will provide methodological and analytical aspects of my research project. In chapter four, I will share the findings of the study, mainly the longitudinal impact in perception of teacher empathy for each participant, the motivations and

challenges they faced during the implementation. In chapter five, I will share the relation between my findings and the broader literature along with the implications and future work of this study.

## CHAPTER 2

### LITERATURE REVIEW

The use and research of the term empathy has increased significantly in recent years in engineering education (Walther et al., 2020). But almost all of the research is focused on empathy as a skill for engineering students to meet the current multi-disciplinary work culture (Levy, 2018). If we take a systems perspective about empathy in engineering education, most previous research concentrates on students and we overlook the faculty and their empathetic skill development. In higher education, researchers from fields like medicine (Wear & Zarconi, 2008), nursing (Mikkonen et al., 2015b) and psychology (Bozkurt & Ozden, 2010) have tried to understand the concept of teacher empathy and its effects in the classroom and education. I aim to explore teacher empathy within engineering education and expand empathy research in engineering education.

Research around teacher empathy in higher education dates back to the late 1970's and early research was primarily quantitative. Coffman (1981a) expanded upon Bochner and Yerby's (1977) initial data suggesting that instructor empathy had positive correlation in creating a positive learning environment. Coffman studied the relationship between student perception of teacher empathy and perceived learning outcomes with a sample size of 615 students. Coffman's findings support the possibility that the perceived amount of instructor empathy plays a positive role in students' estimations of their final grade. Waxman (1983a) used the term Teacher Empathy explicitly and his results showed a positive correlation between students' perception of Teacher Empathy and students'



motivation. Such quantitative studies highlighted the potential of using Teacher Empathy to create a positive learning environment and improve students' motivation.

Teacher Empathy (Tettegah & Anderson, 2007a) refers to the empathetic skills of teachers and is defined as the ability of teachers to understand and take students' perspectives to provide a better learning experience. Research on top qualities for a teacher indicated "the most demanded quality of the teacher in the world is the ability to feel empathy." (Ilaltdinova et al., 2018, p. 45). Teachers' social and emotional competence is directly related to their ability to provide a conducive learning environment to the students and also manage teacher stress and burnout (Jennings & Greenberg, 2009; Vučinić et al., 2020a). Teacher Empathy is also found to promote student-centered instruction (Arghode et al., 2013b) and incorporate culturally relevant pedagogy (Warren, 2013, 2015, 2018). Teacher Empathy helped in improving student learning and overall performance (Bozkurt & Ozden, 2010). Research has pointed out that there is a high correlation between Teacher Empathy and student performance. Students also highlighted that they were able to develop empathetic skills more effectively when they had empathetic teachers as role models (Mikkonen et al., 2015a). All the above studies have demonstrated the positive impact of Teacher Empathy indicating the importance of developing the empathetic skills of teachers.

In the past decade, engineering education researchers and educators have begun focusing efforts on increasing empathy of engineering students through course modules and interventions (Hess & Fila, 2016; Walther et al., 2012b, 2016, 2020). In 2012, Hess and colleagues explored the literature to develop an understanding of empathy in engineering education and they found that there was not an explicit definition of empathy

within engineering education (2012). In interviews, Hess and colleagues learned that engineering faculty members refer to empathetic behavior as care for their students and found that some engineering faculty members consider themselves to be empathetic explicitly or implicitly (2012). Hess and Fila developed educational contexts and pedagogical techniques such as role play to introduce empathetic skills to students (2016). Walther and colleagues (2012b, 2016, 2020) developed course modules emphasizing empathy and implemented them in an engineering course where they found that while the students were able to understand the need for empathy, the students had difficulties adapting to the new learning modes in an engineering classroom. While this work is critical to our understanding of empathy in engineering education from the student perspective, there is still little known about faculty or Teacher Empathy in engineering.

In my prior work, I explored the current perceptions about Teacher Empathy of engineering faculty and found that engineering faculty have some understanding and exposure to empathy within engineering classrooms (Sundaram et al., 2021). Engineering faculty's perceptions and definitions were in alignment with prior empathy research (Arghode et al., 2013a; Hess et al., 2012), which highlighted the complexity in defining and implementing empathy in engineering education. From my pilot study, I found that the Model of Empathy Framework (Walther et al., 2017a), initially developed for the engineering professions, helped me to effectively capture the complex empathy construct within engineering education settings and hence utilized this framework for the current study.

One exception of the dearth of literature around Teacher Empathy in engineering is Kate Youmans dissertation work, where she explored “students’ perceptions of how engineering professors currently express empathic concern as part of their teaching practice” (Youmans, 2020a). Empathic concern refers to behavioral and motivational empathy, which is similar to the concept of Teacher Empathy explored in this study. Youmans found eight distinct experiences among 27 student participants that were viewed as professors expressing empathic concern for the students. They grouped these into three fundamental themes namely, “(1) expressing care for the students as individuals; (2) cultivating student learning; and (3) acknowledging the challenges of engineering education” (p.174). Youmans also provided recommended actions that could fall within these experiences (Youmans, 2020a). These recommended actions were provided to the participants in this study to either choose the recommendations or to help the participants inspire and come up with their own empathetic actions. Kate Youmans’ study provides insight into the engineering students’ perceptions of Teacher Empathy. In this dissertation, I aim to develop an understanding of engineering faculty’s perceptions of Teacher Empathy as they experience implementing empathetic actions into their classrooms.

In recent events, the COVID pandemic has shown us that empathy may be critical in teaching and learning. For example, during the pandemic students encountered difficulties in learning due to the virtual transition and lack of empathy from their instructors (Sealey et al., 2021). These difficulties were exacerbated for Underrepresented Minority Students. Students pointed to “lack of flexibility or empathy as reasons for frustration during transition” from in-person to virtual learning environments (Earle &

Kennicutt, 2021). The move to online learning during the pandemic also highlighted the need to not only concentrate on the intellectual growth of an engineering student but also their emotional state and growth. The pandemic has shown us that it is important to be empathetic with the students in-order to help the students gain the academic knowledge and become better professionals (Earle & Kennicutt, 2021). I want to acknowledge that we had started to go back to in-person teaching and learning during the data collection period, and the opportunity to be empathetic towards the students has increased along with the need for such empathy towards students.

### **Theoretical Framework**

Strobel et. al (2013) pointed out the absence of a coherent framework that contextualizes empathy specific to engineering. The prior frameworks related to empathy in engineering refer to empathetic design and “early accounts of empathetic design were often characterized by a business-model approach” (Walther et al., 2017a, p. 132), which means that the primary intention to understand the user is for profit and not genuine customer satisfaction through concepts like human-centered design. Since then, two potential frameworks were developed. Hess and Fila (2016) proposed a conceptual model and a definition for empathy within the context of engineering education. The Hess and Fila model is based on literature from various fields such as social psychology, moral philosophy, and engineering education. Hess and Fila’s model defines empathy as a concept that “includes both affective experiences and cognitive processes.” The affective experiences refer to the emotional distress or joy felt by an individual. The cognitive processes refer to Perspective Taking. These two empathy types are further divided based on self-oriented empathy or other-oriented empathy. The model captures the cyclic

relationship between affective and cognitive empathy and between self and other orientation. Hess and Fila's framework is to develop strategies to teach empathy to students and to understand the development of empathy as a skill. While teaching empathy is important and is related to this current research, I wanted to find a framework that could help understand not only how best to teach empathy and to develop skills around empathy, but how to be empathetic.

Walther and colleagues formulated a Model of Empathy Framework to overcome the lack of a proper definition of empathy within engineering education. The model was created based on "intellectual and pedagogical traditions of social work" (Walther et al., 2017a, p. 124). This framework provides a foundation to further understand the presence of empathy among engineers and engineering students. Walther and colleagues created this framework with the main intention to provide a foundation to develop pedagogical techniques to teach and practice empathy as a skill in engineering. Hence the model has various attributes of empathy that can be developed as a skillset. While it was not created with Teacher Empathy specifically in mind, it appears to be a framework that is flexible and adaptable enough to apply to others including, for example, engineering faculty (Walther et al., 2017a).

The model (Figure 1) is created with three dynamic and interdependent layers of empathy: the Skills Dimension, the Orientation Dimension, and the Being Dimension. The following sections elaborate on these three dimensions.

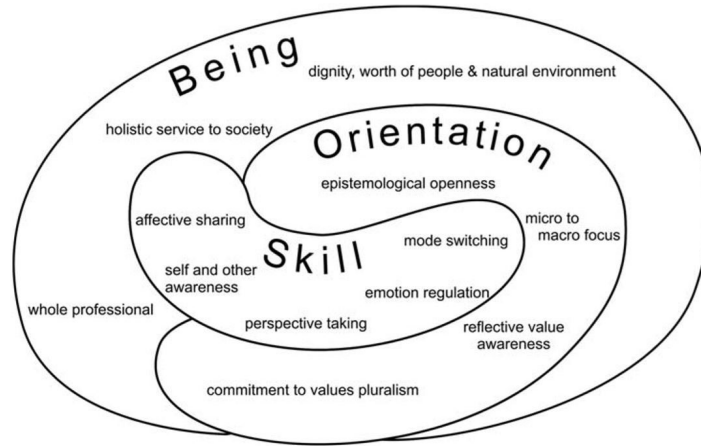


Figure 1: Model of Empathy Framework (Walther et al., 2017a)

Skills Dimension: The innermost layer is the Skills Dimension, which provides attributes that form the base for “empathic communication, relationship building and decision making” (Walther et al., 2017a, p. 133). The five attributes that form the skill dimension are socio-cognitive in nature and are interdependent with each other. The *Affective Sharing* attribute is defined as “a person’s capacity to share the emotions of the emotional state of the other” (Walther et al., 2017a, p. 134). The *Self and Other Awareness* attribute builds on the Affective Sharing attribute and is the ability of a person to understand the subjective situation of the other without losing their own perspective. While these two attributes are implicit by nature, the *Perspective Taking* attribute is more explicit and is the ability of a person to adopt a more conscious step to understand the situation of the other. *Perspective Taking* captures the interactions of a person to understand another person. *Emotion Regulation* “describes an individual’s ability to influence the ways in which they experience and express the emotions resulting from empathic interactions with others” (Walther et al., 2017a, p. 134). The fifth attribute specifically added for the engineering field is the *Mode Switching* attribute, which is a

person's capability to effectively switch between empathetic and analytic thinking processes.

Orientation Dimension: This second interdependent dimension helps to contextualize the key factors that influence how engineers and engineering students respond empathetically. It provides the lens to view the possible reasons behind the choice of an engineer to act empathetically and capture the mental disposition of engineers. There are four main attributes within this dimension: 1) *The Epistemological Openness* attribute captures the inclination of an engineer to “recognize and value the subjective experiences and perspectives of others as valid and important source of knowledge” (Walther et al., 2017a, p. 135). *Epistemological Openness* allows a researcher to capture the thought process behind the various actions of an engineer. 2) The second attribute is the *Micro to Macro Focus* which informs the need for an engineer to consider the system-level implications of their action along with the individual level implications. 3) The *Reflective Values Awareness* attribute covers the need for ethical and professional impact of an engineer's action. The ability to reflect on their own values and improve their internal disposition in terms of empathetic actions aligns well with the need of life-long learning skills for an engineer. 4) The fourth attribute is *Values Pluralism* which emphasizes the need for purposeful and transparent discourses among the various stakeholders for embracing and supporting diversity within engineering.

Being Dimension: The third interdependent dimension provides a broader value for the development of the skill and orientation of empathy within the engineering domain. Walther and colleagues argue that educators cannot expect their students to embody the first two dimensions “without fundamentally grappling with the contextual

and deeply personal questions of what it means to be an engineer in the world” (2017a, p. 137). There are three attributes that allow for effective understanding of the contextual framework of an engineer. The *Service to Society* attribute helps to broaden the discourse “to include a deep consideration of, and genuine service to all human and non-human stakeholders” (Walther et al., 2017a, p. 138). The *Dignity, Worth of People, and Natural Environment* attribute enables deeper understanding of the reflective values and Epistemological Openness concepts by providing a broader belief in the dignity and worth of all people and the natural environment. *The Whole Professionals* attribute covers the need of empathetic skillsets among engineers by focusing on the need to integrate personal values and beliefs with professional goals and actions.

### **Appropriateness of the Model of Empathy Framework**

In the creation of the Model of Empathy Framework, Walther and colleagues pulled from and synthesized multiple frameworks from social work and engineering (Decety & Moriguchi, 2007; Goleman, 2006; Kouprie & Visser, 2009; Segall, 2002). The social work empathy models provided the grounding for the framework. The empathetic models in engineering primarily had three gaps that were addressed by the Model of Empathy Framework. The first gap was that “early accounts of empathic design were often characterized by a business-oriented approach” (p.132). The users were viewed as customers and were understood only to ensure that the product was successful. Recent approaches have changed to “genuinely engage with and involve users” (p.132) and the framework addresses this gap by creating a fluidic connection between the three dimensions. The second gap was a lack of understanding when to switch between analytical and empathetic mental modes. The field of engineering requires a lot of



analytical thinking and “the ability to switch modes is central to developing a context-appropriate understanding of empathy in engineering” (p.133). The framework addresses this gap by specifically adding an attribute, ‘Mode Switching’ that expands upon the need to switch between analytical decision making and empathetic interaction and understanding. The third gap was the locus of practice. The initial empathic approach concentrated only on the user-designer interface and not a holistic view of interpersonal interactions and social challenges. The framework addresses this gap by adding the Being Dimension “that embraces the inherent humanism and social embeddedness of engineering practice” (p.133).

The Model of Empathy Framework was developed with engineering professionals at the core. While this framework was not developed specifically for engineering educators, Walther and colleagues, explain that this framework can be used as a “lens to further develop emerging research that considers conceptions of empathy held by engineering educators” (Walther et al., 2017a, p. 142). For my study of Teacher Empathy among engineering faculty members, I needed a framework that is broad enough to capture the concept of empathy along with the complex interconnections between the empathetic actions and the reasoning behind those actions. The distilled nature of the framework created from a systemic approach of the major frameworks makes the Model of Empathy framework a better choice for this study. The Model of Empathy Framework has well defined attributes and dimensions to capture the empathetic actions, the reasons behind those action choices and the fundamental belief systems of engineering faculty members. The framework allows us to understand the complexity of teacher empathy in its entirety. The 12 attributes of the Model of Empathy comprises of the affective

experiences and perspective taking concepts of Hess's framework (Hess & Fila, 2016) and hence the Model of Empathy Framework is a better framework for this study.

In previous work, I used this framework to understand the current perceptions of Teacher Empathy among engineering faculty members and found that the framework was effective in capturing the perceptions and also understanding the fundamental principles behind their actions (Sundaram et al., 2021). This framework is used in this study to view engineering educators as professionals and to understand how they perceive and implement empathy in their teaching profession. The attributes and dimensions were used as codes during the data analysis phase of this research and are used to structure the findings of this project. One of the limitations of the Model of Empathy framework is that it relies heavily on context and situation. The Model of Empathy framework was designed for engineering professionals as the situation/context and not from an academic setting. Walther and colleagues summarize the different dimensions of the framework and how it applies to engineers,

If the Skills Dimension describes empathy as what we can do, and the Orientation Dimension as what we will do in a given situation, the Being Dimension captures how we fundamentally think and feel about the situation, our actions in it, and our role as engineers in the world. (Walther et al., 2017a, p. 139)

The Skills Dimension allowed me to connect the empathetic actions implemented by the participants to the framework. The Orientation Dimension allowed me to understand the reasoning behind the participants' choice of an empathetic action in a particular situation and the Being Dimension allowed me to capture the participants beliefs and how they perceive their role as engineering faculty members. The Model of Empathy Framework (Walther et al., 2017a) helped me

to see the connection between an empathetic action and the reasoning behind the action and the fundamental belief for implementing empathy in an engineering classroom, thus making the Model of Empathy Framework is best suited for this study.

**Definitions of attributes and dimensions from the framework**

To utilize this framework to share with participants, I came up with layman versions of the definitions that are specific to Teacher Empathy to enable quick and easy reference to the core concepts of each of the attributes. The definitions from the original article and my simplified definitions are presented side by side in Table 1 for easy understanding and comparison.

Table 1: Original and Simplified Definitions of the Attributes from the Framework

<b>Attributes</b>	<b>Definition from the article</b>	<b>My simplified version</b>
Affective Sharing	A person’s capacity to share the emotions of the emotional state of the other	Understanding and feeling what the student feels
Self and Others awareness	The ability of a person to understand the subjective situation of the other without losing their own perspective	Extension of Affective Sharing to our own self, thereby understanding both the students’ and our feelings.
Perspective Taking	The ability of a person to adopt a more conscious step to understand the situation of the other	Intentional and conscious step to learn more about the student’s state (emotional/situational)
Emotion Regulation	Describes an individual’s ability to influence the ways in which they experience and express the emotions resulting from empathic interactions with others	Having control of how much we experience and express emotion when having empathetic interactions with student(s)

Mode Switching	A person's capability to effectively switch between empathetic and analytic thinking processes	Ability to switch between empathy and logical decision-making based on the dynamics of the classroom
Epistemological Openness	Recognize and value the subjective experiences and perspectives of others as valid and important sources of knowledge	Willingness to be open to students' perspectives, to value their experiences and perspectives
Micro to Macro Focus	To consider the systems-level implications of their action along with the individual level implications	Trying to see the bigger picture. Trying to predict the broader impact based on individual interactions
Reflective Values Awareness	Ethical and professional impact of an engineer's action. The ability to reflect on their own values and improve their internal disposition in terms of empathetic actions	Be aware of one's own values and be aware of its connection to empathetic actions
Values Pluralism	Purposeful and transparent discourses among the various stakeholders for embracing and supporting diversity within engineering	Willingness to have open conversations with students to embrace students' values and support diversity within engineering
Service to Society	To include a deep consideration of, and genuine service to all human and non-human stakeholders	A deep consideration of and genuine service to all human and non-human stakeholders impacted by engineering and engineering education
Dignity and Worth of all Stakeholders	Deeper understanding of the reflective values and Epistemological Openness concepts by providing a broader belief in the dignity and worth of all people and the natural environment	A belief in the dignity and worth of all people and adopting a strengths-based perspective when interacting and discussing with students and other people
Engineers as Whole Professionals	The need of empathetic skillset among engineers	Understanding that students have more roles

	by focusing on the need to integrate personal values and beliefs with professional goals and actions	and responsibilities other than the course. It is the willingness to come out of the stereotypical “objective” definition of an engineering student and to see students as embodying these personal values and beliefs with professional goals and actions.
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### **Terms used in this study**

In this study, I used multiple terms for empathy that look similar and might need further clarity to differentiate the meaning of each term. This section explains the definition of the key terms used in this study. I intentionally organized the terms in the below order to show the cascading relation of each term to each other. Instructor empathy and empathic concern are similar to Teacher Empathy from a conceptual standpoint and my understanding of these terms aided me to understand and choose Meyers definition of Teacher Empathy, thus showing the cascading relation between these terms.

Instructor empathy is a term directly taken from Coffman (1981b) highlighting the first reference of research done on the concept of teachers having empathy. Coffman (1981b) laid the foundation for similar studies in higher education and in the formation of the term Teacher Empathy later on by Waxman (1983b) who expanded and verified Coffman’s findings (Coffman, 1981b). Although instructor empathy and Teacher Empathy are different terms, they are conceptually the same, which can be inferred from Waxman’s article (1983b) stating that the findings confirm Coffman’s (1981b) results.

Empathic concern is a term directly taken from Kate Youmans study. Empathic concern is defined as “motivational and behavioral components of empathy that are often interpreted as outward expressions of care or concern” (Youmans, 2020a, p. 6). Kate Youmans study is similar to my Teacher Empathy study with a major difference in that, Kate Youmans’s participants were engineering students and their view of empathic concern from their faculty members. The findings from Youmans’s study are a list of empathetic actions that became the starting point of this study. I focused on engineering faculty and their journey in implementing the actions suggested by Kate Youmans study. I used Teacher Empathy instead of empathic concern to highlight the focus on the teacher’s side of the implementation.

Empathetic skills refers to the abilities/skills of a teacher that can be related to empathy (Tettegah & Anderson, 2007a). I refer empathetic skills to highlight the overall intention and effort that a faculty makes to be empathetic towards their students, thus differing from empathetic actions which refer to specific actions chosen by the participant.

Empathetic actions is a term I coined based on the findings of Kate Youmans study (Youmans, 2020a). Empathetic actions refer to the recommended actions and behaviors that the participants (students) came up with for their teachers.

Empathetic interactions is a term I coined to refer to the interactions between student and teacher utilizing one of the empathetic actions. For example, an interaction between the student and teacher (participant) that involves active listening and responding to the questions (which is one of the empathetic actions chosen by the participant) is referred to as empathetic interactions in the study. The use of such specific

terminology helped me to observe any actions by the participant in the classroom, refer to the empathetic action list and connect the interaction to empathy. Using empathetic interactions as a terminology also helped me to separate the interactions that were not directly related to empathy or not considered to be empathetic according to the participant. For example, asking questions related to the topic being taught and getting answers from students is an interaction that happens in a class but does not have any relation to empathy and hence such interaction will not be considered as empathetic interaction.

Teacher Empathy: In my study I use Meyer's et. al (2019) definition of Teacher Empathy, "the degree to which instructors work to deeply understand students' personal and social situations, feel caring and concern in response to students' positive and negative emotions, and communicate their understanding and caring to students through their behavior" (2019, p. 161). This definition not only defines the various aspects of what empathy is but also highlights the effort taken and the work done by the teacher to be empathetic which aligned well with the goal of my study (to observe the implementation of empathetic action and understand the motivations and hurdles that an engineering faculty faces during such implementation; and to understand the longitudinal impact in the faculty's perception of Teacher Empathy).

## CHAPTER 3

### METHODS

The aim of this study is to understand the longitudinal impact in perception about Teacher Empathy among engineering faculty members and the use of Teacher Empathy in an engineering classroom. I also wanted to explore the motivations and challenges that engineering faculty members could face, so that I can have a better understanding of the potential hurdles that a faculty might face when trying to utilize Teacher Empathy and how to leverage some of the motivations to overcome those hurdles. I utilized purposeful sampling method to select the participants, inductive and deductive coding for the analysis, and Teacher Action Research as the methodology to guide our research methods.

#### **Potential methods for this research**

In selecting a methodology, I considered many potential methodologies that could have aligned with the requirements of the study. This decision-making and considerations of other methodologies is included here to help others who may be making similar decisions in similar studies.

I first considered using autoethnography (Chang, 2013), a methodology that allows the use of personal experience as data for the study. But in this case, although I have teaching experience, I was not a full-time faculty member at the time of this study, so was not working as a teacher of record for a class. In this case, I would have needed to be a teacher (and not a Teaching Assistant) to conduct autoethnography. Next, I considered a collaborative autoethnography (Chang, 2013) but soon realized that I should equally contribute as a participant leading to similar problem with autoethnography.



I also considered phenomenology and phenomenography methodologies. “A phenomenological research approach strives to understand the ‘essence’ of the phenomenon by understanding the individuals’ lived experiences of the phenomenon” (Youmans, 2020a, p. 52). Phenomenography could be considered as a subset of phenomenology (Cibangu & Hepworth, 2016) and the primary focus is to understand “how people perceive, experience and conceptualize” a phenomenon (Marton, 1981a, p. 181). I decided against these methodologies as I wanted a methodology that involved an active action-reflection-iteration of actions as part of the study. In other words, I wanted to focus on a form of action research that would iteratively improve the class throughout the study instead of primarily developing an understanding of a phenomenon.

Through peer discussions and literature search, I came up with three very similar methodologies that would iteratively improve the class during the study. These methodologies are Action Research (Lewin, 1946), Participatory Action Research (McIntyre, 2007) and Teacher Action Research (Pine, 2008a). Action Research could be considered as the source for all types of Action Research. The foundation of Action Research is to “care about social action that is practical and emancipatory” (Bradbury, 2015, p. 7). While my study about Teacher Empathy in an engineering classroom could be seen as social action, this study is not emancipatory in nature and hence Action Research is not the best choice. Similarly, in Participatory Action Research (PAR) there is more emphasis on participant agency and involvement in the study (McIntyre, 2007). While PAR was not a perfect match due to the emancipatory requirements, examples of PAR gave me ideas to come up with the various levels of involvement to be suggested for the participants of my study. Like Action Research, PAR was also to focus primarily on

issues of underrepresented communities and to be emancipatory in nature and hence not a best fit for my study.

Teacher Action Research utilized all the process and techniques of Action Research but focused on research to improve teaching and pedagogy. The primary requirement of Teacher Action Research is to improve teaching methods, principles or perceptions and understanding of teaching approaches and it is not required to be emancipatory in nature (Pine, 2008a). Teacher Action Research aligned with my needs and intentions for this study and hence I chose Teacher Action Research for this study.

### **Teacher Action Research Methodology**

The main intention of this Teacher Empathy study is to provide practical action, reflection and improvement of engineering classroom environment using teacher empathy as a tool. In my research I concentrate on the teacher and their interactions with the students. Hence, I chose Teacher Action Research methodology (Pine, 2008b) because it is a variation of Action Research focused on teachers that enables the researcher/practitioner to understand a problem and help solve the problem with the participant. Teacher Action Research enables a teacher to inquire and take action to improve teaching and learning intentionally and dynamically. A more specific definition of Teacher Action Research by Pine is, “Teacher Action Research as professional development is characterized by (a) a collegial environment and community of inquiry in which teachers reflect, question, hypothesize, document and evaluate; and by (b) a safe and supportive environment in which teachers commit to, risk, and implement experimental actions” (2008b, p. 93).

According to Pine, Teacher Action Research is a paradigm, which allows the researcher to embrace a wide variety of research methodologies and forms of inquiry. The main characteristic of Teacher Action Research is its ability to allow ongoing systematic study of a problematic situation and provide “a recursive way to take action” (2008b, p. 30). It provides an opportunity for the practitioners to deeply understand their practice and improve those practices. One of the key aspects of choosing this method for this study is because Teacher Action Research is also a mental disposition and improves the lifelong habit of learning and inquiry. Teacher Action Research fundamentally approaches knowledge as contextual in nature and hence allows the possibility to take the context into consideration to better understand why teachers do what they do.

My foundational drive for this research is to provide agency to the participants and to ensure that the faculty members can continue to reform and refine their teaching and learning practice and improve the engineering education system from the classroom level. Teacher Action Research is relevant as the methodology states that the faculty members are the sources of educational reforms. “[Teacher] Action Research enables teachers to reflect on their practice to improve it, become more autonomous in professional judgement, develop a more energetic and dynamic environment for teaching and learning, articulate and build their craft knowledge, and recognize and appreciate their own expertise” (Pine, 2008b, p. 30). This aligned perfectly with the intention of my research.

I wanted to impart Teacher Empathy actions as the practice and to observe and aid the faculty over a period of one semester to observe, recognize, appreciate, and further improve on their practice through reflection and be more autonomous in creating a better

learning experience. The use of Teacher Action Research in this study has allowed me to provide the participants with the agency to choose the empathetic actions that they would like to implement and experiment with in the class. This also meant that they could add, remove, or modify a particular action later in the research implementation as well. I was able to let the participants choose their extent of involvement in the study. This methodology provided us with the necessary guidance and steps to ensure that implementation, reflection and improvement happened in a systematic process. One of the biggest advantages of using Teacher Action Research is that it allows the teacher to understand themselves and refine their skills (Kochendorfer, 1997).

Pine provided a consolidated list of advantages of using Teacher Action Research for teachers. Some of the relevant advantages for this research are the following:

1. Improves teachers' ability to be analytical about their practices.
2. Improves instructional effectiveness.
3. Improves decision-making skills/awareness.
4. Increases reflection about teaching.
5. Can revitalize teaching and reduce burnout.
6. Encourages teacher-researchers to be active learners among others. (p.47)

As can be seen from the above list, some advantages such as reducing burnout and improving active learning align with Teacher Empathy benefits found in higher education research (Jennings & Greenberg, 2009).

Teacher Action Research methodology allows the researcher to provide agency to the participant and work *with them* instead of *on them*. In this study, engineering faculty members chose a set of empathy actions, implemented over a period of one semester, and

reflected and shared their experiences, motivations and challenges during empathy action implementation. Since the participants are the primary drivers of the research, it allows them to be as close to their natural environment and classroom experiences instead of having a more controlled intervention-based study approach.

Specific to this study I refer to the following levels of involvement that I designed to facilitate better understanding for the participants and the amount of time and effort required from their side. These levels were suggested to the participants during the first pre-study meeting.

Level 1: Choose actions to be implemented in the course. Implement and reflect on those actions on a regular basis (reflections after every class and long interview reflections roughly after every 7 or 8 class sessions). Modify the actions during the study whenever the participant feels necessary.

Level 2: Level 1 + Actively involved during the data analysis phase and provide more context or clarifications of data interpretation whenever necessary.

Level 3: Level 2 + Actively involved during the article writing as a co-author.

I believe that the accuracy of the findings and their interpretation increases with the increase in level of involvement from the participant. The possibility of researcher bias decreases significantly (possibly capturing the bias at early stages of analysis) with increase in level of participant involvement. I also believe that the long-term effect of the study and benefits of reflection for the participants increases with increase in level of involvement, as they will be more deeply involved in analyzing their own reflections and context of their actions which will enable them to further improve their Teacher Empathy.

## **Participant Selection**

The participants were selected using a purposeful selection method (Maxwell, 2013). With purposeful selection, I deliberately chose my participants and settings to gather information that can best answer my research questions. Maxwell listed five goals for choosing purposeful selection in which my study aligns with one of the goals, which is “to select groups or participants with whom you can establish the most productive relationships, ones that will best enable you to answer your research question” (2013, p. 100). Because of the in-depth nature of the data collection (such as semester-long study with daily reflections and classroom observations) I decided to recruit three participants with as much variation in gender, years of experience and position. In my three years as a PhD student, I had the chance to interact with many faculty either as my course instructor or as a Teaching Assistant. I utilized the relationships developed during those experiences to choose my participants. I utilized purposeful sampling to shortlist the faculty to meet the desired demographics. I was able to satisfy the demographic criteria through three participants who accepted to be a participant after I explained the concept of the study and the time investment. The semester-long intervention and the time required for reflection was significant and the purposeful selection allowed me to benefit from prior interaction with the faculty. It was interesting to note that disability, LGBTQIA+, and industrial experience were additional diverse characteristics of the participants. These dimensions are not included in the details for the participants below to maintain confidentiality.

My first participant was my advisor, Nadia. I utilized Teacher Action Research methodology to include Nadia as part of the research team while also being the

participant. Nadia was involved in the data analysis and co-authored a conference article pertaining to her data (Sundaram & Kellam, 2022). I was the Teaching Assistant for the course during the data collection. She is an Associate Professor at the University. She is tenured and has 15 years of experience during the data collection period. She was the first participant, and her semester long experimentation was done during 2021. She was teaching an Engineering Mechanics course (lecture-based) for second-year students during data collection, and this was her 7th time teaching this course since 2015.

The second participant is Samantha. She is an Assistant Professor in a tenure-track position with eight years of experience as a faculty member at the time of data collection. The third participant requested to keep his identity confidential and chose Robert as his pseudonym. Robert is a Teaching Faculty with a primary role of teaching and has more than 15 years of teaching experience. Both the participants were teaching a design-based course for second-year students. Data collection with these two participants took place in 2022.

All three faculty members were teaching second-year undergraduate engineering courses in the engineering school at a large southwestern Public R1: Doctoral Universities – Highest Research Activity university according to its Carnegie Classification (*Carnegie Classification of Institutions of Higher Education*®, n.d.). The size of each class was around 25 to 45 students. The students were enrolled in a general engineering program with a variety of emphasis areas (e.g., mechanical engineering, electrical engineering, robotics). The primary intention of this study is to gain insight into the experiences of engineering faculty members while implementing Teacher Empathy and their perception about the effects/outcomes of their implementation. The students’

experience of Teacher Empathy is not in the scope of the study and hence the details of the student body were not noted explicitly as part of the study. It is to be noted that some participants used formative assessment techniques with their students to assess their Teacher Empathy implementation. Such feedback is the participant's own class assessment and is not included in this study.

In terms of level of involvement in the study, Nadia chose level 3. Samantha and Robert showed willingness to provide more context or clarification only if I reach out specifically, which could be seen as something between level 1 and 2. All three participants were willing to do member checking as part of the analysis to ensure that the data interpretation resonated with their lived experiences.

### **Data collection**

The primary mode of data collection was interviews. Interviews included two pre-study meetings, three 45- to 75-minute-long interviews, and audio reflective journaling after every class. I chose to have two pre-study meetings to explain about the study to the participant, share the Model of Empathy Framework and Kate Youmans's empathetic action list (2020a) during the first pre-study meeting, and during the second pre-study meeting (at least a couple of days after the first meeting), choose the empathetic actions that the participants would implement in their classroom. I had the pre-study meetings before the start of the semester. The semester schedule consisted of 15 weeks of class (two class sessions per week) and one exam week. The long interviews were planned after every 5<sup>th</sup> week so that there was an equal gap and sufficient experience with the empathy implementation to get quality data through the long interviews. Some of the questions included in the long interviews were, "how would you describe your



experience during the last month based on these empathetic actions?” and, “did you face any challenges or hurdles in being empathetic towards the students at any instance?” The interview protocol for the pre-study meetings and long interviews are available in Appendix A and B respectively.

To collect reflective data throughout the course of the semester, I used audio reflective journaling methods. The benefit of audio reflective journaling was that the reflection happened immediately after the class and since I was asking the questions and recording, it felt more natural as a conversation. Alternatively, I could have used written reflective journaling where the participants would write responses to a questionnaire after each class. I decided to use audio reflective journaling methods as that would be less cumbersome for the participants and was a natural way to debrief on the classes immediately after each class. Some of the questions used in the audio reflective journaling were, “how did you feel in the class?” and, “were there any incidents that made you feel happy or motivated or energized or good moments in general?” The complete reflective journaling questionnaire is provided in Appendix C. I, as a researcher, had the opportunity to be in the class and observe the faculty. This allowed me to add a few nuanced questions along with the other questions in the questionnaire to get more specific data based on that day’s experience. For example, when I observe a particular interaction that could be related to empathy, I ask the participant about their interpretation of that incident. This also helped in preventing researcher bias and misinterpretation by clarifying my observation with the participant and capturing the participant’s input. There were a few instances when the faculty was not able to reflect immediately after class due to another meeting/work immediately after class or meeting

the students after class took most of the time that reflection was not possible. Such situations came with all the three participants but all three of them helped in providing a combined reflection after the next class or whenever it was possible.

Apart from the interviews and audio reflective journaling, I conducted classroom observations and wrote analytical memos (Maxwell, 2013). Observing the class and noting down the activities and empathetic actions that the participants tried gave more information to ask specific reflective questions. It was also helpful to improve the long interview questions to better gather specific data for the study. I wrote analytical memos after each long interview and after the audio reflective journaling. Such analytical memos helped in noting down some potential patterns or important points to observe or ask the participant later. I did analytical memoing while coding to help keep track of the thought process during every coding cycle. I transcribed all the recorded interviews to get more acquainted with the data and for a deeper and more insightful analysis. I utilized Oliver's (2005) denaturalized method of transcription which captures the content of the recorded data without the utterances and grammatical mistakes. My aim of this study is to capture the essence of the motivations, challenges, and the longitudinal impact in the perception of Teacher Empathy among the participants and for this context, a naturalized (verbatim) transcription was not needed.

### **Data Analysis**

To get the most out of the data, I utilized Saldaña's three cycles of coding, namely, first cycle coding, after first cycle coding and second cycle coding (2015). I went through more than one iteration for each cycle to ensure that the data is captured in its entirety. I used Dedoose software for the first steps of the coding process. Then I

downloaded the data excerpts with the applied code and memo in an excel file for the final iterations of coding. Figure 2 is a concept map showing the data analysis method, its connection with Saldaña's three cycles of coding. I also added a particular example to show the transition of a particular excerpt through the data analysis process.

In first cycle coding, I used two iterations of coding. In the first iteration, I used a combination of structural coding and values coding to capture all aspects of the data relevant to the study. Structural coding refers to the coding of data "that relates to a specific research question used to frame the interview" (2015, p. 98). Structural coding allowed me to capture the excerpts that directly align with the motivations and challenges research and interview questions. For example, I created a "motivation to be empathetic code" to capture the excerpts that the participants share as a motivating experience to be empathetic towards the student. Values coding allows me to capture "the qualitative data that reflect a participant's values, attitudes and beliefs, representing his or her perspectives or worldview" (2015, p. 131). I used values coding to capture the attitudes and beliefs of the participants that might not be captured using the Model of Empathy framework. For example, I created a "personal preference" code to capture the participants values and preferences that might be related to their teacher empathy implementation.

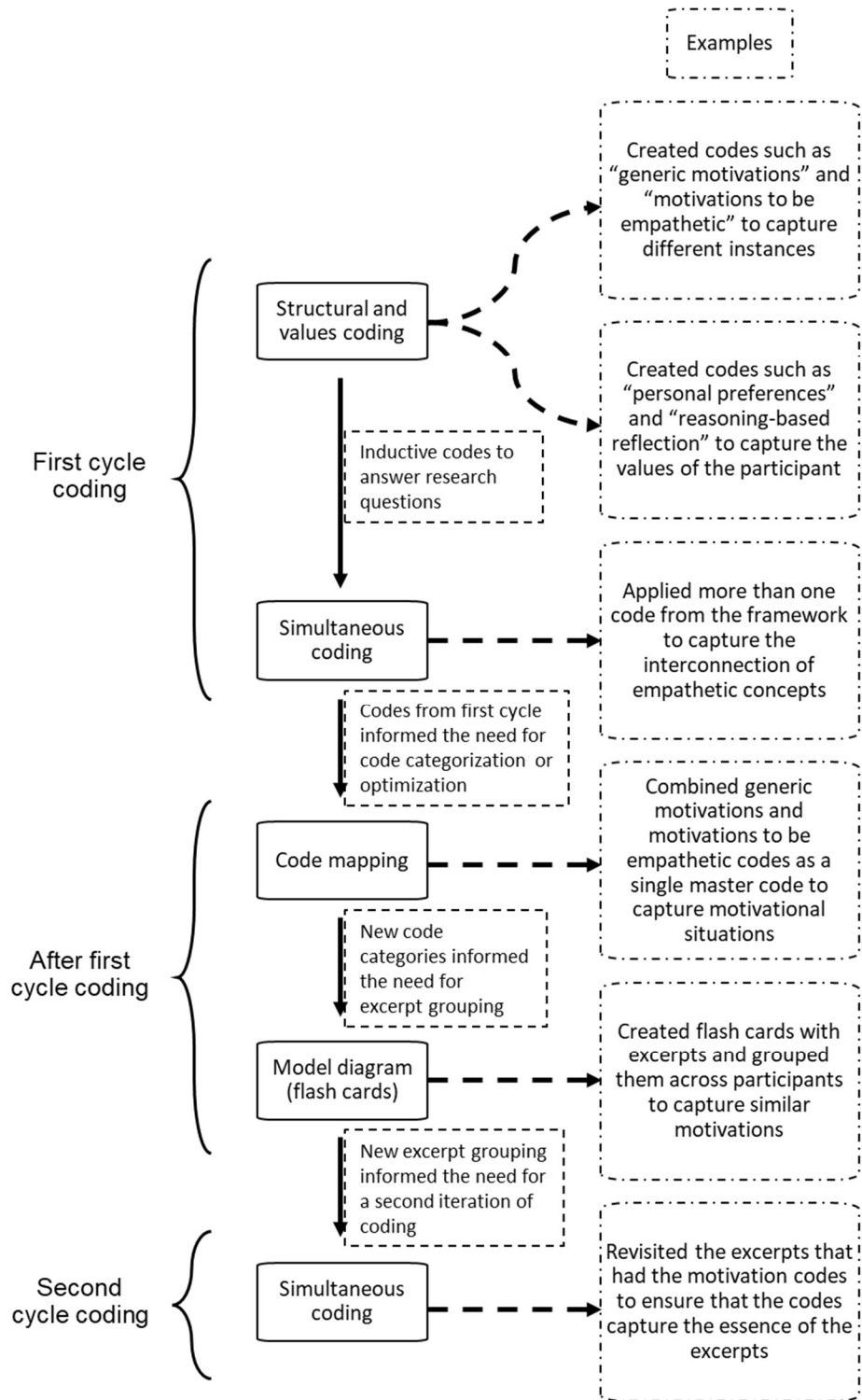


Figure 2: Flowchart of Data Analysis Cycles with Example

In the second iteration of first cycle coding, I used the Model of Empathy Framework (Walther et al., 2017a) as a reference and used a codebook that I created in my prior, related research project (Sundaram et al., 2021). I used the simultaneous coding method. Simultaneous coding method refers to the process of applying different codes on the same excerpt (Saldaña, 2015). This enabled me to capture the excerpts that align directly with the various attributes from the framework. Table 2 represents the codebook from my prior research. Simultaneous coding allowed me to code a particular excerpt with attributes from all three dimensions of the framework along with the codes from previous coding cycle, thus allowing me to see the interconnections between an empathetic action, the logical reasoning behind that action, the underlying belief system of the participant to approach a particular situation and the motivations or challenges that the participant experienced during teacher empathy implementation. For example, I was able to apply one of the attributes from the Orientation Dimension of the framework on the excerpt that was already coded with motivation code. This allowed me to see the relation between empathetic reasoning and motivation to be empathetic.

Table 2: Thematic Codes and their Corresponding Concept Codes with Description

Concept Code	Description
<b>Theme 1: Skills Dimension - Captures the socio cognitive process</b>	
Affective Sharing	A person's capacity to share the emotional state of the other. Cognitive mechanism - automatic mapping between self and others
Emotion Regulation	Ability to influence the ways in which they experience and express the emotions resulting from empathetic interactions with others. Intended to prevent undue "empathic distress" or "emotional over-arousal"
Mode Switching	Ability to recognize, consciously apply or switch between empathic and analytic cognitive mechanisms
Perspective Taking	Ability to adopt more or less consciously the subjective point of view of the other

Self and Other Awareness	Ability to feel with others and experience their internal world as if it were our own while being aware of and never losing the 'as if' quality
<b>Theme 2: Orientation Dimension - Captures the mental disposition as per the framework</b>	
Epistemological Openness	Recognition and valuing of the subjective experiences and perspectives of others as valid and important sources of knowledge of engineering work in practice.
Micro to Macro Focus	Awareness and consideration of structures of power and social organization as both contexts and consequences of engineering work
Reflective Values Awareness	Not only to be attuned to the inherent values dimension in engineering, but also to be oriented towards fully engaging with ethical issues through critical consideration of their impact on both a professional and personal level
Values Pluralism	Commit to engaging in an active, purposeful, transparent, and equitable discourse around heterogenous values. Informed purposes driving different forms of engineering work
<b>Theme 3: Being Dimension - Captures the contextual framework as per the theoretical framework</b>	
Dignity, worth of people, and natural environment	A genuine belief in the dignity and worth of all people. Inherently implies an Epistemological Openness that is reflected in adopting a strengths perspective when interacting with others
Engineers as Whole Professionals	The need to develop empathic skills and orientations alongside intentional connections to students' maturing personally and morally
Service to Society	Includes a deep consideration of, and genuine service to all human and non-human stakeholders impacted by engineering

In after first cycle coding, I utilized code mapping (figure 3) to categorize and organize the codes into categories that provide a clear understanding of the data (Saldaña, 2015). I used code mapping to understand the relation between different first cycle codes and group them to better understand the data. For example, I was able to group benefits of teacher empathy with motivations of teacher empathy as the benefits were acting as

motivators to be empathetic. In the Dedoose software, I did this by changing the benefits code as child code with motivations code as the parent code.

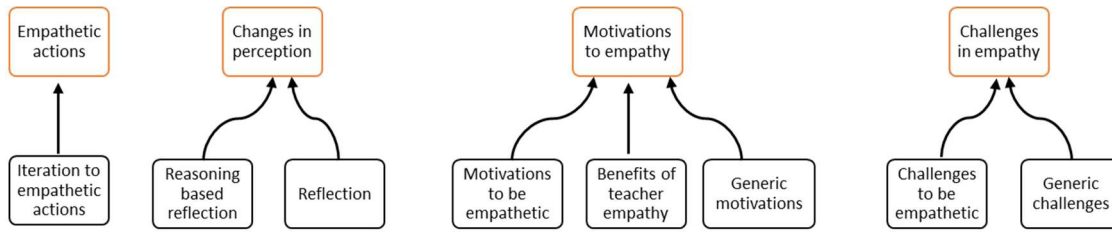


Figure 3: Example of Code Mapping that Represents Grouping of Codes

In the second iteration, I utilized a combination of operational model diagramming and tabletop categories of organizing coded data to extrapolate the bigger theme or concept across the three participants. Operational model diagramming is the process of creating a mind-map like diagram that shows the relation between the major codes “for the researcher’s analytic synthesis and the reader’s visual grasp of the study” (2015, p. 226). Tabletop categories is the method that “involves the spatial arrangement on a table of coded and categorized data” (2015, p. 230). I wrote the key findings from each transcript into flashcards for each participant and then rearranged across the three participants to capture the overall theme of the data. This also allowed me to capture the longitudinal impact in perception of teacher empathy among the participants.

In second cycle coding, I downloaded the data from Dedoose software into an Excel file and utilized simultaneous coding to verify the application of the codes after the code mapping step. The final list of codes apart from the codebook is provided in table 3.

Table 3: Codebook Created After Code Mapping

<b>Code</b>	<b>Definition</b>
Motivations in empathy	Any excerpts that indicate a positive experience in their experience that can be directly or indirectly related to empathetic actions
Challenges in empathy	Any excerpts that indicate a hurdle or challenging experience having direct or indirect relation to empathetic actions
Definition	Any excerpts that directly or indirectly indicates the participant's definition of empathy or teacher empathy
Empathetic actions	The excerpts that indicate the empathetic actions implemented in the class
Longitudinal impact in perception	Any excerpt that shows that the participant shares as a new way of viewing their empathetic actions or teacher empathy
Need for empathy	Any excerpts that indicate the participant's view of the need for empathy in the classroom
Personal identity	Any excerpts that refer to the participant's identity when sharing about teacher empathy or empathetic action

In second cycle coding, I took the categorized data in the flashcards and verified code application to match the final codebook. I also used the flashcards to come up with major themes as findings. For example, I was able to use the number of motivations that the participants had shared and capture common themes of motivational factors that could be related to teacher empathy. This analysis step helped me to write my findings in a more cohesive and easier to understand format. I was also able to identify a potential relation between the nature of engineering faculty members and their teacher empathy implementation. Some of the excerpts related to the instructors' nature was not captured by the Model of Empathy Framework. This indicated a potential modification of the framework specific to the context of engineering educators. This is not further explored



as it is not within the scope of this study and is covered in the discussions chapter as part of future work for this research.

### **Positionality**

I had both advantages and challenges based on my positionality in my study. I have prior experience as an Assistant Professor in India. I was a Teaching Assistant for multiple undergraduate courses in my university in the United States. I am also an Instructor of Record for first year courses in my university in the United States. This allowed me to consider myself as part of the engineering faculty community. The advantage I had based on my teaching experience was the ability to observe the dynamics of the classroom and ask specific questions related to subtle student-teacher interactions that could have been missed otherwise. For example, based on my prior experience, short interactions before the start of the class are equally valuable experience as the interactions during the class. I was able to observe a short informal conversation between one of the participants and a student before the start of the class. I felt that interactions had some relation to Teacher Empathy. I wrote an analytical memo of the same and verified with the participant during audio reflective journaling. The challenge my prior experience brought was that I could have implicit bias and express my own interpretation of a situation rather than the participant's interpretation. I used analytical memos and member checking as techniques to overcome this challenge.

In specific to Nadia, I was also the TA of the course which allowed me to contribute to course preparation in some forms. I was also helping with preparing some of the exam question papers. I interacted directly with the students and helped them understand how to solve problems. Being a TA gave me the advantage to be involved in

the course preparation. Nadia was able to share some of her plans for the class and those interactions helped me to gain deeper understanding of the context of student interactions. For example, I was directly involved in the preparation and testing of an oral exam for the students. Being a TA, I was able to understand and articulate Nadia's perception when she shared that having a cohesive teaching team is a motivation to be empathetic in the classroom. The challenge that I faced as both a TA and a researcher for Nadia's class was that I was also interacting with some students when Nadia was also interacting with other students. This limited my extent of classroom observations relatively to the other two participants.

As mentioned in the data collection section, I used purposeful sampling and reached out to faculty members I already had worked with as a TA or knew them before the study. Nadia is my advisor and during the study, I was the TA for her class. I had prior interactions with Robert and Samantha. Such prior interactions with the participants gave me the advantage to have a more natural conversation during audio reflective journaling and the participants also felt comfortable in sharing the challenges while implementing Teacher Empathy. This also meant that there is an increased probability of assuming their perception. I overcame this challenge using analytical memos and member checking.

### **Limitations**

The main intention of this study is to develop a complex, nuanced, and in-depth understanding of three engineering faculty's experiences integrating empathy into an engineering class. The Teacher Action Research methodology encouraged this in-depth exploration of the ways in which empathy might be introduced in a classroom setting

while also providing agency for the participants to meaningfully integrate empathy into their classroom. Teacher Action Research is an intensive research methodology that produces large amounts of data from a relatively small group of participants. Thus, the value of such methodologies lies in their ability to provide rich, nuanced, and contextualized understandings of social phenomena that cannot be achieved through generalizable and quantitative research methodologies. While a three participant study could be seen as a limitation, our engineering education community values such small numbers studies (Burt, 2020; Pawley, 2019; Secules et al., 2018) suggesting that small numbers research contributes in different and important ways to engineering education research.

When applying the Model of Empathy Framework to engineering educators (instead of professional engineers), I found that the framework was not capturing the viewpoints of the educators. From an educator standpoint, the attributes of the Being Dimension might not cover certain specific foundational values for the faculty to choose the profession of engineering faculty. It might also be possible that the Orientation Dimension (that captures how we feel) might also face a similar lack of attributes specific to educational context. I chose inductive coding to overcome the above-mentioned limitation and capture potential patterns arising in the data that could lead to a new value/attribute specific to educational context. I would like to highlight that such emerging potential attributes could be noted as suggestions for further exploration, as the scope of the Teacher Empathy study is to understand the faculty's journey and not to develop the framework to better suit the academic context. One possible impact of the limitation of the framework on my inductive coding approach is the possibility of

narrowing my thought process to the concepts of the framework. As I have spent a lot of time in understanding the framework and creating a codebook for deductive coding, my ability to think beyond the concepts of the framework could be limited. I overcame this limitation through extensive analytical memo during the inductive coding cycle, effectively capturing my thought process behind selecting or creating a code for a particular excerpt. Memoing helped me notice if my thought process was narrow because of the heavy reliance on the framework. Detailed analytic memos also provided more context for my research team to notice an overreliance on the framework during member checking.

### **Quality**

The combination of Teacher Action Research methodology and small number of participants allowed me to take an inquiry approach to data collection. This allowed me to shadow the participants during their Teacher Empathy implementation. To ensure the quality of my research, I utilized four processes namely analytical memo, transcription, member checking and shop talk (Maxwell, 2013; Saldaña, 2015). All four processes enabled me to reduce researcher bias and express the participants' voice as close to original meaning as possible. In the following section, I explain how I used each process with an example.

I took detailed analytical memos throughout my study (Saldaña, 2015). During the data collection phase, I took analytical memos during classroom observations and after audio reflective journaling. The memos that I took during the classroom observation helped me to capture certain incidents in the class to add as part of that day's reflection. This process helped me to verify with the participant if that incident has any value for the

participant, thus making sure that it is the participant's interpretation and not mine. Taking memos after audio reflective journaling helped me to capture my initial thoughts on the data. I used memos to note the context of some of the incidents that the participants were referring to in the reflection. I captured my interpretation of the data when the experience was fresh in my memory. I also captured any potential code that might be helpful during data analysis. These memos were helpful during the initial phases of data analysis and while writing the results chapter. I wrote detailed analytical memos during each iteration of data analysis. I noted my interpretation of the excerpt, my reasoning for assigning a particular code for an excerpt, any doubts that I might want to verify with the participant. Such detailed memos were helpful in the next iteration to track my thought process.

I transcribed all the daily reflective journaling and long interviews. This allowed me to get acquainted with the data before the data analysis process. I did my best to transcribe as soon as I collected the data recording. This helped me to check with the participants if I did not understand their pronunciation of a word or phrase. I listened to the audio several times during the transcribing process thereby spending more time with the data thus increasing my chance to understand the participants' voice.

Member checking is the process of verifying with the participants any interpretations of their voice (Saldaña, 2015). Teacher Action Research methodology approach of working with the participants instead of on the participants enabled me to integrate member checking throughout the data collection process. I verified multiple times during classroom observations to ensure that I understood the context to represent their interpretation and not my own. During the process of writing the results, I member

checked with the participants related to the extent of confidentiality that they would want in this study. After completing the results and discussions chapter for this study, I shared the chapters to check if I have effectively captured their voice and not misrepresented them. Frequent member checking helped me to reduce the researcher bias significantly.

I used shop talk (Saldaña, 2015) with my research team (my advisor and two doctoral students) during data analysis. When I was comparing the three participant's data, I shared my reasoning for any common patterns or unique aspect of any particular participant with the research team and had a discussion to ensure that my findings could be reached through logic and not through my bias. I was able to capture a unique approach of one of the participants towards teacher empathy through shop talk which I missed due to my bias. I had a couple of shop talks during the data analysis.

I used all four processes during the study to represent the participants' voice with minimal researcher bias. At any point of the study, there were multiple instances where I used more than one of the above processes simultaneously to improve the quality of my study.

## CHAPTER 4

### RESULTS

The results section starts with the initial definitions of empathy by all the participants, followed by the list of empathetic actions they chose. Then I discuss the approach and beliefs each participant expressed when they chose empathetic actions. I used the Model of Empathy Framework to identify how their beliefs are related to the empathetic actions they chose. Then I discuss two specific empathetic actions namely, collecting feedback and learning student names. All participants used the feedback they received in the classroom as a prerequisite to choosing further empathetic actions according to the situation. Learning student names is a suggested empathetic action that was implemented by all three participants, but their approach and reasoning were different. Next, I discuss each participant's overall beliefs regarding Teacher Empathy and then share the longitudinal impact in perception of Teacher Empathy for each participant. I use this structure (figure 4) to be synergetic with the data analysis and to have a cohesive flow in answering the first research question (What is the longitudinal impact of engineering faculty's perceptions of Teacher Empathy while implementing empathetic actions in engineering courses?). The final two sections of the results are the motivations and challenges that came up during the implementation of Teacher Empathy, which answers the second research question (What motivations and challenges are experienced by faculty while implementing empathetic actions in an engineering course?).

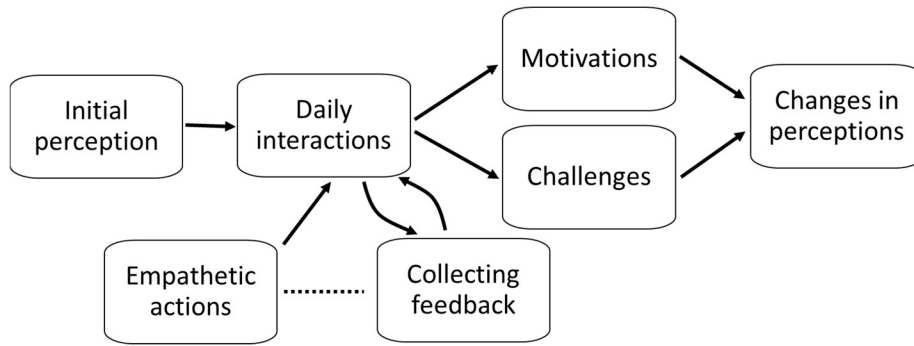


Figure 4: Journey of Engineering Faculty Members

### Initial definitions of empathy

All the initial definitions were captured during the first pre-study meeting which was not recorded as per the IRB. The definitions shared during the daily reflections were also covered as part of the initial definition. The final definition provided by the participant near or at the end of the study is captured to highlight the overall longitudinal impact in perception about Teacher Empathy. The process or incidents that led to those longitudinal impacts are covered in the next section.

Nadia defined Teacher Empathy to understand another person by trying to be in their shoes and highlighted the difficulty to empathize when the individual's background is different from their own. She explained,

The first thing that comes to mind is the 'living in someone else's shoes' or trying to sort of feel what another person feels or what it's like to be another person. I think that's a hard thing to do. And maybe hard to do depending on your background or where you come from. But something that can be improved also, by learning about other people's stories and other people's experiences, through talking to people, I think you can start to get a sense of what it's like to be someone else. (Pre-study meeting 2)



Within engineering education, she felt that empathy has value, and empathy leads to a more humane way of being. Based on her prior exposure and experience through research, workshops, and conferences, she related empathy with concepts such as sense of belonging, creating better environment for students and other aspects that are helpful for students.

Samantha initially shared that empathy is rooted in caring about others, trying to put ourselves in their shoes and understand how they think. She also said that empathy helps us to sit, talk and address the real problems or underlying problems the student faces. Empathy is also to provide a safe space to be open, vulnerable, and express themselves. She also touched upon the background of the students by defining empathy as trying to understand where the students come from and trying to respond to that.

Robert defines empathy as putting himself in the students' seat and forming a professional relationship with the students with the primary intention to better understand the students. He also stated that empathy is a foundation to know your audience. He has a strong identity that he is an empath and empathy is not like a switch that you can turn on and off, but it is who he is.

In my viewpoint, empathy is very audience centric. Right. So, who is the audience and at what level are they at and what do they, what do they hope to attain from the course. (Day 6)

During the daily reflections, Robert referred to empathy as a way to align the course content and teaching according to the audience. He also referred to empathy as a philosophy and not a process that someone can follow to be empathetic. He shared that one of the key reasons for his success in the engineering workplace was his empathetic

skills and that he continues to use his empathetic skills to effectively teach in an engineering classroom.

All three participants refer empathy as ‘being in others’ shoes’ and to understand the other person. This common definition aligns with the Perspective Taking attribute of the Model of Empathy Framework. As per the framework, when we have an intentional approach to understand the other individual, it is referred as Perspective Taking (Walther et al., 2017b). When I analyzed the data to understand their reason for being a part of this Teacher Empathy research, the three participants had unique points of view. Nadia’s nature is to be very experimental and is willing to try new pedagogical techniques often. She attends workshops and conferences regularly and takes notes of the techniques that are interesting to her and immediately tries to incorporate those techniques.

[Speaker] presented yesterday and he does at the beginning of the class, ask for songs that students like and then makes a playlist with them. And I was like, 'that’s a great idea'. So, we are doing that. (Day 16)

For example, during the time of the study, Nadia attended a seminar focused on culturally relevant pedagogy. One of the ideas that was shared to bring in more culturally relevant conversations in an engineering classroom was to request students to suggest their favorite song and create a Spotify playlist and play it in the starting 5 minutes of class when the faculty is setting up for the class. Nadia found it interesting and since the concept aligned with our Teacher Empathy study, she integrated that question as part of the check-in question and created a Spotify playlist.

Samantha’s nature was to ensure that she is respectful and inclusive in any interactions which was observed in the classroom. Gender and underrepresented minority

equity is extremely important for her, and she utilized empathy as a way to be respectful, inclusive, and supportive of the students.

But one thing that we started doing last spring that I think we can continue doing is, we have had panels come to class to talk about different issues in engineering. So, for example last year we did an imposter syndrome panel. And you might think like, 'why is that happening in the design course,' but you might also ask that, 'why not'. And so, I believe that there is going to be another one about implicit bias and micro aggressions in engineering and how people deal with those. I don't know to an extent, my students having, you know, they are all male and most of them are, they seem white. So, I don't know how much they experienced those things, but at least they will learn about them, which I think is important. So hopefully, raising their awareness. So, I think that kind of goes with, 'understanding the implicit culture of engineering programs including, rigor and meritocracy', it being gendered and racialized in many aspects. (Pre-Study Meeting 2)

For example, one of the empathetic actions was to bring in subject experts to present various topics. The topics were related to implicit bias and micro aggressions in the engineering workplace. She pointed out that most of her students are white male and might not have experienced biases but still wanted to raise their awareness to improve the overall culture of engineering.

Robert approached the whole concept of empathy from a unique perspective. He strongly identifies as an industry person and all his actions, behaviors and interactions in the classroom had one primary goal – to make the students ready for a career and to be the best engineers they can be. To attain this goal, he used empathy to better understand his students and help them become great engineers. He referred to empathy as a pathway to achieve his goal. He not only empathizes with the students, but he also empathizes with the employers who need engineering students that can adapt to the industry setting efficiently. His approach was evident when he shared his perspective on the emotions of

the students. He had clear boundaries when it came to the feelings and emotions of the students and wanted to keep his interactions with the students focused on the students as future engineers, not with any thoughts or concerns about them as people.

I am only here to help them improve as engineers. My focus is [on] them as a student, then as a technical competent human. Not how, where they live, what they do, what they enjoy in life... You could even call it a threshold. Because I don't ever go over it. I don't ever go to the other side of it... I stay out of people's personal lives. None of my business. (Day 6)

During daily reflections, while he shared what he considered as his role as an empathetic faculty member, he also added what he considered as not his role and where he limits his student interactions. He makes sure that he knows only the things that are relevant to helping them become better engineers. He further explained his approach as follows,

I, by design, limit my exposure to their personal lives. There are people on campus trained for that and much more capable than I am. As a practicing engineer, I tend to have a more 'black and white' look at life. What you are talking about here is the grey area that I am not at all familiar with. And that requires a different perspective. Now, do I listen to their personal problems, especially in the midst of a pandemic? Of course. Do I encourage them based on that focus, recommend [what] they do to maintain their course, absolutely. If they come in and tell me about their personal lives, I will send them to someone else... I will not enter into that area. That is not a place where I have any expertise and I don't even want to go there. People have their own difficulties, situations. I'm here to teach them engineering, I'm not here to be their resource for mental health issues or other issues that pertain to topics outside of the classroom. (Long Interview 1)

When explaining his role and his perspective of Teacher Empathy, Robert has a clear boundary as to what extent he would try to understand his students. Although he does not empathize with the student's situation outside of classroom, he made sure that he pointed the students to contact the department chair who he believes can better help direct the students to campus resources.

## Participants Empathetic Actions List

The primary intention of choosing Teacher Action Research as the methodology for this study is to provide agency to the participants in terms of choosing and implementing empathetic actions for this study. All three participants created a list of actions which aligned with their teaching methods/philosophy.

Nadia utilized Youmans's empathetic action list (Youmans, 2020b) as a guide and came up with her own actions. These actions aligned with the categories of the action list. She also chose a few suggested examples that she was already implementing before the start of the study. This approach of hers aligned with her natural teaching approach of trying new pedagogical techniques to improve the classroom experience and provide the best learning for the students. Nadia felt that having such a list was helpful in thinking and coming up with ideas for empathetic actions and to also understand what we are aiming to achieve through such actions by referring to the themes.

So I like these three categories [referring to the empathetic action list] ... I kind of like the idea of going through this list and brainstorming ideas. Because I think it might help us come up with some different things. (Pre-Study Meeting 2)

Nadia likes to try new methods, learn from them and improve. Her teaching approach to implementing new methods is reflected in her choice of empathetic actions list. She also came up with multiple ideas to refine the actions throughout the semester as she implemented and got feedback.

...that also maybe a thing of the way that I teach. Or it's just an individual thing, like I'm a little bit ADD about things. I was like, 'ooh, like that sounds like a good idea, I'll try that'. Sometimes I tend to do that whereas other people might be more of like, 'this is what I'm doing, this is what I

said I was going to do and I'm not going to make any changes to it', you know. I tend to be a little bit more willing to try, to move, to make some shifts and stuff to it to try to improve things as I'm going and not just at the end. (Long Interview 3)

During the last long interview, she highlighted her nature to try new things and how her nature could be one of the reasons to explain how she approached this Teacher Empathy research. Table 4 represents the list of empathetic actions chosen by Nadia for the study.

Table 4: Nadia's Empathetic Action List Used in the Study (Sundaram & Kellam, 2022)

<b>Empathetic Action</b>	<b>Description/definition</b>
Grace period	The option to provide students a deadline extension for 48 hours beyond the deadline when requested.
Student introduction slides	Students were asked to create a google slide and share something about themselves, what they like and what are they looking forward to learning in the course.
Student-paced Pear Deck ( <a href="https://www.peardeck.com">https://www.peardeck.com</a> )	Using Pear Deck, an add-on to google slides, and selecting the option that allows the students to access that day's slides and move through the slide content at their own pace while at the same time the faculty using the same slides to explain the concept and solve problems.
Check in questions	2 versions – First version is to ask students to share their current emotional state using just two words and hence shortly called as 'two word check in'; Second version is to ask some theme-based questions that are not related to the course so that it brings some humanistic touch into an engineering classroom.
Window masks	Masks with small see-through windows/clear screen so that students with hearing disabilities can lip read.
Dropping the lowest score	Dropping the lowest score in each assignment section (three sections) so that the students have a second chance to demonstrate their understanding of the course material.

Samantha chose the suggested empathetic actions from Youmans's list. Her reasoning aligned with her primary intention of being respectful of the students and to be inclusive

of all students. She mentioned in her pre-study meeting 1 (not recorded as per IRB) that all her actions and decisions are based on the philosophy, ‘I would treat others how I would like to be treated’. She decided to start with the recommended action list and then as the semester proceeds, she implemented new ideas as and when these ideas come up. During the end of the semester, she felt that the empathetic action list was helpful to alleviate doubts and be more confident in continuing some of the actions.

I’m just thinking through all the actions. I think some of them, I would say were already part of my natural practice, I just didn't maybe consciously know it. And then other [actions] help think through the structure of the course upfront ... That removed some of the second guessing and, [clarify] when is it fair when is it right when do you say yes, when do you say no. It was just a blanket yes and so that made things a lot easier and it made it easier to make a decision and just not have to revisit it. So, in that way, it was helpful. And then other things like setting intentions and then having you in class, it's like ‘I have downtime let me learn their names’ or let me circulate the room and strike up a conversation where fewer people are. I think the combination of the list and your presence did have an impact, yes. (Long Interview 3)

During the final interview, Samantha reflected on all the empathetic actions and was able to see that most of the actions were in alignment with her nature and what she had been doing to be respectful of the students. The use of the empathetic list helped her to provide a more inclusive and equitable learning environment. The ability to integrate some of the empathetic actions with the structure of the course enabled her to be fair with all students. Table 5 represents the list of empathetic actions chosen by Samantha.

Table 5: Samantha’s Empathetic Action List and Corresponding Sources from Youmans’s Empathetic List

<b>Empathetic action</b>	<b>Youmans’s expression of empathic concern</b>
Provide zoom link and allow students to attend through zoom	Understand individual’s situations and make accommodations

Plan to support accommodations as and when they come up during the class	Understand individual's situations and make accommodations
Having integrated office hours across two sections throughout the week (instead of just one hour per week)	Commit to students' success
Providing full attention to students when they ask questions	Commit to students' success
Acknowledge students feeling and provide appropriate support	Care about students' well-being and respond non-judgmentally to emotion
Build connections with the students by learning names	Create a dynamic lecture environment and a safe space for asking questions
Providing assignment extensions whenever necessary to support learning	Adjust the pace of the course based on student needs
Prioritize learning by allowing the students to provide reasons for late or missed assignments and provide grades accordingly	Prioritize learning over grades through the design of course material
Acknowledge students' questions during class time and respond to the questions	Create a dynamic lecture environment and a safe space for asking questions
Having panel members come in and discuss about topics related to implicit bias and other cultures of engineering	Recognize the culture of engineering programs and prioritize learning over grades through the design of course material
Acknowledging the challenge of engineering by guiding students through project planning	Acknowledge the challenges of engineering program
Taking time to listen to individual students' situations and provide appropriate support	Understand individual's situations and make accommodations
Check in with the students at regular intervals to ensure progress in their class work	Adjust the pace of the course based on student needs
Validating students' ideas and progress in the project work	Prioritize learning over grades through the design of course material

Robert chose not to use the empathetic action list as it did not align with his nature of being adaptive to the situation. He wanted to get some understanding of his current batch of students and adapt the course content before thinking specifically about empathetic actions. According to Robert, empathy is not an ingredient that can be added



by following a list of actions. He believed that those who are born empathetic can continue to improve their empathetic skills but it might not be the case for those who are not born empathetic.

It's that the assumption for the actions was that you would add these pieces in or try to integrate them into your plan to develop empathy. My point is, I don't need to do that, because the basis is empathy. Everything I do, everything I structure in my courses is through their lens. Everything. I don't ever ask for something that is just an expectation of an academic outcome. ... This is ad-hoc, thus the foundation. (Long Interview 2)

Although he did not choose any actions prior to the start of the semester, he agreed to go through the action list during the long interviews. Table 6 shows the list of actions that aligned with his interactions in the classroom. He also clearly articulated the extent of each activity and provided his reasoning to implement those limits.

Table 6: Robert's Empathetic Action List and Corresponding Sources from Youmans's Empathetic List

<b>Empathetic actions</b>	<b>Youmans's expression of empathic concern</b>
Allowing lab assistant to deliver project work instructions to better align with students' peer learning efficiency	Prioritize learning over grades through design of course material
Listening to students and providing safe space to ask questions and answer them	Create a dynamic lecture environment and a safe space for asking questions
Allowing them to share assignments prior to deadlines for feedback	Understand individual's situation and make accommodations
Being available to students and lab assistants when they need clarifications	Commit to helping students succeed
Adjusting due dates to accommodate learning	Adjust the pace of the course based on student needs
Adjusting the pace of the course to accommodate learning	Adjust the pace of the course based on student needs
Provide alternate assignments and extra credit to prioritize learning over grades	Prioritize learning over grades through the design of course material
Relationship building with the students in the start of the semester to better	Create a dynamic lecture environment and a safe space for asking questions

understand student requirements and adjust content delivery	
Check-in with student teams regularly to ensure learning	Create a dynamic lecture environment and a safe space for asking questions
Accessible office hours through appointments to better suit schedule	Commit to helping students succeed
Validating students' feelings related to coursework	Care about students' well-being and respond non-judgmentally to emotion
Bring in industry experts to improve and prioritize learning	Prioritize learning over grades through the design of course material
Using personal anecdotes to build connections	Create a dynamic learning environment and a safe space for asking questions
Learning student names based on interactions	Create a dynamic learning environment and a safe space for asking questions
Providing opportunities to develop fundamental concepts	Convey the challenge of learning engineering concepts.

### **Collecting Feedback – The Prerequisite to Other Empathetic Actions**

All three participants implemented one empathetic action from Youmans's list extensively, which is, "collect feedback from students throughout the semester." According to Youmans's study, collecting feedback was one of the many recommended actions. But when those actions were provided to engineering faculty members and observed for an entire semester, I found that collecting feedback through observations, asking informal questions, direct feedback questions were not only frequent, but was also the first step to choose which empathetic action to be implemented in a situation. For example, Nadia incorporated check-in questions as first slides for every class as one of the empathetic actions. Based on the response to those questions, she was able to understand the students' mindset and altered her explanations to better suit that particular day. Another specific example for Nadia emerged when students shared that they did not

have Wi-Fi access in the classroom and how she changed her plans for testing using her “fail until you succeed” exams due to this constraint.

Apparently, they [the students] are still having trouble with Wi-Fi in the classroom. So... We have three of us there. It [The test] could still be timed; you have two opportunities to do it in this hour and fifteen-minute block. But if they had a cover sheet where they had all the answers. We could still do multiple choice or fill in the blank, but something so that it is easy for us to look at it and mark it, check the answers being right or wrong. And if they get it wrong, they can fill in the second, or then they can sit in their desk and work on it again and then bring back the second answer. And then that's the one that we grade. So maybe we could do that. we do it manually... That might be good. Because I don't want the Wi-Fi to be an anxiety provoking thing. (Day 4)

During the first two weeks of class, she observed that the Wi-Fi was not working properly in the classroom. She checked with the students and collected feedback to see if it was the same for the students on their laptops. After reporting the problem, there were still Wi-Fi issues after a few weeks into the semester. Based on the difficulty the students were facing, she prioritized learning, committed to students' success and used that information to change the mode of test in her class from an online to a paper test.

Samantha used observations and informal interactions with the student teams in her project-based course as a primary form of collecting feedback. For example, during the first week of class, she observed that the small size of the class could indicate a need for a different approach than for a class with larger size.

In a big class... this is a much smaller class than I taught before. And so like, very eager kids and then disengaged kids and then everyone in the middle. Because it's when you think, this class feels a little bit more bipolar in terms of like people who are wide eyed and bushy tailed and then other people who are just kind of like, 'ehhhh' [disinterested disliking facial reaction]. The tables in the back weren't necessarily as engaged.

Maybe that's why they sit in the back, I don't know. But I'm just thinking, how to get them to kind of reach out a little bit. (Day 2)

Samantha noticed that the smaller class size ended up creating a more distinct type of student groups. In her previous years teaching the same course, she had a larger number of students that ended up with a more diverse student mindset. In this particular set of students, she observed two major mindsets, namely interested and disinterested. This feedback through observation helped her to plan for student interactions and empathetic actions to be implemented specifically for such a student group.

Robert used direct questions, observations and team interactions as the source of feedback. For example, he asked for direct feedback from the students while providing the introduction of the course on the first day.

If you read the slides, you will notice that I asked them on every other slide how they feel and if we are hitting their expectations. (Day 1)

Robert wanted to make sure that he understood the student's expectation of the project course and if they aligned with his content and his expectations. Based on the students' responses, he planned on providing support when the students needed it. He also decided to interact with each team regularly to provide support for the students to succeed in his course.

### **Learning Student Names as an Empathetic Action**

Learning or knowing student names is another unique empathetic action that was approached differently by each participant. The reason for each participant to learn student names was captured using the model of empathy framework. Nadia was trying to learn the student names so that it would help her to connect better with the students,

especially in a lecture-based course. She used the students' names whenever interacting with them or answering their questions. This empathetic behavior was noted and appreciated by one of the students who was positively surprised that her professor knew her name. Nadia explained this incident,

I thought for the empathy thing when she was like, 'you know my name'.... 'yes I know your name. I'm trying to learn everybody's names'. She's like, 'wow'. But you could tell that was like a big deal [for her]. I've been trying to study those introduction slides so that I learn all their names (Day 4)

According to Nadia, knowing the names of the students brings more humanity and acknowledges that students have lives beyond the engineering classroom. Her intention to be respectful of the student aligned well with the Dignity and Worth of all Stakeholders attribute of the framework. The students reached out more often and asked more clarifying questions and displayed good academic progress, showing a positive impact of empathetic actions in an engineering classroom.

I think that [introduction slides to know names] is helpful for them to get to know each other and for us to get to know them. And to get to know some other aspects of them, treating them like a human, like a person that has other things going, I think that important. (Long Interview 1)

Nadia also pointed out that the use of Introduction slides in the classroom helped the students to know about each other, be respectful of everyone and create a more positive learning environment. Nadia used one of her empathetic actions as a way to model empathetic behavior to the students and encourage them to be empathetic in their profession which is one of the benefits of Teacher Empathy (Mikkonen et al., 2015b).

Similar to Nadia, Samantha also approached the action of knowing student names with the intention to be respectful and treat the students as a person. For Samantha, one-

on-one interactions were more due to the project-based class and the questions that came up were mostly related to the project work. According to Samantha, knowing the names of the students might make the student feel that she, as a faculty member, tried to get to know them and earn their respect in the classroom. Using names in a conversation makes it personal and respects the student as a person. This aligned with the Dignity and Worth of all Stakeholders attribute of the framework thus aligning it with Teacher Empathy.

I can't put myself in their shoes and mindread what they are thinking, but I would imagine that it would just make it seem more personal and [that] I've taken the time to get to know who they are. That's helpful because, 'hey you' just isn't acknowledging of the other person as a person. (Long Interview 1)

During the first long interview, Samantha shared her perspective on the usefulness of learning student names. She also acknowledged that it is her perspective and she cannot know for sure what the students thought about the faculty learning their names.

Robert approached the empathetic action of learning names quite different from the other two participants. He was able to learn the names of the students who interacted with him and showed interest in learning. He expected the students to take the first step in interacting and making an impression for him to learn their names. He shared that it is hard to know the names of all the students in all of his classes.

I see a hundred Joe's, Jim's and Nancy's in here, I don't need any more of them. What I need are those that want to gain some perspective, that need something out of me that I can help them with. Knowing their name alone isn't going to solve your problem. As I'm being empathetic, I'm sitting in their shoes thinking. Now for those that are on the outside that don't know how to come in, would calling them by name help to bridge that gap? Possibly, it could. But, again, I'm here as a resource, I'm not here to direct their lives. They are here to gain knowledge; they need to figure out how to get that knowledge. That's my perspective. (Long Interview 2)

Robert acknowledged that knowing student names might help a few students who might feel hesitant to reach out to a faculty but also states that knowing and calling students' names alone is not the answer to make students more interactive and engaged in a classroom. He connected his reasoning to his belief that his job is to make the students better engineers/professionals and not to be their social collaborator.

Here is how I learn names; you have to make an impression on me. My whole life is, 'you get what you give.' If you want to be involved, you want to be part of the process, I will find out in a minute who you are. If you want to sit in the back, be quiet and climb into your shell, then, you are just another student. I teach between four and six to seven classes a semester. I see a lot of different faces. I do not make it a priority to learn all their names. (Long Interview 3)

Robert believes in the philosophy of 'you get in life what you put in' and hence expected the students to take the first step. He pointed out that he must teach around four to six classes apart from other academic works and learning all the names might not be practically possible. My classroom observation memo showed that he knew quite a few of the students and used their names while interacting with them.

### **Instructor's Beliefs**

In order to have a better understanding of the journey of each participant, I used the Being Dimension of the Model of Empathy framework to gain insight into their beliefs and values that defined their actions or lack of actions. All three participants indicated some aspects of all three attributes of the Being Dimension with one attribute as the major belief and values. Nadia and Robert wanted to provide the best service to the

students and Samantha had the Dignity and Worth of all Stakeholders as the foundation in Teacher Empathy implementation.

The primary goal for Nadia was to provide the best learning environment for the students and support their learning. She believes that everyone can get an A in the class, and everyone can do great in her course. To achieve her goal of providing the best support to the students, she is always on the lookout for new pedagogical techniques and principles that she can try in her class. Teacher Empathy is one such pedagogy that she chose for this semester to improve classroom learning. As part of implementing Teacher Empathy, when any particular action does not go well, she immediately reflects on her own role as a teacher to understand and improve next time. She noted the extent of success or failure of a particular empathetic action and immediately planned on some minor iterations to improve that particular action so that a better outcome is possible.

Well, I think for me, it's just always makes me reflect back on my role in it, as it is more of where I tend to go. Like if the test was designed differently would we have gotten to a different answer. We have been spending more time on this material than I have ever spent. Usually we [would] have moved along quite a bit past here, so it's like, what am I doing wrong is where I go first. I've taught this class so many times and I've had [previous TA] help me and now your help and it's still a problem. I just want them to do better. And I wonder if there is some special thing that I could do that would make them do better. (Day 14)

When I asked the reason for her persistent approach to improve her teaching skills, she pointed out to the current advancements in the online learning platforms such as Khan Academy, where students get to learn a particular concept with lots of visual aids and less time in a video format that allows students to watch as many times as they need.



If you are just doing lectures, then, sometimes I'm like, 'why am I even doing this'. There is someone's better lecture that could be providing those, so they could be watching a video like Khan Academy. He is pretty good. So, what is it coming from me and having that be different or be helpful. What are we as a university offering to students? Why should they come here? Because it is easier to engage online. (Long interview 1)

Such online learning advancements made her question the difference between online and in-person learning. Improving the in-person learning environment and adding value to attending university for education is her approach to be different from online learning. Nadia also takes a systems view of the situation and in combination with her exposure to other pedagogical approaches such as Culturally Relevant Pedagogy, argues that it is more important to concentrate on how we teach and support the students rather than aiming to cover all the content of a course without connecting it to critical thinking and lifelong learning.

So related to the culturally relevant pedagogy, they said that the things that we need to think about are how we are teaching. The next thing is what we teach in engineering. And the reality is, we have been teaching the same stuff for a hundred years. Is it so important that every engineering graduate knows how to solve truss problems? Is the content that is the most important or is it lifelong learning and the critical thinking and creative thinking, is that the most important thing. And so, I think that's where you will have those problems and that's where the traditional ones are like, 'no it's all about the content'. And that is the easier thing to think about and to teach. But I would push back on that. That's not what we actually need. And so maybe it is ok that we are not going to cover all the content, but we were more responsive to the students' needs and the teaching and give them the confidence that they can learn this stuff. (Long interview 2)

Nadia prioritized the need to be responsive to students' needs and to increase their confidence in learning engineering. She used the concepts of Culturally Relevant Pedagogy to empathize and support student learning. Nadia's deep consideration of the

needs of the students to provide the best service to support those needs aligned well with the Service to Society attribute of the Model of Empathy framework. Being respectful and inclusive of the students (Dignity and Worth of all Stakeholders) and having the intention to prepare the students for their engineering career (Engineers as Whole Professionals) were also part of Nadia's reason to explore Teacher Empathy which were captured in certain interactions and reflections.

Samantha focuses on the student-teacher interactions with the intention to be respectful and inclusive while providing a better learning environment. She took an epistemologically open approach with a belief that students could come up with great ideas and as faculty, it was important for her to understand their ideas and reasons before providing guidance. When we discussed about the challenges that she faced in the past two months of implementing Teacher Empathy, she was able to articulate her belief and approach towards teaching, which is to be aware of how a faculty's actions and messages might come across in a diverse class.

I think that in any design course where students are working on projects, there is a fine line that you walk between encouraging them for their creativity and engagement and giving them feedback and pushing them to think a little bit more critically about certain things. I guess in this case, empathy is putting yourself in the role of the students who are learning and being sensitive to how those messages come across. Because on the one hand you don't want to be inauthentic and just tell them that everything is great. On the other hand, you don't want to be negative. It's really striking a balance between, giving them feedback but doing it in a way that is still affirming and not as constrictive to them in that to not keep them on a positive trajectory as opposed to making them feel like they are not doing the right thing (Long Interview 2)

Samantha utilized Perspective Taking as one of the tools to try and strike a balance between engaging their creativity while pushing them to think critically. This

aligned with the Dignity and Worth of all Stakeholders attribute of the Model of Empathy Framework. Her attention to the role of gender and race in the classroom is evident through one of her reflections about a particular activity done in the class.

What I have noticed in terms of gender and race is, just being aware of in what we talk about, like, we talk about the superheroes and how all of them are white males. I know that this is probably reading too much into it, but I didn't like that. I didn't keep great track of time on that day in the presentations. One of my teams that were traditionally marginalized. I didn't set timers, I had intended to, but I just didn't, because I didn't set a timer for the first one. I just started to grade based on how well they stayed within their constrained time. But I ran out of time at the end, and I just noticed that I had afforded a bunch of typically white male groups extra time and in doing so taken, not taken away time, but, pretty much just inconvenienced these two marginalized students. Again, I'm sure some people would argue that I'm reading too much into it. I didn't feel good about that because everyone's time should be respected. And other people should not be inconvenienced at the benefit of, again white males. So, in my mind that was a misstep on my part. (Long Interview 2)

As part of explaining an engineering design process, Samantha used the process of choosing the best superhero based on certain criteria. In the middle of the activity, she realized that all the superheroes listed for the activity were white males and no female superheroes were mentioned. She wished she had noted it before and suggested to have a woman superhero to be inclusive. Another incident related to race was observed by the participant during the final project presentations. When she ran out of time to complete the presentations, she observed that there was only one team left which had a couple of traditionally marginalized students. This situation was unintentional, but Samantha felt bad for putting those students in such a situation that could be interpreted as inconveniencing marginalized students. She wished that she could have been more alert and ensured that everyone's time is respected equally. During the reflection of this incident, she acknowledged that she might be reading too much into it, but her ability to

notice and reflect on such incidents indicates her natural drive to be respectful of all students irrespective of their race or gender. Samantha's consideration of race and gender were not only to be epistemologically open towards their ideas, but also to provide the best learning environment for all students. This aligned well with the Service to Society attribute and Dignity and Worth of all Stakeholders attribute from the framework.

Robert identified himself as a practicing engineer and chose to come back to engineering education to better prepare students for their professional careers. To achieve his goal of aligning students' professional and engineering skills with the requirements of the employers, he used empathy as a foundation in his course and formats his course content and delivery based on each batch of students.

My job is to make them ready, to provide them with the knowledge that I have in a format that will make them better assimilate into society as an engineer. That's what I do, that's my job. It's not about teaching them a specific requirement. I'm not in a box, I format my courses based upon the audience. (Long Interview 2)

All of Robert's student interactions indicated his goal of preparing students for their careers. On a particular day, many students were either late or absent and did not inform prior to the faculty as he had mentioned in the first week. He wanted to remind the students that they need to be in the class as it is a project-based course, but also wanted to support and encourage the students who came on time to continue coming on time. He came up with the idea of asking the students who are present in the class to send him an email within the next two minutes to consider it as an attendance and get a few extra points on the next assignment. One of the students who was present sent an email late. Because it was received by the faculty after the mentioned due date, Robert did not give

the student the extra credit. The student approached him in the next class with this issue and framed the conversation as if it was not the student's fault.

I have to mold you [the student] into an engineer. It's my job. So, what I did was I flipped this [issue in sending email on time] on her and I said, 'ok, how did you send it?' [student said] 'I used my Gmail account'. Ok. [Robert said] 'I received it after 10AM'. And she said, 'doesn't sound like my problem'. I said, 'oh in contrary, it's very much your problem, why would it be my problem', I said. [She] couldn't answer. I said, 'let me frame this for you. You are going to go out in the world as an engineer and you are going to be working for [industry name]. And they are going to have assignments and you are going to get it done. And you send it in some generic Gmail account and the latency in the servers ends up somewhere half hour late. What do you think your boss is going to say to that? Think he is going to say, 'oh gosh [student name] you tried'. He is going to say, 'figure out how to get command of the technology. This is because you took an easy path'... My whole focus is about employment, about 'you are here to get yourself on a career path'. Everything I do is pointed to that end. So, to that, what we have to do is better condition them so that they don't feel like they are being scolded or being dismissed. They need to understand what's going on. (Day 20)

Robert, based on his experience, knows that such excuses will not work in the student's career and hence had a one-on-one conversation with the student about the implicit expectations in a workplace and helped her understand. He gave an alternative to get those extra credits. Robert utilized empathy during the conversation and ensured that the expectations are understood by the student without being dismissive during the interaction. Robert's use of empathy to provide the best learning environment so that the students get employed aligned well with the Service to Society attribute. Since his goal was to help the students to mature personally and morally to become better engineers, it also aligned with the Engineers as Whole Professionals attribute of the Model of Empathy framework.

## **Longitudinal Impact in Perception**

All three participants shared multiple variations of their definition of what Teacher Empathy was during the entire semester. The changes in the definitions for Nadia and Samantha directly indicated that their understanding of Teacher Empathy changed through this project. Nadia had one critical incident for her longitudinal impact in perception. Samantha's longitudinal impact on her perception about Teacher Empathy was gradual throughout the semester. Robert's perception did not change but he shared that his empathetic repertoire had developed through peer interactions with me as part of his teaching team.

Nadia's perception about empathy expanded based on a critical incident on a particular day in class. The general structure of the class was that she would teach a particular concept, solve an example problem to explain how to approach the problem with the concept learned. Then she will give a set of problems for the students to solve and be available for the students if they have any questions. Near the end of the class period, she will quickly go through the steps to solve the problem to ensure that all students understood the concept. Going through the problems was to be empathetic towards the students who are hesitant to ask for help. In one of the class periods, near the end of the second month in the semester, she gave a set of problems, and the students were supposed to solve problems on their own. The students can get help from the faculty or the TAs if they feel stuck in solving the problem. As she was going around the classroom to see how the students were doing and be relatively near if they wanted support, she saw that many students had written down the problem but were not trying to

solve the problem. In the usual format, she was about to solve the problems in front of the class to help those students. Right at that moment she had an epiphany. She realized that her initial understanding of empathy was primarily focused on being nice to the students and making them comfortable in the class. She also realized the importance of struggling to learn a concept on their own, a part of life-long learning. She decided not to solve the problems and informed the students of the importance of solving on their own and struggling a little bit. She added videos of the solutions as resources in Canvas later. She continued to reflect on her understanding of Teacher Empathy and questioned if it is possible to be tough on the students and still be empathetic.

I just noticed that there was a large group of them that weren't doing anything. Or they wrote the problem down but then they weren't working on it. And so I went up and I was going to do it for them really quick for the last ten minutes and decided, just in that moment, I was like, 'no this is making it too easy for them to do it for them.' So then it got me thinking about empathy, like, does empathy mean being nice, like hand holding? Or is it ok to be tough and also empathetic? What's the correlation between being nice and, I don't know if it is mean but, forcing them into that uncomfortable zone of learning or working (Day 21)

During the reflection for that day, she articulated her thought process and realized that there is more to empathy than just being nice. Her perception of Teacher Empathy evolved based on a particular critical incident and continued to think and expand her perception of Teacher Empathy.

I think maybe I associate empathy [as] sort of being nice. I've never said that but sub consciously that being empathetic is sort of, thinking about where the students are and meeting them there. But there is something about making them more comfortable or something which is kind of interesting. But I don't know if it necessarily is. But that could be where people could have tensions or problems with it [Teacher Empathy]. (Day 21)

Nadia attended many workshops related to culturally relevant pedagogy and compassionate teaching. Her prior research area of emotions in engineering combined with her exposure to many workshops and conferences related to teaching pedagogies and emotions in engineering can be observed through her reflections on her implementation of Teacher Empathy. Many of the actions were already experimented with by her in previous semesters and hence there was not a gradual change in perception. But being more intentional in viewing all interactions with empathy at the center led to such an epiphany and evolution of her perception.

Samantha showed a gradual evolution of her perception of Teacher Empathy over the course of the research. The first evolution of her perception started as early as week three of the semester. The semester began with the COVID restrictions, especially to wear masks in the classroom. Part of the third week of the class was to work as a team on a particular activity in class. One of the students came in late and requested to talk with her outside of class.

There wasn't too much interaction with students today other than, one student arrived late and asked to talk outside. I actually felt that he was empathetic towards me. Because he asked to talk outside where we didn't have to wear a mask, because we are social distancing (Day 6)

At that point, Samantha started to not only recognize her empathy towards the student but also recognized that the students are empathetic towards her. She felt that the student was empathetic to her by asking to talk in open space so that they can remove their mask while maintaining social distance. The concept of empathy in the classroom expanded from a form of one-sided interaction, teacher showing empathy to students, to a form of two-sided interaction, students also showing empathy towards the teacher. Another



similar experience that empathy is a two-way process happened in relation to the mask policy. The mask mandate was removed in the middle of the semester, but Samantha continued to wear the mask to be respectful of students' potential apprehension of being exposed to COVID even though she was completely vaccinated.

I was motivated to take off my mask today, because a lot of other students had taken off their masks and I feel like it helps me significantly to not have a mask. I know I'm soft spoken. And so, I was motivated to take off my mask, it's reciprocation. So, I was motivated, and I think that's grounded in a sense of empathy. Even if they weren't doing it to help me, it helped me, so I am motivated to help them back because I know that I project more when I don't have a mask on, it is easier to understand than when I have the mask. (Day 17)

Samantha is a soft-spoken person and removing her mask will significantly improve her interactions. She saw that all the students took off their masks and were comfortable in the class. The students' decision to remove their masks became a motivation for her to feel comfortable in removing her mask. She felt that this mask removal was grounded in empathy in the form of students being empathetic towards her.

The next growth in her perception was observed during the first long interview. When reflecting on the empathetic actions she had implemented over the first month, she realized that observing the students in the classroom and proactively guiding them in the right direction is also empathetic.

I think I've come to see being anticipatory as being empathetic. And when I say anticipatory, I mean, observing what the students are doing and if I see them, not that I am preventing them from failing because I don't want them to learn from failures, but if I see them going down a wrong path, I do it as empathetic to nudge them back onto the right task without giving everything away. I think I've come to understand that as an empathetic action that I didn't necessarily think of it as one. (Long Interview 1)

While the concept of observing the student comes under collecting feedback recommendation from the empathetic action list, her own version of defining the action as being anticipatory indicated a growth in her understanding of what Teacher Empathy is in her own terms. Samantha was able to connect some of her natural ways of interactions with empathy and develop her self-confidence as an empathetic teacher.

Samantha's perception of Teacher Empathy further developed based on a negative outcome for one of her empathetic actions. To support the students during COVID pandemic, she decided to provide zoom access to students who were not able to come to class. Zoom access support was not mandatory during the time of the study, but she chose to continue providing that support as one of the empathetic actions.

Ideally, the case would be that, if the student is not feeling well, if they are isolating or quarantining if they are feeling sick, they can come on zoom, but I think that at least two students are beginning to use it as their preferred mode of interaction. And I don't think it's fair to their teammates because it creates a logistical complication. And so, I have reached out to those students to ask like, what their plans are for the final project. Because, like not inclined to make a teamwork with the one who is never in the classroom, because they are tired, it's not fair, so, they have like two and a half weeks to figure out that. Maybe there are limits to empathy. (Day 12)

She noted that two of the students were using zoom as the primary mode of attending class. Those two students were absent for more than 2 weeks (which is the suggested duration of quarantine) indicating that they were misusing the support. The teams that had these two students were getting affected and made her realize that empathy in a classroom can have limits and boundaries. A negative outcome of an empathetic action ended up expanding Samantha's perception of Teacher Empathy allowing her to realize that she can have boundaries to Teacher Empathy.

After two months into the study, Samantha shared that the study had helped her to be more comfortable in understanding and defining empathy in her own terms and feeling confident in connecting her classroom interactions with Teacher Empathy and providing a better learning environment for the students. Her response suggests that using empathetic actions and exploring Teacher Empathy not only broadens a faculty's understanding of Teacher Empathy but also makes them feel more confident in coming up with their own empathetic actions.

I think it [the study] has made me more comfortable in my own understanding of empathy or rather, as you have said, in my own ability to define what empathy means for me. For example, you have already said that it's what I really think. And even though I haven't got an explicit validation of like, 'ok yes this is empathy and that's not empathy', It at least makes me feel, it makes me see the things that I am doing that could possibly contribute to empathy and overall contribute to a positive learning experience for my class for my students. (Long interview 2)

One of the unique outcomes with Samantha was her increased enthusiasm to explore and articulate Teacher Empathy in her own terms. During one of the daily reflections, she tried to connect one of her interactions with a team to empathy. Since the reflections were designed to be like a natural conversation, she posed a question to me as to how that interaction is empathetic but immediately stopped me and wanted to try on her own.

And so, I thought, in a way that's empathy because it kind of demonstrating to them. How is that empathy? Don't tell me, I'll figure it out. Like reaffirming that its ok for them to have an idea that they got. Ideas don't come from just thin air, ideas come from people, they come from sources, they come from things, and so, I was trying to, again, reaffirm them in terms of like, 'it's great that you took that idea and run with it. It's yours now, own it, its ok'. (Day 26)

While guiding the team with project ideas, Samantha proposed some ideas that the students ended up pursuing. One of the team members referred to that idea as Samantha's idea and gave credit for her contribution. The students did not feel that it was their idea moving forward. Samantha appreciated the students for giving credit to her and informed them that ideas have sources and they can take ownership of the current idea moving forward as they are adding specifics to the idea. This interaction made her feel that this could be empathetic but could not immediately articulate the reason. Her personal interest in the study has evolved into an enthusiastic self-exploration of what Teacher Empathy means to her.

During the final reflection at the end of the semester, she reflected on the whole Teacher Empathy intervention she did and felt that it had a positive outcome. She shared that her own identity as an empathetic teacher has evolved. She felt that the study and the daily reflections had helped her to realize and connect many of her student interactions with empathy and pointed out her understanding that empathy can also have limits in an engineering classroom and to strike a balance between empathy and accountability.

And I've said this before, but I think empathy can have limits. I think this is a balance between empathy and accountability. (Long Interview 3)

Samantha was able to recollect all the positive experiences and the reflections she had throughout the semester. She acknowledged that her views on Teacher Empathy have changed and helped her to notice how her own actions in the classroom relate to Teacher Empathy. She also summarized that Teacher Empathy can have limits and it is a balance between empathy and accountability. Samantha was relatively new to the concept of Teacher Empathy and all her prior research was related to career pathways and

professional development. Some of the related workshops that she had attended were related to Culturally Relevant Pedagogy and through peer interactions to improve classroom environment. Her newness to the topic of Teacher Empathy led to the gradual change in perception.

Robert shared that he did not have any change in perception related to Teacher Empathy but felt it was valuable for him to be a participant for this study. His fixed definition of empathy (as something you are born with) is unique among my participants and might contribute to the lack of change in Robert's perception. His perspective that empathy is a foundation and not an implementation that can be added like an ingredient using the suggested empathetic action list is also unique from the other two participants.

Well, it's not an implementation. That's the issue that we have. Empathy is the structure from what we build from. Every aspect of the course is viewed through the eyes of the student. So, the learning has to be adjusted, the expected outcomes have to be adjusted by this paradigm of empathy. But it's [empathy] not something that's added. It's not a component of the recipe. It's the foundation of the course. (Long Interview 2)

Robert referred to empathy as a foundation of the course and the entire teaching and learning is adapted to the students' needs. He used Perspective Taking as a way to understand the students and use that information to adapt his teaching. On further reflection with Robert, he referred empathy as a variable that cannot be compiled into a list of actions that can be used as an ingredient to be added in a classroom interaction.

There is no way to provide them [faculty] with a written text on how to do this. Because empathy is a variable. It's not a constant. It's nothing that you can just assign. That's why it's not an ingredient. It's not, 'gosh, if you do this this and this, this will occur'. It won't. You have to assess it on the fly. (Long Interview 2)

He continued to explain his perspective regarding the use of empathetic action list, and it became evident that he took a positivistic epistemology regarding empathy and engineering as well. He believed that a person is either born an empathetic person or not, but for those who are born empathetic can be benefitted through such interactions and suggestions from an empathetic list.

It's not something you can install, you either are this way or you are not. It's the same thing I talk about with engineers. Not every kid that walks in this school is going to be an engineer. You're either born an engineer or you are not. We can't make you an engineer. Now where you fall in the gradients of engineering, that's different, ok. But we are all different here. We are all going to be in a different area. So, that's how I approach empathy. (Long Interview 2)

In the start of the study, he did not use the empathetic action list as a reference to choose for the study. He took an ad-hoc approach to the study. I was able to identify many of his actions in alignment with the categories and actions mentioned in Youmans's list. When I asked his perspective on the empathetic list, he believed that it is not possible to use these suggestions like a recipe and become genuinely empathetic. He reiterated his point about being born an empathetic person and in such a case, these suggestions could be considered as tactics to further improve oneself.

Can they follow a recipe and become genuinely empathetic? No, I don't think they can. It's the same thing I would say about an engineer. You're either born one or you are not. Now can you improve who you are, and can you gain some better tactics and concepts, of course you can. Everybody can do that. You did it for me. But would I go to the library, pull a book down that says, 'how to be empathetic in university courses', no I would not. (Long Interview 3)

In the final interview, he further clarified that his perspective is different because he believed that it is who he is, and it is more engrained. He also shared and gave credit to the industry for his effective use of empathy as a tool to get his point across.

I feel it's different because it's not a step-by-step approach, it's more engrained. It's a technique. It's not empathy for the sake of empathy. It's empathy for the sake of learning and progressing. That may be the difference. This is just who I am. It's a very effective means to get your point across. How did I learn this? I didn't. I've always practiced it. I don't see how you could learn this. I don't see how you could do it. You either are one of these people or you are not. You just look through other people's lens of how you how to get the point across. How I learned it most effectively was in the industry. (Long Interview 3)

Robert believed that empathy is not a step by step and empathy is an effective way to share information with the students. As part of being a participant in this study and interacting with me regularly, he said that this study helped him to understand the second-year students better and learned the importance of rubrics and providing detailed instructions for assignments from the students' perspective.

Is there anything I can denote directly, now the rubrics are the big standout for me. Ok. The other thing, the other thing that just came to my mind is, I am absolutely anti trail of breadcrumbs. 'You are an engineer, find your path. I give you a flashlight, figure out where the path's at'. Ok. That's because most of my students are more mature than what I'm dealing with in this course. You have enlightened me to, trail of breadcrumbs isn't necessarily a bad thing in the beginning. They must have a map. They can't just wander around with a flashlight. Then it's like 'ok'. So that also came through this semester. I do a lot more trail of breadcrumbs than I ever did in my past. Ok. But is it because I read it, no, it's because we had a conversation. We had multiple conversations. Because I typically must look at a solution from different angles to see how, where its true value proposition is, makes sense. That's how it would have had an impact. (Long Interview 3)

Robert usually teaches upper level and graduate courses. According to him, the mindset of upper level and graduate students is much different than the second-year students. His relatively new exposure with a different set of students motivated him to empathize and Robert's positivist epistemology that you are either born an empathetic person or you are not, combined with his definition of empathy as a foundation, paradigm, structure, and technique contributes to the lack of change in perception about Teacher Empathy. While his understanding of Teacher Empathy has not changed, he acknowledged that he was able to better understand his audience and gained new tactics to be empathetic in the classroom.

### **Challenges in Implementing Teacher Empathy**

When the participants were implementing Teacher Empathy in their classroom, there were four major challenges that the participants faced. Robert had only a few challenges and it was found to be related to his perception and definition of empathy. This is covered in the last part of this section. Apart from the four major challenges discussed, each participant had their own minor challenges that they faced.

#### *Challenge 1: External Situations That are Not in a Faculty's Control*

One of the biggest challenges that all three participants faced was external situations that were not in their control. These situations ranged from minor technical difficulties with the computer systems in the class to the cultural mindset on what are considered engineering skills. For example, the classroom setup and the lack of proper mic setup were not helpful to ensure that the students at the back of the class could hear the faculty from the front. The monitors present in the classroom were also not that



helpful as the screen size was smaller and it was hard to see some of the content displayed by the faculty.

Technology. There's my challenge. It's hard to broadcast. Being in the back of the room gave me the empathetic viewpoint of what the students that are at the farthest tables are up against as trying to learn. And you just can't hear. And so, the screens are relatively small which makes it difficult to see what they are looking for. And they can't hear the instructor, so it makes it challenging. And most of them, because they don't want to be exposed for asking questions, simply keep their mouth shut, do the best they can and wing it. And it's not a good learning experience. (Robert, Day 6)

Robert was able to notice this challenge when the lab assistants were providing a short demonstration for the project. He stood at the back of the class and found it difficult to hear the lab assistants. He tried to see the monitors in the class and was not able to see the details of the content. He felt that such difficulties hinder the connection with the students and form a barrier in creating a positive learning environment. Through my class observations, I found that he was able to magnify the content being displayed on the monitor and raise his voice so that students at the back can hear well. While he was able to overcome the challenge and continue empathizing and supporting the students, it was evident that such issues can become a hurdle in the long run for Teacher Empathy.

Samantha's class was at noon, and she had a three-hour class before this class on Monday and a few meetings on Wednesday before class. This workload before the project class under observation reduced the overall energy level of Samantha and thus became a hurdle for her to implement some of the empathetic actions that needed more interactions.

I think that a great piece of this [interaction] is energy level. So, I do teach on Mondays before coming to class. I put in half of the full workday before coming to class on Wednesday too. So, for some reason I thought that Wednesdays are going to somehow be better because I wasn't teaching but I am still meeting and doing work, so it's about the same. And I just noticed that, compared to a year ago, when I was teaching these classes, I remind myself how important it is to sleep and have lunch. To just generally take care of myself so that I can be in the classroom on and not feel like I am doing the students a disservice by being off or having an off day. (Samantha, Long Interview 1)

Samantha came up with mitigation plans but still she was not able to be as empathetic as she wanted in the class, especially when a few students had some doubts at the end of the class. Through classroom observations, I noticed that she asked them to email their question to ensure that the students are getting the support, which aligned with her empathetic action to answer students' questions, but during reflection, she felt that she could have done better. She made an effort to be more aware and take care of herself and keep up the energy level.

Nadia also faced some technical issues with the classroom computer and Wi-Fi. But she shared how the engineering culture could be an external hurdle that she and other faculty who would implement Teacher Empathy have to overcome.

You wonder how much of it [problems] is the system that we are operating within. Our focus is on the analytical mind and not on creative, artistic [skills], we are like the numbers people, it's just about the numbers and technical stuff. It's not about the social side of things. Wonder if that is just so engrained in us that it is hard to take three minutes at the beginning of class and actually have a conversation about some things that are not related to the topic. (Nadia, Long Interview 1)

As part of the empathetic actions, Nadia had check-in questions at the beginning of each class. She used the first five minutes of the class to ask a few generic questions unrelated to the technical course content to learn more about the student and to bring

some aspects of humanity and social context in her mathematic lecture-based course. She immediately started to notice some hesitation and lack of interaction in the beginning. She reflected on it from an engineering culture perspective and felt that the overall tradition of viewing engineering as analytical and not artistic and viewing engineers as numbers of people has engrained to such an extent that the students were hesitant to come out of that mindset. The current engineering workplace requires engineers to be more creative, empathize and actively communicate in a multidisciplinary environment, but the education system is still engrained with the previous culture of engineering being purely analytical and objective. This culture was an underlying challenge that Nadia faced when implementing some of the empathetic actions that required students to be more articulate of their creative skills and share their prior knowledge that might be related to the engineering content being learned in the classroom.

All three participants had various levels of challenges that were not in their control but still had an impact on their Teacher Empathy. While this challenge might not have a clear solution, all participants showed some aspects of overcoming those challenges and still being empathetic towards their students.

*Challenge 2: “Is it ok to be tough and also empathetic?”*

The next challenge was related to the difficulty in balancing between being empathetic and letting the students learn through some degree of struggling. Both Nadia and Samantha faced similar challenges in terms of choosing when to help the students and when to let them come out of their comfort zone. This similarity in the challenge for both the participants could be considered as an indication that the type of course (lecture

or project based) does not have an effect on some of the challenges in Teacher Empathy. In her epiphany moment described in the longitudinal impact in perception section, Nadia not only started to realize the evolution of her perception about Teacher Empathy, but she also noticed the difficulty in choosing between being tough and being empathetic.

One of the design process steps in Samantha's class was to submit a reimbursement form that is linked with the university. This requirement made the process slightly unpredictable to know when the process will be approved. The next steps in the process could not be completed without the reimbursement approval.

I think most of them [students] understand that it is a process that they have to engage in if they want to get reimbursed. And that is not necessarily my doing. It's the university's doing. I have a lot of empathy for that process. I hope they feel alright about it. I know it's frustrating to like want to get going and then have to wait for things to get bought. But I think this is sort of why we are so, put in like modeling analysis just so that there is something that they could feasibly doing, they could be doing CAD models right now. But yes, if I was in their shoes, I'd be annoyed that this is the thing. Yeah. Especially since it's my student fees, they are paying for this. And so hypothetically the students wouldn't have to pay and then they could just go buy the stuff for themselves because they have already paid in money. They want to use that money and it doesn't seem fair. I don't think that's fair. On the other hand, there is only so much you can do. (Samantha, Day 22)

Samantha was able to empathize with the students' situation and the potential frustration that they might have as this step comes near the end of the semester and fabrication cannot be started without approval.

### *Challenge 3: Lack of Student Engagement*

The lack of student engagement in class is another challenge for Teacher Empathy. Nadia and Samantha explicitly mentioned it as a challenge that affected their

Teacher Empathy. Robert also had similar issues with student engagement but did not relate it to Teacher Empathy. In her mechanics course, although Nadia keeps trying new teaching techniques, including Teacher Empathy this semester, she still faced the challenge of engaging the students in the problem-solving sessions. She still faces challenges in encouraging the student to solve the problems even though she tried multiple empathetic actions, and such failures seem to become a hindrance to implement Teacher Empathy in an active-learning, lecture-based class.

And I am always experimenting and trying different things. So, it is just something that I could change pretty easily. But getting them to spend more time working problems or whatever. That's harder to figure out how to do, you know, how to motivate them to do that. (Nadia, Long Interview 2)

During the long interview, Nadia was reflecting back on the low-test scores of the students and wanted to find the reason. She felt that it might be because of the lack of student engagement in the class. Although she kept trying new teaching approaches over the years, including Teacher Empathy as the latest option, she still could not motivate the students to solve the problems to the extent she had wanted to. The lack of motivation from the students was a challenge for Nadia in her lecture-based course.

Samantha faced a similar challenge in her project-based course. One of her empathetic actions for the study described in the longitudinal impact in perception section is to continue providing zoom access for the students who might be sick. But a couple of students used that as their preferred mode of attending class, thus misusing the empathetic action. Samantha interpreted this as an unfair situation for the teams of such students. Such potential unfairness due to the misuse of empathetic actions seemed to be

a challenge to being empathetic towards the students. Samantha reached out to those students individually and eventually mitigated the unfair team situation in the project-based course, but it was still a challenge that might affect the persistent use of Teacher Empathy in an engineering classroom.

#### *Challenge 4: Nature of a Faculty Influencing Empathetic Choice*

Both Nadia and Samantha mentioned that the nature of a faculty could be one of the hurdles to implementing some of the empathetic actions, especially the ones that require discussions around emotions. Nadia was comfortable in implementing the check in questions in her class and discussing the students' emotional state and sharing her emotions and providing some suggestions to handle difficulties.

I think maybe the first time, but I had done it before this class, like with the two-word check ins and some of that stuff. I played with it. It was just at the end of last semester. I think maybe the first time I did that; I was a little bit nervous about it. I don't think it is enough just to ask, what are two words that describe how you are feeling today? You have to talk through them. And I think for a faculty, that could be really hard, talking about emotions. Because it is taboo for the most part in engineering classrooms. So, I think that would be a challenge for people. Especially, it is just not the status quo or the norm in engineering. So maybe I was a little bit nervous the first time I did that. And then I was like, oh its ok. Because it's not like I have to have all the answers, you don't have to fix anything. You are just trying to get a feel of where people are or how they are feeling. So I think that would be a challenge for some people. (Nadia, Long Interview 3)

During the last interview, Nadia acknowledged that when she implemented the empathetic action of asking check-in questions at the start of the class for the first time, it was difficult to ask questions about emotions and have a small discussion about it in an

engineering classroom. She was able to get comfortable in implementing that action, but she recognized that such empathetic actions could become a hurdle for faculty members who are not comfortable with talking about emotions.

Samantha directly touches upon the concept of nature being an influence in the empathetic actions that a faculty could implement in the classroom. During reflection, Samantha felt that she is empathetic in the classroom and does a lot of empathetic actions but there are a few of the actions that she felt do not align with her nature.

I wonder [about] the most empathetic you can be and I would believe that I'm probably not hitting that. Because for example, in my mind, to be empathetic would also be just doing more, like embed culturally relevant pedagogy into the classroom. But in terms of the training I've attended, I think I do many of the things that I have been recommended. I'm not asking people what their favorite songs are. I wonder if it has to do with personality because I remember doing pear decks last semester and opening up every class with like a question. Maybe I'm just not like a good small talker, but I actually found that some of the responses were overwhelming to synthesize and it felt kind of fake for me. But I know other instructors who have a lot of success with working connections with students through that. And so, I do wonder if it's just a matter of finding the things that feel natural to you and adapting those. So, I feel like there are other things that I see other faculty doing that I am impressed with but I don't think that they match my personality per se. (Samantha, long interview 1)

In the above quote, Samantha describes trying to use pear deck and having some small conversations with the students. It is interesting to note that Samantha tried some of the empathetic actions in the beginning to understand if those actions align with her nature. Based on her experience she chose not to implement empathetic actions that did not align with her nature. Her point of certain empathetic actions not aligning with a faculty's nature might be a hurdle in implementing or sustaining motivation to continue being empathetic in the classroom. This point also highlights that there is not one correct way

of using Teacher Empathy and that a faculty's action list must align and be able to be integrated with their way of teaching.

Part of the faculty nature that could be a challenge for Teacher Empathy is the influence of habit. One of the main habitual responses that Nadia wanted to avoid as part of being empathetic was to minimize the frequency of saying 'it is easy.' She wanted to reduce this phrase to implement the empathetic action - acknowledging challenges from Youmans's action list. In her previous semester of teaching the mechanics course, she used to say that solving problems is easy as a form of motivation. She realized that while some students may be motivated when their faculty says that it will be easy, many students might get demotivated or feel unsupported. She wanted to overcome this as part of this study.

I did catch myself saying something like, 'this is kind of easy'. I was [correcting myself] like, 'it is not easy, it's a different thing to learn but it is just the x and y forces. So we are not doing moments, in that way it's a little bit easier'. But I try to step back a little bit from that. (Nadia, Day 19)

While Nadia was explaining a problem that had more steps but conceptually simpler than the previous problem, she said that the problem they are solving is easy as a part of her habit. As she caught herself acting out of habit, she explained to the students as to how the current problem is different from the previous problem and how it is relatively simpler than the previous problem. Actively thinking about Teacher Empathy enabled her to be more aware of her actions and improve her interactions effectively.

Samantha felt that she could have done a better job of observing and supporting diverse students in the classroom. In specific, she felt that she could have been more aware of the identity when choosing superheroes for an activity in the classroom. She



also connected this to the opportunity to understand her students better and implement culturally relevant content. She did change some of the superheroes before continuing with the activity to overcome this hurdle. But the chance of habit becoming a hindrance while trying new empathetic actions was noted by both the participants.

It took me a little bit too long in class today to realize that all of the superheroes we were coming up with were white males, or presumably white males. Until the middle team asked just one of them, they were like, 'we don't really know'. And these were two students of color saying 'we are not really familiar with some of these superheroes. I can do black panther'. And that makes total sense in that, it was a good example for me of maybe [implement] culturally relevant pedagogy and making sure that people can identify themselves or can see their interest or what they are familiar with in the activity and if they are not familiar with the same things that other students might be, like other students that are in more of a white male majority of the class than that might be limiting to them or make them feel certain way. I'm not going to guess how they felt but, I wonder if that was like, 'ooh', and it also made me think of like, 'well should we have added like wonder woman or super woman'. And in the past, we have. Because there's been more women in the class. And so, it's just one of those things where it was just a very real reminder of being in tune with the students and what they might be thinking and feeling in that moment and how to adapt like, 'of course you can change it, like it doesn't have to be this at all, it can be anything'. And so, I hope that made them feel like they had some agency in the situation to tailor it more to what they were familiar with. (Samantha, Day 18)

As part of the reflection, Samantha made sure that she does not assume and guess how the students of color might feel but accepted that it might be a unique experience for them and such an experience might not lead to a conducive learning environment. As part of her Teacher Empathy experiment, she was able to observe such a situation in the class and made efforts to be respectful and inclusive of all students and not just one particular group of students. She wanted to provide some agency to the students of color and provide a more inclusive activity.

Apart from the common challenges, there were challenges unique to the lecture-based and project-based course. In the lecture-based course, Nadia had a lot of content to cover within the 15-week period. While she was able to integrate most of her chosen empathetic actions, one of the empathetic actions was a challenge to incorporate in terms of time required. The empathetic action was to get students to fill in a PowerPoint slide providing introduction about the students and share their interests and then present their slide in the class.

I like the introductions. The only problem was that it was taking too much time in class. I think I do want to keep doing them. Maybe next time I should just do them all in the first day or something or take one day and just do all of them. (Nadia, Long Interview 3)

In the first week of the semester, she spent the first or last ten minutes letting some of the students use the slide as a reference and introduce themselves to the class. The choice of spending ten minutes for introduction for the first few classes took a little more time than planned. Although she felt that it took more time than expected making it a hurdle to balance content coverage in the remaining time, she saw the value in the introduction activity. She planned on an iteration of the action for the next semester, indicating a plan to overcome this challenge without losing much time.

Samantha had a unique challenge in her project-based course, which was related to team dynamics. Most of the assignments and activities done in a project-based course are designed to be done as a team. This created a very dynamic class environment where each team might require a different level of support and at different times. Samantha referred to such dynamic situations in her class and how it could lead to a potential

challenge to be empathetic and supportive for each team, especially when some of the team members are absent for a team-based class activity.

You never know how things are going to go and you want people to have good team experiences but if their team doesn't show up or if their team leaves, it's hard to have this [team experience]. Like when we were talking about how this is a discussion tool, not just a numbers tool, you kind of need a team there to discuss. So that can be a challenge. (Samantha, Day 18)

During one of the classes, the teams were introduced to a design tool that required the team members to work together and come up with logical reasoning and choose a rating for their designs. This activity relies greatly on the team members communicating with each other. Samantha felt that it was hard to provide a fair and empathetic solution for a team that had some team members absent. Based on my classroom observation memo, she was able to provide a solution for that team dynamically on the spot, but during reflection, she shared that situation as a challenge and how such issues could be common in a project-based course.

Robert approached the concept of challenge from a unique perspective. He shared some situations as challenges but pointed out that they are a motivation to be empathetic. His teaching style and his ability to quickly adapt to each team's unique situation without reducing the high expectations of assignment quality was his justification and reasoning for his ability to view a challenge as a motivation.

So, the challenges we are going to have are, how do we take this group of individuals and get the same outcome. Well, they are all looking through a different lens, so we have to focus that lens. But most importantly, it's their lens not mine. I'm the one who has to make the changes. I have to move and pivot so that they will better understand... You play to your audience. And that doesn't mean you give in. That just means you have to

assess, and you have to be able to provide the information through maybe a different means. Ok. Those are the challenges that you have to put up with. So, another [faculty] that's not used to using that method would have to figure out how to pivot. And it's not about giving in and it's not about making it easier for the student, it's about you changing how you express yourself so that they can better understand. That's what I would say as one of the biggest challenges. Every time you hit a different group, you have to speak differently. You'll notice I use the word or the term overachievers frequently. That is a category I fully understand how to deal with. It's the others that are the challenges to me... How would I motivate them into the people they can be. With overachievers, it's really easy. With those that are just here to get a degree, I don't resonate in that world, that becomes a really big challenge for me. I don't know how to make their lives better. (Robert, Long Interview 2)

Robert summarized the overall challenge that he faced in terms of Teacher Empathy. He pointed out that every student had a unique perspective and approach towards the course and he felt that it is the responsibility of the faculty to ensure that their explanations are reaching all the students. He used Perspective Taking to understand the students and customize his teaching to suit the current batch of students. He also pointed out that using empathy as a way to align with the students' perspectives does not mean that we have to make the content less or easier. He made sure that he did not sacrifice his high expectations of the students to be empathetic towards them. His empathetic approach was to express differently for diverse groups of students. He categorized the students based on their interests in engineering and their expectations from the class. He used the term 'overachievers' to refer to the students who are motivated to learn and have high expectations from the class. He referred to the students who are there just to get a grade and get a degree as just 'students.' He was able to support the overachievers with ease when compared to the other students. He referred to difficulty in being empathetic with

the students who are there just to get a grade as a big challenge, he approached it as a motivation to improve his ability to adapt and support all the students in his class.

### **Motivations to Implement Teacher Empathy**

During the course of the entire semester, all three participants had multiple motivating experiences due to Teacher Empathy. There was a total of five major motivations that were observed among the three participants. There were a few motivations unique for each participant.

#### *Motivation 1: Supportive Teaching Team*

One of the biggest motivations for all three participants was to have a teaching team with a similar mindset towards Teacher Empathy. Being a part of a team with a primary intention to being empathetic and to have a peer to share ideas and inspire each other was a big motivation for all three participants. Nadia had me as a Teaching Assistant and had an undergraduate grader. All three of us were very enthusiastic about providing the best learning environment for the students. Having a supporting teaching team with high energy to implement any empathetic action was very motivating for Nadia. She shared a lot of small appreciation throughout the semester for having such a team in her course. One of the biggest success stories for having a cohesive teaching team was that she was able to implement an empathetic action that might not have been possible to be done only by her.

I wonder if it was in some ways easier because of the teaching team we had put together. I don't know if it's a specific incident, but, it was definitely helpful in having you and [grader name] as part of [the team]. We had these three people that really were empathetic and cared about the students and wanted to help the students. And thinking about challenges or

difficulties in doing some of the stuff, I think it would have been a little bit harder if it was just me. But it gives extra motivation if you are working with these other people and extra support for the students. Whereas before I wouldn't have suggested the oral exam thing. Because it's just a lot just to do it by yourself. But because I knew I had support, I was able to do that. And then, because we had [grader name] we knew we can trust him for the grading and you could focus on other things with the class, so I think all that sort of helped make the class better but then also allowed us to be more empathetic, maybe in our interactions with the students and learning about them. (Nadia, Long Interview 3)

After a major test, she found that many students had lost a lot of marks affecting their grades. She empathized with the students and wanted to give them another chance for the students to show that they learned the concept that they had missed initially. She came up with an empathetic action idea to have a one-on-one oral quiz as a chance to provide students to earn points back on the test. She chose to have one-on-one meetings with students so that if the students did not demonstrate understanding of the concept, she could still help them learn the concept during that meeting. This empathetic action took a lot of time and effort and had to be implemented on multiple days through zoom meetings. This also brought a challenge to continue grading the other weekly assignments. She felt that she was able to implement that empathetic action with personal satisfaction because she had a reliable grader to grade the assignments and a Teaching Assistant who understood the requirement and took the time and effort to support student learning. Such a supporting team motivated her to implement even time and effort consuming actions in the classroom.

Samantha also shared a similar motivation in terms of having a teaching team. She also had a peer instructor to share some of the preparation work for the class. Similar to Nadia, Samantha also had a Teaching Assistant and an undergraduate grader as part of

her teaching team. Apart from this, she also felt that my presence in the class for the research was motivating to try some of the chosen empathetic actions, specifically related to student-teacher interactions.

You being in the classroom is sort of a reminder to try to be empathetic. The TA, it was his day, he was answering questions. So, I kind of felt like, more of in a supporting role. And before I went out to talk to him, his name is [student name], I was just trying to be in the room, present, ready for anything that happened, not on my phone, just kind of there. I had motivation and that's how I enacted it. (Samantha, Day 6)

Samantha felt that she was motivated to be empathetic and try to interact and support the students when they are working on the projects. She was also motivated to be empathetic with her Teaching Assistant and provide a supporting environment during the day that her Teaching Assistant was discussing one of the topics. She was also motivated to see her position as a supporting role and be ready to provide any kind of support anyone might need in the class while learning and working on the class project.

Samantha also felt that having a peer instructor to share the administrative work and course preparation was a big motivation to concentrate on students and implement Teacher Empathy in her classroom. There were two sections of the course and each section had an instructor. Both the instructors had different Canvas courses but developed the course content together to make sure that both the sessions had the same content. The decision to develop the course content together reduced some of the workload for both the instructors. Samantha used this reduced workload to concentrate on Teacher Empathy.

I was a lot more relaxed in this semester than I did in other semesters and I think it's because I knew that everything was set up and that I am sharing

the load with co-instructor, because we are sharing a canvas page, we are sharing material, there were some updating requirements like dates and stuff and setting things up in Canvas, I mean I would do half and he would do half. So, I do think that having less administrative work and just having to show up and be present did help me engage with the students more as opposed to feeling like I was engaging with the structure and paperwork and the grading. I did not have to do [grading], I had to grade one assignment all semester. And so, our grader was amazing, and I think that also took off a lot of pressure and a lot of just administrative clutter. In the mind, that could then go to like focusing on the students and what the students needed. (Samantha. Long Interview 3)

Samantha felt that having a reliable grader to grade the assignments, a reliable Teaching Assistant to support the teams during in-class assignments and having a co-instructor to share the administrative workload reduced a lot of pressure and administrative clutter. This motivated her to concentrate on students and Teacher Empathy.

Robert considered me as part of the teaching team although I was not officially part of the course. He had two lab assistants who were in their upper-level classes and also had taken the same course under Robert in previous years. The perspective of young lab assistants who are much closer to the age of the class students was a substantial support for Robert to understand the students' perspectives and be empathetic towards them. He felt that it is motivating and helpful to have a supporting peer with similar goals for the classroom. Robert shared that he was motivated to utilize the perspective of the lab assistants and me to come up with ideas and provide a good learning experience for the students.

I think it's good to have somebody to run ideas off of. Now does it impact anything? It depends on what that situation is. It could. Today was hugely helpful. I like to have a team effort. And the other side of this is, your [Bala] age and your [Bala] perspective are what I am really looking for. That's why those two youngsters in there are so hugely helpful. A different perspective is what you [Bala] give me. So, when I ask the



question or came up with a challenge that I did not know how to provide a positive message to those students who put in the extra work, you [Bala] were there to help me better understand options that made me effective. And we came up with a solution. Same thing I want out of those lab assistants. Right. Everybody has a purpose. (Robert, Long Interview 2)

When discussing motivations in the second long interview, Robert shared that he was able to come up with solutions that better align with the student requirements through peer discussions. He pointed out the relative similarity in age between me and the students and how that helped him to better understand the students' difficulties with assignments. In specific, most of the teams did poorly on one of the team assignments but a few teams did complete as per his expectations. As most of the teams did not do well, he took the time to provide further explanation of the assignment. He also wanted to provide an extension for the teams to complete and show their learning. But he also wanted to support and validate the teams that took the time and effort to complete the assignment on the first attempt. He discussed with me to come up with some ideas and came up with a solution that supported every team. According to him, everybody has a purpose and the purpose of a teaching team is to best support student learning.

### *Motivation 2: Positive Teaching Experiences*

The next major motivation was the positive teaching experiences that the participants felt when implementing Teacher Empathy. I am referring to the faculty members' personal satisfaction or self-appreciation of their own efforts. This is not the same as the positive student experiences that the faculty members observe based on Teacher Empathy in their classroom. Nadia felt that she was making some difference in the culture of engineering by implementing Teacher Empathy and talking about emotions

in an engineering classroom. She was motivated to be a role model in acknowledging the possibility of being good at engineering skills and empathetic skills. Such an approach towards Teacher Empathy provided a positive teaching experience for Nadia and motivated her to continue to be empathetic towards the students.

I think slowly but maybe, the last one, the Engineers as Whole Professionals, like if we can start to do things like this in the classroom, then maybe it won't be as taboo to talk about your feelings in an engineering workplace. I mean, it's not like we are not going to change engineers, or the whole system of engineering, but this might be like one little dent and starting to be like, 'ok you can be an engineer and be, analytically good at your job, but then you can also be empathetic. It's not either you are really good at math and science, or you are really good at people. You can do both. And the students can do both in the classroom also. Or the teachers can be both. But that is a big change from what we have done in the past (Nadia, Long Interview 3)

In the last long interview, Nadia pointed out one of the attributes from the framework – Engineers and Whole Professionals and connected her efforts to be empathetic in the classroom having a potential positive effect in the engineering workplace. She felt that, by implementing Teacher Empathy in an engineering classroom, there is a possibility to break the stereotypical taboo of talking about feelings in an engineering workplace. Her empathetic behavior in the classroom could be considered as a role model for the students and create a minor change with these engineering students to be more open to talk about emotions and be empathetic towards everyone in the engineering workplace. This possibility of improving the culture of engineering through empathetic role modeling in the classroom is a big motivation for Nadia to implement Teacher Empathy.

Being a part of the Teacher Empathy research, Samantha was able to improve her awareness of her actions in the classroom. Reflecting on her actions in relation to Teacher

Empathy helped her to see that some of her natural practice was part of empathetic actions provided in the study. She felt a positive reinforcement of her actions and feels more value in her actions creating a better learning space for the students.

I thought it was a fun and productive experiment. I do feel like, again with your involvement in the class, daily reflections after class, it brought it present to mind, more so than other semesters. And it changed how I think of myself as an empathetic teacher. It [daily reflections] helped me recognize that like, ‘right oh you do do things that are empathetic and there are also things that you can do to improve.’ And I’ve said this before, but I think empathy can have limits. I think this is a balance between empathy and accountability. (Samantha, Long Interview 3)

In her last interview for the research, Samantha shared that the Teacher Empathy experiment was a productive implementation for her. She felt that the daily reflections and active conversation about Teacher Empathy helped her to improve her self-confidence as an empathetic teacher. Having multiple positive experiences while implementing empathetic actions during the semester became a motivating factor and also a foundation for her longitudinal impact in perception.

### *Motivation 3: Positive Feedback from Students*

Getting positive feedback from students is another motivation for the participants. Apart from the personal satisfaction of their own teaching practices, it was also motivating to receive positive comments from the students, especially related to empathetic actions. The feedback could be both direct and indirect. It could be in any form but most of the feedback seemed to be through classroom observation or through direct informal one-on-one interactions with the students.

Both Nadia and Robert shared a similar metaphor of ‘light comes on’ when the student understands a particular topic or a concept. Such a positive body language was a motivation for the participants to continue doing actions that will help the students to get such positive experiences.

I think it’s starting to make sense [to students]. Like you could see. I guess not all, just a light comes on and then it totally makes sense. It’s a struggle. But, I feel like they are gaining ground by working at it and gaining ground. so, I think it felt good. It is nice to interact with them in that level and not just stand up in front of the room. (Nadia, Day 5)

In her lecture-based course, Nadia was able to observe such eureka moments with students early in the course. She observed that some of the students were struggling to understand the concepts being covered in the class. When the students were solving problems on their own, she interacted with some of the students to explain the concept further and help them understand. She was able to see that ‘a light comes on’ for the students when the students understood the concept.

In his project-based course, Robert had multiple team assignments that are interlinked and structured to emphasize learning and not worry about grades. He explained to the class that all the team assignments related to the main project are considered as live documents and that it is expected to be updated as the project progresses.

When the light comes on in their little eyes when they finally figure out what it is I am trying to do. That is the part that makes me want to be here. [It] happened twice today. The reality of, 'that’s what you want', 'Oh that makes sense'. I like that identification that what we are doing isn’t just an exercise but actually has value. And so, putting extra effort in, realizes a better outcome. Not just a better grade (Robert, Day 18)

Initially the students felt vague and were not sure what Robert meant about it. But as the course progressed and some of the team assignments were done by the students, they were able to understand the big picture of the course. When he interacted with some of the teams to get informal feedback on the course and the assignments, the students asked a few questions to better understand the overall objective of his approach. When the students understood, their eyes lit up indicating to Robert that the students finally understood that he aimed to provide a better learning outcome and not just a better grade. He had two such explicit feedback from the students, which he shared as a motivation to be a faculty and use Teacher Empathy as a way to teach engineering.

Nadia took the time to interact with the students whenever they were solving the problems on their own during class time. In one of the problem-solving days, Nadia interacted with a few students and a student expressed to Nadia that some of her ideas to remember the concepts were helpful.

And she said that she has taken statics before at her other university. And she said that, 'this is the first time it's starting to make sense to me'. I was like, 'that's good'. She was like, 'there are some things that you do that really help, like the rainbow method'. I'm like, 'you do know that that's not actually a method'. But I guess that's what I always laugh about I always taught that somehow. But I don't know anyone calls that the rainbow method. So, she's like, 'no that never made sense to me and that was finally making sense with the cross products'. [I'm] like, ok. (Nadia, Day 13)

Nadia used a metaphor to explain one of the statics concepts so that the students can easily remember and not make mistakes while solving problems. One of the transfer students had already taken a similar course in another university but had difficulty understanding the concepts. Nadia's use of metaphors and her effort to explain a concept

in more than one way to help students understand was appreciated by the student. Such positive feedback motivated Nadia to be empathetic in the classroom.

Robert shared that the positive feedback could be also seen in the form of increased course evaluations indicating that students appreciate the empathetic teaching approach the faculty utilizes in his course.

I redesigned the course. I am the only one currently that's using this [empathy] paradigm in the course. This [course] is now in the mid to high 4s [course average], meaning the students appreciate what they are getting out of it. Contextually that is why, maybe. Probably though it's the empathy that they are receiving. The value they see. The why it matters. (Robert, Long Interview 2)

#### *Motivation 4: Reduced Teacher Burnout*

Feeling more relaxed and less burnout was another motivation to use Teacher Empathy in the engineering classroom. Teaching multiple courses and teaching the same course multiple times could lead to stress and burnout for any faculty. Nadia and Samantha felt that their stress and teacher burnout were reduced when they implemented Teacher Empathy. This reduced stress was a motivation for them to continue to be empathetic in the classroom.

But if you did it without active learning, which you could, I don't think it necessarily means that you are going to cover less content. For me I think its good. It makes me feel like you are actually doing something positive. So, it maybe helps with not feeling so burned out about teaching. As that happens sometimes. (Nadia, Long Interview 2)

While discussing about the effort needed to balance the integration of empathetic actions in a content heavy lecture-based course, Nadia shared that most of the empathetic actions that did not involve active learning would be possible to integrate without sacrificing on

content. Nadia felt that it was motivating to do something positive for the students and such a positive learning environment might reflect as a potential reduction in teacher burnout.

Samantha related being empathetic to being grateful. She was able to feel a lot less burnout as she was implementing some of the empathetic actions. Teacher Empathy helped her to be more aware of her actions and the positive student experiences they might have. Such positive feedback was a big motivator for Teacher Empathy.

I had a lot less teacher burnout this semester and in fact I actually feel like I was able to do more research wise, than I have another semester. And I think that that's partly mitigated by the grading, is partly mitigated by like not really doing a lot of course prep but, but I do think that, the focus on the experiment on empathy, it kind of reminds me of the experiments that people do with gratitude, where it's just kind of thankful for what you have and what you're doing and you're just happier, and feel less like it was a chore, like I kind of feel like with the empathy thing it just gave me something different to focus on. I didn't have to worry too much about what was going on in class and outside of class about class, it was more of 'when u show up for those 75 minutes I'm going to be present, I'm going to listen, I'm going to be responsive, I'm going to be empathetic'. And then that's success for the day, for that class. (Samantha, Long Interview 3)

When we discussed teacher burnout during the last long interview, Samantha shared that she had taught this course multiple times in the previous years and had many minor iterations each time she taught. But the main content of the course remained the same, which made her feel that some parts of the course were a chore at times, potentially leading to teacher burnout. But the concept of Teacher Empathy brought a new topic to think about and hence bringing back the enthusiasm for the course. Teacher Empathy directly helped Samantha reduce teacher burnout.

### *Motivation 5: Improved Student Teacher Interactions*

Improved student teacher interactions in the classroom were another motivation to implement Teacher Empathy. Interacting with students was part of most of the empathetic actions. As covered in the previous section of this chapter, collecting feedback involved a lot of interactions with the students. Having positive experiences with most of such interactions motivated the participants to further support the students through their empathetic actions. Nadia felt that it enabled her to have a more enjoyable class and care for the students more as she was able to have more interactions with the students.

I think just getting to know people better is encouraging. It makes you care more also. Because then you know them a little bit more. So, I think it makes for a more enjoyable [experience] in the classroom. [In previous classes] It was like no one says anything, you just feel very alone. But this class sort of had a good feel to it. It could have been just that people we happened to have in there but I think people just sort of opened up and relaxed and [you] could sense that. So, I think to me, that's motivating (Nadia, Long Interview 3)

The usual experience of a lecture-based course for Nadia is that she stood in front of the class and explained the topic for the day, solved a problem, had the students solve problems, and asked if the students have any questions. As part of the Teacher Empathy implementation, Nadia learned more about the students through the Introduction slides and check-in questions. Such interactions helped the students feel more comfortable and interact more with her. She related such positive student teacher interactions to Teacher Empathy and felt motivated to continue being empathetic.



Samantha felt that she was able to provide better support for the students as she interacted more. She was happy to know that she had some veterans, some parents and was able to learn more about them through email conversations and felt that she was able to provide more meaningful support for the students through such empathetic interactions.

I'm making connections with them. I hadn't thought about this before, but, I am aware of several of their situations. And this happens a lot, not in the classroom. That was an email. In terms of like them reaching out for help or them contextualizing what's going on in terms of needing an extension. So, I do know I have some veterans in my class. I have some active duty in my class who are doing training right now. I have National Guard kind of thing. I have some of them who are study abroad from another country in my class. I have a few parents in my class, so I feel like I know. We don't talk about it all the time but I do feel like I'm starting to know. Like for example, I haven't seen a few students in my class for a few days. So, I thought that if there's something going on, I want to know so I can help. So, through those emails, getting a sense of what's going on behind the scenes. (Samantha, Long Interview 1)

Samantha utilized the build days (class time allocated for students to work on their project) in her project-based course to interact with each team, understand the students' situations better and provide support to improve students' learning experience in her classroom. Samantha was able to observe the positive impact of such empathetic support and felt motivated to continue such interactions with the students.

Nadia reflected on the easiness of some of the empathetic actions not only for her but also in general. In specific for her experience, she felt that she was able to integrate new empathetic actions and culturally relevant pedagogy into already implemented actions without losing much class time. For example, she learned about the positive

effects of using music in the classroom to bring in a more culturally inclusive space in any engineering classroom.

I like that a lot of them [empathetic actions] don't necessarily take a lot of time out of the class. I felt that they are the stuff that would be easy for people to adopt if they were interested in it. I think these like, the Spotify playlist was easy to just like integrate it into what we were already doing. So, we are already asking questions at the beginning of the class, so it was easy for that question to be like, 'what's your favorite song? I would like to make a playlist about this'. (Nadia, Long Interview 3)

While being a participant in this Teacher Empathy research, she also attended a seminar on Culturally Relevant Pedagogy (CRP). She was able to instantly connect the similarities with Teacher Empathy and CRP. She also saw that she would be able to integrate one of the suggested CRP actions with her existing empathetic action. She integrated the use of music as a way to implement CRP with her already available check in questions to gather students' favorite song. She created a Spotify playlist for the class and used it to play during the problem-solving session. This was greatly appreciated by the students. Such potential of Teacher Empathy to integrate with other relevant pedagogies was a motivation for Nadia to further explore Teacher Empathy.

## **Summary**

The initial perception of Teacher Empathy for all three participants were similar and more in alignment with Perspective Taking when they said “being in their shoes” as part of their definitions. On further analysis using the Model of Empathy Framework, I found that Nadia approached Teacher Empathy to provide the best learning experience for the students in the classroom and to be respectful of the students. Samantha utilized Teacher Empathy to be respectful and inclusive of all students and also to provide a safe

learning environment. Robert used Teacher Empathy as a paradigm to provide a learning environment that will help the students to become the best engineers in their careers.

All three participants took the empathetic action list very differently. Nadia used the action list as a reference and came up with her own actions. Her action choices aligned with the categories provided in the action list. Samantha directly utilized the provided example actions as a starting point with the intention to expand her actions based on her experience. Robert did not use the empathetic action list as he wanted to take his own implementation of Teacher Empathy as he believed that empathy is not something that you can add as an ingredient, but it is the foundation of a course.

One of the questions in the daily reflection was, ‘how was the class and how did you feel about it?’ All three participants shared their responses based on their observation-based feedback of the students in the class. Observing the students’ behavior and actions in the classroom was one of the primary modes of collecting feedback. Based on such feedback, the participants were able to analyze if their empathetic approaches were received positively or not and refine their actions based on that feedback.

Learning student names was a key empathetic action that was implemented by all three participants but with different intentions and expectations. All three participants used student’s names while interacting with the students in the same way irrespective of their beliefs and type of course (lecture-based or project-based course). Nadia and Samantha took the first step and learned the student names to develop the student-teacher relationship, but Robert expected the students to take the first step for him to learn their names and further develop the student-teacher relationship. The student-teacher

interactions across all three participants were similar after they learnt the names of the students.

All three participants had challenges at various stages of the semester. External situations that are not in the control of the faculty such as technology issues, having prior classes and the culture of engineering education was one of the major challenges for all three participants to implement Teacher Empathy. The second major challenge was to balance between being empathetic and being tough to ensure that the students learn the necessary skills to be an adaptable engineer. All three participants shared that a lack of engagement from the students was another major challenge to be empathetic towards the students. Nadia and Samantha pointed out that the nature of a faculty could influence the choice of empathetic actions and thus be a challenge to implement those actions that do not align with the nature of the faculty, for example, a faculty with introvert nature might find it difficult to talk about emotions with the whole class but still be able to talk and support the students on an individual basis. Robert did not face specific challenges during the semester but shared an overall challenge of understanding the perspective of the students who are taking the course with the primary intention to get a degree and motivate them to meet the high expectations of his course and become better engineers.

All three participants had multiple motivations throughout the semester. Most of the motivations were not specific to the course type (lecture-based or project-based) with some positive experience having more impact in each course type. Having a supportive and like-minded teaching team with similar empathetic goals was a huge motivating factor for all the participants. Positive teaching experiences and positive student feedback

throughout the semester due to the empathetic actions motivated the participants to continue implementing teacher empathy. Improved student teacher interactions and reduced teacher burnout motivated the participants to further explore the potential of teacher empathy in an engineering classroom.

## CHAPTER 5

### DISCUSSION

Through this study, I strove to understand the motivations and challenges engineering faculty might face during implementation of Teacher Empathy in their engineering classroom and how those motivations and challenges could influence their perception of Teacher Empathy in engineering education. I consider my research as an extension of two main studies. The first study is related to empathic concern by Youmans (2020b) who came up with three themes and eight categories of empathic concern that could translate into empathetic actions for faculty members to implement in their classroom. She also provided a few examples of empathetic actions for each category that could be used as a starting point for engineering faculty. I utilized her empathetic action list and used it as a primary resource for my participants to choose the empathetic actions. The findings of my study indicated that Youmans's empathetic action list was a good starting point for faculty irrespective of the difference in their way of using the action list. Although Robert did not use the empathetic action list as a starting point, his empathetic actions were in alignment with most of the categories and themes of Youmans's empathetic action list thus verifying the effectiveness of Youmans's findings.

The second study that this research extended is the Model of Empathy Framework created by Walther and his colleagues (2017b). The framework was primarily created with engineering professionals as the main context, but one of the future directions suggested by the authors was the potential use of their framework with engineering faculty members as the context. I used the framework as a lens in my study to capture the empathy components in the data and understand the complex nature of empathy in an

engineering educational context. I was able to understand the interconnections between the participants' belief systems and empathetic actions using the Model of Empathy Framework. I also had some data indicating potential refinement of the Model of Empathy Framework which I have covered in the Implications chapter.

In my study I used a combination of Teacher Action Research, Teacher Empathy and longitudinal data collection. Such a combination to explore Teacher Empathy is new in engineering education research and higher education research. Most higher education research is either a quantitative study (Bozkurt & Ozden, 2010; Coffman, 1981b; Hassan et al., 2011; Waxman, 1983b) or a qualitative study with large number of participants (Arghode et al., 2013b; Warren, 2013, 2015, 2018). The use of Teacher Action Research and longitudinal data collection to explore Teacher Empathy allowed me to capture the nuanced way that engineering faculty members approached implementing Teacher Empathy in their courses. My approach in this study could be considered as a potential novel methodological approach in exploring such pedagogical research in engineering education research (Case & Light, 2011).

I was able to use the Model of Empathy Framework to understand each participant's beliefs and how it influenced their Teacher Empathy implementation. All three participants showed a combination of two or more of the attributes in Being Dimension. Samantha's values aligned with the Dignity and Worth of all Stakeholders along with Service to Society. Nadia and Robert had the intention to provide the best service to students as part of their jobs, thus aligned with Service to Society attribute. But when I took a big picture view of their approach, we found that Nadia primarily focused on the learning experience in the class and had an epistemologically open approach in her

interactions thus aligning with Dignity and Worth of all Stakeholders, while Robert focused on the students' future and to ensure that the students are ready for the workplace requirements thus aligning with Engineers as Whole Professionals attribute of the Model of Empathy Framework.

In the following sections, I first discuss the benefits and need for Teacher Empathy in engineering education (related to RQ2: What motivations and challenges are experienced by faculty while implementing empathetic actions in an engineering course?) shared by the participants and how it correlates to literature on Teacher Empathy in higher education. The benefits of Teacher Empathy were in alignment with the motivations found in this study. The participants also shared the need for Teacher Empathy when they shared the challenges in implementing Teacher Empathy. Thus, the motivations and challenges research question could be compared with the benefits and need for Teacher Empathy in higher education literature. Then I discuss how the nature of faculty members influences their approach to Teacher Empathy and their perceived motivations and challenges in their daily classroom interactions (related to RQ1: What is the longitudinal impact of engineering faculty's perception of Teacher Empathy while implementing empathetic actions in engineering courses?). Finally, I discuss the potential of using Teacher Action Research for engineering educators and researchers. My findings show that Teacher Empathy does have a positive impact in an engineering education context. These findings expand upon Youmans's study (2020b) where she approached the concept of Teacher Empathy (using the term empathic concern) from engineering students' viewpoint.



## **Benefits of Teacher Empathy in engineering education**

Apart from sharing the motivations to implement Teacher Empathy in their classroom, all three participants shared the benefits of Teacher Empathy in an engineering classroom. This indicated a correlation between the motivations they experienced to the benefits of Teacher Empathy. One of the motivations, which was also shared as a primary benefit, is the positive learning experience of the students and better learning outcomes such as improved project work and improved understanding of concepts. Coffman found a similar positive correlation between Teacher Empathy and student learning in a quantitative study in higher education (1981a). Another meta-analysis of literature in higher education also pointed out that empathy is one of the primary teacher variables that contributed to positive student outcomes (Cornelius-White, 2007). Nadia and Samantha shared that they were able to care more for the students' learning and wellbeing as they learned more about the students. They also indicated that such increased care for the students motivated them to keep improving their empathetic skills. Samantha indicated that her self-confidence in her ability to be empathetic increased significantly. All these benefits align with a higher education study which indicated that caring teachers were more committed to their students, were constantly motivated to improve their skills and indicated a positive correlation between caring teachers and their self-efficacy (Collier, 2005). My study showed that Teacher Empathy has positive outcomes for engineering faculty members and students thus expanding empathy research in the field of engineering education.

Reduced teacher burnout is another major benefit of Teacher Empathy indicated by the participants of this study. Having regular interactions with the students, having a

supportive and like-minded teaching team, and having time to revise curricula and reflect on impacts of teaching empathetically were primary motivators that highlighted the benefits of Teacher Empathy in reducing overall teacher burnout. Similar outcomes were observed for Teacher Empathy in higher education where there was notable reduction in stress and burnout when implementing Teacher Empathy (Jennings & Greenberg, 2009; Vučinić et al., 2020b). Such similarities in the outcomes of Teacher Empathy in both higher education and engineering education highlight the potential transferability of positive outcomes of Teacher Empathy from higher education to engineering education.

### **Need for Teacher Empathy in Engineering Education**

While sharing the challenges the participants had during the Teacher Empathy implementation, they also shared some of the ways they tried to overcome them. As part of those attempts to overcome the challenges, the participants shared their reasons as to why Teacher Empathy is needed in engineering education. One of the primary needs for Teacher Empathy indicated by all three participants was to overcome the weed-out culture within engineering education. Nadia highlighted that Teacher Empathy could help in creating a safe space within engineering to talk about feelings and emotions.

Empathetic teachers could become role models for future engineers to be comfortable in learning empathetic skills and be good at both analytical and social skills. Samantha and Robert highlighted that Teacher Empathy could be critical in combating meritocracy and rigor in engineering education. They pointed out that empathy would be vital in providing the necessary support for all students to be successful and persist in engineering. In engineering education, research has discussed the negative impacts of meritocracy on students, especially when considering racial and gender equity in engineering education

(Rohde et al., 2020; Slaton, 2015), and concerns about discussions of rigor as being harmful to students and faculty by limiting what counts as engineering (Riley, 2017). A higher education study on promoting students' success also found that positive support and feedback from the instructors were important factors for students to overcome their own fear of higher education, especially for less advantaged students (Cox, 2009). The outcomes of my study indicated that Teacher Empathy is a way to be inclusive and promote students' success, thus contributing to the needs of empathy in engineering education literature.

The other major need for empathy was related to providing a better learning experience for the students. All three participants mentioned that empathy can be a tool that can help them to provide a positive learning environment and incorporate other teaching strategies such as culturally relevant pedagogies. Nadia felt that it is equally important if not more to concentrate on how we teach engineering concepts and not just concentrate on what topic we teach. She attended a seminar by Dr. James Holly, Jr. from the University of Michigan that highlighted the 'spirit murdering' of Black engineering students, which might be improved by engineering educators being more empathetic and thus indicating the critical need for empathy in engineering education (Black In Engineering, 2021). She also shared about the importance of the need for 'critical liberative pedagogies' in transforming our approach to teaching in engineering (Riley, 2003) and importance of the need for Teacher Empathy. Samantha utilized Teacher Empathy to directly relate real-world situations to classroom rules, especially related to deadlines. Teacher Empathy helped her to provide a clear explanation of the need for deadlines, the responsibility of the students for meeting them, while at the same time,

informing the students of the ability to request extensions if they had valid reasons. According to Robert, Teacher Empathy is critical in helping the students mature as critical thinkers and understand their place in the industry. Robert used empathy as a paradigm to align the course content as per the needs of the current batch of students to better facilitate an effective learning environment. All three participants' experiences indicated that Teacher Empathy could be used with other pedagogies and classroom interventions thus expanding the potential of Teacher Empathy in engineering education.

Bozkurt did a quantitative study in a K-12 educational setting and found that an empathetic classroom climate had conceivable positive impacts on students' performance (2010). I observed that students in all classes showed increased interest in classroom activity. For example, in Nadia's class, some of the students felt supported and gave informal feedback to Nadia and me that they were able to perform better in the exam because of the two-attempt option Nadia gave in the exam (an empathetic action where Nadia gave the students two chances to answer the exam questions). Samantha shared that the students' project at the end of the class was much better and felt that it could be a direct relation to Teacher Empathy. The participants noted such an improvement in the students' involvement in class activities, thus expanding on Bozkurt findings in an engineering education context.

Hassan and colleagues found that when teachers develop their emotional intelligence, especially empathy, they would have better classroom management skills and provide a conducive learning environment (2011). I was able to observe improved classroom management skills by all three participants. For example, Nadia was able to cover most of the concepts while also spending the first 5 minutes of every class with

check-in questions (an empathetic action Nadia chose for this study). Samantha shared that Teacher Empathy helped her to feel more confident in her teaching approach. Her choice to integrate the assignment extension as part of the course structure (an empathetic action Samantha chose for the study) helped her to provide a conducive learning environment while feeling relaxed and not stressed. Robert was very dynamic in taking extra time to explain a topic if the students were struggling to understand. All three participants shared aspects of improved classroom management thus contributing to the outcomes of Teacher Empathy in an engineering education context.

Warren found that empathy helped white women teachers to be flexible in their instructions, develop trust and provide culturally responsive interactions to ensure success of Black male students, thus indicating a connection between Teacher Empathy and culturally relevant pedagogy (Warren, 2013). I observed similar approaches among all three participants. Nadia was able to develop trust and improve persistence of a Black woman in her class by learning her name and using the name during interactions. The student gave informal feedback to Nadia that she felt included and was motivated to do better in the class. Samantha had two underrepresented students (who she was aware of) and she made sure that those students felt included in the classroom. Samantha altered a superhero activity discussed in the results chapter to include superhero characters that underrepresented students could relate to, thus incorporating culturally responsive interactions through Teacher Empathy. In Robert's class, he took the time to explain an assignment with more relevant and detailed explanations for an International Student. All three participants utilized Teacher Empathy to incorporate culturally responsive

interactions in their classroom thus indicating the potential of Teacher Empathy to integrate with other teaching methods.

### **Nature of a Faculty Influencing Their Approach to Teacher Empathy**

The Being Dimension of the Model of Empathy Framework (Walther et al., 2017b) allowed us to identify the underlying belief system of each participant that reflected their nature and approach towards Teacher Empathy in general. The uniqueness of each participant could be attributed to their belief systems resulting in differences in their definition of Teacher Empathy, their perspectives of which incidents are considered motivations and challenges, how such daily experiences reflected in the evolution of their perception about Teacher Empathy at the end of the semester-long Teacher Empathy experiment.

I observed the influence of a faculty's nature in their use of the empathetic action list provided as a resource in the beginning of the study. Nadia's interest in providing the best learning experience and her prior exposure and experience with various engineering education research and faculty development seminars was reflected in her process of choosing empathetic actions. She utilized the empathetic action list as a reference and came up with her own actions, for example, providing students with an exam format that she called "Failing your way to success" exams, which allowed students to have a second attempt on the wrong answers within the exam time. This empathetic action can be connected back to prioritizing learning over grades category of Youmans's empathetic action list. Her definition of Teacher Empathy of understanding the students and utilizing that information to provide a more suitable teaching approach indicated her strong intention to be as supportive for all students and to be respectful of students' prior

knowledge and experiences. Her belief indicated a balanced mix of the Service to Society attribute and the Dignity and Worth of all Stakeholders attribute of the Being Dimension. On taking a bird's eye view of all the daily reflections, Nadia not only reflected on the effectiveness of her empathetic actions but also frequently came up with minor modifications and improvements to her empathetic actions. As the semester continued, she was able to notice how her current understanding of Teacher Empathy could hinder the life-long learning of students and utilized that reflection to broaden her understanding and definition of Teacher Empathy. Nadia had a subconscious understanding of empathy as a way to be nice to the students and provide the best support for the students to learn. She was able to realize that in the context of engineering classroom, some level of struggling is needed for learning professional skills, especially life-long learning. She was able to ask herself the question "can we be tough and also empathetic?" This self-reflective question allowed her to expand her conceptualization or understanding of Teacher Empathy. Nadia's prior research experience related to emotions in engineering and experimenting with new teaching techniques might have been the reason to observe a lot of iterations and plans for improving empathetic actions. The continuous process of collecting feedback and reflection after class enabled Nadia to notice the effect of her actions as a particular situation was unravelling. The relationship between Teacher Empathy and Nadia's nature can be captured by the Service to Society attribute and Dignity and Worth of all Stakeholders attribute of the Model of Empathy Framework.

A bird's eye view of Samantha's Teacher Empathy experiment for a semester shows us that for an engineering faculty relatively new to Teacher Empathy the probability of experiencing the benefits and motivations to continue being empathetic

towards students is high. Samantha's nature to be respectful of all her students and her intentions to provide an inclusive learning environment was reflected in her approach to using the suggested examples in the empathetic actions list. Samantha's interest in teaching pedagogies led her to attend various faculty development workshops and seminars. She attended a culturally relevant pedagogy seminar and was motivated to integrate some of the culturally relevant concepts as part of her Teacher Empathy implementation. Her engineering education research experiences were a primary motivation for her to explore the use of Teacher Empathy in an engineering classroom. Samantha's nature of self-reflection was evident through her approach in answering the audio reflective questions. She was able to quickly identify a lot of motivations and benefits of Teacher Empathy in her project-based classroom while answering the reflective question prompts. Her perception and understanding of Teacher Empathy was gradually changing over the semester based on many small incidents. She realized that some of the empathetic actions were hard and energy consuming because they were not in alignment with her nature. This enabled her to be more aware and choose the empathetic actions that are more aligned with her nature. As a cumulative experience, she was able to realize the relationship between her nature and her overall identity as an empathetic teacher. Implementing Teacher Empathy as part of this study helped her to improve her confidence as an empathetic teacher that aligned with her own nature. The relation between Teacher Empathy and Samantha's nature could be captured by the Dignity and Worth of all Stakeholders attribute and Service to Society attribute of the Model of Empathy Framework.



Robert's belief that a person is either born an empath and empathy cannot be learned indicated his positivistic epistemology. His definitions had clear indications of what he considered as empathy and what he did not, which could be seen as his way of articulating what he considered as boundaries of empathy in an engineering education context. He identified himself as a born empath and hence an empathetic teacher. His identity as an empathetic teacher combined with his positivistic epistemology could indicate the lack of change in perception while also indicating an increase in his repertoire of empathetic actions. He identified himself as an engineer with strong problem-solving skills, which could be the reason for the lack of challenge as he approached every potential hurdle as a motivation to overcome and improve the situation. He utilized Teacher Empathy as a tool to achieve his passion to create the best engineers out of his students. The relation between Robert's nature and his Teacher Empathy implementation could be captured by the Service to Society attribute and Engineers as Whole Professionals attribute of the Model of Empathy Framework.

### **Teacher Action Research Methodology in Engineering Education Research**

I used the Teacher Action Research methodology (Pine, 2008b) in my study with the main intention to provide flexibility and agency to the participants. I consider my study as an applied research study where I used Teacher Empathy as a form of intervention and analyzed the potential usefulness of Teacher Empathy in an engineering classroom. I wanted my study to represent the natural engineering classroom context as close as possible. One of the best ways to achieve this is to provide maximum agency to the faculty who volunteered to be my participants. Teacher Action Research had the structure to provide agency to the participants. I observed that all three participants felt

more comfortable in choosing and implementing Teacher Empathy in their own way. Such freedom to integrate an intervention allowed the participants to behave in their natural way of handling the class along with Teacher Empathy implementation. For example, I observed the positive impact of Teacher Action Research with Robert. While he did not show any change in perception about Teacher Empathy, he was able to utilize the reflections and empathetic actions to further develop his empathetic skills in his engineering classroom. This study could be considered as an example of successful use of Teacher Action Research as a methodology in engineering education. Similar intervention-based research studies could consider Teacher Action Research as one of the methodologies to work with the participants instead of on them and provide agency to the participants.

### **Summary**

In summary, all three participants were able to successfully integrate Teacher Empathy in an engineering education context. The nature of a faculty had a considerable influence on how they approach and implement Teacher Empathy in their engineering classroom. Nadia and Samantha felt that the empathetic actions list was a good starting point to explore Teacher Empathy thus expanding Youmans study (2020b). The motivations shared by the participants were directly related to the benefits of Teacher Empathy that aligned with the higher education literature. Although the participants faced challenges, they shared the importance of the need for Teacher Empathy in an engineering classroom which helped the participants to continue implementing Teacher Empathy. I used the Model of Empathy Framework as a lens to capture the longitudinal impact in the perspectives of Teacher Empathy among the participants. Based on the

findings from this study, it is safe to say that there was an evolution of perception among two participants while the third participant had a growth in the list of empathetic actions that can be used in the classroom. My study highlighted the potential use of Teacher Action Research methodology in engineering education to explore such intervention-based studies. My study also verified the positive impact of Teacher Empathy in engineering education as found in higher education literature thus contributing to empathy research in engineering education literature (Bozkurt & Ozden, 2010; Collier, 2005; Cox, 2009; Jennings & Greenberg, 2009; Warren, 2018). The evolution of the participants' perception and its relation with the nature of the participant was a significant contribution of my study to engineering education literature and creating a new space of research within empathy research in engineering education.

## CHAPTER 6

### IMPLICATIONS AND FUTURE WORK

The findings of this study indicated multiple benefits and articulated a need for Teacher Empathy in an engineering classroom. In this section, I first discuss how Teacher Empathy can be utilized by individual faculty members, then discuss how the outcomes of this study could be used in Learning and Teaching Centers, and finally share how Department Heads and University Deans can use this information to promote Teacher Empathy in their programs. I also discuss the implications for researchers in further exploring the use of the Model of Empathy Framework in engineering education.

#### **Implications for Engineering Faculty Members**

Engineering faculty members will be the primary stakeholders that get the most out of this study. The outcomes of this study indicate that engineering faculty members could start exploring Teacher Empathy in their classrooms using Youmans's empathetic action list as the starting point. Faculty who are new to the concept of Teacher Empathy could use the suggested empathetic actions directly. They can use as little as one or two suggested actions in the beginning. Collecting informal and formal feedback from students regularly could be one of the first empathetic actions to consider as feedback can help engineering faculty become more attune to their students. Engineering faculty can use that feedback to then develop more empathetic actions and ways to support the students. Faculty who has experimented with multiple pedagogical teaching methods can use the categories and themes to come up with their own empathetic actions that align with their current teaching methods.

Based on the outcomes, I found that both lecture-based and project-based courses have benefits of Teacher Empathy, suggesting that Teacher Empathy could be implemented in most of the engineering courses. For example, in a lecture-based course, faculty can integrate a check-in question either at the beginning or at the end of class to understand if the students understood the topic of the day and use this information to adjust the pace of the course. Adjusting the pace of the course to support learning is an empathetic action.

The motivations found in this study could be used as references while implementing Teacher Empathy by other faculty members. For example, one of the motivations found in the study was positive teaching experiences due to Teacher Empathy. A faculty could use this as a reference while implementing some of the empathetic actions and gain similar positive teaching experience in their classroom. The challenges indicated in this study could be used as reference and proper mitigations could be integrated in the implementation of Teacher Empathy in other engineering courses. For example, one of the challenges shared by the participants was to balance being empathetic and being tough with the students. Faculty could come up with a more structured approach in implementing empathetic actions and also explicitly articulating the need to learn from their mistakes. Irrespective of the differences in the nature of the three participants in this study, all of them had some overlap in terms of benefits of Teacher Empathy including increased job satisfaction and reduced teacher burnout. Such exploration taken directly by engineering faculty members indicates the potential of Teacher Empathy to expand through a bottom-up approach within the engineering education system.

## **Implications for Learning and Teaching Centers**

Learning and Teaching Center staff can use the outcomes of this study to develop a workshop to help engineering faculty members implement Teacher Empathy in their classrooms. In specific, the empathetic action list could be used to create a set of suggested empathetic actions that can be implemented without major time and effort requirement for the engineering faculty. For example, a suggested empathetic action set could be collecting feedback regularly using a check-in question at the end of class, adjusting the assignment due dates to support learning, and encouraging students to ask questions in lecture. The major motivations along with the quotes could be used as examples to explain the benefits of Teacher Empathy to workshop participants and how it can be achieved in the classroom. For example, one of the motivations from this study was reduced teacher burnout. This could be used to explain how implementing some of the empathetic actions could lead to reduced teacher burnout. The challenges observed in this study can be used as a reference and suggest potential ways to overcome some of the challenges in implementing Teacher Empathy. For example, one of the challenges found in this study was the nature of the faculty becoming a challenge to implement some of the empathetic actions. Learning and Teaching Centers can be used as a space to brainstorm possible empathetic actions so that faculty can decide which ones would be easily implemented into their classroom based on their teaching style and nature. The program can also be used to suggest the benefits of reflection to further improve the faculty's Teacher Empathy implementation. One of the biggest motivations shared by all three participants in this study was to have a supporting and like-minded teaching team. Learning and Teaching Centers can be used as a place to form such teaching teams who

can implement Teacher Empathy and reflect on their progress through working with faculty, graduate students, and undergraduate student graders. Based on the positive effect of Teacher Action Research and reflection after class, new procedures for faculty observation and evaluation could be added in Learning and Teaching Centers. One possible procedural change is to integrate reflections (around 10 to 15 minutes) after regular observations as this might create opportunities to have similar positive outcomes like Robert's journey.

### **Implications for Department Heads and University Deans**

The findings of this study could also be used by the Department Heads and University Deans to integrate Teacher Empathy through a top-down approach. The needs and benefits of Teacher Empathy combined with the potential motivating experiences for individual faculty members provides a compelling argument to implement teacher empathy training to engineering faculty members. Department Heads and University Deans could provide training courses for new faculty members to integrate Teacher Empathy in their classes from the start of their job. Training courses could be provided for all faculty members and, if faculty engage in them, they could use this training as evidence that they are improving their teaching in their annual evaluations. We can utilize higher education studies on empathy training for pre-service teachers as a resource to implement similar training in engineering education for graduate students (Tettegah & Anderson, 2007b; Whitford & Emerson, 2019). With the aid of Learning and Teaching Centers in the universities, Department Heads and University Deans could prepare engineering faculty to overcome potential hurdles and maximize the motivations and benefits of teacher empathy. A policy on faculty evaluation could be added alongside

such empathy training. Faculty evaluations could have a refined section to recognize and consider such empathy trainings and implementations in the classroom to be considered during evaluations and promotions.

### **Implications for Researchers**

The similarity in the benefits and needs of Teacher Empathy between the findings of this study and higher education literature indicate a potential transferability of Teacher Empathy from a higher education to an engineering education context. The successful use of Youmans's empathetic action list (2020b) within the context of Teacher Empathy indicate a strong possibility of further expanding the integration of Teacher Empathy in engineering classrooms through evidence-based applied research.

The Model of Empathy Framework was effective in capturing the complex nature of empathy in an engineering education context. However, some of the findings indicated that the framework could be refined to be used within academia, especially to understand engineering faculty members' empathy. One of the significant reasons shared by the participants is the reciprocity of empathy from the students. The empathetic interactions being a two-way process was one of the motivations for Samantha to further explore and implement empathetic actions in the classroom. This reasoning was not effectively captured in the framework. A potential attribute I could suggest would be *Empathy as Two Way* to capture such reasoning. When looking into Robert's journey, his foundational belief that his job as a faculty is to make the best engineers out of his students. While this was captured under the Service to Society attribute of the Being Dimension, it did not capture the essence of his belief effectively. A potential attribute needs to be added in the Being Dimension that captures the reason as to why the



engineering faculty members chose to be in academia and not in a professional career. A potential attribute that I could suggest would be *Engineers as educators* to capture the reason why engineering faculty members chose to be in academia. While my findings indicate the potential for refining the framework, it is out of scope of this study and hence I have suggested further exploration of the framework within academia as future work in the next section.

### **Future work**

There are two future research directions that I would like to propose as possible next steps. The first is to expand the research of Teacher Empathy in different institutional contexts. In the current study, the context is specific to faculty members teaching undergraduate second year engineering courses in a Public University. The type of university (public and private university), type of course (lecture-based or project-based), the year of study (first year, second year, third year and fourth year), the degree (undergraduate or graduate) and faculty members' demographics (gender, age, years of experience, designation, roles and responsibilities), size of class are some of the major variables that could be varied in the next iteration of this study. Such future work will not only provide insight to the extent of Teacher Empathy implementation, but also indicate the optimization of the approaches in implementing Teacher Empathy in an engineering classroom. As discussed in the methods chapter, I chose Teacher Action Research methodology to gain in-depth understanding of the journey of three engineering faculty members. Based on my findings, there is an influence of the nature of the faculty in their understanding and implementation of Teacher Empathy. I would like to use phenomenography as a methodology with more participants (preferably more than 15

faculty participants) to develop an understanding of how more diverse faculty from more diverse institutions understand and implement Teacher Empathy into their teaching. Phenomenography is a methodology that allows us to understand “how people perceive, experience and conceptualize” Teacher Empathy (Marton, 1981b, p. 181). This will allow me focus on differences of ways that people perceive Teacher Empathy, ranging from being born with empathy to being empathetic only when intentional to being empathetic, thus further understanding how a faculty’s nature can influence the integration of Teacher Empathy in their classrooms.

The second is to explore and optimize the Model of Empathy Framework for engineering education context. Walther and colleagues Model of Empathy Framework was primarily created with engineering profession as the context and not engineering education (2017b). As discussed in the implications section, some of the data that indicated the participants’ beliefs and values for implementing Teacher Empathy were not effectively captured by the Being Dimension of the Model of Empathy Framework. This could suggest a potential for optimizing the framework specific for engineering education context. A future study could concentrate specifically on exploring the beliefs and values of engineering faculty members and use the Model of Empathy Framework to capture the values that do not align with the Being Dimension. Such data could be analyzed and used to suggest a potential improvement of the framework to better suit engineering education context.

In summary, Teacher Empathy has multiple benefits and needs within engineering education. Both faculty members and students gain positive experiences and outcomes by integrating Teacher Empathy. While there are some challenges in implementing Teacher

Empathy, the benefits and needs outweigh the challenges. Further research could expand on how to overcome such challenges and expand the use of Teacher Empathy in an engineering classroom.

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APPENDIX A  
PRESTUDY MEETING QUESTIONNAIRE

Pre study meeting 1: Arrange for an in person/virtual meeting. Provide a quick introduction to the project and the reason for the meetings.

Key points to introduce:

- This is a type of case study to understand the efforts that a faculty puts in to implement a new change in their teaching or interaction method in the classroom. This research is also to capture the changes (growth/detriments) that the faculty undergoes based on the motivations/hurdles that they face while implementing something new in the classroom.
- The key concept under study is the term empathy and the site is an engineering classroom. This mainly covers the faculty side of the student-teacher interactions along with other possible opinions/decisions/curriculum changes made by the faculty to help the student in any way.
- The actual intervention will be the behaviors/actions that will be new/modified undertaken by the participant in their current semester engineering course. The action/behaviors will be decided by the faculty which is the main input for the study and makes the participant a co-creator of the study.
- The main empathy framework and some proven empathetic behaviors will be shared with the participant AFTER gaining their initial views and perspectives about empathy in engineering classroom.

Questions:

1. What does the word empathy mean to you? What do you think of the terms care, compassion and is it same or different from empathy?
2. Have you come across any studies/research articles/workshops or anything similar that talks about empathy or care or compassion in engineering education?
  - a. If yes, what is your take on it and do you see value in it and would like to try them in your own classroom?
  - b. If not, would you be interested in knowing and trying some of the faculty empathetic behaviors that has been proven to improve student learning and outcome?
3. What is your opinion on “being empathetic towards students in classroom”?
4. Can you see or imagine the use and value of “empathy in engineering classroom” and “empathetic student-teacher interaction”?
5. Do you see yourself as being empathetic towards your students in your current and past interactions with the students and in the classroom?
  - a. If yes, could you provide an example of the action/behavior which you consider as being empathetic towards the students.
6. Do you want to be empathetic towards your students?
  - a. If yes, what are the reasons that motivate you to be empathetic towards the students?

- b. If not, what are the hurdles that are stopping you from trying to be empathetic with the students? or what kind of doubts or disbeliefs that is preventing you from trying to be empathetic with the students?

Provide a copy of the summary of the Model of Empathy Framework and the list of empathetic behaviors from Kate Youmans thesis. The actual framework and list are available in Appendix D and Appendix E

Researcher to Participant: “It would be great if we could go through the empathy framework that would be used for the study. This framework will basically provide a common base language for defining empathy and to connect the behaviors we are going to decide with the content of the framework to enable effective data analysis.”

After discussion, arrange for the second meeting to finalize the intervention actions/behaviors and to give sufficient time for the faculty to think and decide the same.

Pre-study meeting 2: Have a quick introduction, recollect about the project scope and idea. Then use the following guiding questions to finalize the list of behaviors that will be documented by the participant and the researcher.

1. Do you have any doubts or need clarifications on any aspect of the study?
2. Could you provide your reference or version of the definition of empathy?
  - a. Based on the definition, collaborate with the participant, and connect the definition with some aspects of the Model of Empathy Framework and document the consensus.

3. Can we discuss and finalize the list of behaviors/actions that you will be trying in the class?

After finalizing, document the list of the behaviors for data and also for reference during implementation.

Re-check with the participant if there is anything that needs further discussion or clarification.

APPENDIX B

SEMI-STRUCTURED INTERVIEW QUESTIONNAIRE



The following prompting questions will be used for the semi structured interviews.

1. How do you feel overall during the last month class interactions with the students?
2. What are the specific empathic actions that you tried this month?
3. Did you try any new actions that you might consider empathetic although it was not planned in our study?
  - a. If yes, how was it and would you like to add it to the list and continue seeing how it goes?
4. How was the implementation of empathic actions during the past month?
  - a. Could you share a little more about it with specific examples?
5. How would you describe your experience during the last month based on these empathic actions?
  - a. Could you explain a little more about that experience?
6. Did you face any challenges or hurdles in being empathic towards the students at any instance?
  - a. If yes, could you explain the incident and the challenge?
  - b. If not, why do you think that you did not have any challenges?
7. Did you face any motivating incidents or experiences while being empathic towards the students at any instance?
  - a. If yes, could you explain the incident and the motivation that you had?

- b. If not, why do you think that you did not have any motivation?
8. What is your opinion on how the intervention (your empathic actions) were received by the students?
  9. Would you like to add anything specific to this interview data?

APPENDIX C

AUDIO REFLECTIVE QUESTIONNAIRE

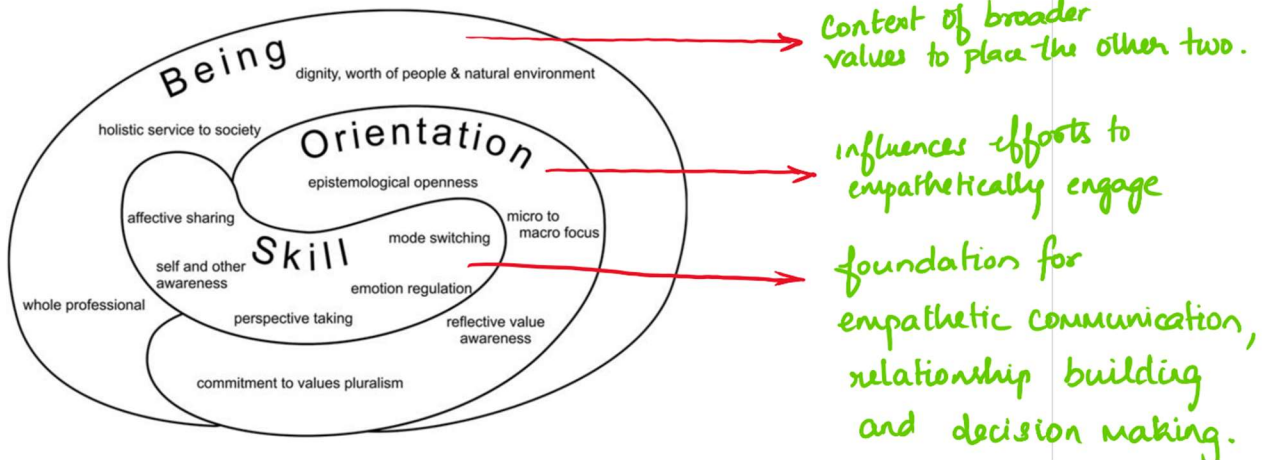
Based on the possible time that the faculty can provide (anywhere between 2 to 10 minutes), the order and number of questions could be changed. If it is going to be a relaxed and longer conversation, we can ask all the questions in order. If there is less time or the faculty is less enthusiastic to share, then questions 6, 4, 5 and 3 can be asked in that respective order.

1. How was the class today in general? *(This will capture the faculty's overall grasp of the classroom and give a quick understanding whether the class went in a positive, neutral or negative way)*
2. How did you feel in the class? *(This question is an extension of the previous question that explicitly tries to bring up the conversation about the faculty's emotion)*
3. Did you try or recollect any specific incidents that you might think of as being empathetic? *(This question jumps directly into the core requirement of reflective journaling and try to bring out the specifics of that particular class session with respect to the research)*
4. Did you feel any hardships or challenges in class? *(a direct question to capture the hurdles)*
  - a. If yes, could you tell me more about it? *(This lets us delve more into the incident)*
  - b. If not, why do you think that this class did not have any such hardships? *(This will provide the chance to reflect back and see what and how there was a lack of hardship in that particular session and if there could be any connection with the study)*

5. Were there any incidents that made you feel happy or motivated or energized or good moments in general? *(a direct question to capture the motivators)*
  - a. If yes, could you tell me more about it? *(This lets us delve more into the incident)*
  - b. If not, why do you think that this class did not have any such good moments? *(This will provide the chance to reflect back and see what and how there was a lack of motivation or good feel moment in that particular session and if there could be any connection with the study)*
  
6. Is there anything specific that you noted with respect to our research study that you feel might provide more insight? *(Open ended question to provide the faculty to share anything they feel that it could provide more insight into the research)*  
*(Questions 4b and 5b will also enable the faculty to try and understand the classroom situation and think about the students and see from their perspectives which is part of being empathetic towards students)*

## APPENDIX D

### MODEL OF EMPATHY FRAMEWORK



Model of Empathy Framework: (Walther et al., 2017a)

Following are the definitions of the attributes taken directly from the article.

1. Skills Dimension: Socio-cognitive process

- a. Affective Sharing: Person’s capacity to share the emotional state of the other. Cognitive mechanism – automatic mapping between self and others.
- b. Self and Other Awareness: Ability to feel with others and experience their internal world as if it were our own while being aware of and never “losing the ‘as if’ quality.”
- c. Perspective Taking: Ability to adopt more or less consciously the subjective point of view of the other. Through considering the features and dynamics of our interactions with others, we can intentionally learn what they might think and feel.
- d. Emotion Regulation: Ability to influence the ways in which they experience and express the emotions resulting from empathetic

interactions with others. Intended to prevent undue “empathic distress” or “emotional over-arousal.”

- e. Mode Switching: Ability to recognize, consciously apply, or switch between empathic and analytic cognitive mechanisms.

## 2. Orientation Dimension: Mental dispositions

- a. Epistemological Openness: Orientation to recognize and value the subjective experience and perspectives of others as valid and important sources of knowledge of engineering work in practice.
- b. Micro to Macro Focus: Awareness and consideration of structures of power and social organization as both control and consequences of engineering work.
- c. Values Pluralism: Commit to engineering in an active, purposeful, transparent and equitable discourse around the heterogeneous values-informed purposes driving different forms of engineering work.
- d. Reflective Values Awareness: Not only to be attuned to the inherent values dimension in engineering, but also to be oriented towards fully engaging with ethical issues through critical consideration of their impact on both a professional and personal level.

## 3. Being Dimension: Contextualizing framework.

- a. Service to Society: Include a deep consideration of, and genuine service to, all human and non-human stakeholders impacted by engineering.



- b. Engineers as Whole Professionals: the need to develop empathic skills and orientations alongside intentional connections to students' maturing personally and morally.
- c. Dignity and Worth of all Stakeholders: a genuine belief in the dignity and worth of all people inherently implies an Epistemological Openness that is reflected in adopting a strengths perspective when interacting with others.

APPENDIX E

KATE YOUMANS EMPATHETIC ACTION LIST

Kate Youmans recommended actions and behaviors: (Youmans, 2020a)

<b>Theme</b>	<b>Expression of Empathic Concern</b>	<b>Recommendations for Engineering Professors</b>
<b>Express Care for Students as Individuals</b>	Understand individual's situations and make accommodations	<ol style="list-style-type: none"> <li>1. Take time to listen to individual students' situations</li> <li>2. Reflect on the importance of deadlines and due dates</li> <li>3. Make accommodations when they support learning</li> </ol>
	Commit to helping students succeed	<ol style="list-style-type: none"> <li>1. Establish an open-door policy or accessible office hours</li> <li>2. Encourage students to ask for help during lectures</li> <li>3. Give students your full attention when providing help</li> </ol>
	Care about students' well-being and respond non-judgmentally to emotion	<ol style="list-style-type: none"> <li>1. Acknowledge and validate students' feelings</li> <li>2. Know resources on campus to support mental health</li> </ol>
<b>Cultivate Student Learning</b>	Prioritize learning over grades through the design of course material	<ol style="list-style-type: none"> <li>1. Review and refine learning outcomes for courses</li> <li>2. Prioritize learning in designing assignments and assessments</li> <li>3. Collaborate with teaching and learning experts</li> </ol>
	Create a dynamic lecture environment and a safe space for asking questions	<ol style="list-style-type: none"> <li>1. Acknowledge and validate students' questions in a lecture environment</li> <li>2. Build connection with students by sharing personal anecdotes and learning students' names</li> </ol>
	Adjust the pace of course based on student needs	<ol style="list-style-type: none"> <li>1. Collect feedback from students throughout the semester</li> <li>2. Plan for flexible days if additional time on a topic is needed</li> <li>3. Adjust assignment due dates to support learning</li> </ol>
<b>Acknowledge Challenges of Engineering Programs</b>	Convey the challenge of learning engineering concepts	<ol style="list-style-type: none"> <li>1. Explicitly convey the challenge of learning complex engineering topics for the first time</li> <li>2. Provide opportunities to master fundamental concepts that will be needed for future success in engineering</li> </ol>
	Recognize the culture of engineering programs	<ol style="list-style-type: none"> <li>1. Understand the implicit culture of engineering programs including rigor and meritocracy</li> <li>2. Explicitly acknowledge the challenges of this culture</li> </ol>

APPENDIX F

IRB APPROVAL DOCUMENT



EXEMPTION GRANTED

[Nadia Kellam](#)  
[IAFSE-PS: Polytechnic Engineering Programs \(EGR\)](#)  
480/727-1917  
[Nadia.Kellam@asu.edu](mailto:Nadia.Kellam@asu.edu)

Dear [Nadia Kellam](#):

On 8/26/2021 the ASU IRB reviewed the following protocol:

Type of Review:	Initial Study
Title:	Exploring the dynamics involved in implementing Teacher Empathy by a faculty in an Engineering classroom - An experimental Participatory Action Research
Investigator:	<a href="#">Nadia Kellam</a>
IRB ID:	STUDY00014331
Funding:	None
Grant Title:	None
Grant ID:	None
Documents Reviewed:	<ul style="list-style-type: none"><li>• Consent Form_Final, Category: Consent Form;</li><li>• IRB HRP 503_Final, Category: IRB Protocol;</li><li>• Supporting Documents_Final, Category: Recruitment materials/advertisements /verbal scripts/phone scripts;</li></ul>

The IRB determined that the protocol is considered exempt pursuant to Federal Regulations 45CFR46 (2) Tests, surveys, interviews, or observation on 8/25/2021.

In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

If any changes are made to the study, the IRB must be notified at [research.integrity@asu.edu](mailto:research.integrity@asu.edu) to determine if additional reviews/approvals are required. Changes may include but not limited to revisions to data collection, survey and/or interview questions, and vulnerable populations, etc.

REMINDER - All in-person interactions with human subjects require the completion of the ASU Daily Health Check by the ASU members prior to the interaction and the use of face coverings by researchers, research teams and research participants during the interaction. These requirements will minimize risk, protect health and support a safe research environment. These requirements apply both on- and off-campus.

The above change is effective as of July 29th 2021 until further notice and replaces all previously published guidance. Thank you for your continued commitment to ensuring a healthy and productive ASU community.

Sincerely,

IRB Administrator

cc: Bala Vignesh Sundaram  
Bala Vignesh Sundaram  
Nadia Kellam