

What is teacher empathy in engineering education? A review of the literature

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Abstract:

This study reviews the literature on teacher empathy. Our purpose in doing so is to develop a preliminary understanding teacher empathy and showing the evidence necessary for developing future research on teacher empathy in engineering education. This literature review was conducted in two phases. First, works from non-engineering disciplines were reviewed to identify popular threads and major areas of research related to teacher empathy. This phase was meant to establish specific themes of importance derived from the larger body of literature on teacher empathy. Second, a literature review identified engineering-specific research on teacher empathy. The results indicated that the term “teacher empathy” is infrequently applied in an engineering education context. Yet, in others educational disciplines the definition of teacher empathy involves cognitive, affective, and behavioral components. According to the findings, empathy in education plays a critical role in developing teacher-student relationships and positively impacting students' learning. Finally, we suggest that it would be beneficial to characterize teacher empathy in the engineering field and recommend employing a qualitative research approach to study how engineering faculty understand the role of teacher empathy, how students understand teacher empathy, the potential barriers to demonstrating teacher empathy to students, and how teacher empathy impacts student success.

Introduction: Empathy and Teacher Empathy

Empathy has been explored in multiple fields, including psychology [1] and business [2], and in the so-called “helping professions” such as nursing [3] and teaching [4]. The extensive application of empathy in various disciplines implies its potential significance for developing student-professor relationships [5]. A considerable part of teaching includes interacting with students during classes and office hours. In these environments, professors and students usually discuss topics related to the structure of the course; assignments; enthusiasm, or lack of it; and personal concerns and tragedies that students share [6]. Indeed, research shows that teachers apply empathy in their interactions and relationships with students [6].

Researchers have conceptualized empathy in multiple ways. Empathy is a complex concept that has been generally defined as an individual’s ability to understand and respond to another person’s perspective and feelings [7]. Cuff et al.’s [8] review of empathy research identified forty-three distinct definitions of the concept. In another review, Batson describes eight distinct yet related concepts of empathy [9]. In the context of nursing education, Kunyk and Olson [3] categorized types of empathy into five groups. Clinical psychologists describe empathy as involving three components: the ability to share between the self and the other, the cognitive ability to self-other awareness, and the mental flexibility to adopt the subjective perspective of the other [10].

Empathy is a topic of growing significance in engineering education because it is increasingly recognized as a critical skill in the engineering profession. According to *Educating the Engineer of 2020* [11] the next generation of engineers will be called upon to address multiple challenges, including deteriorating urban infrastructures, degrading environment, and increasing need for provide housing, food, water, and health care for the world population. Woods [12] posits that engineering students need to develop non-technical professional skills such as empathy because those skills will determine how they solve problems, write reports, work in teams, and go about learning new knowledge, among others. Research on empathy in engineering education has focused on the integration of empathy in design [13] and development of curricular initiatives to foster empathy as a professional skill in students [14].

As the emphasis on empathy as a professional skill in engineering grows, studies have investigated current levels of *student empathy*. In particular, research has focused on engineering

students' ability to understand the user's perspective to gain a better understanding of their feelings and needs, to define problem statements and solution spaces more accurately [15].

The extensive application of empathy in various disciplines implies its potential significance for developing student-professor relationships [5]. The concept of *teacher empathy* is important for both student-teacher relationships and student learning. Literature outside of engineering education has indicated that teacher empathy can improve student performance [16], support diverse and inclusive learning environments [4], as well as reduce teacher stress [17]. It is part of the experience of teaching and is often present in their interactions and relationships with students as teachers and students seek to teach and learn the material, understand each other, and move through the course [6].

While the existing research on teacher empathy tends to focus on K-12 education or collegiate levels in fields other than engineering, we argue that teacher empathy has potential benefits in diversifying engineering education.

Research objective:

This study reviews the literature on teacher empathy in order to develop a preliminary view of the evidence necessary for developing future research on teacher empathy in engineering education.

Methods:

Our literature review followed the basic guidelines detailed by Borrego and Froyd [18].

a) Search procedures

We searched several databases considering key words to retrieve relevant studies. These databases included ERIC (EBSCO), Academic Search Complete (EBSCO), Web of Science, and ASEE Peer Document Repository. The search included the search terms (“Teacher empathy” and “Engineering”); (“Teacher empathy” and “Students”); (“Teacher empathy” and “College”) and (“Teacher empathy” and “School”).

b) Inclusion criteria:

For inclusion in this review, studies were required to have the following attributes:

- Peer review process: the paper should be published in a peer-reviewed process in a journal article or conference proceedings, or in a book chapter.
- Definition: Teacher empathy is directly mentioned or alluded to and is investigated as a main phenomenon of the study in a way that explores empathy of instructors, faculty, etc.
- Language: The paper is published in English, due to limited resources for translation.
- Date range: We limited the sample to papers published from January 2000 to July 2021.

Results:

The results of the literature search included a variety of articles (16), book chapter (1), and conference proceedings (2). We found that research on teacher empathy has primarily focused on K-12 education. Although empathy is part of the learning process, there is little literature regarding empathy at college level [5], [6]. Table 1 reports the details regarding reviewed publications.

Table 1. Summary of publications included in this review.

K-12	College	Engineering
[17], [19]–[27]	[5], [16], [28]–[31]	[32], [33]

In the next section we present an overview of *teacher empathy* in K-12, *teacher or faculty empathy* at the college level in general, and *teacher or faculty empathy* in engineering specifically.

- Teacher empathy in K-12

Empathy can influence teachers' attitudes and behaviors toward vulnerable populations and diverse youth in multicultural schooling contexts. Some studies show that empathy is beneficial to improving how teachers communicate and respond across racial and cultural difference [19], [20], [22], [23], [25]. Furthermore, Makoelle [23] argues that teacher empathy is critical to understanding and validating students' ways to learn and socio-emotional contexts. Long et al. [22] explains that students with dyslexia need to feel empathy from their teachers to develop the self-confidence to interact comfortably with their classmates.

Empathy can influence teachers' attitudes toward students with problem behaviors. Wink et al. [17] show that teachers higher in cognitive empathy reported more positive feelings about behaviorally challenging students, greater competence in managing problems, greater relationship closeness, and lower levels of job burnout. Shechtman and Tutian [26] provide evidence that training can improve teachers' ability to manage students with problematic behaviors and improve students' impressions that teachers feel empathy toward them.

Teacher empathy is central to students' learning process and success. Cooper [20] mentions that teacher empathy is vital to successful learning; he also argues that empathetic relationships between students and teachers create a better and more supportive classroom, which in turn improves the learning process. Based on the motivation perspective, Ge et al. [21] findings might indicate that the teachers' beliefs of the ability of students could predict empathic motivation and teacher empathy. O'Connell Schmakel [24] demonstrates that teacher empathy is related to motivational support and that it can improve student engagement in academics. Swan [27] shows that empathetic interactions result in motivation to know what student's think and feel and connect with them, resulting in a positive classroom.

- Teacher or faculty empathy in postsecondary education

Empathy is important for graduate students and their faculty advisors. Woolhouse [30] shows that graduate students expected their advisors to show empathy (among other characteristics), while O'Meara et al. [29] explained that doctoral students and faculty saw empathy as one of the important emotional competencies in PhD mentoring and advising relationships.

Some research focused on the relationship between teacher empathy and the engagement and learning process of students. Arghode et al. [16] conclude that empathy plays a critical role in student learning. Similarly, Bockmier-Sommers et al. [28] show that teacher empathy, defined as helping students feel understood and supported, was significantly related to all four of the engagement variables (i.e., skill, emotion, interaction, and performance). In the context of health education, pharmacy faculty's perceptions of empathy revealed empathetic teaching plays an essential role in developing teacher-student relationships and positively impacting students' learning [31].

Only one study we found in higher education provide a definition of the concept of teacher empathy. Meyers et al. [5] defined the concept as, “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”. This definition involves cognitive, affective, and behavioral components. Meyers and colleagues [5] also claim that teacher empathy enhances student learning and offers suggestions for increasing teacher empathy. For example, the authors [5] recommend that instructors dedicate time to understanding their students’ personal contexts and create course guidelines that show a deep awareness of the personal and social circumstances of their students.

- Teacher or faculty empathy in engineering

Our findings indicate that the term “teacher empathy” is infrequently applied in an engineering education context and has not been well defined in the field. Hess et al. [32] conducted a study to investigate how engineering faculty conceptualize empathy and care and how and whether they perceive empathy, care, and engineering to be interrelated. Their results show that empathy is the ability to understand their academically diverse student population, and that effective educators need this skill; as one of the participants in their study stated, “It’s important to understand [students’] perspective to help them more.” [32]. Additionally, participants believed this ability permits educators to assist students in need of more direct and personalized intervention, which they perceived or described as the active form of caring. Those results could be a preliminary approach to the understanding of teacher empathy in the field. However, one participant also mentioned that most of the engineering faculty they knew believe that “academics and life is separate and it doesn’t matter what the reason is that [the student] can’t get their work done” [32]. Unfortunately, this point of view is closely related with the opinion that engineering culture has a stress culture with high stress as the norm [34].

Recently, Sundaram et al. [33] conducted the first approach in the field to understanding how engineering faculty members define, understand, and value teacher empathy. They related their finding with the Model of Empathy Framework [14] to categorize their results, yet their work stopped short of providing a clear definition of teacher empathy.

Discussion and conclusion:

Based on the literature review results, we conclude that empathy in education plays a critical role in developing teacher-student relationships and positively impacting students' learning. Teacher empathy or faculty empathy has been studied in K-12 education, and to a much lesser extent, in post-secondary education. Yet, there is limited work in the field of engineering education. In particular, the concepts of teacher or faculty empathy as they relate to engineering are not yet well defined. By contrast, research in other educational disciplines indicate that empathy involves cognitive, affective, and behavioral components [5].

Empathy involves three distinct skills: the ability to share the other person's feelings, the cognitive ability to intuit what another person is feeling, and a "socially beneficial" intention to respond compassionately to that person's distress [10]. Research shows that at the K-12 level all these dimensions are included. Meyers et al. [5] argue that at the college level instructors provide a better education when they empathize with their students. Their work provides a promising model to continue examining teacher empathy at the post-secondary level, including in engineering education.

The literature on empathy suggests that understanding of the process of empathy, in view of its potential for enhancing learning and social behavior, can make an important contribution to students' education. However, several research gaps and challenges remain before the educational potential of empathy can be fully realized, particularly at the college level. For example, Jordan and Schwartz [6] provided an explanation about why faculty believe it is hard to show empathy, which includes the possibility that faculty think that they need to maintain distance in their relationship with students when they ask for personal advice or when students talk about personal issues. If engineering researchers, faculty and administration realize the educational power of teacher empathy, it could improve students' success, increase diversity, equity, and inclusion, the relationship between faculty and students, and develop a better culture in the engineering field.

Lastly, many different methods have been used to enhance empathy in teachers and in students, and it remains for systematic research and analysis to determine which interventions and which components of an intervention are most effective. In consequence, there is a need for additional

research concerning the empathy training of teachers and its effects on student behavior and achievement.

Future research:

In order to improve the understanding of teacher empathy in engineering, both instructor and student measures of teacher empathy are needed. Given the potential benefits of teacher empathy in engineering such as improving the success, increase diversity, equity, and inclusion of students, future work should study the student' and faculty' perception of teacher empathy in engineering education. Such work could facilitate understanding of the concept, the potential barriers to demonstrating teacher empathy toward engineering students, undergraduate and graduate, and how teacher empathy impacts engineering student success.

Limitations:

First, the search terms used may not have found all relevant literature for this literature review. The search generated limited research on teacher empathy in college. These limitations may be addressed through future research, such as a systematic literature review that would be more exhaustive.

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