34th Australasian Association for Engineering Education Conference
3 - 6 December 2023 – Gold Coast, QLD

What is Empathy – A Multi-Disciplinary Approach

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ABSTRACT

CONTEXT

As engineers spend much of their time in meetings and working through human-factors in their work (Trevelyan, 2014), the need to understand clients and other stakeholders is more important than ever. To understand stakeholders effectively, engineers need to practice empathy, a skill that is not commonly taught or even mentioned in engineering education. Empathy is increasingly important for engineers in the workforce. While the study of empathy in engineering has increased recently, there remains a limited body of research.

PURPOSE

The purpose of this paper is to 1. Identify what is meant by the use of the term empathy in academic literature (psychology, medicine, business, engineering); 2. Understand how empathy has been studied and taught in engineering literature; and 3. Understand how empathy has been studied and taught in other professional fields. The goal is to achieve a better understanding of the nature and teaching of empathy, allowing us to better teach it in our classes.

APPROACH

We conducted a literature review to understand how empathy is defined in engineering, how it is defined in other fields, and how it has been taught in engineering and other professional fields. Papers on empathy were initially searched for in Google Scholar and the Journal of Engineering Education, and then reference snowballing was adopted for the remaining papers.

OUTCOMES

There is general agreement amongst the literature that the definition of empathy should contain both an affective and a cognitive component, although there is a dispute over the balance of these components. This dispute stems from the different applications of empathy in different fields (particularly that of psychology and medicine), implying that the definition depends on the context of the application. Primary teaching methods in the Literature include Implementing service-learning; teaching human and behavioural psychology; and using reflections, roleplays and perspective-taking exercises to enhance empathy.

CONCLUSIONS/RECOMMENDATIONS/SUMMARY

It is concluded that empathy's application in engineering is more similar to how empathy is applied in the medical field than the field of psychology. As such, it is recommended that a reasonable definition would be one that is similar to that of medicine, defining empathy in engineering as a "predominantly cognitive (as opposed to affective or emotional) attribute that involves an understanding (as opposed to feeling) of people's experiences, concerns, and perspectives combined with a capacity to communicate this understanding." (Hojat et al., 2009) Learning more from methods of teaching empathy currently in place in medical education could enhance empathy in engineers.

KEYWORDS - Empathy, Engineering, Psychology

Introduction

The role of an engineer has evolved over time. While engineers once spent much of their time doing manual calculations, increasingly engineers are spending their time in meetings, corresponding with others and writing documentation (Trevelyan, 2014). An engineer's technical skills are still important, but with the continuous improvement of design and analysis software and the advent of artificial intelligence (AI) assisted technologies, it is expected that the role of an engineer will only continue to broaden over time. Given this, it is imperative that we equip our engineers with the full breadth of skills that they will need in their careers.

One skill that is becoming increasingly important for engineers is that of empathy. Engineers are usually required to work with and understand many different types of stakeholders and consider problems through the eyes of someone else. However, despite the increased importance of empathy in engineering, little has been written about empathy in the existing body of knowledge. As such, there is minimal practice of the teaching of empathy, and many lecturers have indicated that they believe they lack the expertise to integrate "human and social issues" in their teaching (Burnett et al., 2021).

This paper presents a literature review on the definition of empathy, what has been written about it in engineering, and how it has been taught in engineering and other professional fields including Psychology and Medicine, as well as Business and Project Management. The first two are investigated as they both deal with the definition of empathy but apply it in different ways. The latter two were selected as they are fields which have significant overlap with the roles of many professional engineers but have investigated the phenomenon of empathy more deeply.

What is Empathy?

Throughout the literature, empathy is defined in a variety of ways using differing terminology. Riess (2017) describes empathy as the capacity to share in the experiences, needs, and desires of others. This involves perceiving the emotions of others, resonating with them emotionally and cognitively, and taking their perspective. Similarly, Batson et al. (2007) uses the term Empathetic Concern to convey "The other-oriented emotional response elicited by the perceived welfare of a person in need". In this context empathy typically consists of feelings such as sympathy and compassion, and the purpose of this concern is to encourage a person to assist others.

Coke et al. (1978), on the other hand, define empathy as both the cognitive process of taking another's perspective and the ability to emotionally feel another person's situation. Other papers (Perenc & Pęczkowski, 2018) agree with this breakdown and refer to the breaking up of empathy into equal affective and cognitive components.

In contrast to this, Hojat et al. (2009) argue that empathy is predominately Cognitive, in contrast to Sympathy which is predominately Affective. This distinction is made as they believe there to be no harm in an excess of Cognitive empathy in the field of Medicine, whereas they do see harm in a doctor showing excess Sympathy. Separating the two out, therefore, allows institutions to focus on maximising empathy in their students without the concern of them showing too much sympathy.

Empathy vs. Sympathy

Examining the arguments made by Hojat et al. (2009) and Coke et al. (1978) reveals that the distinction between the affective and cognitive parts of empathy is more important in the professional practice of medicine than in the empathy experiments done by psychologists as the desired outcome is different. Psychological research into the nature of empathy seeks to understand how empathy motivates pro-social behaviour, and thus focuses on the factors that increase or decrease it. In this context, both understanding the needs of the other and feeling the emotions of the other can lead to pro-social behaviour, and so the distinction is not needed.

However, in the professional practice of medicine, the question is not about whether or not Doctors exhibit pro-social behaviour (it is expected that all doctors will help their patients) but it is instead about the effectiveness of patient outcomes. Hojat et al. (2009) argue that an increased understanding of a patient's circumstances can only improve patient outcomes, whereas sharing the feelings of a patient may be initially helpful but may worsen patient outcomes in the long-term.

The importance of this distinction then, depends on the context that empathy is being studied in. In this case, it appears that engineering is closer to the medical field than that of Psychology, as it is less concerned with pro-social behaviour and more with the effectiveness of an engineering solution for all the stakeholders involved. As such, engineering research may want to make a distinction between Empathy and Sympathy, but it should also recognise that this distinction is less vital in other fields.

Defining Empathy in Engineering

While there is no singular agreed definition of empathy, it should be noted that all papers agree that empathy has an emotional component. The disagreement is only about the level of emotional engagement that is called for. Part of this disagreement is due to the nature of the different fields as emotional engagement is a more important component of the work of some fields than others. Defining empathy in the context of engineering then requires an understanding of the output and role of an engineer and how it compares to the role of other fields.

Current engineering empathy research targets two main contexts for empathy in engineering. Hess et al. (2017b) and Marinelli et al. (2022) are investigating the components of empathy that are considered most important by industry. However, other researchers such as Bairaktarova (2022), Tang (2018), and Walther et al. (2016) are interested in the application of empathy in situations beyond industry, such as in interpersonal relationships and global citizenship. These different applications naturally lend themselves to a different definition of empathy and to the emphasis of different components.

In engineering, similarly to the practice of medicine, engineers must use their technical knowledge to interact with and find the best outcome for their stakeholders. This would base the engineering definition of empathy on Hojat et al.'s (2009) definition that it is:

A predominantly cognitive (as opposed to affective or emotional) attribute that involves an understanding (as opposed to feeling) of people's experiences, concerns, and perspectives combined with a capacity to communicate this understanding.

This definition is in line with the role of an engineer as someone who interacts with multiple stakeholders and seeks to design a solution based on their diverse requirements, particularly where these requirements often compete. This definition also highlights the importance of communication in engineering, as it is just as important for stakeholders to know that they have been heard as it is to listen and engage with them.

It should be noted that while engineers naturally interact with their stakeholders in different ways to doctors (doctors give medical treatment to individuals, whereas engineers often have to focus on the well-being of wider groups and the environment) the similarity that ties them together is their intention of achieving a positive balance of outcomes for their primary stakeholders (usually clients).

How has Empathy been studied in Engineering?

Models and Frameworks

One of the earliest models of empathy in engineering is Kouprie and Visser's (2009) 4-step framework for empathetic design: Discovery, Immersion, Connection and Detachment. This model encouraged engineers to 'dip' in and out of the experience of an end-user to create a product more suited to their needs. Following this framework improved the chance of empathetic user-centric design occurring and typically resulted in a much better experience for the user.

However, this utilitarian use of empathy was criticised by Tang (2018) who argued that focusing on Empathetic Design encourages the view of empathy as just a tool that engineers can use in the design process. This prevents us from embedding empathy in engineering more broadly. Tang argues that empathy in engineering can be used as a way to understand people from other cultures and other bodies of knowledge. This approach seeks to make empathy a part of an engineer's being, and recognises the important idea that empathy is not just a design tool.

This sentiment is echoed by Walther et al. (2017) in their paper *A Model of Empathy in Engineering as a Core Skill, Practice Orientation and Professional Way of Being.* In this paper, Walther et al. outline a 3-part model which describes empathy as "A Way of Being" (recognising that empathy needs to be part of an engineer's values), a "Practice Orientation" (empathy as a lens to view the world) and a "Learnable Skill" (recognising that empathy contains skills that can be learned and practiced). This model has been seen as a key work in the field of engineering empathy research, being cited by the majority of authors writing about empathy in engineering post-2017 (Bairaktarova, 2022; Burnett et al., 2021; Marinelli et al., 2022; Yeaman, 2020).

Student Perceptions

Initial studies of empathy in engineering sought to understand the pre-existing perceptions of engineering students (Walther et al., 2020, 2016; Yeaman, 2020). It was found that there was a mix of student perceptions, but one of the most common was students not associating the concept of empathy with engineering (Walther et al., 2020). Additionally, when students were asked to empathetically engage in classes with things like roleplays, many felt awkward and struggled to play the role of someone who was so different to them (Walther et al., 2016).

However, it should also be noted that some students were initially confident in their empathetic skills, and believed that they had adequately considered the needs of their stakeholders during their design (Yeaman, 2020). But even these students recognised that their empathetic skills were lacking when they had a chance to meet some of the stakeholders in their projects and found that their stakeholders' views differed drastically form their own (Yeaman, 2020).

One study looked at engineering student perceptions on empathy through the framework of 3 metrics – Distance, Difference and Power (Walther et al., 2020). It was found that some students saw that it was an engineer's job to be emotionally distant from their stakeholders and had an easier time solving the problem when they distanced themselves. These students also tended to see themselves as very different from their stakeholders, noting that they were "not an engineer" and so they didn't expect them to give coherent engineering information. Finally, some students also had a high power-disparity between themselves and their stakeholders. They felt like as an engineer they had all the power and their stakeholder had none of the power.

Teaching and Assessment

Some general engineering research has been undertaken on the activities that proved most effective in challenging student's pre-existing conceptions of empathy (Hess, Strobel, & Brightman, 2017; Walther et al., 2016). Through this research, Hess et al., (2017) identified 5 main experiences that were helpful in changing an engineer's conceptions on empathy. These five experiences were: sharing diverse perspectives, the challenge of ethical decision-making, deliberate role-taking, the repetitive application of principles, and the experience of cognitive dissonance. These insights were gleaned from interviews with students who were asked to share a time when their perspective changed.

In the humanitarian engineering stream, papers tend to argue for multiple different methods of teaching empathy namely: increasing the teaching of ethics, having open dialogues between students and teachers, having communication with people from developing countries, incorporating multi-disciplinary organisations, and encouraging diversity (Al-Khafaji & Morse, 2006; Ba-Aoum, 2016; J. Smith et al., 2020; Thomas et al., 2017).

Amongst these papers, one common teaching method was “Service Learning” (Al-Khafaji & Morse, 2006; Birzer & Hamilton, 2019; Patterson, 2019; Yeaman, 2020). Service-Learning states that serving at places that need help can teach students empathetic skills whilst benefitting other organisations. It was noted however, that the effectiveness of this service can be reduced when it is incorporated into a university curriculum (Birzer and Hamilton, 2019). This occurs as once service-learning is part of a curriculum, all students will need to be allocated to a project, and so projects that are more easily accessible may be prioritised over mutually beneficial experiences.

Multiple fields have also been assessing the effectiveness of teaching empathy using VR. The majority of studies either compared a VR empathy intervention to a non-VR equivalent, or created a VR intervention and compared it to the baseline case. These studies typically used Pre-Test and Post-Test questionnaires or surveys to assess the impact of VR. The majority of studies (Dyer et al., 2018; Formosa et al., 2018; Hu & Lai, 2022; Louie et al., 2018; Stavroulia & Lanitis, 2019) showed that VR enhanced a student’s empathy and understanding in comparison to either a non-VR intervention or a baseline. However, there have been some studies (Dean et al., 2020; Estrada Villalba et al., 2021) that questioned the long-term effects of VR. These questions noted the emotional nature of many VR experiences and questioned how long the effects of VR could last. They also questioned if the results could be replicated when the novelty of VR ‘wears off’.

How has Empathy been studied in other Professional Fields?

Empathy in Business and Project Management

Empathy in Business and Project Management is often taught in the context of understanding stakeholders and their needs. Initially, the definition of a Stakeholder is discussed with multiple definitions being given (Carroll & Buchholtz, 2006; Freeman, 2010), but the definition is usually simplified to “anyone who can affect or be affected by the project”. This definition encourages students to think about and empathise with both the stakeholders who hold power over the project and the stakeholders the project will impact.

These subjects also emphasise the importance of understanding a stakeholder’s motivations. These motivations typically draw from behavioural psychology, economics, and other fields, and attempt to give students a well-rounded understanding of stakeholder motivations. Some motivational theories include Rational self-interest (A. Smith, 1776), the Logic of Consequentiality (March & Heath, 1994), the theory of Planned Behaviour (Ajzen, 1991), the Logic of Appropriateness (Cyert & March, 1992), and the Perception of Fairness (Bosse et al., 2009). These theories help students see their stakeholders as multi-faceted people who behave differently in different circumstances.

Multiple models of Stakeholder Management are taught to give students a larger toolset to manage stakeholders. These models help students Identify, Assess and Prioritise their stakeholders, allowing them to manage competing stakeholder interests. Some models include: the stakeholder commitment matrix (Turner, 2008), the two-step model (Freeman et al., 2007), the help-harm matrix (Savage et al., 1991), the power-interest grid (Ackermann & Eden, 2011), the salience model (Mitchell et al., 1997), and the stakeholder circle (Bourne & Walker, 2005). These frameworks all categorise stakeholders based on different attributes, encouraging students to empathetically think about how their stakeholders relate to the project.

The models all suggest strategies for engaging with these stakeholders but are mainly differentiated by the attributes and impacts they choose to focus on. These different foci rarely contradict one another (just because a stakeholder has high power, does not mean they don’t also have high legitimacy) but instead give different perspectives on how to think about stakeholders. These different perspectives help lead to a more robust understanding, enabling students to better empathise with the stakeholders they work with.

Empathy in Medicine

Like engineering, Medicine is a field that deals with people in technical ways. Doctors must understand the complexities of how the human body functions, but they also must be able to listen to patients to accurately diagnose them. One recurring theme in Medical empathy literature is that Medical Students experience a decline in empathy in the clinical year of their degree (Hojat et al., 2004, 2009; Michalec, 2010) due to their over-exposure to patient concerns.

However, Riess (2017) suggests that any empathy deficiencies can be counteracted by deliberately training students to be more empathetic. In a medical context, this may include training doctors to be aware of any biases they may have, as well as teaching them to communicate with their patients in a way that makes them feel heard. The natural implication for empathy in engineering, then, is that if students have a natural or learned empathy deficiency, targeted interventions to increase cognitive empathy and communication skills can be used to reverse these declines.

Conclusion

One conclusion that can be drawn from this review is that while the definition of empathy is certainly complex and multi-faceted, many of the differences in its definitions stem from its diverse application in different fields. This is most clear in the difference between medical and psychological literature on empathy. The concern raised in medical literature is that it is not good to have Doctors who are too emotionally invested in their patients, whereas in psychological empathy experiments, greater emotional investment in others is no bad thing.

Given that empathy's application in engineering is more similar to how empathy is applied in the medical field than the field of psychology, it is recommended that a reasonable definition would be one that is similar to that of medicine. This would define empathy in engineering as a "predominantly cognitive (as opposed to affective or emotional) attribute that involves an understanding (as opposed to feeling) of people's experiences, concerns, and perspectives combined with a capacity to communicate this understanding." (Hojat et al., 2009)

Another conclusion that can be made is that there are many techniques used to teach and assess empathy in other fields that engineering can learn from. Service-Learning is one that is used frequently in humanitarian engineering and could be beneficial for engineering as a whole. Similarly, explicitly teaching some human psychology and behavioural theory to engineers, as is common in project and business management, could help engineers understand the reasoning of others better and help humanise their conception of stakeholders. More generally, the use of reflections, roleplays and perspective-taking exercises can help enhance empathy in engineers.

It should be acknowledged, however, that the literature review undertaken in this paper was not comprehensive and we are not claiming that this is the only definition of empathy or the only techniques that can be used to teach it. Rather, the definition suggested in this paper is *a* helpful way to think about the teaching of Empathy in Engineering.

Overall, more research needs to be undertaken to understand the effectiveness of using these methodologies from other fields in the context of engineering. While it is likely that the methodologies will be helpful, it is also likely that engineering students will react to them differently compared to students from other disciplines. Understanding these differences may allow for better targeted empathy interventions in the future.

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