AC 2012-4670: EXPLORING THE ROLE OF EMPATHY IN ENGINEERING COMMUNICATION THROUGH A TRANSDISCIPLINARY DIALOGUE

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Exploring the role of empathy in engineering communication through a trans-disciplinary dialogue

Abstract

This paper explores the role of empathy as a core aspect of engineering communication which serves to integrate multifaceted information about, and make sense of, complex socio-technical contexts. We argue that empathy, which we understand to entail both the intuitive emotional, as well as, cognitive aspect of "perspective taking", enables engineering students to develop a nuanced, critical understanding of the multiple perspectives which characterize contemporary engineering problems.

This project draws on a collaboration between faculty from engineering and social work to develop a series of course modules to infuse communication empathy into an undergraduate environmental engineering course. The development of the instructional modules builds on research from the field of social work education which conceptualizes various ways of engaging students in authentic personal interactions. More specifically, the modules incorporate elements of group reflection, communication skills building, role play, and authentic stakeholder scenarios that are commonly employed in social work education.

The design of the course modules is presented with reference to the theoretical foundations from the field of social work and a particular focus on issues concerned with the transfers of these concepts to an engineering context. This includes the discussion of lessons learned from the transdisciplinary dialogue. More specifically, these insights provide a new perspective on engineering communication on a conceptual as well as instructional level.

1 Introduction: The need to foster empathic communication as part of engineering students' professional development

As the nature of engineering work changes from well-defined, technological questions to broad, multi-facetted, and ill-defined issues [1], a focus of engineering education on preparing students for socio-technical complexity emerges [2-6]. The socio-technical systems, that constitute the core of the engineering work our current students will be engaged in, are characterized by the nuanced needs and requirements, and the goal and value conflicts that are inherent to the multiple perspectives of the stakeholders concerned.

As a consequence, engineering has developed approaches that consider stakeholder perspectives in the design process (e.g. QFD in [7]) by "engaging the public" [8]; and engineering programs increasingly emphasize professional communication as a core learning outcome. However, we contend that these efforts are undertaken from an essentially dualist perspective where engineering students and practitioners view themselves as separate from the context of their work. In this view, the consideration of the existing multiple perspectives on the problem at hand all too often takes the form of a purely intellectual analysis (see, for example, the remarks on risk management in [9]).

In order to develop a holistic and critical understanding of the socio-technical challenges, we believe that engineering students need to be equipped with empathic communication skills to allow for a genuine, personal engagement with others. This process of "perspective taking" in a cognitive as well as affective sense would transform stakeholders into partners in a not only participatory but truly dialogical process of addressing the challenges of the future [10].

This paper addresses this educational need through a trans-disciplinary dialogue [11] and shared educational initiative between faculty from social work and engineering. Drawing on the field of social work, that has traditionally held the use of self in communication as a core aspect of students' professional development, we first outline the theoretical framework for the notion of empathy and discuss principles of fostering empathy in instruction. Based on this theoretical foundation, we describe the design and implementation of a series of course modules that will be integrated in an existing Synthesis and Design Studio course [6] in the first and second year of an environmental engineering program. Drawing on this discussion of the trans-disciplinary process of developing the course modules, we reflect on a number of challenges that were encountered in this process. This reflection allows us to distill lessons of trans-disciplinary engagement that could be transferred to similar contexts or efforts. We conclude the paper with an outlook on the plans for an empirical investigation of student development through this initiative.

2 Theoretical framework: Conceptions and functions of empathy in the field of social work

The historical evolution of the concept of empathy has its roots in the German aesthetic idea of Einfühlung ("feeling into" objects) introduced by the philosopher Robert Vischer in the late 1800s, reflecting the "projection of human feeling on to the natural [or physical] world" (as cited in [12]). Building on Vischer's work, in 1903, Theodor Lipps, another German Philosopher expanded the notion of Einfühlung away from its application to humans' relationship to the non-human world, to focus on human interrelating. For Lipps, Einfühlung was the "source of our knowledge about other individuals" [12]; his explication focused on the human ability to recognize another human organism as "minded". Lipps' conceptualization of Einfühlung captured a tendency for "inner imitation" related to recognition of emotions expressed in body language, but also to the capacity for recognition of all mental activities [13]. In 1909, an American psychologist, Edward Titchener coined the term empathy to reflect Lipps' notion of Einfühlung, which marked the beginning of psychologists' continuing efforts to clearly define the concept, to determine how it develops and when, what it looks like in application, and its implications for human social relating.

Empathy in action has always been present in some form or other among humans, but has evolved with shifts in socio-cultural context [14]. Conceptualizations of empathy have shifted as well. In the mid-20th century, psychological conceptualizations of empathy were primarily resonant with Freudian-trained psychoanalytic thinkers, particularly Heinz Kohut and Theodor Reik. For Kohut [15] empathy was "…vicarious introspection…the capacity to think and feel oneself into the inner life of another person. It is our lifelong ability to experience what another person experiences, though, usually and appropriately, to an attenuated degree" (p. 82). Veering away from classic psychoanalytic thought, Carl Rogers, the father of person-centered therapy, a

philosophically humanistic method, had a profound effect on the notion of empathy in psychological practice. He defined empathy as the ability "to sense the client's private world as if it were your own, but without ever losing the 'as if' quality" [16]. Rogers' ideas prevailed, and had profound impacts on the understanding of empathy and its place in relationship formation. In 1969, Carkhuff moved away from Rogers' ideas to suggest that rather than solely an interpersonal process, empathy is a specific skill designed to facilitate communication [17]; Carkhuff's work can be understood as elemental to some of the communication skills taught in contemporary social work education [17].

In the 1980s and 1990s, social and developmental psychologists including, C. Daniel Batson, Martin Hoffman, and Nancy Eisenberg, played a key role in expanding the scope of understanding regarding empathy. According to their perspectives, empathy had two key components, including the physiological aspect of connecting to what someone else is feeling, and the cognitive engagement with these feelings. "Cognitive processing includes rational analysis of one's own empathy and is necessary for intellectual practices such as perspective taking, role taking, conditioning and social learning" [17]. In an attempt to cull the breadth of conceptual complexity, Levenson and Ruef [18] identified three essential qualities of empathy that appear in the body of literature including the cognitive component – *knowing* what another person is feeling, the emotional component – *feeling* what another person is feeling, and the responding component – *responding* with compassion to another person's experience [18]. These components ground the efforts to teach toward empathy in schools of social work. As the field of empathy research continues to develop, current advances include the neurobiological discovery of "mirror neurons", nerve cells that allow sentient animals to understand the experiences of others via the mechanism of a neurological response, or "echo" when observing behavior. Combining the expansive psychological literature regarding empathy with the neurobiological research, Decety and Moriguchi [19] posited a definition of empathy as rooted in four observable neural networks, which match to four components of empathy including: affective sharing, self-awareness, mental flexibility and perspective taking, and emotion regulation. The evolution of the conceptualization of empathy creates opportunities to further ground educational efforts to enhance empathy in professional communication, and provides opportunities to consider how to assess the development of empathy as a potential educational outcome.

As the conceptualization of empathy has been honed over time, its relevance to social work education and practice has remained consistent. For almost 50 years, schools of social work have specified empathic responsiveness as a key skill around which social workers are to be educated [17]. Social work as a profession has broad practice applications with links to systems of all sizes. Given the breadth of application in practice, social workers are educated to develop knowledge, skills, and values elemental to practice across client systems (micro-macro), across diverse populations, and across practice environments. There are some key perspectives that serve to link diverse social work practice applications including a focus on "person-in-environment", a "strengths perspective", the notion of cultural competence, and a commitment to social justice. Central to all of these perspectives is the idea that social workers "start where the client is" and approach from a place of empathy, warmth, and genuineness in all interchanges. Part and parcel to this kind of engagement across systems of all sizes, in the employ of the above perspectives, is the notion that social workers will function empathically in relationships with client systems. There are striking parallels between this tradition in social work and the needs for a transformation of engineering education systems as briefly outlined in the opening paragraphs of

this paper. In social work education, empathy is a means of relating that is developed or enhanced through active engagement. In this project, we draw on these pedagogical traditions to introduce the notion of empathy and the intentional development of empathic communication skills into the engineering education context

For the past 50 years, and beyond, social work educators have established various means of educating students across the curriculum, to enhance, deepen, and learn to apply empathy in practice. Methods of teaching toward empathy begin with exercises grounded in the basics of communication, both verbal and non-verbal. For example, students start by deconstructing what they think they understand about talking and listening, about observing, and about developing professional relationships. Students are asked to engage in exercises that challenge them to consider how they currently use themselves to communicate, and to become more conscious of the implications of communication choices for relationship development through a focus on self- and other-reflection. Students are also asked to participate regularly in role play exercises of various kinds designed to teach toward empathy by promoting "affect-based understanding and generat[ing] opportunities for perspective-taking insights, self/other awareness, and emotion regulation" [17]. Students learn a series of communication skills (ways of asking questions, ways of responding in terms of content, ways of responding in terms of meaning, ways of responding that combine the two (a deeper level of empathic engagement)); these skills are reinforced in multiple classes, are modeled by their instructors, are assessed via multiple assignments, and are applied in a field internship setting. Students engage in role plays in large groups, small groups, and through video simulation, for example. Students are also asked to write in a critically self-reflective way – prompts can include case scenarios, experiences, the application of theory to personal experience, responses to media, to name some. Building on these critically self-reflective exercises, students are asked to critically reflect around the experiences of others; by immersing themselves cognitively and affectively in the experience of others, and asked to reflect around what they observe, students are invited to build on their self-reflection to engage with perspective taking but also to enhance their clarity around self-other awareness. Because the development of empathy is an explicit objective of social work education, and is widely understood as a cornerstone of effective practice, students recognize the stakes are high and challenge themselves, and are challenged by their instructors, to fully engage with these assignments.

3 Context: Holistic student development in environmental engineering Synthesis and Design Studios

The modules proposed below will be implemented into the Synthesis and Design Studio in the Spring of 2012. The Synthesis and Design Studio is a series of courses that occur during the first three years of an Environmental Engineering curriculum with the final year including a traditional Senior Design course. The Studio that will be the context of this project will be described here (for more information about the other Studios and the larger program please see [6]). This Studio consists of both first and second year students and is divided into two sections with roughly 15 students per section. The Studio primarily consists of projects, course readings, and reflections; these components of the Studio will be described below.

Projects: The projects included in Studios are open-ended and ambiguous (ill-structured) to encourage students to develop an understanding of the importance of systems thinking in

engineering practice and to encourage their holistic development. Studios are project-based courses and this Studio will consist of four projects:

Project 1: How can we embed less energy in our food? This is an individual project that involves the development of an awareness campaign to address the amount of energy embedded within our food. Students are required to make observations of a local grocery store, complete a personal food log, and conduct research on energy embedded in food. The deliverables include a poster and a report that includes all aspects of their project.

Project 2: Athen's new 60 mile diet proposal. This is a group project that involves the design and writing of a magazine article describing a hypothetical proposal to restrict all food in Athens, Georgia (the city in which the University is located) to a 60 mile radius, and the production of an opinion video that is meant to represent the opinions of the team members concerning the 60 mile diet proposal. The magazine article must include facts, figures, and voices from local Athens stakeholders.

Project 3: Casting call video. This project involves the same groups of students and involves the development of a claymation video centered around the concept of sustainability. The video also includes photographs that students selected with a voice-over of each student describing what sustainability means to them.

Project 4: Sustainability proposal. The final project involves the same group of students and involves each team developing a sustainability proposal that will be presented to the "Mayor" of Athens who in the scenario proposed the initial restriction on food transportation. This project is more ill-structured than the other projects while building on background knowledge gained in the three prior projects.

Readings: In addition to the projects, this Studio will involve readings and subsequent discussions and reflections on these readings. The course readings are structured around the role of engineers within larger socio-technical systems. It includes case studies that highlight unintended consequences of engineering work[20, 21], articles that discuss the social context of engineering practice, readings that explore the relationships that engineering work is embedded within, and readings that discuss the necessity of a moral stance for engineers.

Reflections: To encourage holistic student development reflections are included throughout the studio [22, 23]. Reflections include short written reflections, visual journal entries, focus group discussions, and a reflection report at the end of the semester. These reflections help students realize their personal and professional development over the course of the semester.

The Studios' project-based nature with a heavy reflection component position them to be a well-suited context to implement the proposed integrated modules that are described in the following section.

4 Implementation: Integrated modules to develop empathic communication skills as part of student projects

To facilitate empathic communication skills among engineering students, a series of modules was designed. The modules employ theory and methods utilized in social work education, and

are modified to fit the educative objectives in the professional development of engineers. The engineering educator and the social work educator work collaboratively to facilitate these modules, and modules are designed and timed to fit with the course outline and student project assignments. Four modules were developed and are matched to the course plan as follows.

Module 1: Focuses on effective communication including talking, listening, and observing. Students are asked to talk with two to three other students in the class who they do not know well and to gather information about five things they share in common. Once students have completed this exercise, they are asked to reflect on how the exercise felt, what they actually did to approach others and elicit information (what interpersonal skills they employed), and why they think they were asked to participate in this exercise. Then the facilitators will focus on breaking down the key elements of use of self that factor into communication. Students will then be asked to participate in exercises (in pairs) that focus on eye contact, proximity of bodies, facial expression, voice modulation, listening, and information retention. The exercises will be followed by a guided debriefing discussion, and students will be asked to ground the purpose of these exercises in their understanding of their professional role as environmental engineers.

Module 2: During the class session following the completion of Project 1 (as described above), students will participate in role-play activities drawn directly from their real-time experiences. Taking on the role of the observed (the stakeholder) enhances students' capacity for perspective-taking, including both cognitive and affective components, and could serve to enhance their compassion, how they think about solving or addressing problems, and can further cement their experiential understanding of systems.

Module 3: Prior to engaging in an exercise designed to illustrate team building concepts and to employ students' team-based problem solving methods, students will participate in a directed five-ten minute writing exercise in class focused on identifying the roles they play/played in their families of origin. Students will be asked to identify the roles they play(ed), to identify where they think those roles came from – were they appointed, assigned, assumed, naturally emergent out of the system, etc?, and how the role(s) served the family as a system. Following this reflective writing, students will participate in a team building exercise. After the exercise, students will engage in a facilitated debriefing regarding what happened, how they approached the problem as a team, and what roles they played/took on in that exercise. Students will be asked to consider any connections between what they identified as the roles they played in their family systems and the roles they took on (or were appointed) in their team challenge. Following a brief discussion regarding an understanding of those family-based roles as an element of how people behave in other relationships and social situations, and how this affects use of self, students will be asked to challenge themselves to do at least one thing outside the realm of their typical roles in their next team meeting. Taking risks and shifting their typical patterns of use of self could serve to enhance students understanding of how they have an impact on relationship building and group outcomes, and how dynamics of the system shift in response to their attempts at change.

Module 4: After completing their final group project, students will participate in a rich picture exercise [24] focused on one of the stakeholders they identified through their project. They will be asked to consider and to illustrate through their rich picture, a comprehensive sense of the collection of potential outcomes (intended or unintended) for that stakeholder. This module is

designed to enhance perspective taking (cognitive and affective), self-other awareness, compassion in problem-solving, and is grounded in an understanding of peoples' reciprocal relationship to systems.

5 Discussion

This paper described the theoretical foundation and the design of course modules to foster empathy in engineering students. The modules are set in the context of an innovative Synthesis and Design Studio with a focus on students' holistic professional and personal development.

A main focus of this paper in this early stage of the project is to share a number of critical reflections of the teaching team on the trans-disciplinary process of designing the integrated course modules. More specifically, from regular reflections during the design process emerged three themes that concern the nature of trans-disciplinary pedagogy and are perhaps relevant for similar settings or initiatives. The following discusses the issues of (i) the danger of disciplinary separation of content, (ii) the challenges of students' gradual transition to accepting a concept such as empathy as relevant to engineering, and (iii) the role of epistemological differences for both students and instructors.

(i) As current educational approaches tend to emphasize the separation of disciplinary content, one of our main concerns in developing the course modules was that the trans-disciplinary content, namely the development of empathic communication skills, could be perceived by the students as separate from the 'real engineering' content of the course [14, 25, 26]. This risk is potentially exacerbated by the trans-disciplinary content being associated with the instructor from social work. Such a dynamic, while perhaps instilling some of the desired skills in students, would not achieve the goal of an empathic mindset as one facet of student overall professional way of being, a quality that Rifkin [14] sees as essential in the "third industrial revolution" and describes as "developing empathic ethics and a sense of social responsibility that takes the position that we all share the same life boat".

In addressing this challenge, we feel that modeling this empathic engagement for the students in all our teaching interactions is a key in avoiding this above-described fragmentation. More specifically, the modules are co-taught by the engineering and social work instructors on the bases of a substantive personal and trans-disciplinary engagement that is reflected in the design of the course modules as described above. This means, there will not be an empathy expert visiting the course on occasion to pass on specific skills to the students. Rather, the development of empathy will be infused throughout the course and carried equally by engineering and social work instructors.

(ii) Another facet of fostering students' integrated understanding of the role of empathy in engineering is to acknowledge that this is potentially a very significant transition for students (see section (iii) below) that entails cognitive as well as emotional aspects. While the cognitive component of empathy might flow more naturally from the systems understanding fostered in the class, the emotional aspects are perhaps more significant and usually not acknowledged in our approaches to engineering education [27-29]. Taking these challenges into account, the course modules progress from the more concrete skills development (modules 1 and 2) around the use of self in effective communication to more substantive issues concerned with an awareness of

self and the relationships within social systems from the level of a team to the role of engineering in society. In this transition the class activities centered on self-reflection will provide students with additional opportunities to make sense of their experiences. In the past iterations of the course, particularly the group reflective activities provided students with a certain level of comfort from the exploration of the shared nature of their experiences within the cohort.

(iii) At the core of the two above-described challenges lies the degree to which the disciplines of social work and engineering differ in their epistemological and ontological bases. On the level of students' understandings we hope to address this challenge through the gradual, guided engagement process discussed above. On the level of faculty, the epistemological differences between the disciplines are perhaps more subtle but were nonetheless experienced as both significant challenge and stimulating opportunity.

The challenge of the differing viewpoints lies in their implicit nature and can in our experience be addressed in a sustained, genuine dialogue that acknowledges and challenges assumptions. This dialogue benefits from trust and personal engagement and takes, above all else, time. However, through this dialogue in an area that is, despite the differences, after all shared terrain, we experienced a significant creative energy that not only drove this project but also informed all of our respective work in other areas.

6 Outlook and future work: Empirical investigation of student development

In this paper we describe the beginning of a collaboration that promises to address the growing need of engineering students to develop empathic communication skills. This initial collaboration involves engineering and social work faculty engaging in a meaningful dialogue and developing instructional modules to address this growing need within engineering education. After this initial development of instructional modules, we plan to empirically investigate student development related to engagement in these integrated modules. This research will explore the extent to which these integrated instructional modules increase engineering students' skills in empathic communication. Does participation in these modules encourage students to have a genuine and personal engagement with others? Does participation in these integrated modules encourage students to view themselves as being within the context of their work? In order to answer some of these questions, we plan to employ the use of established self-report instruments designed to measure empathy (see for example, The Emotional Intelligence Scale (EIS) [30]; the Interpersonal Reactivity Index (IRI) [29] in conjunction with qualitative research methods, including phenomenological observation, to explore how the development of empathic skills is grounded in students' shared lived experiences of the modules and the overall course.

As engineering work is changing from solving well-defined, technological questions to approaching ill-defined, broad and multi-facetted issues there is an increasing need for engineering students to first understand the complex, socio-technical context that their work is embedded within and second, to understand their role in this context. Engineers have traditionally separated themselves from their work, as this was considered appropriate when the types of problems engineers were dealing with were well-structured, technological problems. Now, however there is an increasing need for a different type of engineer--one that recognizes their inherent role within these complex socio-technological systems within which they work. This consideration of the self within one's work is central to the field of social work and thus an

authentic, trans-disciplinary engagement with social work faculty promises to help engineering faculty design learning experiences that encourage engineering students to transition from considering themselves to be separate from their work and stakeholders to considering themselves as being within their work.

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