

Engineering to Help: The Value of Critique in Engineering Service

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Abstract

This article is a reflection on significant recent growth in engineering education programs devoted to service-learning, sustainable development, humanitarian engineering, and so on, which we group under the term “engineering to help” (ETH). ETH programs are touted for their ability to provide engineering students, mainly from wealthy nations, with an opportunity to practice small-scale engineering and gain awareness of social, cultural, economic, and environmental constraints. However, because ETH programs are motivated by a desire to “help,” they may unwittingly re-create or implement neo-colonial, neo-liberal, or other problematic globalizing tendencies, such as affirming Euro-American supremacy abroad. The voices and desires of “developing” communities are often muted or ignored in favor of privileging engineering students’ learning. This paper historically contextualizes the emergence of ETH within the engineering profession, and briefly outlines pertinent critiques of “helping” that may enrich ETH educators’ approaches to such projects.

Introduction

An informal survey of engineering programs in the United States suggests that a growing number of universities offer classes, initiatives, programs, or degrees in engineering and sustainable development, community service, service learning, and/or humanitarian engineering (to name just a few in the U.S.: Engineering for Developing Communities (EDC) Program, University of Colorado, Boulder, 2006; Engineering Projects in Community Service (EPICS) Program, Purdue University, 2006; Humanitarian Engineering, 2005; Humanitarian Engineering Leadership Program (HELP) at Dartmouth; Mulrairie, 2006; Selingo, 2006; Shallcross, 2005). Similar programs are also burgeoning in Australia, Canada, Europe, and elite universities in Latin America. Although these programs are conducted under a number of auspices and with varying objectives, they share one thing in common: an expressed desire to “help” communities “in need.” Such programs generally hold as objectives the performance of some needed service and learning via reflection by those performing the service. To be inclusive, we refer to this diversity of programs under the umbrella term “engineering to help” (ETH).

ETH programs, which have recently emerged in the United States and abroad, are receiving increasing attention from engineering educators. For example, in 2000 the term “sustainable development” appeared in eight presentations at the American Society for Engineering Education Annual Conference. By 2007, that number had jumped to 42 (ASEE Conference Proceedings, 2000-2007).¹ Further, the *International Journal for Service Learning*

¹ These numbers reflect only searches for “sustainable development.” Other “helping” technology programs may use terms such as “humanitarianism,” “service learning,” or “volunteering.” As a result, this brief survey is only intended to be representative, not inclusive of all ETH programs.

Engineering debuted in 2006, and the *European Journal of Engineering Education* published a special issue on the topic of Educating Engineers for Sustainable Development in 2008 (Desmazieres, Foxley, & Mulder, 2008). Also in 2008, the National Academy of Engineering's Center for Engineering, Ethics and Society sponsored a workshop on the theme of Engineering, Social Justice, and Sustainable Community Development (Engineering, Social Justice, and Sustainable Community Development, 2008). And a number of conferences devoted to this and related themes have been taking place regularly around the world, including but not limited to the Engineering Education in Sustainable Development conference in Europe (Engineering Education in Sustainable Development, 2008), the EPICS national conference organized by Purdue University (EPICS Conference, 2008), the Engineering, Social Justice, and Peace conference (Engineering, Social Justice and Peace, 2008), and the Engineers Without Borders annual conference (Engineers without Borders, 2008), all begun in the last five years or so.

Given this fairly recent yet dramatic increase in the number of ETH programs in the developed world, it seems we are observing a trend that resonates with engineering students and faculty. As a result, this short paper has two goals: first, it positions ETH programs within a history of the US engineering profession generally. We argue that the emergence of ETH programs represents a shift in how some engineers and engineering educators are re-imagining and re-framing their profession and engineering education from a constraining concept of "service" to include a broader notion of "helping."

Second, we want to question the notion of "helping" as a defining framework for ETH initiatives. Engineering students and faculty, though well-intentioned and motivated by altruism, should be aware of significant critiques from fields such as development studies, feminist critical theory, and cultural studies. These critiques may both problematize and enrich theoretical frameworks among ETH practitioners and guide future practice. Because of space limitations, we can provide only a broad introduction to these frameworks here, but we hope that this paper will serve as a springboard for further inquiry, reflection and reform.

1. From Service to Help: A Short History

Concluding his analysis of early French engineering, historian Ken Alder states that "[e]ngineers have been designed to serve" (Alder, 1999, p.124). Since the early 19th century, engineers in diverse countries have served their societies by enacting various knowledges and practices. In France, engineers have served society from the State via an emphasis on theoretical math and science to organize and maintain French society (Alder, 1999; Downey & Lucena, 2004). In 19th century Britain, engineers at the nexus of engineering societies (institutions) and industry hoped to serve society through "self-directed 'improvement' over the past, demonstrated by material comforts and elevated character in the lives of elites, and measured by the distance achieved from manual labor" (Downey and Lucena, 2004, p. 404). Histories of engineering in Germany and Mexico also trace such calls to service, emphasizing different forms of knowledge and practice (Downey & Lucena, 2004; Lucena, 2007). From inside private corporations, U.S. engineers have tried to serve society by producing products and services for mass consumption at low cost (Downey, 2007).

In the early 20th century, U.S. engineers tried to deal with the conflicts that arose between corporate employment and their desire to serve the public by "revolting" against the constraints placed on their autonomy by corporate employment (Layton, 1971). Failing to "revolt," U.S. engineers developed codes of ethics that, at best, affirmed a commitment to public safety but not much more (Layton, 1971; Mitcham, 2009).

Since becoming "enmeshed in corporate hierarchies" (Reynolds, 1991, p. 172), U.S. engineers have tried to expand their field of practice and service beyond their countries. Beginning in the 1950s, many engineers have been involved in international development projects and bureaucracies that were part of U.S. foreign policy (Adas, 2006, chap. 5). In the 1960s and 70s, some engineers attempted to provide technical information and assistance to communities in the "Third World" through appropriate technology (Williamson, 2008). In the early 1990s, many engineers embraced the challenges of sustainable development by developing technological fixes that would allow "constrained growth" without compromising their commitment to mass use at low cost (Lucena & Schneider, 2008). Although these practices beyond country could be understood as attempts to help others (or the environment), they never scaled up to make inroads in US engineering education or in the professional conduct of engineers, until now.

In the last decade, we have witnessed a surge in ETH activities both in the professional and educational arenas,² as evidenced by the founding of organizations like Engineers Without Borders International (EWB) (ca. 2003) and Engineers for a Sustainable World (ESW), to name only two, with an associated explosion in student chapters of these type of organizations and upsurge in ETH courses and projects in US universities. These activities are taking place at the historical convergence of three key events: the globalization of US engineering education (Lucena, Downey, Jesiek, & Elber, 2008), the dislocation of engineering corporate employment (Friedman, 2006), and the unparalleled media coverage of humanitarian crises, violent conflict, poverty, and environmental degradation taking place around the world (Hoiyer, 2006). We briefly analyze the first two here.³

The end of the Cold War and the new challenge of global economic competitiveness brought significant changes to US engineering education, including a redefinition of engineering competencies embodied in the ABET EC 2000 criteria (Lucena, 2005, chap. 5). The movement of engineering competencies, intended in part to create global engineers who can successfully operate in other parts of the world, “has also provided opportunities to other programs and organizations not explicitly aimed at producing competencies for industry” such as EWB, ESW, etc. (Lucena et al., 2008, p. 5). In short, ETH initiatives have conveniently emerged at a time when engineering programs still struggle to address challenges of ABET accreditation such as developing the abilities “to design a system to meet desired needs...to function in multidisciplinary teams... to understand professional and ethical responsibility...[and] to understand the impact of engineering solutions in a global context” (ABET, 2004).

Also since the 1980s, engineers have been experiencing significant dislocations in corporate employment. Practices aimed at increasing work productivity (more output per unit of human labor) put in place since the 1980s have resulted in continuous cycles of layoffs and workplace restructuring (Aronowitz and DiFazio, 1994; Rifkin, 1995). Deregulation of trade and investment in the 1990s led to a massive movement of engineering jobs outside of the U.S. No longer committed with long-term loyalty to their corporate employers, increasing numbers of engineers have become “itinerant experts in a knowledge economy” outside of mainstream employment (Barley & Kunda, 2004). These dislocations of engineering employment over the last two decades have opened opportunities for many engineers to serve the public beyond the constraints of existing codes of ethics by volunteering and/or even seeking employment as “relief engineers” (Davis & Lambert, 1995) in humanitarian, community development, or sustainable development organizations. In short, like their academic counterparts above, these engineers are finding more opportunities to redefine service in terms of help.

This historical explanation is not meant to be all-encompassing, nor are we attempting to reduce the multiple and diverse motivations of individual engineers and engineering students involved in ETH activities to one particular grand narrative. Rather, we wish to provide a broad historical backdrop for understanding the emerging ETH movement. Although we do not have the space to explore them in depth here, we could also have mentioned the historical backdrops of technocracy, which as an ideology continues to encourage engineers’ desire to fix problems and solve crises through science, engineering and technology (Akin, 1977; Jordan, 1994); the enormous political and economic machinery of the development enterprise, which supports and motivates particular kinds of “development” (Adas, 2006; Jackson, 2005; Lucena and Schneider, 2008; Rist, 2002); the tendency to locate problems in the “other” before we identify them in ourselves; and even the belief that North American ways of seeing, doing, and solving problems are better than the alternatives (Escobar, 1995; Heron, 2007).

² Stimulated by a desire to “help” since the early 1990s, engineers from rich countries independently organized a number of groups going under some form of the name “Engineers without Borders”: Ingénieurs Sans Frontières (France), Ingénieurs Assistance Internationale (Belgium), Ingeniería Sin Fronteras (Spain), Ingenieros uden Graenser (Denmark), Ingenjörer och Naturvetare utan Gräns-Sverige (Sweden), Ingegneria Senza Frontiere (Italy), and others.

³ This media exposure, coupled with enduring ideas of progress and superiority of the North over the South, have produced what Barbara Heron calls “a planetary consciousness” and “a sense of entitlement and obligation to intervene globally.” She argues that this sense of entitlement and obligation explains “why middle class Americans respond to media portrayals of global problems by feeling, as [Edward] Said argues, that it is up to them to set right the wrongs of the world...” (Heron, 2007, p. 37)

2. Some Critiques of “Helping”

For engineering professionals invested in transforming their professional identities from ones of “service” to include ones of “help,” ETH offers what seems like an entirely new framework for doing engineering work by helping the underserved. Its core values—altruism, sustainability, justice—are noble, seemingly beyond reproach. Yet, there are bodies of scholarship that have for many years interrogated and critiqued the history of programs like these, and which have lessons to offer engineers. It is important to broadly outline these critiques.

First, ETH activists must understand that their projects have emerged from or are merging with the history of Development (see Rist, 2002). Development, argues Gilbert Rist, “consists of a set of practices, sometimes appearing to conflict with one another, which require—for the reproduction of society—the general transformation and *destruction of the natural environment and of social relations*. Its aim is to increase the production of commodities (goods and services) geared, by way of exchange, to effective demand” (Rist, 2002, p. 13, italics added). Although engineering educators seem to be aiming their efforts *away* from such a definition when they develop ETH programs, they may be in danger of entering into and repeating problematic Development practices, such as those Rist critiques (for concrete illustrations of such pitfalls, see Epprecht, 2004, Jackson, 2005, and Sichel, 2006).

Such a possibility exists primarily because ETH programs are fundamentally based on an inherently problematic need/help conceptual model. Having emerged out of the history of Development and conceptualized through the lens of engineering problem solving, ETH is still committed to a paradigm that imagines the “developing world” as characterized primarily by *needs* (Riley, 2008; Selingo, 2006). Engineers often interpret needs as parameters or constraints in their problem solving or designs.⁴ The concern is that the more engineers conceptualize their relationship with communities or the “underserved” in terms of need/help, the more they see communities as problematically “other” and defined by what they lack, while re-affirming themselves as “problem-solvers” or “planners” with solutions (Easterly, 2006; Schneider, Leydens, & Lucena, 2008; Sichel, 2004). Such a need/help model is fraught with complexities. As one development scholar puts it, “Nor is help any longer, in fact, help to someone in need; rather it is assistance in overcoming some kind of deficit. [...]. Help is much more often the indispensable, compulsory consequence of a need for help that has been diagnosed from without” (Gronemeyer, 1992, 54).

Speaking anecdotally, we have noticed that engineers involved in ETH activities sometimes react defensively to such critiques because they fear their intentions and identity are being called into question. They re-affirm their commitments to community development and humanitarianism because in doing so they validate their identity as problem-solvers, though outside corporate and government environments. They often strongly resist critiques of Development, preferring to commit uncritically to what we call “technologies of help” (we define these as technologies whose stated aim is to “develop” the communities they claim to serve, whether in terms of resources, economic development, or personal development; e.g., see Jackson, 2005). ETH engineers, in spite of their willingness to critique traditional engineering practices embedded in corporate or research environments, ultimately resist giving up their identity as problem-solvers (Downey, 2005; Downey and Lucena, 2007; Vaughn Koen, 2003). By imagining themselves as solvers of developing-world problems, they may unknowingly entwine themselves in the long histories of colonialism, imperialism, and neoliberalism, as has been argued by many engaged in development studies and feminist critical theory (Berlant, 2004; Heron, 2007; Jackson, 2005; Peters, 2004; Riley, 2007; Sylvester, 2002).

⁴ Maslow’s hierarchy of needs provides engineers a convenient framework to reduce and homogenize human needs, regardless of cultural diversity, to five categories: physiological, safety, love/belonging, esteem, and self-actualization. ETH ‘solutions’ tend to focus on the physiological (air, food, water, shelter, excretion) and on safety, when the context allows, but rarely address the other three categories.

3. Rethinking “Help:” Questions for Practitioners

Although a more detailed summary of these critiques of globalism, neoliberalism, and Development is beyond the scope of this article, we can think in terms of broad areas of concern that ETH workers, organizers, and educators should consider. Below, we provide a list of these broad areas, amalgamated from the work of the scholars referenced above. We provide these considerations as a list of questions ETH organizers might consider before they embark on projects:

a. What are your motivations? There is a big difference between going into a community to perform charity, which implies that we see the recipients as “less-than” or inferior to us, and being invited into a community to redress injustices, or to learn from that community. As Benjamin Sichel puts it, “If I’m going somewhere to ‘help people,’ what am I assuming about those people? How effective a worker can I be in a place where I hardly speak the local language, and where my specific skill set might bear only a passing resemblance to what is actually needed? And—one of the most difficult questions of all—do the people I’m working with really want me there?” (Sichel, 2006). Sichel’s comments invite us to be critical about our motivation to help, and to maintain humility about our ability to help (see also Heron, 2007, 13).

In a 1968 address to groups of privileged foreign volunteers in Latin America, philosopher Ivan Illich stated, “Use your money, your status and your education to travel in Latin America. Come to look, come to climb our mountains, to enjoy our flowers. Come to study. But do not come to help” (Illich, 1968/1990). Or, as Esteva recently put it in dialogue with our ETH students, “Don’t come here to help! Come here to listen, to find out if *our* struggles are *your* struggles. Then and only then, we can sit and discuss how, if at all, we can work together.” Such perspectives pose serious challenges for ETH initiatives, especially if students define much of their identity as problem solvers (Downey and Lucena, 2003)—as doers who think, plan, design, then implement for others “in need.”

b. What is the history and context for development projects in the area? ETH groups may not understand the “political, cultural, and economic contexts of neoliberalism that create the needs [often in the form of markets] they seek to resolve through engineering” (Riley, 2008, 77). In other words, ETH groups often step into gaping holes of “need” created by institutionalized neoliberalism or globalization. They may not know that their development or “helping” projects take place within a context of inequity that rich countries helped to create, but the communities they are visiting probably do. If they do not already, ETH practitioners should endeavor to understand the larger historical and political contexts (and not just cultural contexts) into which they are entering when they practice ETH.

We call on universities with ETH initiatives to integrate development or critical studies in the required curricula for students working with “underserved” communities. Humanities scholars, social scientists, and engineers who teach in and coordinate these programs should instill in students a deep sense of long-term responsibility towards their ETH projects by challenging them to explore long-term evaluation of current and past projects and to learn from past successes and failures.

c. Who benefits and who suffers from the project? ETH programs, particularly those involved in doing development work abroad, require substantial resources, both in terms of travel costs and equipment transport. Marc Epprecht and others argue that ETH programs may also create an exploitative relationship between privileged students and “developing” communities such that learning opportunities for the students are emphasized above all else (Epprecht, 2004, Riley, 2008, 79; Sichel, 2006). Engineering students get to develop their identity as problem solvers (Downey and Lucena, 2003) while communities get designs or systems that often have short working lives (see Jackson, 2005; Easterly, 2006).

d. Who is held accountable? Engineer Donna Riley argues that there is little accountability for ETH programs, and little attention paid to past failures, or to preventing future ones (Riley, 2008, 79). Similarly, a review of recent ASEE presentations on ETH programs suggests that while engineering educators are willing to think self-critically about why certain ETH programs fail, they rarely place individual failures within larger institutional or historical contexts. In other words, project failures are frequently chalked up to technical problems, communication problems, or cultural problems, all of which are important. Few, if any, papers about specific projects, however, placed project failures in relation to systemic inequities or injustices that may create patterns of failure across multiple projects.

We also offer up the possibility that the best expression of North and South American and European impulses toward humanitarianism and technologies of help might be in addressing the social and ecological consequences of our own national imperatives to growth, globalization, and environmental despoliation. In other words, our and our students' energies might best be directed at examining and alleviating the systemic conditions that lead to dire economic and ecological conditions in our own countries (e.g., see Mies & Shiva, 1993; Peters, 2004).

e. What are the possible unintended consequences? Although many ETH projects could be considered near-term successes, either by the engineers involved in them or by the communities they seek to serve, the long-term consequences of such projects might not be known for years and often require in-depth study of socio-economic dislocations. Even when ETH projects are small, technologically, socially "appropriate," and environmentally sustainable, without the involvement of the community, policymakers, and other stakeholders, "the cumulative effect of many individual [actions] may have consequences as far-reaching as those of a large-scale technical project." (Bernard and Pelto, 1972, p. 319).

f. Do we view communities as "less-than?" Engineering students and faculty devote much time and energy to develop and design technologies in an effort to improve the lives of the poor or "disadvantaged." However, such practices are frequently conceptualized within the frameworks of people in relatively privileged countries. What if the conceptual framework shifts to the perspectives of the local communities? What is it like to be seen as in "need" of "help?" Development critic Gustavo Esteva traces the birth of development to January 20, 1949, when US President Harry Truman outlined in his inaugural address what has become known as "Point Four." As described by Truman, Point Four was a "bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas" (qtd. in Esteva, 1992, 6). Esteva notes that

[o]n that day, two billion people became underdeveloped. In a real sense, from that time on, they ceased being what they were, in all their diversity, and were transmogrified into an inverted mirror of others' reality: a mirror that belittles them and sends them off to the end of the queue... (7).

Esteva accentuates how the need/help model is imbued with traits of a deficit model: in international contexts "for two-thirds of the people on earth, this positive meaning of the word 'development' [from ecology]—profoundly rooted after two centuries of its social construction—is a reminder of *what they are not*. It is a reminder of an undesirable, undignified condition. To escape from it, they need to be enslaved to others' experiences and dreams" (10).

4. Conclusion

We ignore Esteva's and other critiques of development at our peril, and the peril of those whose lives we enter when we embark on ETH projects. If we do not critically engage the history of development, with its colonial and post-colonial implications, including its omissions and failures, we risk repeating the most serious errors of development (e.g., see Rodney, 1982, Jackson, 2005, Easterly, 2006, Adas, 2007). That is, we risk doing more harm than good, despite our best intentions. Our students have much to gain from ETH initiatives, and the recipient communities much to lose.

We encourage ETH educators, as they move forward, to foster opportunities for empathy (not sympathy). Such empathy is crucial to re-envisioning a community not exclusively through the lens of what it lacks but through its multiple social, cultural, and other assets and capacities, and most of all, its own dreams and aspirations. We reiterate that we are not arguing for an abdication of ETH efforts, nor for American isolationism. We believe there is much to be gained for our students, and for the communities they visit, when interactions are welcomed and agreed upon by both groups, problems are defined by communities, and solutions are provided only when communities request them. But we also know that wanting to do good and doing good are not always the same thing. To that end, we would call on engineering educators and practitioners to critically engage and assess their allegiance to "engineering to help."

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