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International Humanitarian Engineering

Who Benefits and Who Pays?

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Many engineering educators want their students to travel internationally to engage with marginalized communities. International service learning placements offer pedagogical advantages such as practical design experience, opportunities to develop communication skills, and a means to see technology in a broader perspective. But there are some legitimate ethical concerns as well. Qualitative, phenomenographic research was conducted in order to understand the benefits and limitations of international humanitarian engineering placements. Thirty-two semi-structured research interviews were conducted in Canada and Ghana before an analysis resulted in a distinct outcome space. It is concluded that placements must be considered on a case-by-case basis as the placements by themselves are neither inherently good nor bad, and there are many potential problems. The success of an international engineering humanitarian placement often depends on intangible qualities, such as the student's attitude, communication skills, and cultural awareness.

Engineering Education in Flux

The field of engineering education is in flux. Many researchers and educators are calling for new ways to understand engineering's social role. There are two emerging approaches to engineering education that are of particular interest to this study. First, there is a growing trend for engineering education to address issues of human development. Vesilind suggests that, historically, engineers have been employed as "hired guns, doing the bidding of both political rulers and wealthy corporations." However, he says, there is a new kind of engineering emerging, one "rooted in the greater ideas and aspirations of engineering as a service to all

humanity" [17]. In an issue of the *Journal of International Development*, Robbins also predicts that we are at the beginning of an emerging field in engineering [12].

Second, there is a call to respond to globalization with a curriculum designed to prepare students to work in a global context. A variety of researchers have argued that presenting engineering within a global concentration is necessary for global competitiveness [18], cultural inclusivity [7], and sustainable design [8].

More engineering faculties are including international service learning or humanitarian placements in their curricula. Educators claim success with international service learning in engineering because it affords opportunities in practical design experience, as well as in developing communication skills, and because it is a means to see technology in a broader perspective [15]. According to Borg and Zitomer, international service learning is beneficial in teaching civic responsibility and for strengthening community, while addressing issues of the environment and poverty [1].

While international humanitarian engineering placements offer pedagogical advantages, there are important concerns as well. For example, do the short overseas stints create a positive outcome for the community, for example, or do they simply create a dependency on an outside technology? Also, volunteer work for credit is something of an oxymoron; students who are expected to provide service and reflection will sometimes resort to seeing the tasks as part of a checklist [13]. Another concern is expressed by Riley, who argues that seeing the developing world as "the classroom of the 21st century" is simply a new form of colonialism, where a positive learning experience is one more thing to take out of the developing world [11]. It is widely believed, according to Eprecht, that "the work-study abroad

experience is so intrinsically valuable that neither the ethics nor the pedagogy requires dedicated reflection" [3]. He fears that "work-study programs contribute to the very kinds of underdevelopment and colonial-style North-South relations that they are intended to critically address."

This article looks in more detail at the merits of international humanitarian engineering placement by asking "who benefits and who pays?" This question is inspired by the work of Ursula Franklin, who insists that it should be asked in light of every new technology or policy [5].

Phenomenographic Approach

A phenomenographic approach was used according to the methodology developed by Marton [9]. Phenomenography is a qualitative methodology that focuses on the variety of ways in which individuals describe specific phenomena. In this methodology, the research data, such as transcribed interviews, is pooled together to form one source. This pool of data is then organized into various categories of description, which in turn are organized into a hierarchical structure [2]. The structured data, called the outcome space, represent some of the possible ways a concept can be understood. The individual conceptions are not important in phenomenography, as the goal is to reach a description of variation of the collective [10], and hence the pooling of the data.

Research into the conceptions of an international placement was conducted between 2006 and 2008 as part of a larger project at Queen's University in Kingston, Ontario, Canada, a project that explored engineering curriculum changes to better address social justice and human development [16]. Thirty-two qualitative, semi-structured interviews were conducted in Canada (Ca) and Ghana (Gh). Engineers and non-engineers involved

The person who has the cross-cultural experience, with the intent of helping, will benefit the most.

in engineering and international development were interviewed in order to collect a large pool of data before an analysis resulted in a distinct outcome space.

The data from the transcribed interviews were analyzed to identify dimensions of variation within that pool of data, which in turn helped identify the categories of description, and eventually the outcome space. The data was organized so that the categories that were constructed bore some logical relation to each other, as recommended by Walsh [19]. The aim of this study is to identify and describe the qualitatively different ways in which the interviewees conceptualize an international humanitarian engineering placement.

Results and Analysis

The outcome space that is presented below is only a subset of all possible categories of description of the phenomenon, but there is enough variation to make some useful conclusions about the merits of an international humanitarian engineering placement.

Category 1: Placement is Inherently Good

In the first category, an educational international placement is seen to be intrinsically good. Interviewees were quick to point out numerous benefits. Several interviewees suggested that the international placement should be a requirement for a curriculum with a focus on human need. Other people were enthusiastic about the many benefits of the placement.

These projects are life changing. [Students] come back with a whole different ap-

proach to life.... They are incredibly beneficial for our students. (Ca16)

Opportunities to interact with marginalized or impoverished people are seen to be extremely beneficial. The following quote suggests that there can be benefit through helping a community alleviate a problem and that there is an opportunity to learn because of the cross-cultural experience. In the end, the overseas endeavor is described as very positive.

JDJV: Is there a benefit for us to be sending engineering students to developing countries?

Ca7: I think most certainly. For obvious reasons for the country—if their water is polluted and they need clean drinking water and they're not sure how to do it. There's a benefit to them and we're loving our neighbors by helping them do it. There's also great benefit for the student in going over and working in another country. For one thing, it is going to humble them and they'll realize how fortunate we are in Canada. We don't have to worry about drinking dirty water and having to walk miles for it. So just that experience alone is a very valuable lesson.... Maybe they'll learn about how to treat their elders or how to live in community.

In thinking more broadly, several people suggested that humanitarian engineering placements would have monumental impact. They would increase the quality of engineering designs and simultaneously create a critical mass of thought-

ful workers. One practitioner said that this type of opportunity was necessary for the students to fit into the current globalized way of life.

Ca15: [Engineers overseas] will be more relevant in our globalized society.

JDJV: Why would they be more relevant?

Ca15: Because they are going into different cultures and contexts. And if they are not, they are going to be failures. They may be the best engineers, but if they do not fit and work with other people, there is going to be a problem.

JDJV: So, you are saying that, inevitably, students are going to have to work in different cultures.

Ca15: Definitely. They need to get that international experience.... They will see another way of doing the same thing. And I think that will only enrich our students.

Many of my discussions in Ghana also demonstrated this category of understanding. Many of the Ghanaian interviewees saw the placement as inherently good. One interviewee immediately said that the placement was a great idea and added that:

Engineers can help bring more modern technology. Africa requires this.... Africa needs technology for development. (Gh15)

Another interviewee had similar enthusiasm, but looked at the benefits more from a community level.

I think it is very good—especially in our situation. When students go outside and practice their theory in a more practical setting, I think the communities will benefit

from their services. And the engineer will learn from the community about their practical needs and it could set an agenda for some practical research. . . . So, once you are in the community, you will find such interesting needs that trigger engineering solutions. (Gh7)

In summary, in this category, an international placement was seen as a great advantage for everyone involved.

Category 2: Placement Requires Careful Training

In the next category, the placement is seen as favorable only if careful training is provided. There are many administrative, logistical, and safety issues involved. Epprecht says that “the possibilities for worrying about young, relatively privileged, often naive, linguistically underdeveloped, and sexually curious students sent from North America to work for a short stint in the developing world are, in short, truly endless” [3]. This category examines concerns from the sending country and institution’s point of view.

The placement can be good, but we have to make sure the students are properly prepared. Communication and safety issues will have to be well thought out. (Ca5)

Other interviewees brought up the critical issue of liability when the idea of humanitarian engineering was initially suggested to them:

You will have to be very cautious on things like liability. For a university-sponsored program, you don’t want anyone who is going to be attacked. (Ca17)

This second category portrays a humanitarian engineering interna-

tional placement as a good idea if safety and other logistics are well considered: everyone benefits with proper training. International travel can often put a student at risk—overcoming these risks is critical to a successful placement.

Category 3: Placement Can Work with the Right Attitude and Dialogue

The third category of this concept adds to the previous one, except that the concerns are not just for the student and sending institution, but also for the receiving community. There are concerns over the impact of the placement, but the overriding perception in this category is that the placement can be beneficial with the right approach, including participatory dialogue. People going overseas without the right qualifications and sensitivities increase the risk of failure. Problems, to some extent, are inevitable, but with the right approach much good can be done. The following short quote introduces this category.

Depending on your outlook, you can have a real positive experience overseas, both for yourself and the other country. (Ca8)

A student’s openness was emphasized as a key component to the success of an international placement. For example, after a discussion about some of the concerns of the placement, one student stressed the importance of attitude and humility. He said that visitors cannot think they know what is best for another culture:

We should go with an open-minded approach. We should first ask, ‘What can we do for you?’ We shouldn’t say, ‘This is what you need. I have your solution.’ . . . The way you approach a discussion can really turn them on or off. (Ca7)

This next quote expands this thought:

I think [the success] really has to do with the sensitivity of all of the people involved: the senders, the receivers, and the people being sent. It really has to do with their sensitivity about positionality, about paternalism, about colonialism, about the whole constellation of things that have to do with power between people—people of different cultures, people of different genders, people working with different generational separations, people with different educational backgrounds, dominant culture, minority cultures, all of these sorts of things. (Ca1)

While understanding the engineering/development placement as a useful endeavor if the correct approach is taken, several interviewees focused on the need to remain community-centered. This of course, is related to the student’s attitude, but it does go beyond that. It is not just about asking community leaders about their needs, it is also about working to know and understand some of the dynamics of the community.

This point was stressed in some of the Ghanaian discussions. Many interviews and conversations in Ghana around the placement involved stories of failed development projects where the development agents did not understand the local culture. At the same time, there were a couple of positive stories that involved foreigners who spent the time to really understand the nuances of the community. One interviewee told a story about how an outsider endeared himself to the community because the outsider was eager to learn the language, eat the food, and get dirty by working hard and breaking through some social barriers. She gave the following advice.

Let the people feel like you are part of them. It's the way you talk to them. It's the way you make them feel. (Gh2)

The importance of the relationship between the student and the community cannot be over-emphasized. The following quote suggests that this relationship along with a strong learning attitude can help optimize the placement.

Placements can be powerful, not just for the [student involved], when there is real communication, real relationship, over what's needed. Usually, the intern is told what to do and arriving at the placement, finds out that that isn't what's really needed at all. Or, they already have people there who can do that. In real community, the student can have enough self-confidence, but also humility to say, "what can I credibly do?" ... "I'm going to ask people about how I can fit in." And so they can empower themselves to revamp their placement in response to what they were able to learn from the locals. (Ca1)

This category is concerned with a healthy understanding, attitude, openness, and approach: everyone benefits with proper engagement and participatory dialogue. If community engagement is not appropriate, the receiving community stands to suffer.

Category 4: The Placement is Most Valuable for Student Learning

In the fourth category, the international humanitarian engineering placement is seen as something that offers only a small chance to really improve a community directly, if at all, but it is valuable for student learning and awareness. The international experience offers the

students many lessons: communication, language, culture, compromise, and to fend for themselves, for example; the students will return with great personal growth. It is no surprise that students with this sort of experience are valued in the work force. In addition, the returning students are a valuable asset to their sending agency.

Opportunities already exist for engineering students at Queen's University and elsewhere in Canada to get involved in engineering and development projects during their summer months. One interviewee talked about the positive and negative impact of placements from her university on the student, the NGO, the host community, the host family, and the sending institution. She suggested that the placement did indeed create some problems, especially because of the short timeframe, but said that the learning opportunities for the student and the sending institution were great.

The real benefit is when the student comes back. Our students have to present to the major sponsors, and the first year engineering students. ... It comes down to their experience and their ability to allow others to feel the same thing that they felt, while overseas. That's where the value is. ... That's really important and that is to be counterbalanced against their effect overseas—whether they are creating some sort of cultural dependency. (Ca3)

It is ironic that the person who has the cross-cultural experience, with the intent of helping, will benefit the most, while it is questionable whether the experience will be a benefit or a detriment to the host.

A placement is really rich for the intern, but is that the point? (Ca1)

One intern discussed how life-changing an international engineering project was for him, but also identified many dangers. When asked if the great learning experience was worth the expense. He said,

Because we are not an international development agency—as... an education institution, it is from our point of view, worth it. The educational worth of sending students abroad is infinite. (Ca2)

Similarly, the following dialogue repeatedly stresses the benefit of the learning. The interviewee suggests that it is important to be explicit about the student's experience being mostly about their own learning. It is ironic to note that the student can contribute the most to the host community when he or she goes with the attitude of "going to learn."

Ca15: When you send a student overseas on a placement, it's not just an academic credit that he or she gets. She learns far more than that. ...

JDJV: You have focused a lot on the learning of the student, yet so much of this is done in the name of helping, right? The students want to help and yet you have focused on the student learning. Is there a problem here? First of all, is the student able to help?

Ca15: If anyone who works in an aid program, if he or she thinks they can contribute a lot to others, she will contribute. But actually what he or she learns is far more than he or she can contribute.... We may have some expertise, but actually, in the learning part, the person who goes gets far more than the other person gets. So I think it is better to acknowledge that at the very beginning

and say to the person, yes, I have come to help, but I have come to learn too.

While the point of this subsection was to show that the main benefit of the international placements was the students' learning opportunity, several of the quotes also alluded to the large dangers that could be associated with international placements. In some of these quotes, the interviewee discussed a tradeoff between the learning opportunities and the potential problems. The next category discusses some of the risks in more detail. The following quote again discusses the great learning benefit to the intern and mentions the tradeoff, and in doing so, points to the next category.

I think that it is obviously for the benefit of the student and not the benefit of the community. I think there is an enormous benefit to the student for going over and an enormous amount of awareness and a deeper understanding that comes from doing that kind of a placement. But there is obviously a danger in using a community as a learning tool. There's a horrible power relationship in that... It is very much a balance in how much you can justify the educational opportunity with the detrimental impact on the community. (Ca4)

Category 5: The Learning Experience Comes at a Great Cost and the Right Decision Might not Involve a Placement

In this next category, the international humanitarian engineering placement is seen as something that comes at a great cost. Cost was acknowledged in the previous category, but it was assumed that the cost was smaller than or equal to the learning benefit. This category

suggests that the cost outweighs the benefits. The complexity of this issue made it difficult for many people to suggest outright that the placement was a complete mistake, but the interviewees who showed this level of understanding could readily point out the great cost. Essentially, this category contains two groups of understanding: one that could identify the many potential problems and one that saw these potential problems as an insurmountable obstacle.

Several of the quotes in the previous categories have alluded to some of the problems of the placement: creation of dependency and power relationships, for example. The following series of quotes indicate more of the perceived potential problems. First of all, several students indicated that they did not have the necessary skills to work in an engineering and development project and were concerned that they could not do anything useful for an outside community.

I have no transferable skills that are useful to these people. What am I doing here? What kind of a pain in the butt am I? Thank goodness, I can buy groceries, so I'm not just a leech. But really, what do I have that is transferable? (Ca1)

Several undergraduate engineering students expressed the same opinions. As undergraduates, they have little practical experience, and wonder if they are even capable of good engineering. A Ghanaian interviewee talked about a problematic intern with whom he had to work. He was expecting someone with more practical skills, and the partnership did not work out.

Many respondents discussed what is sometimes known as the "ethics of whiteness." This is an assumption that the often white outsider, often with flashy technological devices, knows what is best

for an international community. Sometimes this idea is held by the white visitor, sometimes held by the local people. The white person represents a land of knowledge, progress, and technology and, as a result, demands a certain amount of respect and power. The following two quotes capture some of these extremely challenging and troubling nuances.

I think that a lot of us are still in this white man's burden mindset where we think we have some superior awareness of what needs to be done. I think we overdo it and I think that the people who go overseas are aware that we overdo it. (Ca13)

Frankly, I think there are a lot of harmful things being done. I am somewhat skeptical of many NGOs. There is a wonderful little book called *Hope for Africa* by Dr. George Kinoti, a professor emeritus from the University of Nairobi. He says, "I wake up in the morning and wish everyone would go home—go back to Europe and North America and leave us alone." We're creating a dependence. It's been very detrimental. It becomes this demotivational force and it gives people an inferiority complex. (Ca16)

The following excerpt refers to the same phenomenon and points to the danger of reinforced stereotypes. Prior to this excerpt, the interviewee had discussed many benefits for the Canadian engineering students in Ghana.

JDJV: There's no doubt that it will be great for the student, but will it benefit the community in which they will work? Is this just one more thing that the West is taking out of Africa: an exciting experience?

Gh9: ...For so long as it doesn't contribute to an improvement in the living condition of the developing country people, the Africans, then I guess, yes. But if it does contribute to improvement in the living conditions, then I say it is worth it. Even if it is something that the West is taking out of Africa, if it is contributing to an improvement in life, then it is worth it. Now, this isn't going to be the first time there is placements, so do international placements contribute to life in the developing world, that's a big question. I can well imagine that there are communities that can have their colonial mentality reinforced with the coming of interns. It is possible that the people think that these white guys are so much better than our black guys who don't do anything and they reinforce stereotypes.

Other problems included the expense and the ecological footprint of this sort of endeavor.

The expense should be a real concern. How much carbon emissions are you emitting. And where is that money coming from? Why do you have \$2000 to get a [plane] ticket to Africa? Because your dad works for mining companies that are exploiting people in Africa? It's a big issue. Unfortunately, it is not as if that money is either going to go for my trip or that it would go to farmers in Latin America. That's not a realistic choice. (Ca4)

Another interviewee saw the border-crossing component of the international placement to be intrusive, exploitive, and patronizing.

Ca2: I recognize now how dangerous my experience was for others. The impacts that my presence and project must have had on other people's lives are not by any means positive... I recognize how dangerous of a process it was—not for myself, although sometimes it was—but more for the community I sought to help.

JDJV: And how was it dangerous?

Ca2: This is a very big debate, but it reinforces the idea of neo-colonialism. This dependency on outside sources, this destruction of local self-sufficiency by the presence of outsiders who are there to help, but most often do nothing. Most often the projects fail. Beyond that we have the impact of arriving, back to our comfortable lives. To me I put myself in the shoes of the people I was surrounded by there, and I'm afraid that my presence wasn't a positive one. I didn't leave anything worthwhile really, but I did show them the wealth and prosperity that I live with and how I was somewhat separate from them and that I came with an intention to help them and really I was a salesman of the Western way of life. My presence destroyed a whole local philosophy, a whole culture, a whole way of life that prevents them from really raising themselves and that is what fundamentally needs to happen. Now if we send hundreds of thousands of students across the world it will become tourism—poverty tourism.

In the previous quote, the interviewee made reference to a well known quote from Ivan Illich's address to the Conference on InterAmerican Student Projects

(CIASP): "You cannot help being ultimately vacationing salesmen for the middle-class [North] American way of life, since that is the only life you know" [6]. In this speech, Illich talks about the dangers of paternalism inherent in any international service mission and pointedly recommends against going overseas to "help."

Despite all of the criticisms and warnings raised in the interviews, very few were willing to say outright that placements should not be part of the curriculum. One interviewee, for example, said that "unfortunately I've read very few development projects that have been successful," but when asked for a final answer, said "yes" after a bit of a pause, quoting student experience and benefits to the sending organization. This quote also captures this tension:

I'm a hypocrite when I say this because I've benefited from it, but I don't want there to be placements... I think people are going to be doing it no matter what, so if we can train people to be cognizant of all of these challenges and be sensitive and aware and conscientious when they go, we can minimize these negative impacts. (Ca2)

Most of the criticisms mentioned above have to do with the dangers of intervention in another culture. Technology itself is a cultural entity, and when it is transferred to another culture, the receiving community must adjust itself to adapt to the technology. Technology transfer is not a straightforward task and it often has a political dimension. Indigenous knowledge can be lost when confronted by imported technology, which in itself may not be negative. But when a new technology creates a dependency, while destroying indigenous knowledge, the transfer is indeed negative. While technology

can be used to meet needs, transporting technology across a border can undermine a society's ability to care for itself.

While in Ghana, many stories of failed development projects were told. In one instance, volunteers from an American university were used to build a small runway. The project was criticized because it cost a great deal of money for a short international stint, and could have easily employed local labor in a community where the unemployment rate is high. Other anecdotes included stories of latrines not used because of a cultural convention unknown to the visiting engineers, or wells that were not used because of lack of simple maintenance. Another development worker expressed frustration at the futility of actually reaching the people who were in need:

The people who don't really need the improvement are getting it. (Ca8)

The final quote of this category acts as a good summary of the fifth way of understanding international humanitarian engineering placements:

there are risks great enough to discourage many placements. It is clear that in some cases, the marginalized pay for the benefits received by the students.

The assumption of "doing good" cleans out the ethical problems associated with what we are doing. Of course, "doing good" is actually part of reproducing every sort of paternalistic relationship. Like the idea that I could do good for somebody else immediately suggests that I know what good is for them and that they don't have any agency of their own or that their agency is somehow compromised. (Ca1)

It is questionable whether the experience will be a benefit or a detriment to the host.

Category 6: Placement Must Incorporate Social Justice

In the final category of this phenomenon, the humanitarian engineering international placement is seen as a benefit to the community only if it incorporates social justice. (There are many context specific definitions for social justice, but in most cases it deals with the struggle to end different kinds of oppression and exploitation, to create social and economic equity, and to restore relationships among all people and the environment.) In spite of the negative impacts mentioned in the previous category, it is impossible to rule out placements completely, for a number of reasons.

This category adds to the previous categories: there is a learning opportunity that often comes with some costs. Whether or not the scales are tipped in favor of international placements for credit will depend mostly on the underlying principles behind the individual placements. Thus, it is difficult to either approve or condemn the placement outright because the impact depends on many complex issues, including the historical and cultural context. A couple of interviewees said exactly that:

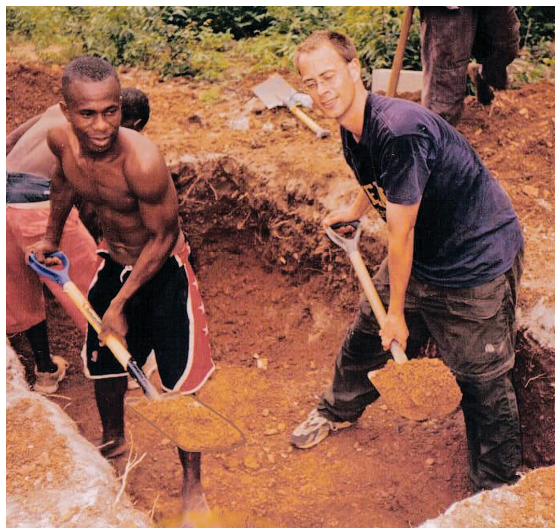
Practical experience can be a very good thing and so the placement in itself is neither good nor bad. If the student is doing a placement for [a corporation] and learns about how to be dominating and exploitive, then it is not a good placement, but it could be very positive if students could work for alternative communities. (Ca6)

Centuries of damage, including colonialization, slavery, and poorly prepared decolonialization, have caused a plethora of problems including economic dependency and the loss of indigenous knowledge. Short-term projects can do very little, but "small things with great love" can make some important changes in people's lives. The placement can inspire a lifetime commitment to create good change. On the other hand, there is important social justice work to do without ever crossing international borders.

The foreigner has arrived from overseas to exploit resources or to spread ideologies. The debate over having international placements or not having them is also complicated by the fact that opportunistic foreign investors are going to remain at their posts. History cannot be rewritten, and the forces of globalization cannot be reversed. We have already introduced much from Western culture to marginalized international communities. Whether or not it is the right technology, it is clear that technology from the West is desired, even as indigenous knowledge is being lost. How do these facts affect the argument for and against intervention? Several interviewees reflected on this:

Where I was, it was very poor and everyone had a cell phone. And most families had DVD players and their kids had no shoes. They really wanted their DVD players. It was hard for me to say you don't need a DVD player, you need clean water. I guess it is a balance because we have gone overseas and now, can we really stop? (Ca4)

Do we have the luxury of doing nothing after all of the damage done by outsiders? Indigenous knowledge has been lost. It is hard to abandon people and this is a difficult challenge, but in many cases you find that people don't want your "help" anyways.... Ideally, our focus should be on social justice, which often needs to be anti-government, anti-corporation, and often even anti-NGO. (Ca6)



Digging a hole for a septic tank in Gamoa Dago, a small coastal town near Winneba in the Central Region.

international travel, the important lesson for students is that they learn about the powers of injustice.

[S]tudents who go overseas will become critical of the development model and understand their limited role. It will give them an excellent experience that they can return to Canada with and discuss with this community. It's not all bad, but why do the privileged need to get more privileged?

Short-term projects

do go beyond the short stay in the developing community. For a student with a desire for social justice, a placement can be the catalyst for a lifetime of change. The following dialogue captures this idea.

Ca11: It is a minimal effect during their stay. It is an investment in the future.... They would do some service, but the purpose of the service wouldn't be so much helping the community so much as experience....

JDJV: And the purpose again would be so that the student would then go back and work in that community or in another community later on?

Ca11: Yes. Or that they would practice engineering with a new awareness.

JDJV: And do you think that this sort of approach deals with root causes? Is it part of the right move towards justice and equality?

Ca11: I would say it opens the right doors through which we can, whether or not we later utilize that channel is the question.

In a sense, many marginalized communities are caught between two worlds. There is a saying in First

Nation Canadian communities, that they "have each foot in a different canoe." One canoe represents the ways of the globalized world, and the other canoe represents a more traditional culture. One interviewee who was from a low-income country struggled with this concept. He said, "culture is what makes the world a beautiful place" and then later said "you can't expect people to keep all of their old values—those things have to change with the changing world" (Ca9). As a society, if we decide we do have a role, we then have to decide how to best bring these marginalized communities around us from where they are now to a place where they can be more independent. The path from our present position to this more equitable and sustainable position will not be without suffering, though, as dependencies have already been created.

There is a body of literature that suggests that the removal of unfair trade rules is much more useful than aid and development projects. (See [4], for example.) Addressing agricultural subsidies, or limiting the resource drain from low-income countries would be much more empowering, for example. There is much work to end exploitation that can be done, and while this does not necessarily require in-

They are far better off fighting the injustices that keep the poor, poor. . . . Going overseas is not intrinsically bad—the warlord in Nigeria who is getting cutbacks from Shell is not the source of the problem. You can work to change the system from many places, but the best work is to try to end exploitation. (Ca6)

It is not easy, but there is potential that both student and receiving community can benefit if effort is made to fight oppressive and exploitive forces, to create social and economic equity, or to restore relationships among all people and their environment. This sort of work is not always obvious for an engineering student working cross-culturally, but international work can inspire a lifetime of work for social justice.

Ethics of Sending Students Abroad

The hierarchy of ways in which the international humanitarian engineering placement is understood is important because this placement could be a critical component of an engineering program. Also, the ethics of sending students abroad is directly related to the

ethics of teaching engineering students about their role in providing engineering solutions in marginalized communities abroad. The overall outcome space progresses from a simplistic notion that the placement is good to a greater complexity where concerns for a receiving community can be seen. In the end, it suggests that a deeper understanding does not mean that there is a simple right or wrong approach, but that the decision making requires complex reasoning. This hierarchy suggests that it is important to weigh the many negative impacts placements can have against the possible benefits because an international engineering placement in a marginalized community for an academic credit is neither intrinsically good or bad. Reflective thinking about who benefits and who pays is critical.

There are many benefits, especially pedagogical benefits, but the list of liabilities discussed in the data and seen in the past decades also is impressive:

- 1) Cross-cultural social structures are difficult to understand.
- 2) The creation of dependency can be very damaging.
- 3) Placements can undermine others' ability to care for themselves or to demand good governance for themselves.
- 4) Adjusting cultural practices via external influence may not be in the best interest of the community.
- 5) Technology transfer is extremely difficult.
- 6) Outsiders create unequal power relationships.

Despite the significant concerns, it is impossible to reject outright international placements based on the data. International placements can create opportunities to work for greater social justice and can inspire a lifetime of working with marginalized communities. Placements can also result in positive

change, even if there is potential for damage. The success of a placement depends on the following:

- The attitude and cultural awareness of the student—the difference between a good project and a bad project may be the student's approach.
- The details of the receiving community.
- A good match between the student and community.
- Good organization, administration, and preparation.

Any engineering program considering international service placements should send students into the field with a sense of worry and trepidation. Students should be selected with great care—a sense of humility is necessary. In preparing the students, it should be stressed that the opportunity is a privilege and should not be seen as a sacrifice. The engineering student is bound to benefit, but the failures of engineering for development in history must be understood if meaningful and lasting changes are to benefit and not harm the receiving community. Smillie suggests that the failure to address the liabilities of applying technology for development should not be ignored or the receiving community will pay dearly.

One important solution to problems of poverty is technology. Unfortunately, in the hands of governments, foreign engineers, experts, amateurs, bureaucrats, corporations, and aid officials, the lessons of technology in history have been largely ignored. In the quest for sales and a search for the big breakthrough, they have colluded in one of the most expensive and tragic hoaxes of all time [14].

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