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Engineers Without Borders at Montana State University: Student-Led Engagement and Transnational Collaboration

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Abstract

The Montana State University student chapter of Engineers Without Borders USA is a student-managed partnership with the people of Khwisero, Kenya. The primary mission, to bring potable water and clean sanitation facilities to 61 primary schools and the surrounding communities of Khwisero, necessitates a long-term commitment to collaboration and cultural exchange. Engineers Without Borders has helped transform views regarding engaged scholarship at Montana State University. Students and faculty members are collectively advancing interdisciplinary, service-learning, and global action initiatives across the campus. This article describes the growth, organizational principles, and goals of Engineers Without Borders at Montana State University.

Introduction

Montana State University (Montana State) was founded in 1893 as Montana's land-grant institution. The Montana State Bozeman campus has more than 14,000 students enrolled in seven colleges. The Carnegie Foundation for the Advancement of Teaching ranks Montana State as one of 108 research universities with "very high research activity." In addition, in 2010 Montana State was awarded the Carnegie Foundation for the Advancement of Teaching's Community Engagement classification designation, which recognizes a commitment to collaboration between the institution and communities (local, regional, state, national, and global) for mutual benefit. The work of the Montana State student chapter of Engineers Without Borders USA was identified as one of 15 key partnerships exemplifying community engagement in Montana State's 2010 Carnegie engagement designation application. In 2011, the partnership between Engineers Without Borders and the people of the Khwisero District of Western Province, Kenya, was awarded the 2011 Outreach Scholarship/W. K. Kellogg Foundation Engagement Award for the Western region and, competing with three other regional winners, won the national 2011 C. Peter Magrath University/Community Engagement Award. In this article, the authors describe how the partnership between Montana State University's chapter of Engineers Without Borders USA (EWB-MSU) and the people of Khwisero, Kenya,

developed into an award-winning example of university-community engagement.

Setting the Context

The Khwisero District of Western Province, Kenya, is home to approximately 150,000 inhabitants who live primarily by subsistence agriculture. As is typical throughout rural Africa, access to basic infrastructure in Khwisero is minimal; few institutions such as schools and hospitals, and even fewer individual homes, have on-site electricity, water, and safe sanitation facilities. Although many publicly accessible springs and shallow wells are distributed throughout the region, one-way travel distance for individuals to access this water may be one mile or more, and the dependability and quality of the water is questionable. Additionally, the chore of fetching water has historically fallen almost exclusively upon women and girls. This has led to a gender disparity in terms of education because girls often miss school to fetch water.

The Khwisero District of Western Province, Kenya: Recognizing a Need for Potable Water and Sanitation Facilities

The inhabitants of Khwisero are almost exclusively from the Luhya tribe, but the region is organized around clans, sub-clans, and extended families that are often centered on the locations of primary schools. Therefore, even more than in the "developed" world, primary schools serve as a social hub. Ronald Omyonga, a graduate of one of these schools and a successful architect living in Nairobi, wished to increase opportunities for social and economic mobility and well-being for the people of Khwisero. Recognizing that education, gender equity, and community engagement coalesce around local schools, he wrote a proposal to Engineers Without Borders–USA asking for help to develop potable water and sanitation facilities for 56 primary schools in Khwisero.

Montana State University's Chapter of Engineers Without Borders

In 2002, a group of engineering students established a Montana State University student chapter of Engineers Without Borders–USA, and in 2003 accepted Omyonga's proposal for a partnership to address water and sanitation concerns at the primary schools of Khwisero. Like other Engineers Without Borders–USA chapters, EWB-MSU provides engineering services and generates financial resources for student travel and construction of facilities. But unlike other chapters, Montana State's project (working with a multitude

of schools without a pre-established local organization with the same mission) has prioritized building long-term and sustainable relationships across race, class, and cultural differences. Indeed, Montana State's chapter has embarked on an ambitious development strategy whose success depends on securing the ongoing trust of, and collaboration with, the people of Khwisero. By recognizing that successful project implementation is multifaceted and fraught with non-technical impediments, EWB-MSU has morphed from its engineering-focused beginnings nearly a decade ago, into an award-winning, 70-member, interdisciplinary, student-led organization focused on university-community engagement.

A strong commitment to fostering social change and development from the grassroots is the guiding principle of EWB-MSU's current strategy. EWB-MSU now enters every context and new project as a partner, offering technical expertise but taking guidance from the community to ensure that the expertise is both appropriate and well utilized. EWB-MSU's mission embodies a democratic reflexivity, acknowledging the power differentials inherent in partnerships, and committing to disrupting the hierarchies that often confound mainstream development work. EWB-MSU has followed through on this commitment by establishing community advisory boards and involving Khwisero community members in the decision-making phases of all projects. EWB-MSU students prepare for travel to Kenya by studying the history, cultures, and economics of the region as well as engaging in deep reflection about how their relative privilege may manifest itself in the relationships they are building with Kenyan partners.

The next section describes, more or less chronologically, how Montana State's Engineers Without Borders chapter has used a reflexive learning process, building on successes and learning from mistakes, to become a leader in student-led university-community engagement.

Montana State University's Engineers Without Borders Chapter: Program Details

In 2003, when Montana State's Engineers Without Borders chapter accepted Omyonga's proposal to provide water and sanitation to the primary schools of Khwisero, the chapter had six members (all engineering students). Few faculty members or administrators were aware of the organization's existence, and students sought financial assistance from the local Bozeman business community. Local funding allowed a two-person team to make an initial visit to Khwisero in 2004. By interviewing Omyonga, local school district officials, and headmasters of

several schools, the team concluded that potable water would best be delivered to schools via the drilling of deep-well boreholes. Additional fundraising allowed student-centered teams to return and drill boreholes at Omyonga's childhood school in 2006, and at a second school in 2007. While the chapter's membership grew to approximately 15 students and a faculty mentor during this time, the organization remained predominantly focused on technical engineering projects. Involvement by the Khwisero community happened primarily via the personal contacts of Omyonga. There was a growing awareness, however, that the scope of the project required a greater diversity of talents and perspectives, in both Bozeman and Khwisero.

Multidisciplinary Student Involvement

The 2007–2008 academic year was a turning point for the organization. Several EWB-MSU students were enrolled in the University Honors Program, where high-achieving students interact in small seminar courses about timely social, political, and economic topics. EWB-MSU began to emerge as a topic in seminar discussions. Through the fledgling success of the chapter and those seminar interactions, a larger and more diverse generation of enthusiastic students became actively involved in the organization.

Particularly noteworthy was the involvement of students majoring in sociology and in film. For example, in 2006, Jaime Jelenchick, a graduate student in film studies, traveled to Kenya with the Montana State EWB-USA chapter. She later directed and produced *The Water Carriers*, an award-winning film about a friendship that developed between an EWB-MSU student and a member of the Khwisero community. The film's premiere in 2007 sparked an even greater awareness of EWB-MSU activities on campus and in the Bozeman community. A larger and more diverse student base within the chapter allowed for an expansion of the organization's engagement mission. Sociology students, specifically, brought an awareness of the need to better understand the challenges of working across cultural and power differentials. Students also attracted two new faculty advisors—a professor of civil engineering and an assistant professor of sociology—whose commitments further fueled student enthusiasm and organizational growth.

Funding the Organization

Perhaps the most immediate organizational impact of greater student involvement and Bozeman community awareness was an increase in fundraising capacity. Fundraising became a way for

non-engineering majors to play an active role in the infrastructural development of the projects, and provided a mechanism for underclassmen to assume leadership roles. Fundraising events such as the Clean Water for Kenya Jubilee (a dinner featuring African cuisine with a live and silent auction), and the Junk to Funk Fashion Show (in which students create and don outfits from recycled material) featuring the Catwalk to Clean Water have since become annual events, which raise approximately $30,000 per year and serve to educate the local Montana community about EWB-MSU work in Kenya. The increase in fundraising has allowed more students to travel to Khwisero and to stay for longer periods (up to 5 months), greatly strengthening the base of trust and relationships between students and the Khwisero community. In summer 2008, for example, 14 students and one faculty advisor traveled there. During their stay three boreholes were drilled, and the first composting latrine was constructed.

Refining Community Needs Assessment

During this time, it became apparent that there was no mechanism for identifying which Khwisero schools had the greatest need for water and sanitation. The "community" still consisted primarily of associates of Omyonga, and the five schools with which EWB-MSU had worked. In an attempt to broaden Kenyan participation and support, the chapter established an Engineers Without Borders–Kenya Board to develop a mechanism to select schools. The ongoing membership of the board consists of nine community members representing the school district, headmasters of the first two schools that received boreholes, and members of the local health and water conservation boards. With help from EWB-MSU students, the board developed a survey, which was sent to all schools to collect information on water sources, distances to wells, and sanitation facilities. The board members analyzed the data and ranked the schools based on a balance of need and feasibility of implementation and maintenance. Then, based on the availability of funds, the board selected schools for boreholes or latrines. Board members work with leaders of the selected schools to prepare them for the ensuing EWB-MSU student team visits and construction.

Growth of the Organization

The growth of EWB-MSU has continued (Figure 1). The chapter's membership includes almost 70 students, representing all seven of the colleges on the Montana State–Bozeman campus.

Fundraising has expanded to include submitting grant proposals to national philanthropic organizations. Cumulative fundraising from the organization's founding in 2002 through 2011 has exceeded $500,000, with more than $200,000 raised in 2011 alone. A total of 89 Montana State students have traveled to collaborate with the people of Khwisero in their development efforts. Wells have been drilled at seven primary schools, and a rain catchment system constructed at another. Additional completed projects include 10 composting latrines at nine schools, a biogas latrine, and a distribution pipeline linking one of the wells drilled in 2008 to additional schools. EWB-MSU's work in Khwisero also recently added a public health element. In 2009, Montana State pre-med and nursing students pioneered an eyeglass clinic workshop, where eyeglasses donated from the Bozeman community were distributed by a Kenyan optometrist to Khwisero's schools. This has become an annual activity. Finally, an Engineers Without Borders fellows program has been created, designed to engage younger members of the Khwisero community. Fellows work directly with Montana State student travel teams, acting as guides and liaisons to the non-English-speaking populace, who are primarily older and have low levels of formal education. Water and sanitation education has come to be the core focus of interactions between students and the community. All of these initiatives have developed via collaborations between Montana State students and the Khwisero community. EWB-MSU's geographic reach now spans the entire Khwisero District (see Figure 2).

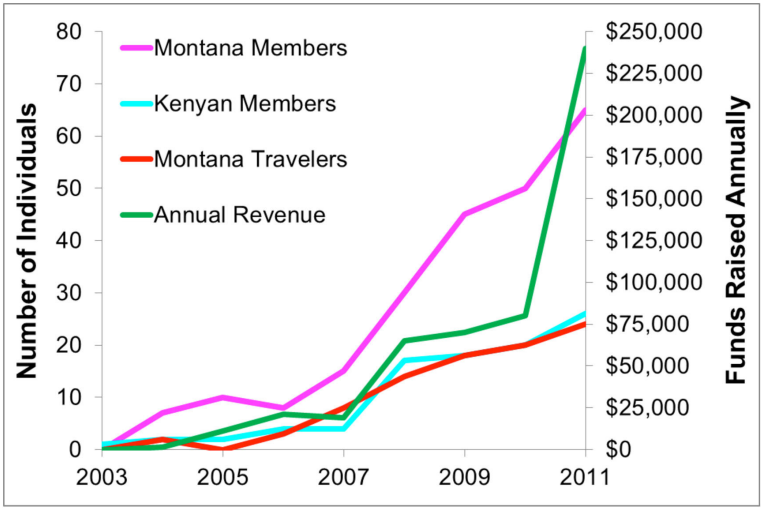

Figure 1. The growth of Montana State University's Engineers Without Borders chapter activities since inception. Note the rapid increase during the 2007–2008 academic year when the organization's focus transitioned from engineering-based service to interdisciplinary community engagement.

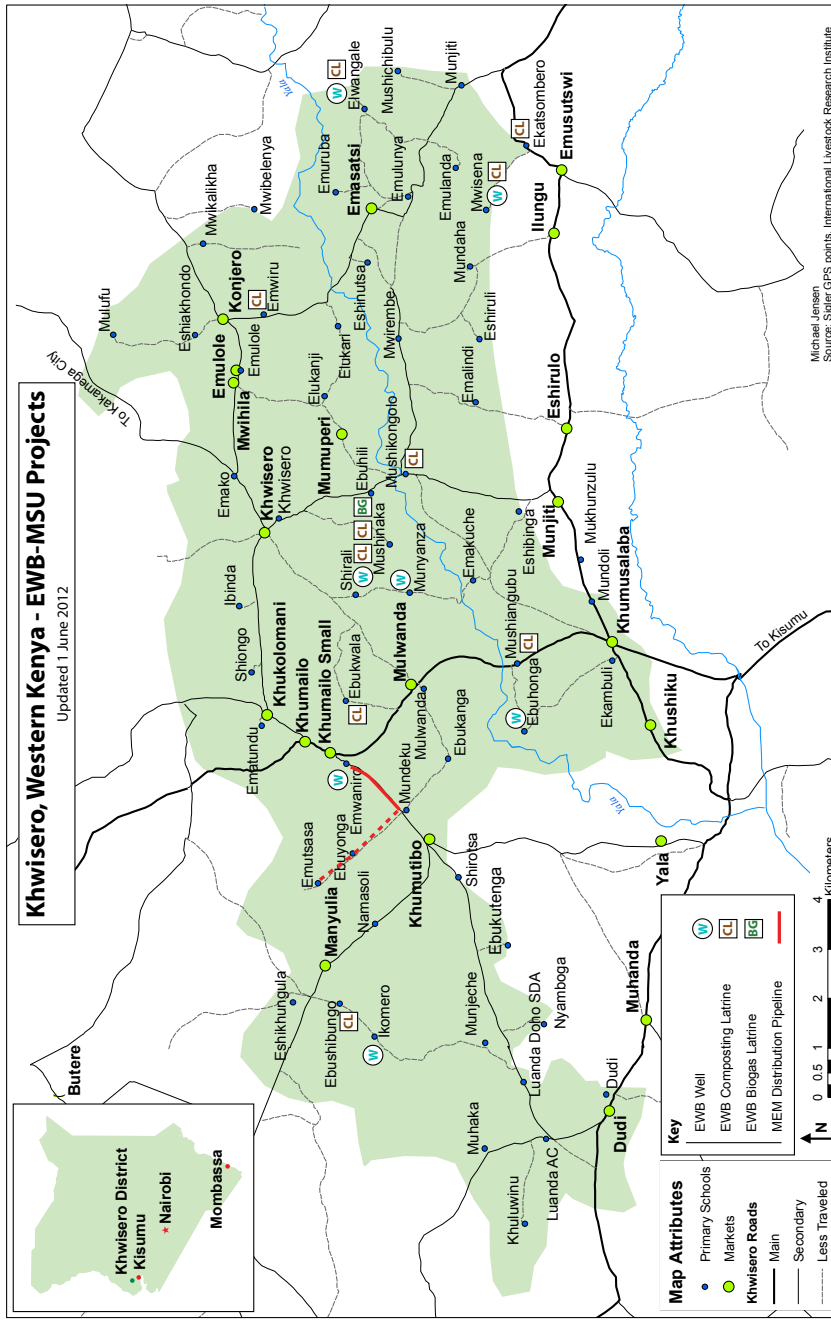

Figure 2. Khwisero, Western Kenya- EWB-MSU Projects

Core Values

EWB-MSU employs a community-based participatory approach *(Swantz, 2008)* to development work in Khwisero. The chapter entered Khwisero by invitation and continues to collaborate with local community members for the direction, method, and substance of its work. The process is often messy and iterative, and requires patience and persistence. However, the participants have learned that, at least in the context of this partnership, "messy" and "iterative" are essential to achieving long-term sustainability. The unique energy, reflexivity, and commitment of Montana State's students have been critical to maintaining patience and persistence throughout the messiness. Indeed, humility is a core value of EWB-MSU's work and its evaluation.

Practicing humility.

Humility means that members of Montana State's chapter of Engineers Without Borders are comfortable saying that they truly do not know what the best path is to sustainable development for the people of Khwisero, yet they are dedicated to working in solidarity with the people of Khwisero to figure it out *(see also Tervalon & Murray-García, 1998)*. Humility also means that they critically embrace the knowledge and wisdom of experienced scholars and development workers, and embrace the traditional knowledge and expertise of local community members. The importance of humility was not obvious at the beginning of the partnership. It took a few years for the participants to realize that things were not working as well as they had hoped, and that this was likely because *they* (the Montana State members), rather than the Khwisero community members, were dictating the managerial aspects of the partnership. Not enough was being done to engage the community.

Valuing local knowledge.

EWB-MSU experienced a turning point when its members realized the value of local knowledge. It has since been acknowledged that localized solutions, while they may not always seem like the best solutions from the standpoint of development "experts" in the global North, tend to work best in Khwisero. Members of EWB-MSU now prioritize the harvesting of local knowledge, energy, and expertise through collaboration. Additionally, they have come to celebrate sporadic tensions with their Kenyan partners as constructive power shifts.

Being attuned to power differentials.

Acknowledging the complexities of power is essential in the context of the partnership's work. Together the partners have embarked on a collaborative path with the goal of disrupting the entrenched inequalities that are the legacy of colonialism, of decades of failed "Western" development projects, and the inherited privilege of United States-born and -based educators and students *(McMichael, 2012)*. Knowing that power differentials cannot be easily or totally erased *(Dodson, Piatelli, & Schmalzbauer, 2007; Stacy, 1991)*, the partners recognize that the intimacy of true collaboration can put people at risk of being manipulated, exploited, or betrayed *(Behar, 1993)*. This is especially important to recognize in the context of Khwisero, which has a history of failed aid projects, alluded to below, that were employed by well-meaning Kenyans, Europeans, and Americans in partnership with multi-lateral and bi-lateral development/aid organizations.

The guiding principles of humility, valuing local knowledge, and addressing entrenched power inequalities direct not only the program's planning, but also its evaluation. A long-term commitment to the partnership has led to ongoing reflection.

Measuring the Impact of Montana State University's Engineers Without Borders Partnership with the Community of Khwisero

With the guiding principles outlined above as a foundation, the authors are overseeing an ongoing process to evaluate the success of work performed by Montana State University's Engineers Without Borders. Student researchers, with faculty supervision, undertake an action research approach to their work in Kenya, which aims to alleviate the traditional disconnect between social science research and praxis *(Greenwood & Levin, 2000)*. Action research entails using multiple methods, both quantitative and qualitative, to measure and explore phenomena, then using the resulting findings to guide community-based development and social change initiatives *(Boser, 2006; Cornwall & Jewkes, 1995; Kemmis & McTaggart, 2005; Maiter, Simich, Jacobson, & Wise, 2008)*. EWB-MSU employs action research with the specific purpose of ensuring that development projects are being performed in a way that is collaborative, democratic, and sustainable.

Quantitatively, EWB-MSU students have looked at the actual project outputs: for example, how many latrines and pipelines have been installed. They have employed large-scale household

surveys (n = 750) to obtain information about water usage in the community. These quantitative methods have been important for ascertaining the level of achievement of the organization's tangible, material goals.

However, many aspects of the work cannot be quantified, and are not tangible. For example, and perhaps most important, EWB-MSU members want to know how the installed pipelines and latrines, and the students' presence and work in Khwisero, have influenced the daily lives of people in the community. What do water and sanitation mean to the people of Khwisero? To this end, student researchers have utilized focus groups, interviews, and participant ethnography. In both the quantitative and qualitative approaches, they have engaged community members at every phase of data collection and analysis. In the subsections below, the specific methods used and how each method has furthered the community engagement aspects of the partnership are outlined. The student researchers who have led the assessment projects have completed human subjects training, and have had their research protocols reviewed and certified by Montana State University's Institutional Review Board.

Household Surveys

In 2008, following 4 years of informal surveying of Khwisero households, EWB-MSU began utilizing interview-assisted household surveys to gain information on the demographic and ritual usages of water in Khwisero. The goal of the surveys was to determine who collects water (gender and age), how often they collect, how far they walk to get water, and how much time they spend collecting water.

Montana State survey sociologists helped create the survey instrument. The survey was piloted among Montana-based Engineers Without Borders members who had spent time in Khwisero, and who could intuit general problems with the survey length, format, and substance. The revised instrument was translated by three of the Kenyan partners to ensure that meaning was not lost in translation. After several iterations, Montana State sociology students trained Khwisero community members to orchestrate the survey's administration.

Implementation of the survey by local community surveyors served practical and philosophical purposes. From a practical standpoint, local interviewers ensured that the survey questions were communicated clearly and accurately. Because respondents

are often more comfortable with interviewers who are "insiders," it was hoped that local interviewers would boost data reliability. More important, however, training local community members to employ the survey helped engage the Kenyan partners in the program. The community members have given critical input and feedback throughout, and were the leaders in administering the survey.

Data entry and analysis of the survey results are an ongoing project for students at Montana State, who are exploring ways to train their Kenyan partners in data analysis techniques. They are currently in discussions with sociologists at Maseno University, which is near Khwisero, to establish a research collaboration in hopes of transferring the data analysis and interpretation from Montana State to Maseno. Montana State students are also in discussion with sociology faculty and administrators at Montana State about how to develop a data analysis course focusing on the Khwisero survey data.

Focus Groups

Household surveys provide data about basic water usage in Khwisero, but survey methods are not conducive to uncovering the meaning of water usage in the daily lives of community members. Focus groups have been used to explore this question of meaning as well as to investigate how local people perceive the work and the presence of Montana State students and faculty members in their community. Focus groups are especially good for entering into conversations with those who might be uncomfortable in one-on-one interaction. They are meant to serve as a safe space for open communication and sharing, which can be especially important when there are power differentials between the researchers and participants *(Madriz, 2000; Morgan, 1988)*. Focus groups can also act as an interpretive method, in which researchers bring preliminary findings back to the community to engage in co-analysis of the data *(Dodson & Schmalzbauer, 2005)*. As a safe space and as an interpretive method, focus groups help shift power and redefine "expert," both of which are at the heart of the EWB-MSU action research approach. Focus groups are typically semi-structured, meaning that the group leader or leaders will use an interview script to guide the conversation but may deviate if a tangent is deemed important. In this way, participants influence the direction and depth of the conversation.

EWB-MSU members learned from observations over years in the community, as well as from the international development literature *(Beneria 2003; Chant, 1995; Moser, 1993)*, that women are the most important carriers of knowledge in terms of water usage and family well-being. Therefore, in 2008, EWB-MSU students, working closely with their Kenyan team members, trained the women from the community how to conduct focus groups and followed the women's lead in terms of recruiting participants. They then organized four formal focus groups, one of older women, one of younger women, and two of mixed-age women. The focus group sessions were digitally recorded, and the sociology students who were part of the focus group process transcribed each session. The transcripts have been block coded, but detailed analysis has yet to be performed. Recognizing the importance of the data from these focus groups, EWB-MSU sociology students are currently revisiting their analysis, coding for key themes in the development literature such as sustainability, empowerment, gender division of labor, and sense of community ownership. They are also coding for themes that they have observed during their work in the development field. These themes include aspirational shifts, public health knowledge, and generational knowledge transmission.

EWB-MSU members recognize the critical importance of ongoing qualitative data assessment to the success of their project. They have come to realize that project barriers are more often social than technical, and that only through an in-depth understanding of community attitudes, aspirations, and concerns about water usage will the project be able to reach its full potential, and, most important, be sustained. A formidable challenge to assessing the impact of the project has been finding the space and time to step back from the hands-on engineering work to reflect on what has been done thus far, and then to determine whether or not the current direction of the partnership needs altering. Assessment is a top priority for the 2012–2013 project cycle.

Participant Ethnography

A third method employed to better understand the outcomes of the partnership has been ethnography, a method of in-depth observation *(Gobo, 2008)*. In participant ethnography, students take part in the rituals and situations that they are observing. Unlike typical participants, ethnographers take in-depth field notes on their observations, staying deeply attuned to the sights, smells, sounds, and emotions of a situation. Basically, ethnographers pay hyper-attention to their environment, and they record their every observation *(Hesse-Biber & Leavy, 2011)*. At its inception, and through

much of the 20th century, ethnography was a colonialist project, in which anthropologists from the "West" spent extended periods of time trying to understand the "exotic" peoples in developing countries. EWB-MSU members recognize the Eurocentrism inherent in traditional ethnography, and approach their observations reflexively, understanding that they are viewing the lives of people in Khwisero through a specific lens. Significantly, they have entered social contexts only upon invitation, and with full disclosure of their desire to better understand the workings of the community.

Following these ethics, sociology and anthropology students from Montana State have embedded themselves in certain households and rituals in Khwisero in order to intensively observe the relationships between water collection and use, and Kenyan daily life. In all cases involving such participant observation, the students have obtained consent from those being observed.

In the summers of 2009 and 2010, anthropology and sociology student Megan Malone undertook an ethnographic study of the ritual of water carrying in Khwisero. She closely followed three women through their daily routines. In addition to observing them and participating in their routines when appropriate (Megan learned early on that water carrying is a strenuous physical task, and shifted from participation to observation to interviewing about water carrying as her time in Kenya went on), Megan assisted the women in keeping weekly time diaries in which they documented how they spent each hour of the day. Megan worked with each woman to conceptualize time in a way that made sense to each. For example, instead of saying "from 6 a.m. to 8 a.m.," they documented what they did between "sunrise and breakfast."

Megan worked with each woman to analyze the time diaries. These diaries became platforms for in-depth discussions about the meanings of "work" and "free time." The combination of diaries, observation, and interviews provided rich data about the centrality of water collection in the lives of women and girls in the community.

In 2010, Eric Dietrich, a civil engineering student, was funded through Montana State's Undergraduate Scholars Program to perform an ethnographic study of the attitudes of local Khwisero residents toward community-based development methods. Through his observations, he uncovered layers of sociological and psychological complexities, which he tied back to colonialism and decades of failed development projects. His study gave program participants a better understanding of how important history is to current development efforts. Indeed, gaining deeper knowledge about the outlooks and thinking of the Kenyan partners has

strengthened the students' commitment to and respect for the Khwisero community.

Preliminary Findings

By triangulating their methods, student and faculty researchers from Montana State's chapter of Engineers Without Borders have begun to identify community needs in Khwisero as well as the potential obstacles and opportunities for meeting these needs. Equally important, the students' commitment to reflexive critical thinking has brought attention to the ways in which EWB-MSU members' work in Kenya has had an impact on Montana State University, as well as what still needs to be done to make the relationship between Montana and Khwisero stronger and more fruitful.

Impact on the Khwisero Community

The quantitative surveys show that as a direct result of Montana State's Engineers Without Borders work, 3,500 Khwisero students, teachers, and staff now enjoy immediate access to clean water and sanitation facilities. The surveys also suggest that surrounding communities are also utilizing the wells, meaning that thousands more enjoy the direct benefits of a clean water supply. Ethnographic observation and data from the focus groups suggest that for some Khwisero youth, the time they previously spent fetching water is now spent in school. Follow-up surveying and in-depth interviewing is needed to measure how widespread the impact of the wells has been on educational participation. More research is also needed to further explore the gender impact of the water projects. Researchers hypothesize that because fetching water is the traditional role of women, gender equity in education is being enhanced. A second and related hypothesis is that because water is now hand-pumped rather than fetched, boys as well as girls participate, further fostering a culture of gender equity.

Ethnographic observation has lent strength to both hypotheses, yet surveys are needed to test them. A new round of surveying in summer 2013 will focus on generational and gender aspects of water usage. EWB-MSU researchers also intend to employ a time-diary method *(Heymann, 2000)* to better quantify the time shifts that have occurred from water collection to schooling, and to better understand how these time shifts break down by age and gender.

As noted above, Khwisero has been scarred by decades of failed attempts by aid organizations to enhance access to potable water. Most schools have broken rain collection systems, and

dozens of hand-dug wells stand abandoned due to lack of maintenance, vandalism, or stolen pump components. Most residents do not even remember which aid organization developed these projects. Student members of EWB-MSU recognized early in their work that a lack of community ownership was a major contributing factor to past failures. This recognition was confirmed by the focus groups and ethnographic research done between 2008 and 2012, in which Khwisero residents deferred to U.S.-based Engineers Without Borders "experts," and expressed doubt in their own abilities. Interviews, focus groups, and ethnographic observation also brought to light a lack of understanding of and enthusiasm for volunteerism. Frantz Fanon *(1963)* in his scathing critique of French colonialism in Northern Africa, emphasized that the psychological scars of colonialism are as important to the well-being of people in "newly independent" nation-states as the physical trauma of colonialism. These psychological scars include damaged individual psyches from centuries of colonial oppression and messages of native inferiority. This theme surfaced predominantly in Eric Dietrich's formal and informal field interviews. He also learned through his field research that traditional development projects compounded local peoples' feelings of marginalization and disengagement.

To subvert the top-down practice of past development attempts and in an attempt to heal colonial scars, EWB-MSU participants engage in grassroots collaboration, living and working in Khwisero, alongside their Kenyan partners. In this spirit, EWB-MSU leaders from Montana and Kenya have also instituted barazas, or local meetings, to encourage local farmers, mothers, and other lay people to take leadership positions in EWB-MSU's projects. This has instilled pride in the water projects, which has inspired local community members to take responsibility for maintaining safety of the wells and water. Through all of these efforts, the Engineers Without Borders–Khwisero partnership is working to rebuild community ties that were eroded by the apathy, corruption, and cronyism that are the legacy of paternalistic development efforts *(Easterly, 2006)*. Omyonga states,

> When we see Montana State students come here and work so hard, it means that somebody cares about us, so we must be friends. And it shows us we can do more for ourselves. A wonderful cultural exchange comes about when we play, work, and stay together. *(R. Omyonga, personal communication, 2010).*

Today, evidence of increased Khwisero community engagement abounds, and includes the nine-member Engineers Without Borders–Kenya Board. Individual schools must apply to this board for EWB-MSU assistance, ensuring that those schools are able to maintain a project. Water-user committees at schools collect nominal fees to pay for repairs, and residents volunteer for training in well and latrine maintenance. Some school communities have organized so successfully that they have independently constructed composting latrines. The Engineers Without Borders–Kenya Board, in collaboration with EWB-MSU members in Montana, successfully petitioned the local Minister of Parliament for a cost-sharing agreement on the pipeline constructed in 2011. Jackson Nashitsakha, a farmer and member of the Engineers Without Borders–Kenya Board, organized his local community, and successfully applied for an additional Kenyan government grant to develop another water distribution pipeline.

Perhaps the greatest evidence of EWB-MSU's impact on the community comes from the intense bonds that have formed between EWB-MSU students and Khwisero residents. For example, Nashitsakha named his daughter Megan, in honor of student Megan Malone. In contrast to traditional development projects that operated on short timelines, EWB-MSU is committed to being in Khwisero for many years, continuing to foster cross-border collaboration.

Impacts on the Montana State University Community

The regional, and now national, recognition of EWB-MSU has enhanced Montana State's recruitment success, opportunities for students, student research, service-learning, interdisciplinary collaboration, and local community engagement. It has also given Montana State students and community members a better sense of themselves as citizens of an increasingly globalized world.

Recruitment.

EWB-MSU has helped recruit students. Notably, the number of female EWB-MSU members is higher than the number of women in the overall demographic profile of the College of Engineering. Several EWB-MSU students have indicated that exposure during recruitment, or in some cases via high school satellite chapters that EWB-MSU has developed, was a major reason for selecting Montana State above other institutions.

Opportunities for students.

The overall scholarship of EWB-MSU students is above the institutional average; many are part of the University Honors Program and are recipients of prestigious academic awards. The leadership of EWB-MSU students extends beyond organizational boundaries. EWB-MSU students also serve as officers in ASMSU (Montana State's student government body), are editors of the student newspaper, lead initiatives to develop curricula germane to the organization's outreach mission, and have represented the university at state legislative sessions. For example, Joe Thiel, a former Project Manager of Engineers Without Borders,was selected as the student representative to the Montana University System Board of Regents in 2011. Katy Hansen, an EWB-MSU graduate, became a Rhodes Scholar, and another, Hillary Fabisch, a Gates-Cambridge Scholar. Two others were Truman Scholarship finalists. In short, EWB-MSU has become a mechanism for Montana State to recruit, retain, and engage nationally recognized students of the highest caliber.

Student research.

Students in several majors have dedicated their time in Khwisero to conducting research through the Montana State Undergraduate Scholars Program. Select engineering and sociology classes now incorporate EWB-MSU goals in their learning objectives. For example, members of the EWB-MSU student board acted as clients in a civil engineering capstone course. The students proposed a problem requiring an engineering solution (in this case, getting water to a school identified as a high priority by the Engineers Without Borders–Kenya Board but for which a well was geologically impractical). The capstone course's students worked in teams to design alternatives. The EWB-MSU students subsequently presented the alternatives to the Khwisero schools' management committee, which adopted a rain catchment system for implementation. The system was built in 2011.

Service-learning at Montana State.

Indeed, EWB-MSU has been a leader in service-learning on campus, pushing beyond "service" to global action. Engineering and sociology students now study engineering and international development theories, and link them to the work they are doing in Kenya. In the words of social scientists, students are linking theory and practice, and in doing so they are not only providing a service (certainly building water systems is a service), but also engaging in

a transnational, transcultural collaboration. Thus, the service component of service-learning in the EWB-MSU model is happening transnationally and collaboratively. All parties are serving, and all parties are learning.

Interdisciplinary collaboration.

EWB-MSU has also become a model for interdisciplinary collaboration. As an example, in spring 2011, three professors (a sociologist, a civil engineer, and a professor of modern languages and literatures) piloted an interdisciplinary class, Engineering in a Global Context, in which students preparing for travel to Khwisero studied the history, politics, and cultures of Kenya as well as the components of community-based development approaches.

Local community engagement.

EWB-MSU members have engaged the local community through several innovative fundraising activities, increasing Montanans' awareness of conditions in Khwisero and the global south. Members have constructed engineering displays at the Bozeman Children's Museum, helped develop a Dinosaur Playground at the Gallatin County Regional Park, constructed three handicap access ramps and a playground on the Crow and Northern Cheyenne Indian Reservations, actively participated in outreach programs (e.g., Science Olympiad, Bridges and Dams K-12), set up workshops for Montana State Extension 4-H Congresses, and developed a pen-pal program between grade schools in Khwisero and Gallatin County, Montana. EWB-MSU students also routinely mentor regional K-12 school youth. One EWB-MSU high school satellite chapter raised over $25,000 for the boreholes in Khwisero. Two Bozeman High School students traveled with EWB-MSU to Khwisero in 2009, and two more again in 2010. In 2012, EWB-MSU students began working with the Crow Nation to test well water quality across the reservation. In summary, EWB-MSU students are fond of saying that they are engaged in "a social project with an engineering component."

Conclusion

Montana State University's Engineers Without Borders organization did not start as a top-down university initiative. After the tremendous growth of the organization, and the increase in the diversity of participating students, the organization came to be recognized on campus as one model of university-community

engagement scholarship. The Engineers Without Borders–Khwisero partnership has since had a transformational effect on the Montana State community.

In 2010, President Waded Cruzado arrived at Montana State with a passionate commitment to invigorate the university's engagement mission, asserting it as central to the university's identity and responsibility as a land-grant institution. EWB-MSU was positioned perfectly to take a leadership role in this endeavor. The administration responded by showcasing EWB-MSU in institutional development initiatives. For example, the organization was one of several community-based initiatives that were recognized by Montana State in seeking the Carnegie Community Engagement Classification designation. The energy and excitement that EWB-MSU brought to the campus and community led Montana State administrators to nominate it for the 2011 Outreach Scholarship/W. K. Kellogg Foundation Engagement Award (Western region). A newly established leadership and engagement working group will provide advice and recommendations for the development of an organizational structure needed for future growth and success of community engagement scholarship on campus.

The success of EWB-MSU serves as a model for partnerships between universities and communities. Three lessons have been learned from this program that may be helpful to readers in creating university-community partnerships: the importance of student-led initiatives, of interdisciplinary collaborations, and of building long-term relationships with the community partner.

Student-Led Initiatives

It is important to note that the current success of Montana State's Engineers Without Borders chapter was not created from a strategic plan, a faculty initiative, or an established organization within the Khwisero or Montana State communities. In 2003, it would have been easy to conclude that success was highly unlikely (in fact, the lead author so concluded at the time); the collaboration seemed nothing more than one man's dream to improve conditions in his birth community and the naïve but passionate interests of a group of students half a world away. But that initial analysis ignored what was, and still is, at the core of EWB-MSU's success: the unbridled enthusiasm of a self-selecting set of students willing to work as a team for a cause in which they believe, and their ability to draw others, including peers and appropriate mentors, to their cause. The story of EWB-MSU's success is really a story of how students

can use experiential learning, and adapt, incorporate, and apply lessons learned to meet their engagement goals. An important lesson for faculty and administrators is that successful community engagement can be achieved by allowing appropriately motivated students the latitude to define the community with which they want to work and how they will work in the community, hence allowing students the space to make mistakes—true experiential learning—while providing guidance to keep mistakes to a minimum. In fact, experience suggests that allowing students to be at the forefront of the EWB-MSU project more effectively engages the community, as students' altruism and genuine humility lay an organic foundation for trust and mutual learning.

All EWB-MSU decisions are made by a student board, elected by student members. A faculty advisor serves as a board member. This board communicates on a weekly basis with the Engineers Without Borders–Kenya Board to plan future projects and develop better integration of student travel teams within the Khwisero community. This arrangement has created student leaders with the confidence to push for the integration of service and global learning initiatives into their programs of study, and has given students insight into how to make these initiatives more effective. In response, administrators have invited EWB-MSU leaders to sit on academic committees charged with improving outreach education.

Indeed, the community engagement of the Montana State chapter of Engineers Without Borders offers a model for successful student-led, university-community engagement. The model requires that the university provide the students with

- a forum for students to connect with communities;
- support to build a long-term community partnership;
- resources to foster leadership skills; and
- academic guidance and support to meet the engagement objectives they and the community have identified.

In short, the university must allow students and community partners the latitude to mutually define the goals and objectives of the engagement. The university provides the support structure and resources that are critical for the relationship to flourish. In the Montana State–Khwisero partnership, community members and faculty members without direct ties to EWB-MSU continue to respond enthusiastically to student passion and leadership.

Interdisciplinarity

The experience of EWB-MSU points to the importance of nurturing true interdisciplinarity. Although there is discussion within the disciplines of engineering and the social sciences about the need for more interdisciplinary collaborations, it is still rare for engineering students and faculty members to engage directly with social science students and faculty. And yet, when the space is created for this to occur, exciting things happen. Students and faculty can literally begin to see the world in new ways. This is not to say that interdisciplinary work is not messy. It is! But out of the complexity of such collaborations emerge new and more sophisticated lenses through which to analyze problems and strategize solutions.

Long-Term Relationships

Finally, a significant lesson to glean from Montana State University's Engineers Without Borders experience is the importance of building long-term community partnerships. EWB-MSU's relationship with Khwisero, Kenya, has evolved over 8 years. The Kenyan partners know that Montana State is not going anywhere. The partners share mutual commitment to each other that has provided the space to develop the partnership organically. When tensions arise over decision-making processes or project priorities, this long-term commitment provides the security to have the difficult conversations that true collaboration necessitates. It is often due to these difficult discussions that the partnership evolves to the next level. Because of the trust and commitment by both partners, they are able to challenge each other, to allow project roles to shift and leadership to change. For example, today empowerment is happening in Khwisero, where enthusiastic new leaders are emerging who are affecting traditional decision-making processes and structures. It is because of mutual commitment that power can and does shift, and when this happens, true engagement is under way.

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