Where is "Community"?: Engineering Education and Sustainable Community Development

Jen Schneider
Division of Liberal Arts and International Studies
Colorado School of Mines
Golden, CO

Jon A. Leydens
Division of Liberal Arts and International Studies
Colorado School of Mines
Golden, CO

Juan Lucena
Division of Liberal Arts and International Studies
Colorado School of Mines
Golden, CO

Abstract

Sustainable development initiatives are proliferating in the US and Europe as engineering educators seek to provide students with knowledge and skills to design technologies that are environmentally sustainable. Many such initiatives involve students from the "North," or "developed," world building projects for villages or communities in the "South." Sustainable development projects in engineering education are being lauded for meeting multiple educational outcomes and providing students with important international training. This paper argues that such programs need to educate students to think critically about their role as development professionals, to understand and value the role of community in development projects, and to develop long-term assessment criteria for such projects. It argues that engineering educators need to meaningfully engage the "community" in sustainable community development.

Introduction

In a 2006 publication, William Easterly examines the past half century of international development aid efforts, efforts in which the "developed" world attempted to develop the "underdeveloped" portions of the world. The results, Easterly concludes, are a "tragedy": "…the West spent $2.3 trillion on foreign aid over the last five decades and still had not managed to get twelve-cent medicines to children to prevent half of all malaria deaths […or to get] four-dollar bed nets to poor families […or to get] three dollars to each new mother to prevent five million child deaths…. It's a tragedy that so much well-meaning compassion did not bring these results for needy people" ((Easterly 2006), p.4).

Why were these well-intentioned development efforts not just a failure but a tragedy? Easterly responds by contrasting the approaches to development of "planners" and "searchers," noting that the former uses top-down methods and treats poverty as if it were "a technical engineering problem that [planners'] answers will solve" (Easterly, 2006, p. 6). In particular, these answers do not incorporate homegrown, local knowledge in conceiving issues or solutions. By contrast, searchers undertake numerous strategies to understand the community, including actively seeking out feedback from multiple stakeholders and putting in place mechanisms to make diverse stakeholders accountable for their development results.

Although a full treatment of the multiple, complex factors that contribute to development failures is outside the scope of this article, we focus here on one significant factor: community. That most development projects have been more recently renamed "sustainable" development projects can be a step in the right direction. Sustainable

development is frequently defined as "development that meets the needs of the future without compromising the ability of future generations to meet their own needs" (1987). Engineers clearly have an important role to play in sustainable development projects, and there are a growing number of engineering education initiatives that claim to educate students in this area. However, we contend that projects laying claim to sustainability often ignore key components of long-term, intergenerational meaningfulness by ignoring significant community involvement. In engineering education, students involved in sustainable development projects are rarely offered substantial theoretical, historical, or practical education in development studies or community interaction. Thus, this article accentuates a missing link in sustainable development (SD) efforts, by foregrounding the concept of sustainable c*ommunity* development (SCD). One purpose here is to address some tensions among engineering education projects that may intersect unknowingly with problematic practices of development, as they are outlined in the introduction to this special issue of *EJEE* (Lucena and Schneider).

Why emphasize community?

We advocate that engineering educators make the shift from thinking about SD projects to thinking seriously about SCD projects. To accentuate why community is a crucial element in SCD, we borrow the words of two engineers involved in development work. These engineers' perspectives provide insight into why many development projects fail, despite good intentions, ample funding, and expert qualifications of development professionals.

In an interview conducted for another research project, one engineer told us about the patterns he saw in failed development projects:

> And [in the 1960s and 70s], I was finding out that […] all the millions and millions of dollars that the World Bank had given to these countries or loaned to these countries, was lining the pockets of the upper twenty percent […] but it wasn't helping the poverty-stricken people in the villages. In fact, poverty was increasing, not decreasing. So I kept thinking, 'Well, what is it that needs to be done differently?'
>
> Then one of our graduate students […] in civil engineering in water resources had gone to work for Camp, Dresser and McKee, which is a very fine engineering firm mainly on the East Coast. And Camp, Dresser and McKee put in a proposal and [the United States Agency for International Development] funded them to put in water supply and sanitation in many villages because half of the children who were dying before the age of six [were dying] because of water-related diseases. And it was usually they'd have dysentery […]. So that made the United Nations declare the decade of the 1980's as the water supply and sanitation decade. Well, this fellow […] was one of our graduates, and he and I happened to be on a national committee together, an engineering committee, and we met once a year, and he was always telling me all the wonderful things that they had done, hundreds and hundreds of villages that now had a clean water supply and sanitation. And that ended, of course, in 1990, the decade of the 1980's.
>
> Five years later, in 1995, they conducted a survey, and found that only thirty percent of those [water systems] were still in operation. And then in the year 2000, they did a survey, and found that only twelve percent were still in operation.

Similar problems in development work are echoed by Stan Burkey, another engineer turned development professional (Burkey, 1993). Among multiple examples, Burkey describes an agricultural development project involving 25 full-time staff from a prominent nongovernment organization (NGO) and investments of roughly US $3,000 per family and $200,000 in silkworm propagation. On his visit, Burkey saw

> two-acre allotments, each with a small, rather dilapidated hut made completely of plaited palm fronds (*cadjans).* Around the huts were rather parched areas of weeds and the remains of previous crops […]. The two factories were not in operation, and there was no sign of any silkworm propagation. After three years, it didn't look very prosperous.
>
> Suddenly, just before the administration compound, we came to an allotment which looked like an oasis. There was a large wattle-and-daub house with a sheet-iron roof. The house was surrounded by tall, thick banana trees. There was an open-pit well about 10 metres from the house. Dispersed over the allotment were fairly mature mango trees and young coconuts. The two acres were

> completely planted with chillies, *brinjal* (egg plant), lady's fingers, and cowpeas. The farmer was watering his brinjals from his own hand-dug well with a small kerosene-fuelled pump. It was beautiful.
>
> I turned to the project administrator and said, 'That fellow is really doing well. He must be one of your best settlers.' The project administrator gave a little snort of a laugh and replied, 'He's not in the project! He borrowed some money privately and has done all that himself.' (p. xv).

The accounts of these two engineers illuminate critical missing links in these and many other development projects—the role of community.

Community Matters

To return to these two engineers, we need to examine why, from their perspective, these development projects were unsuccessful. The first engineer said that

> [The engineers at] Camp, Dresser and McKee were paid for the number of jobs they did and you didn't take time to really explain everything and train those [local] people to operate and maintain those systems. You just put [the water systems] in for them and shook their hands and left. […]
>
> I kept going to these villages years after we did [a post-development project] study, and it was obvious that the only way that you were going to be successful was to get the people to do it themselves. […]
>
> You can't build a sustainable community on one sector. You have to have education, you have to have health, you have to have business and investment and micro-credit, that sort of thing, in order for villages to be self-sustaining and self-reliant […].

Burkey's emphasis is similar in accentuating the vital role of community ownership and self-reliance of community development projects:

> Those who had purposefully stayed out of the project were the ones who had progressed. Yet the project staff all talked about 'self-reliance' and 'people's participation.' […] But the reality was that the projects and its staff had planned and organized everything themselves, and the participants had only 'participated' in carrying out the instructions of the staff. (p. xvi)

One response to such failures is to address the way in which development workers are trained and educated, whether in science, engineering or other fields. Scientists and engineers may play an important role in development projects, and yet their training is often limited to technical problem-solving approaches, approaches that may lead to the types of failures mentioned above wherein the engineers "plan and organize everything themselves." This approach, frequently, will be neither sustainable nor successful.

Have Engineering Educators Embraced the "Community" in SCD?

A significant number of programs committed to sustainable development education exist within and outside the US, and many of these programs require education in the role science and technology play in shaping society and vice versa (e.g., (Mulder 2006). Others suggest that sustainable development partnerships can be built and sustained with partnerships from industry (e.g., (Shafer and Richards 2007). Still others argue that multi- and interdisciplinary learning in sustainable development and design can improve student creativity and other positive learning outcomes (e.g., (Morris et al. 2007). Such initiatives are supported by the "Declaration of Barcelona," which emerged from the 2004 Engineering Education in Sustainable Development (EESD) conference in 2002. That Declaration cites several skills today's engineers must have, including an ability to analyze social and environmental impacts and adapt technologies to "sustainable lifestyles."

What we would like to see more of, however, is education directed at the final bullet of the Barcelona Declaration, which calls for engineers to "Listen closely to the demands of citizens and other stakeholders and let them have a say in the development of new technologies and infrastructures" (2004). Without attention to this point, engineering

education in SD may continue to be a winning proposition for engineering students from the North, and a potentially losing one for the communities—usually in the South—that these projects seek to serve. Donna Riley, writing about the failures of engineering for SD projects, writes that "critical thinking about adverse impacts or the social context and cultural impacts of projects is often lacking" (Riley 2007), p.4). As a result, we fear that Riley's concern, that the "intended beneficiaries" of SD are not helped at all, may become increasingly common. As recent research has indicated, some development projects have done more harm than good (Easterly 2006; Jackson 2005).

Recently, there have emerged encouraging developments in transforming engineering practices towards meaningful participation by communities. For example, a group of social scientists in Belgium and Ecuador have begun to conceptualize knowledge development between engineers and indigenous farmers, showing how a project between engineers and communities that began as a top-down approach can actually be transformed and improved "as the stakeholders gradually contextualized their knowledge creation, bridged the boundaries of the involved communities in practice by engaging mutual knowledge, and shared tacit knowledge by engaging in common practices with concern for the quality of relationships" (Dewulf et al. 2005), p. 175). This research of the evolution of engineering practices into true partnerships with communities is receiving increasing attention by the Flemish Interuniversity Council (VLIR), which is funding a larger project on participatory development of technological innovations for sustainable natural resource management. Another encouraging sign comes from engineers in the field who have learned to listen to and incorporate communities in participatory action (Burkey 1993).

In Europe, a number of organizations aim to integrate sustainable development and engineering. The following description of their efforts is partial, but provides a sense of the energies being put toward SD initiatives in engineering education in Europe. The Environmental Engineering and Engineering (EEE) Network, active primarily in the 1990s, arose from the European Commission's education and training programs. Its objectives were to create networks among educators, industry professionals, and government to foster educational initiatives in sustainable development (1999). From 1998-2004, Britain's Royal Academy of Engineering began the "Visiting Professors' Scheme," which sponsored the development of sustainable development case studies. These case studies were embedded in engineering design courses across Britain (Foxley 2007). The scheme released a report in 2005 called "Engineering for Sustainable Development: Guiding Principles" (Dodds and Venables 2005). Two of the guiding principles put forth are to "seek engagement from all stakeholders" and to "make sure you know the needs and wants" (27). In 2006, EESD, the same group responsible for the Barcelona Declaration, issued a report on the status of European engineering education for sustainable development. That report, sponsored by four universities worldwide, is based on a survey of 51 European Universities, and finds that "there is no European University that shows significant progress in EESD to be considered an inspiration." However, of the 51 universities, nearly half are making progress in EESD by "taking steps to embed sustainability in research, in education, and in the university environment" (Observatory 2006), p. 3-4). It is not clear from the report, however, whether these steps include substantive education in community interaction and involvement.

In the United States, numerous SD educational initiatives are involving engineering students in projects abroad. Most involve some sort of travel component, wherein student groups spend anywhere from two to six weeks in the host community, talking with, learning from, or surveying those communities (e.g., (Frankman et al. 2007; Gephardt et al. 2007; Paterson et al. 2007). These experiences obviously have value for students participating in such programs, though it is unclear—beyond some preparatory language or "culture" courses—whether these students receive training in participatory action research (PAR) or other community engagement approaches (e.g., Salmen & Kane, 2006). While these initiatives hold great promise, more analysis of the many SD projects proliferating in engineering education remains to be done. The long-term viability and outcomes of these student development projects abroad has not been studied.

We do know that there are important gaps in student knowledge with regard to sustainability. In 2002, University of Sydney researchers developed a matrix for assessing and analyzing "expert knowledge" of sustainability among engineering students (Carew and Mitchell 2002). Using the matrix, they found that 65% of their students held "pre- or uni-structural conceptions" of sustainability, and believed this was cause for concern. The findings of this small-scale study were replicated by a larger survey study, completed by Azapagic, Perdan, and Shallcross (2005), which argued that despite the growing number of SD initiatives in engineering education globally, "overall, the level of knowledge and understanding of environmental and sustainability issues by engineering students is not satisfactory and that relatively large knowledge gaps exist." These knowledge gaps include components of sustainable development (economy, society and the environment); approaches to sustainable development; the precautionary

principle; inter- and intra-generational equity; and stakeholders' participation (Azapagic et al. 2005)13). Although the survey did not target students specifically involved in SD initiatives, the overall findings may suggest that too few students are being reached by SD initiatives, or possibly that SD initiatives are not accomplishing as much as we might hope. We have found this to be particularly true in the case of Azapagic et al.'s last "knowledge gap" regarding stakeholder participation, which we find is often absent from SD engineering education.

This begs the questions: why should engineers and engineering educators care about SD? What is at stake? One answer to the first question, as we have seen, seems to suggest that SD projects are ideal for teaching students appropriate competencies, such as those laid out by accrediting agencies like the US Accreditation Board for Engineering and Technology (ABET) (Manion 2001; Phillips et al. 2007). In the United States, engineering universities must receive accreditation from ABET, which plays a formative role in shaping curriculum. In 2000, ABET adopted a new set of accreditation criteria, known as EC2000, which required that students demonstrate abilities to understand the social and global impacts of engineering systems, ethical responsibilities, and "knowledge of contemporary issues," among others. SD projects are frequently ideal for demonstrating ability in these areas.

Another answer has to do with competitiveness: Szymkowiak argues that "sustainable development is destined to become an inescapable dimension of the management of industrial systems" and as a result must become a central concern of engineers (Szymkowiak 2007), p. 180). And still another answer is that engineers have an ethical obligation to redress poverty, inequality, and environmental damage: "While engineering is a profession with a strong ethical dimension…there has been until very recently no reference to addressing two of the most important issues of our times--poverty and underdevelopment and environmental degradation…[I] believe that we, as engineers, need to change the way we envisage our profession" (Catalano 2007), p.2).

An equally important question is, why do engineering students and educators have difficulty teaching or facilitating stakeholder participation? One answer lies at the heart of the engineering curriculum in the engineering problem solving method (EPS). As research by Downey and Lucena has indicated, EPS is *not* neutral with respect to incorporating a diversity of perspectives,

> but has the unintended effect of predisposing engineering students to not value diversity in the first place…. One consequence is that some students emerge from engineering curricula knowing that engineering problems have either right or wrong answers, that the chief metric of ability is the frequency one is right, and that difference may be an indicator or error. In the process, such students have acquired solid grounds, seemingly mathematical grounds, not to trust the perspectives of co-workers [stakeholders, community members, etc] who define problems differently" (Downey and Lucena 2006).

From Humanitarian Engineering to ESCD at CSM

Our own experiences in SD education at an engineering university have led us to grapple with exactly these issues. Virtually all students at the Colorado School of Mines (CSM) study engineering or applied science. The Humanitarian Engineering Ethics team at CSM has been working under the auspices of a Hewlett Foundation Grant and a National Science Foundation (NSF) grant in Ethics Education in Science and Engineering, and has just completed its first year of curriculum building in Humanitarian Engineering Ethics (HEE), including teaching a one-semester combined undergraduate/graduate course of the same name. The work this team was doing in ethics was also connected to already-established Senior Design projects underway at CSM: Seniors involved in the Humanitarian Engineering program were in the process of designing a number of projects in locations such as Honduras, where a team was designing and implementing a wastewater and water quality project. Students working on these projects were not required to take the HEE seminar, however; nor were all students in the HEE seminar working on these Senior Design projects.

Humanitarian Engineering, as it has been defined at our university, is "design under constraints to directly improve the wellbeing of underserved populations" (2005). The curriculum includes an area of special interest and a minor in Humanitarian Engineering as well as a Humanitarian Studies and Technology minor. Students enrolled in one of these programs take courses in ethics, area studies, or economics. Certain of these classes were developed in conjunction with the minor: for example, the course "Engineering Cultures in the Developing World" was

developed to help students understand the limitations of EPS and provide them with alternative methods to understand, value, and engage stakeholder perspectives different than their own (Downey et al. 2006). Students also take technical and design courses in areas such as wastewater management and work on capstone humanitarian Senior Design projects.

Now, two years into the HEE project, the program is in some transition. There have been personnel changes as technical and humanities/social science faculty cycle in and out, and the NSF grant is entering its second phase of curriculum development. The HEE course has been taught one semester, and the faculty organizers are in the process of thinking through important structural and philosophical questions about the meaning of "humanitarian engineering," its relationship to the history of "development," and the goals and outcomes of senior design projects related to sustainable development.

In response to these concerns, the HEE team has begun theorizing SCD in relation to engineering education. One outcome of that work has been the seminar Engineering and Sustainable Community Development (ESCD). The course educates both senior-level undergraduate students and graduate students from a variety of engineering disciplines. The course is structured to provide students with theoretical frameworks for understanding the broad historical, social, economic, environmental, and political contexts in which SCD occurs. By the completion of the course, students will be able to

1) Identify events, institutions, and actors in the history and politics of development as related to SCD and engineering;
2) Identify, relate, and describe the role that engineering might play in the different aspects of sustainability (economic, environmental, ethical, and socio-cultural);
3) Evaluate the strength and limitations of Engineering Problem Solving (EPS) and at least one engineering design methodology with respect to working with communities;
4) Analyze and evaluate project-based case studies in SCD and select criteria for such evaluations;
5) Provide and critically assess definitions of SCD and their relationships with engineering (see appendix for syllabus).

Our goal is to fill what we see as a significant gap in SD engineering education: an awareness of the strengths and limitations of engineering education to engage community perspectives, and theoretical and practical preparation for engineers who wish to work with communities in enlightened, just, and participatory ways. In foregrounding community issues in SCD, we hope to educate students about several important distinctions, some of which we mention briefly here:

- *Technology Transfer vs. Technology Porting*—Our aim is to help students see the limitations in the "universalistic" notion that technology can be transferred from one context to any other without regard for socio-cultural, political, economic, and other systems that inform and are informed by community identity, values, and aspirations. At the same time, we encourage students to critique appropriate technology, the notion that simply because a technology is "small" or environmentally sound, it will be uncritically adopted by a community.
- *Community Deficiencies vs. Community Capacities*—The process of envisioning and listing all the elements that a community does not have, and going no further, emanates from a deficiency mindset, one focused on what is lacking. A capacity mindset asks different questions: What is present? What capacities exist already in the community?
- *Single vs. Multisector Approaches: Community as Atomistic vs. Holistic*—As noted above, a single-sector approach treats the community as if it were composed of discrete components. Students evaluate benefits and limitations of both this approach as well as holistic approaches, which accentuate the interrelatedness and interdependent nature of multiple community systems—economic, technological, social, cultural, and others.

- *Community Charity vs. Community Ownership*—Many development workers will claim an inverse relationship between what is given away (that is, charity) and the success of a development project. Thus, students examine why community ownership and buy-in, sometimes quite literally, are vital elements in SCD project success.
- *Planners vs. Searchers* –As noted above, many of the failures of development can be attributed to top-down planning where engineering has played a significant role. Students learn to critically assess the history of this participation, to question the notion of "engineers as planners," and to assess the strengths and limitations of EPS and design methods in engaging communities as "searchers."

Implications for Engineering Education

Our own valuing of critical understandings of "community" has suggested to us important ways to move educational initiatives in ESCD forward, so that they do not repeat the failures and tragedies of past development projects. Here we offer some recommendations for engineering education reform that take these understandings into account.

1. Engineering education must institutionalize "moments of freedom." Engineering students need room in the curriculum in which to explore other disciplines, such as development studies or cultural anthropology, that may be related to their SD work. Students should be encouraged not only to question existing scientific and engineering frameworks but also to investigate the social sciences and humanities as sites where they might find alternative or complementary frameworks for development and strategies to understand and value multiple perspectives.

2. SD initiatives should make a commitment to meaningfully incorporate community (to move to SCD). Many SD initiatives in the US invite students to engage with their community clients only nominally, via electronic communications or brief, two- or three-week stays in the community. The value of these interactions to students in the North is clear; the value of such short-term commitments to communities, less so.

3. SCD projects should be subject to mid- and long-range assessments. Engineering educators should plan to evaluate the effectiveness of SCD projects. Rubrics for assessment might be developed with the host communities, students, and other stakeholders, and could be part of the long-term educational processes and outcomes of the projects. It is not enough to be in possession of good intentions. Educators and students could learn from failures as well as successes, and use rigorously researched information to improve future projects.

4. Define a criterion for competence in SCD. While governed internally by faculty, engineering curriculum is influenced by ABET accreditation in the US and by EUR-ACE in Europe. We recommend that engineering educators involved in SCD and accreditation bodies incorporate a criterion like the following to accredit those engineering programs that have a significant component or "add-on" (e.g., minor, certificate, area of concentration) in community service and/or SCD: "to demonstrate that students have attained the knowledge, skills, and predisposition to treat the different members of a community as people who have both knowledge and value, may be likely to hold different worldviews than they do, and may be likely to bring these different perspectives to the definition and solution of their problems."

5. Include the above criterion for SCD competence in hiring practices. We recommend that employers of engineering graduates who plan to work in SCD consider including the above criterion for evaluating engineering graduates as job candidates. For example, candidates for a job in USAID or in SCD-related NGOs would be asked to show evidence that they have met the criterion above.

6. Modify funding policies. In the US, engineering educators involved in SCD-related initiatives have relied on public (e.g., the National Science Foundation) and private (e.g., Hewlett Foundation) funding. Hence we propose to add the above SCD competence criterion to existing criteria to determine how future funding for SCD engineering education projects is allocated.

7. Faculty Development. Lucena and Downey (2006) identified the model developed by the American Society of Engineering Educators, the Colorado School of Mines, and the University of Minnesota in their project *Rigorous Research in Engineering Education: Creating a Community of Practice* "as an example where 'powerful partnerships are formed as information about how students learn and [how] teaching methods that support students'

learning are coupled with the content knowledge of practicing engineering educators'" (Lucena and Downey 2006). Following this model, faculty development workshops can be implemented to help faculty connect their research and transform their teaching methods to meet the needs of SCD engineering programs.

We realize that creating space in the curriculum for engineering students to explore approaches outside of their disciplines and to educate them to be critical assessors of their own discipline and methods, while learning to value perspectives outside of engineering, may seem risky to many in engineering education. We also understand the difficulties of "squeezing" more into already packed engineering curricula. However, *not* educating students in this way creates the risks of reaffirming students' misconceptions about what engineering can and cannot do and what constitutes expertise and development. In a worst-case scenario, such exclusions risk engineering education becoming a tool to perpetuate relationships of dominance between the "expert" North and the "non-expert" South. In an increasingly globalized world, such a scenario has important implications for all sectors in which engineers work—from nonprofit development projects to work in the for-profit sector.

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Appendix I: Course Syllabus, Spring 2008

Course No: LAIS 498/598 Title: Engineering and Sustainable Community Development

Class Meetings: Tues and Thur, 9:30 to 10:45 am

Course Website: http://blackboard.mines.edu/

Instructors:
Juan C. Lucena (jlucena@mines.edu, 303-273-3564) (Course coordinator)
David Frossard (dfrossar@mines.edu)
Tina Gianquitto (tinagian@mines.edu)
Jon Leydens (jleydens@mines.edu)
Carl Mitcham (cmitcham@mines.edu)
Jen Schneider (jjschnei@mines.edu)
Jay Straker (jstraker@mines.edu)

Office Hours for Lucena Lucena: Tues & Thurs from 11am to 12m and 1:30 pm – 3:30pm

Required Course Readings:

- Hershey, John. 1989. *A Single Pebble*. Vintage Publishers
- All other required readings available on Blackboard (BB) course website (password protected)

Course Description: This course is an introduction to the relationship between engineering and sustainable community development (SCD) from historical, political, ethical, cultural, and practical perspectives. Students will study and analyze different dimensions of sustainability and the role that engineering might play in them. Also students will critically explore strengths and limitations of dominant methods in engineering problem solving and design for working in SCD. Through case-studies, students will learn to analyze and evaluate projects in SCD and develop criteria for their evaluation.

Learning Objectives: By completion of this course, students will be able to

1) identify events, institutions, and actors in the history and politics of development as related to SCD and engineering

2) identify, relate, and describe the role that engineering might play in the different aspects of sustainability: economic, environmental, ethical, and socio-cultural

3) evaluate the strength and limitations of Engineering Problem Solving (EPS) and at least one engineering design methodology with respect to working with communities

4) analyze and evaluate project-based case studies in SCD and select criteria for such evaluations.

5) provide and critically assess definitions of SCD and their relationships with engineering

Grading:
Class attendance, participation, and respect for the learning process (200 pts):

This area of grading includes attendance, in-class engagement, and relevant participation, e.g., contributing meaningfully to discussion as well as when working in groups or pairs. It also includes turning in work on time, and keeping up with the reading and papers. Attendance and engaged participation will be seriously considered in our final assessment

- **Attendance:** 10 points will be deducted for each unexcused absence. Excused absences are ONLY the following: official sport varsity team travel, a medical condition excused in writing by doctor, a personal matter excused in writing by the Dean of Students office, jury duty, and military duty.

- **Participation:** We welcome many types of contributions to class discussion, and two in particular. Comments that feature a knowledge claim supported by well-structured, logical, and relevant evidence advance everyone's collective understanding, regardless of our own perspectives. Note that well-supported claims are not just stated opinions. Second, we recognize that not all thoughts come out fully formed, so we also invite exploratory contributions to class discussion, comments that are characterized more by questioning and inquiring than by answering and defending a position. We will begin actively seeking student participation after the fifth class meeting in order to give everyone an opportunity to first feel comfortable with the classroom climate, topics, nature of discussion, instructors, and process writing.

Papers (600 pts):

There will be 4 papers. Specific paper requirements will be provided before the papers are due. There might a number of public presentations at CSM that will enhance your knowledge and understanding of ESCD and provide you with further evidence and reflection to be used in your papers.

- Paper 1 on historical and ideological dimensions of development
- Paper 2 on sustainability
- Paper 3 on community dimensions of development
- Paper 4 synthesizes E+S+C+D

Quizzes (200 pts)

After carefully completing the assigned readings on time, you will have the opportunity to enhance and assess your learning by taking unannounced quizzes in class and/or BlackBoard. **There are no make up quizzes unless you have an excused absence (see above).**

Writing Center

You are strongly encouraged to use the resources and experience available at CSM's Writing Center for writing your papers. The Center is located in Stratton 309, and their phone number is 303-273-3085. The Center's hours for Spring 2008 are:

Monday 9-6
Tuesday 9-3
Wednesday 9-5
Thursday 9-5
Friday 9-4

SCHEDULE

(Due to the experimental nature of this course, readings might change at times. Students will be informed in advance.)

WHAT IS DEVELOPMENT?

DATE	**TOPIC & INSTRUCTORS**	**READING DUE**
Thu 1/10	Introduction Self-assessment (ALL)	Film *Darwin's Nightmare* is on reserve and should be watched by all students before class on 1/29
Tue 1/15	What is development? (Gianquitto & Mitcham)	*A Single Pebble* Jackson, Jeffrey. 2005. "Building Dams" and "Fixing Dams" from *The Globalizers*
Thu 1/17	What is development? (Gianquitto &Mitcham)	*A Single Pebble*
Tue 1/22	What is development? (Lucena & Leydens)	Kloby, Jerry. 2003. "The Legacy of Colonialism" from Rothenberg, Paula (ed) *Beyond Borders* Rodney, Walter. 1982. "How Europe Underdeveloped Africa" from Rothenberg, Paula (ed) *Beyond Borders* Adas, Michael. 2007. "Imposing Modernity" from *Dominance by Design*
Thu 1/24	What is development? (Frossard & Schneider)	Gustavo Esteva, "Development," from *The Development Dictionary* Jackson, Jeffrey. 2005. "Introduction: The Globalizers in Honduras" from *The Globalizers*
Tue 1/29	**Student process** **(Leydens & Lucena)**	**On What is Development?** **Watch film *Darwin's Nightmare* on reserve**
Thu 1/31	Does development work? (Schneider & Frossard)	Easterly, William. 2006 "Planners vs. Searchers" from *The White Man's Burden*
Tue 2/5	Engineers and Development (Lucena & Mitcham)	Pursell, Carroll. 2003. "Appropriate Technology, Modernity and US Foreign Aid."
Thu 2/7	**Student process** **(Leydens & Lucena)**	**Paper 1 due** Watch Film *Waste = Food* by no later than 3/6

WHAT IS SUSTAINABLE COMMUNITY DEVELOPMENT (SCD)?

Tue 2/12	Sustainability (Schneider & Lucena)	Bridger and Luloff, "Toward an interactional approach to sustainable community development" Sullivan, Nicholas. 2007. Chaps 1, 2 and 3 from *You Can Hear Me Now: How Microloans and Cell Phones are Connecting the World's Poor to the Global Economy*
Thu 2/14	Sustainability: Economic (Lucena & Frossard)	Sullivan, Nicholas. 2007. Chaps 9 and 10 from *You Can Hear Me Now: How Microloans and Cell Phones are Connecting the World's Poor to the Global Economy*
Tue 2/19	Sustainability: Environmental (Schneider & Lucena)	McDonough, William and Michael Braungart. 2002. "Why Being 'Less Bad' Is No Good," and "Waste Equals Food" from *Cradle to Cradle* Weisman, Alan. 2007. "Polymers are Forever." *Orion Magazine*
Thu 2/21	Sustainability: Socio-cultural (Frossard & Straker)	Achebe, Chinua, "Dead Men's Path." Basso, Keith. 1996. "Stalking with Stories" from *Wisdom Sits in Places* Watch Film *Waste =Food* (by Ron van Hattum) by 3/6
Tue 2/26	**Guest speaker**	**Gustavo Esteva**
Thu 2/28	Ethics of sustainability: Part I (Mitcham & Gianquitto)	Mitcham, Carl. 1995."The Concept of Sustainable Development: its Origins and Ambivalence." *Technology and Society*.
Tue 3/4	Ethics of sustainability: Part II (Mitcham & Gianquitto)	Various online readings on ethical principles of sustainability
Thu 3/6	**Student process day** **(Mitcham)**	**Paper 2 due** Film *Waste = Food* and ethics of sustainability
3/11, 3/13	**SPRING BREAK**	
Tue 3/18	**Guest speaker**	Silvia Perez-Vitoria
Thu 3/20	What is community? (Leydens & Lucena)	Salmen, L. 1987. "Steps in Conducting Participant-Observation Evaluation" from *Listen to the People*
Tue 3/25	What is best for communities? (Leydens)	Salmen, L and E. Kane. 2006. "Participatory Approaches for Learning, Policy, and Action" and "Beneficiary Assessment: An Approach Described" from *Bridging Diversity: Participatory Learning for Responsive Development*
Thu 3/27	What is best for community? (Leydens & Frossard)	Malson, Kevin. 2001. "Participatory Technology Development" from *Brick by Brick* **View film** *The Dreamers of Arnhem Land* for 4/3

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Tue 4/1	How have engineers engaged communities? (Lucena & Schneider)	Williams, Bess. 2007. "Small-Scale Technologies for the Developing World: Volunteers for International Technical Assistance, 1959-1971." Jackson, Jeffrey. 2005. "The Expats" from *The Globalizers: Development Workers in Action*
Thu 4/3	**Student process or invited speaker**	View film *The Dreamers of Arnhem Land*
Tue 4/8	Engineering Science: strengths and limitations in dealing with communities (Lucena)	Downey, G and J. Lucena. 2003. "When Students Resist: Ethnography of a Senior Design Experience in Engineering Education." *Intl Journal of Eng Education.*
Thu 4/10	Engineering Design: strengths and limitations in dealing with communities (Lucena)	Mulder, Karel. 2006. "Design and Sustainable Development" (chap 8) from *Sustainable Development for Engineers*
Tue 4/15	Participatory approaches: Case study I (Schneider & Frossard)	Case study on Wind Power in India **Paper 3 due**
Thu 4/17	**Invited speaker: Anu Ramaswami**	Ramaswami, Anu et al. 2007. Integrating Developed and Developing World Knowledge into Global Discussions and Strategies for Sustainability. 2. Economics and Governance. *Environmental Science and Technology*
Tue 4/22	**Invited speaker**	Bev Sauer
Thu 4/24	Participatory approaches: Case Study II (Lucena & Schneider)	Case-study on Community Mapping in Honduras
Tue 4/29	Can engineers be partners and leaders in SCD? Problem definition and solution (Lucena)	Brand, Ralf and Andrew Karvonen. 2007. "The ecosystem of expertise: complementary knowledges for sustainable development." *Sustainability: Science, Practice & Policy* Dewulf, Art et al. 2005. "How indigenous farmers and university engineers create actionable knowledge for sustainable irrigation." *Action Research*
Thu 5/1	Last class	Student self-assessment on their relationship with SCD **Paper 4 due** **Paper 5 due during finals week**

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Authors

Jen Schneider is Assistant Professor in Liberal Arts and International Studies at the Colorado School of Mines. Her dissertation, *The American Monstrous: Grotesque Bodies in Cold War America*, explored the construction of race, class, and sexuality in American film and literature of the 1950s. Her current research in science communications and rhetoric analyzes the relationship between the scientific expert and the public in a number of fields, including sustainable community development, nanotechnology, and environmental media. Jen is managing editor of the journal *Engineering Studies*, journal of the International Network for Engineering Studies.

Jon A. Leydens has served as Writing Program Administrator in the Division of Liberal Arts and International Studies at the Colorado School of Mines since 1997 and is the chair of the CSM Writing Across the Curriculum Committee. His background is in education and composition and rhetoric. Since 1989, Dr. Leydens has taught at the college level in Europe and the United States. At present, he is researching the role of the social entrepreneur for sustainable community development. In addition to a graduate course in academic publishing, he also teaches undergraduate courses in engineering and sustainable community development, proposal writing, and mass media studies.

Juan Lucena is Associate Professor in Liberal Arts and International Studies at the Colorado School of Mines. He was 2005-07 Senior Fellow in Engineering Education at the National Academy of Engineering and Distinguished Lecturer at the 2006 ASEE Annual Meeting. Trained in mechanical and aeronautical engineering and Science and Technology Studies (Ph.D. Virginia Tech 1996), he is author *of Defending the Nation: U.S. Policymaking in Science and Engineering Education from Sputnik to the War against Terrorism* (University Press of America 2005) and, with Gary Downey, co-developer of Engineering Cultures® multimedia courseware and co-editor of *Engineering Studies*, journal of the International Network for Engineering Studies.