Broadening Horizons for our Students: An Elective Seminar Course on Ethics and Philosophy of Appropriate Technology

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ABSTRACT Engineering education today is focused on outcomes that demonstrate students are competent in technology, communication skills, team work, and multidisciplinary approaches and are equipped with an awareness of cultural diversity issues, social and ethical concerns, and who practice a proactive environmental stewardship (Accreditation Board of Engineering and Technology, ABET). Appropriate Technology (AT) can be broadly defined as technology that is relevant to particular real social needs and that is accessible, affordable, and empowering to the communities it serves and that use it, while not adversely impacting the environment. This seminar course was developed and offered to help fill a student-expressed need for education and enlightenment on this broad issue. The course begins with an introduction to, and discussion of, AT followed by specialist-delivered seminar presentations that expand on particular pertinent topics. Seminar presentations included the history of engineering and technology development, the philosophy and ethics of technology, and the responsibilities of scientists and engineers. Seminars in the course also cover particular case studies including technology education and transfer in Cuba and Zimbabwe; a seminar on global development and implementation of appropriate technology, both in urban and rural settings is also part of the course. Readings are assigned prior to each seminar presentation and students are expected to participate in discussion and research and submit one short paper and one major AT research/design project.

INTRODUCTION

Appropriate technology (AT) is a very broad term that has been applied to a diverse set of technologies that have generally been developed and implemented to facilitate development. The criteria for a technology to be deemed appropriate are broad and subject to extensive debate, and hence AT is difficult to define (Rybczynski, 1991). There is general agreement, however, on what characterizes such a technology. AT requires only small amounts of capital, emphasizes the use of locally available materials, is relatively labour intensive, small scale and affordable to individual families. AT should also be able to be understood, controlled and maintained without high levels of education and training, be able to be produced in small shops and villages, be adaptable and flexible, and include local communities in the innovation and implementation stages. Ultimately, AT should not have any adverse environmental impact (Darrow and Saxenian, 1986).

The rationale of AT resides in its empowerment of people at the grass roots. Development professionals agree that local needs can be met more effectively with the community working to address their own needs. Tools that are developed should extend, not replace, human labour, and AT also emphasizes controllable scales of activity. The rationale is also grounded in minimization of financial, transportation, education, advertising, management and energy services and costs with the goal of engendering self-sustaining and expanding reservoirs of skills within a community. The result is a lowering of economic, social and political dependency, and a move towards sustainable development that is focused on people’s needs and is grounded in empowerment through education, technology transfer, capacity building and local control.

This course provides students with a broad overview and in depth study of AT, and grounds the study in an appreciation for the ethics and philosophy of technology and its uses. In addition to readings and seminars in ethics and philosophy of technology, the course introduces students to, and familiarizes them with, case studies from around the world, focusing particular attention on alternative socio-technological and politico-economical models of development, with particular attention focusing on case studies of AT in Cuba and Zimbabwe.

COURSE OUTLINE

The course was configured as a 3-credit seminar course where students met for two hours each week. The course outline is shown in Table 1 below. Beginning with an introduction to AT, its rationale and characteristics, students are lead in a seminar-type lecture-discussion structured learning environment through various examples of AT. In the second seminar, various case studies of successful and unsuccessful developments and implementations of appropriate technology are presented and discussed potential topics for papers and major projects are discussed.

Assessment and evaluation of student performance in the course focused on three components. Students were evaluated on their class attendance and participation (20%), were required to research, write and submit one short paper (20%), and were also required to research, write and submit one major AT design project, while also...
making a seminar presentation of their major projects. In the major project, two-thirds of the grade was based on the written report and a third on the students’ presentation.

The various seminars were presented by professors with research interest and scholarship in that particular area. Faculty seminar presenters and primary discussants came from a broad array of disciplines including philosophy, chemical, civil and electrical engineering, biology, anthropology and sociology, and science and technology studies.

**TABLE 1: Seminar Course Outline**

<table>
<thead>
<tr>
<th>Week</th>
<th>Seminar Discussion Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>One</td>
<td>What is Appropriate Technology?</td>
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<tr>
<td>Two</td>
<td>AT Paper Topics and Potential Projects</td>
</tr>
<tr>
<td>Three</td>
<td>Ethics as an Experimental Science</td>
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<tr>
<td>Four</td>
<td>Case Study 1: AT in Zimbabwe</td>
</tr>
<tr>
<td>Five</td>
<td>Engineering Ethics and AT</td>
</tr>
<tr>
<td>Six</td>
<td>AT, Anthropology and the Environment</td>
</tr>
<tr>
<td>Seven</td>
<td>Case Study 2: AT in Cuba</td>
</tr>
<tr>
<td>Eight</td>
<td>AT: Local and Global Issues</td>
</tr>
<tr>
<td>Nine</td>
<td>Case Study 3: Automobile Technology and Transportation: An Integral Approach</td>
</tr>
<tr>
<td>Ten</td>
<td>Student Major Project Presentations</td>
</tr>
</tbody>
</table>

Students are provided readings prior to the seminar and the readings, course syllabus and various other internet resources are placed on the course web site. ([http://www.geocities.com/howard_upat/PhEtApTe.htm](http://www.geocities.com/howard_upat/PhEtApTe.htm)). At the end of each seminar presentation and discussion, the seminar material was also placed on the course web site, giving students continuous access to the issues discussed.

**APPROPRIATE TECHNOLOGY**

Students were provided the syllabus, web site as well as several readings at the outset of the course. The introductory seminar set out to define and characterize AT and illustrative examples of technologies that are considered “appropriate” as well as examples of technologies that were initially considered appropriate but were later demonstrated to be unworkable, were presented and discussed. An excellent and early example of appropriate technology that underscores the importance of context in deciding whether a technology is appropriate or not is that of M.K. Gandhi urging his fellow Indian’s to use the spinning wheel to produce homespun cotton while eschewing British-produced clothing. The context is the Indian struggle for independence from Colonial Britain and the role this technology played: it initiated the development of indigenous textile industries and provided a focal and rallying point for the independence struggle.

It is often held that AT is “low-tech", a notion embedded in the historical view of appropriate technology as being “intermediate” and bridging the gap to accelerate development. However, students are shown efforts in developing nations that have focused on “high-tech” applications, including solar energy and energy consumption analysis, biomass energy sources, dry land farming and other “new” agricultural techniques, food preservation and information and communications technology (Thomas, 1988), including, more recently, the rural wireless internet.

Examples of AT that have been ill-thought out and unsuccessful are also provided, including a project to develop, construct and deploy windmills made of local resources but implemented, unfortunately, in a region with little wind. Another example of a failed appropriate technology is the development of soap making skills and resources in a rural setting where the community actually is too poor to purchase soap and those in the community that do have the resources prefer the commercially available and popular versions of soap.

This discussion helps the students understand that AT is highly context and situation-specific, where geography, culture, location, and economics to name a few variables, all play a role in determining the success or failure of a particular technology.

**AT PAPER AND PROJECT TOPICS**

Early in the course (second week), students were introduced to various possible AT topics. The discussion begins with an introduction to various successful appropriate technology projects, including the deep-well hand pumps in India, oral re-hydration therapy worldwide to combat dysentery, bamboo reinforced rainwater storage tanks in Thailand, rural access roads and indigenously produced toolbar plows and carts in Kenya.

AT projects areas include agriculture, water, energy, transportation, health care, education, small business, communications and workshops. In each of these areas, examples of potential AT projects are discussed and students submit a project proposal for approval by the faculty. In the broad area of water, for instance, water supply, hand pumps, water treatment and water storage are some of the specific project focus areas. Another suggested area is energy technology, where projects can include renewable energy sources, biomass and biodiesel, solar energy, bicycle and human power, hydroelectric and micro-hydroelectric energy, cooking stoves and wind energy, amongst others. Projects in the healthcare area using appropriate technology include those focused on the provision of primary health care, dealing with communicable diseases, developing and fostering alternative medicines, dental care and physiotherapy.

**ETHICS AND PHILOSOPHY**
The course is located in the Department of Philosophy and ethics, as well as the philosophy of science and technology, are integral components of the course material. Ethics is introduced early (week three) with a faculty team member from Philosophy presenting the seminar and leading the discussion.

Ethics is introduced as an experimental science that is focused on the critical study of “morals”. How transitions and transformations in society through time change what is considered ethical at given periods in history is described and discussed, with students asked to question themselves and look inwards for the core source of their beliefs in their morality. The concept of ethics as experimental is also underscored by the changes that accrue to our ways of behaving and interacting and what is socially acceptable at different historical moments, and the change in social mores through time. Students in the course were from science and engineering departments as well as from philosophy; this brought interesting interdisciplinary discussions of, and approaches to, dealing with ethical issues. It also widened the range of ethical dilemmas that students brought into the discussion and were exposed to, as the type of professional ethical problems confronting a science or engineering student are usually different from those that might confront a student in the humanities.

AT IN CUBA AND ZIMBABWE

The course format used case studies to expand understanding and discussion in the class room. Two important cases on a country-specific basis are Cuba and Zimbabwe. These two countries present excellent opportunities for students to examine and investigate economic and social development, as well as the progress and evolution of technology, in a socialist environment that eschews private capital. The results are illustrative of the differences that can accrue in terms of development because of the socio-economic and political context of the location these changes occur in.

In Zimbabwe, since independence from Britain in 1980, the country has chosen a socialist, state controlled economic path of development in some sectors while maintaining private enterprise in others. Land ownership and land reforms were recently implemented to correct for many of the inequities of the past racially segregated regime and the manner of its implementation and the white people affected brought about condemnation from the Western powers. As this was instituted on a broader and broader scale, the country was isolated more from the world capitalist system blockades were initiated against Zimbabwe. This isolation from the capitalist world economy forced it to rely more on its own resources for development. Here AT is linked to the control of a nation’s resources, with specific attention in Zimbabwe to the reclamation and redistribution of land through land-reform programs, and to how AT can impact this. The focus is also to decrease the dependence of the people and domestic technology developers on outside resources that consume scarce foreign exchange reserves (dollars or euros) and enhance the poor and small farmer’s capacity to survive and prevail in the face of these tough conditions. Technology transfer, the impact of politics and the power of external multilateral financial institutions on internal development is presented and discussed.

In Cuba, with a long history of being embargoed by its giant neighbour to the north, the U.S.A., there has been a longer tradition of developing self-reliance on internal resources. This became especially important after the collapse of the Soviet Union and the loss of the oil subsidy it provided, as well as the loss of the markets for Cuban products in the Soviet Block, which had ceased to exist. The early 90’s saw this as a special period where Cubans had to rely on internal resources and expend more efforts to harness and develop these resources. For Cuba, with its intense emphasis on education as the true mechanism for empowerment, this transition was difficult but made easier with the large pool of technically and scientifically skilled citizens that had been created as part of the early and heavy emphasis on educating people to move them out of poverty. After the collapse of the Soviet Union and the loss of this superpower patronage, Cuba invested, and continues to invest, in educating its children, making itself self-sufficient in food production, developing and providing adequate housing and in preparing each of its citizens with adequate job-training. Cuba’s economic priorities have shifted, from mainly sugar and tobacco – which are still a good third or more of economic activity – to biotechnology, tourism and historic preservation, and higher education. Cuba’s achievements are impressive: despite a GDP per capita of only $5,200 – the U.S. is $34,320 by comparison – Cuba’s quality of life indicators, including life expectancy index (0.86, world highest is 0.94), education index (0.90, world highest is 0.99), and human development index (0.806, world highest is 0.944) are all at the high end of the scale. This suggests that there is something to be learned from the social and economic development models and emphases that Cuba adopted through its history. This is a necessary part of any discussion of technologies that are appropriate.

CONCLUSION

This seminar course has been offered once to students across the Howard University campus. Interest in the course was high as demonstrated by the proportion of students who audited the various seminars. However, actual enrolment was low, partly due to a delayed listing of the course, but mostly to a lack of awareness on the part of academic advisors that this course could be used by students to satisfy humanities or social science requirements in the various university degree programs.

The seminars were also attended by faculty who had an interest in the intersecting issues of science, technology,
and development. The faculty team has plans to offer this course again and the expectation is that student interest and enrolment will be higher as there has been increased publicity within the university community and awareness of the course amongst faculty academic advisors has improved.

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REFERENCES: