An example of two-way developmental education in design technology: some preliminary findings of the benefits to eco-tourists from the west and villagers from central and eastern Indonesia of building simple solar ovens

An example of two-way developmental education in design technology: some preliminary findings of the benefits to eco-tourists from the west and villagers from central and eastern Indonesia of building simple solar ovens

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Abstract
This paper describes some of the educational outcomes of making solar ovens and promoting solar cooking in Indonesia between 1995 and 1998 in an Earthwatch project. The project's core objectives are about conservation, sustainable development, the economy and public health; however, during the time of the ovens' manufacture, there are formal and informal educational implications which involve the transfer of technology, skills and cultural awareness between Earthwatch 'Volunteers', mostly from the West, and the ovens' recipients, the Indonesian villagers, who work together for two weeks.

The findings in this paper are based on an analysis of interviews and questionnaires with 44 recipients of ovens in Lombok and a qualitative analysis of semi-structured interviews and Final Reports from 10 British Volunteers. Although, statistically speaking, numbers contributing to these preliminary findings are too small to draw overarching conclusions, the evidence still provides valuable insights into the two-way developmental education processes and outcomes for the Indonesian recipients and the Earthwatch Volunteers in both cognitive and affective terms.

Light is also thrown, more generally, onto two other areas. First, the similarities and differences in attitudes towards construction skills, sometimes measured in gender values in a Muslim society; and second, the educational potential for what is likely to become one of the growth industries of the new century – eco-tourism.

Keywords: Indonesia, solar energy, internationality, project-based learning, culture, environment

Introduction

According to government sources, approximately 27.9 million families in Indonesia use charcoal and fuelwood for cooking (Biro Pusat Statistik, 1993), hence household energy usage, which was about 1153 Pica Joules a year between 1983 and 1988, constituted about 35% of the nation's total energy consumption. Recent estimates suggest that the use of biomass energy in Java in the year 2000 will be 5.5 times that of kerosene (Nurdiastuti, 1995), a figure which does not include its consumption by small scale industrial processes, such as brickmaking, which depend on fuelwood. Given the country's recent economic predicaments, the likelihood of a decreasing subsidy for fuel oil in future will increase this tendency to shift away from kerosene to fuelwood. The use of solar energy for cooking, therefore, is of ever increasing importance in an economic climate of this kind.

A solar cooking project, to build simple solar ovens in Indonesia, has been sponsored by the Earthwatch Institute[2] since 1995. (For details of an eco-tourist's eye-view of the manufacturing process, see D'Sena, 1999).

The most advanced solar cooker, field tested in 1998 at Sila and Kewapante villages (Suharta *et al,* 1998; Suharta *et al,*1999) reached temperatures of 202 C, making it capable of cooking a variety of foods for forty minutes or so four or five times daily.

The contexts of health and gender

In Indonesia, many rural, non-professional households use fuelwood and biomass, which is gathered, rather than purchased, locally. The problem of low incomes is exacerbated by time lost (and therefore more potential income lost) in the collection of fuelwood. This makes solar energy economically desirable and necessary. Conservation and economic arguments have an obvious link but there are also issues about public health – the classic, wood burning Indonesian double stove produces many victims of lung disease.

Picture 1 Cooking using a traditional stove

Another significant dimension is that of the many clearly defined gender divisions of labour. Many women's occupations – weaving and making pottery, for instance – can, importantly, be carried out in the home and make child-rearing and cooking possible. At home, therefore, cooking and the preparation of food have unquestionably become women's work. In many ways, the success of the project depends on exploiting (and perhaps entrenching) the relative immobility of these domestic workers as solar ovens need regular attention: opening, closing, turning and so on (D'Sena, 1999). For some this may pose a philosophical dilemma because even though technology such as this supports existing socio-cultural norms that emphasise the pre-eminence of Muslim forms of masculinity and its freedoms, these are norms which fly in the face of more global trends associated with women and opportunity this century (Hobsbawm, 1994). All of these considerations, along with the perennial problems of funding, have had an impact on the overall direction and ethos of the project, though there has been a growing recognition by Project staff that the distribution of the ovens should be accompanied by an educational programme that contextualises the technology and its importance.

The selection of participants/ recipients, the educational approach, the work process and the dissemination of information

The project's success is highly dependent on its contacts with local regional ('Regency'-based) civil servants. In practical terms, it is they who liaise with local groups and recruit individuals and, importantly, continue to provide a notional and actual framework of authority during and after the ovens' construction. Indeed, one critical example is that of their role in the selection process. With men playing little or no part in cooking, the involvement of women in the manufacturing process is imperative, even though construction in resistant materials generally falls into the realm of 'men's work'. Regency officials addressed this by targeting women's groups; as a result there has been a good

Picture 2 Women are involved in the manufacturing process

gender mix in recipients and participants.

The intention of this approach has been to create and strengthen a sense of ownership and technical understanding not only in the recipients and the real users of the ovens, but also more generally in the wider community after the ovens are built and distributed.

In instructing the recipients (and other participants in the construction process) a plural approach, encompassing both intellectual and motor skills, was used. They and Earthwatch Volunteers (mostly from Western Europe and the USA) were all initially given information, through a slide presentation, about climactic change, the safe cooking of food (in terms of bacteriology and nutrition) and the oven's design and data collection (Suharta, 1995, 1996, 1997, 1998). In particular, the advantages of solar cooking, both environmental and economic, are stressed. Instruction is in Indonesian: at this stage, the project's aims are being 'sold' to the Indonesian team members/ recipients.

For the construction process, recipients, other participants and Earthwatch Volunteers, all with their very diverse educational backgrounds, are grouped together, generally in fours. An early decision, to avoid the use of sophisticated tools, was made in order to eliminate losing the confidence of technophobes and those with limited experience in construction (in short, most of those targeted as recipients) and to create an equivalence amongst participants. Tools generally speaking, therefore, were manual tools, with only a few electric ones to speed some processes. Each group made two solar cookers. After construction, some local participants helped with data collection and a volunteer was assigned to monitor the process. The lessons in nutrition, health and safety were reiterated as a preparation for cooking. Finally, local participants complete a questionnaire to obtain their opinions about the training and manufacturing period; these opinions could be of use in the future.

The dissemination of information and the popularisation of the key ideas are given priority throughout. During the manufacturing process, if at all possible, teenage schoolchildren and sometimes undergraduates, are encouraged to visit the project and see the participants at work. With the ovens' completion, the idea that 'the

Picture 3 School children visit the project

proof of the pudding is in the eating' is critically put to the test and all participants taste the products of solar cooking; being convinced of the technology's safety and efficacy is crucial at this point. Additionally, each period of construction culminates in a high-profile closing ceremony, open to the entire public, designed to raise a more general awareness and commercialise the idea in the mind of the community. On some occasions the media, both broadcast and visual, have recorded the participants of the project at work; and documentaries in the Indonesian, Swedish and English languages have disseminated information internationally – all important for future fund raising, global education and the aim of obtaining the backing of governmental decision-makers.

Educational outcomes

(a) Local participants

Local participants and recipients are diverse in their educational and occupational backgrounds. Many have been women and most are villagers; in other words, amongst the poorest and most dependent on wood for fuel. In general, many of the participants are housewives, scouts/trainers from villages, carpenters, farmers, fishermen, employees in domestic industries, women from women's organizations, students, teachers, lecturers and government officials of various ranks. The project has used the premise that the

dissemination of ideas and the fostering of new technology is more effective when placed in society's middle class (and certainly there are precedents throughout history to support this). Ultimately, the hope must be that if solar ovens become more widely available, then their use could percolate down to those most in need.

Completed questionnaires from 44 respondents have produced a wealth of information on the ovens' usage and users' opinions; though with limited space, this article can only give a very brief summary of the educational and attitudinal outcomes. Of the 44, most were positive about the training and manufacturing process: it broadened their knowledge (20), and some, in addition, felt both confident and willing enough to disseminate information learned (6); while many acknowledged the solar cooker's economic value (16). Only two found the manufacturing process tiring and were negative about it. Such was the enthusiasm generated by the whole process, that 26 respondents (59%) strongly expressed the view that disseminating the training, its product and ideas was of importance, while 15 of them offered to do this in their own village. The key weakness of this early questionnaire was its inability to seek out attitudes towards intercultural and cultural as well as process-oriented outcomes.

There are other obvious weaknesses: the difference between answers in a questionnaire and subsequent practice is a fertile area of future investigation, though early monitoring, during the rainy season in 1996, showed that of 28 cookers many had already found an alternative use. While 2 were used for profit (making cakes) and 3 for conventional cooking (18% in total), 7 (25%) were for cooking favourite foods only, 5 were seldom used, 2 used in local exhibitions and 1 for demonstrating the technology in a school; meanwhile, 6 units were not used at all and 2 were broken. Most respondents appreciated the value of the cookers: during the rainy season 14 were stored indoors (since there was the added bonus of using the oven's mirror for other purposes) and 12 stored on a verandah. Usage, therefore, was varied, though of the 44 respondents, the answer to the important question 'Are you willing to use the solar cooker daily?' yielded 27 - yes (25 of them said that saving money and other practicalities were the main reasons;19 stated that the food tasted good!); 14 - a conditional yes, with good weather; while 3 said no. If the educational aspects of the project aimed to secure compliance in the use of the ovens, then there was a significant measure of success.

Finally, recipients were questioned about the problems they foresaw in disseminating the project's technical and other ideas themselves. Only 4 saw no problem in using the same training; while one broadly agreed that dissemination was feasible, so long as a solar cooker could be used for demonstrations, while 7 stated that demonstrating a solar cooker's ability was an absolute necessity in order to convince others. Others pointed to the inconvenience of moving the solar cooker in and out of the house and the longer cooking time. Most agreement, however, was about finance, that the initial cost of making the oven (about $28 US) would be prohibitive (24), while a few (3) believed it would be too difficult to change the people's habits and thoughts. Only 8 believed that people generally would be altogether unwilling to take on the new technology. Only 2 respondents gave no opinion on the subject.

(b) Earthwatch Volunteers

The geographical spread of Earthwatch Volunteers was wide – 64 of them originating from ten 'westernised' nations: Australia (3), Canada (2), Ghana (1), Italy (1), Japan (3), the Netherlands (3), Spain (1), Switzerland (1), Sweden (3), the UK (9) and the USA (37). They make a financial contribution before arrival, as well as an intellectual and manual contribution during the manufacturing process.

Within a month of their return, Volunteers submit a structured report summarising their experiences and reflections on the project as well as an action plan for implementing change in their local environments. The following conclusions are based on an analysis of ten of these Final Reports submitted by

British Volunteers in the period 1997-9 and also from the findings of semi-structured interviews of ten Volunteers (from team 3, Lombok, 1997).

Picture 4 Earthwatch volunteers (back row) with Indonesian students (front)

Volunteers acknowledged their personal development in the realm of technical skills; though the technology of the solar ovens was 'low', there were demands on skills that had not been utilised since teenage years. (All but three of the Lombok team had left school at least ten years before; and all but one were in non-manual occupations.) However, the commentaries which accompanied evidence about motor skills and other technical aspects, contextualised them within the spheres of gender, intercultural co-operation and other cultural issues, including traditional Westernised sentiments about deforestation (Schama, 1995). All Volunteers noted the passivity and deference of Indonesian, mostly Muslim, women to the men in the workplace; their willingness to take on very simple manual-repetitive chores, such as sanding, rather than decision-making and problem-solving roles in the manufacturing process, such as measuring and sawing (especially with electronic tools).

Volunteers' skills in the Indonesian language, were generally little better than very elementary; though the language skills of the Indonesians working on the ovens were slightly better, ranging from no to basic conversational English. Not surprisingly, then, Volunteers reported the importance and significance of body language as well as sign language in developing relationships. In short, the design technology element of the project,

Picture 5 Generally, Indonesian women take a passive role in manufacturing

the 'technology transfer', in both physical and cognate terms, acted as a conduit for an 'interculture transfer': problem-solving issues related to the ovens' plans (written in Indonesian) became the starting point for solving the problem of communicating ideas about the division and co-operation of labour, tasks and materials. This workplace experience of 'cultural immersion', as one Volunteer called it, was a preface for visits to Indonesian homes and villages. It was here, seeing first- hand women using and breathing in the fumes of the traditional wood burning stove, that Volunteers' awareness of the combination of public health concerns, women's issues and social and environmental justice was raised. More sophisticated reports reflected on the debates about ecological imperialism (of which deforestation is the clearest manifestation) and environmental chauvinism. (Griffiths and Robin, 1997:170, 234)

Conclusions

Overwhelmingly then, Volunteers perceived their own personal and educational development to be not just in the physical and technical (the explicit manifestation of the project's demands for demonstrable skills); rather, it was primarily in the socio-political (witnessed by the many references to both political instability and Indonesian team members' reluctance to comment at all on it) and the environmental and cultural, which for them became the core outcomes. The weighting in Final Reports leaned towards what volunteers could take away that was new: it was not the solar ovens or all the necessary technical skills, it was the complex context of

the solar ovens. For DT and other teachers, this two-way developmental education, that of themselves and others, both abroad and subsequently in school, can only serve to enrich the broader classroom experience of pupils in terms of citizenship, environmental and sustainable development, cultural diversity and perhaps also design technology issues. [More broadly, it also anticipates the proposals for the forthcoming White Paper which signal the importance of the interconnectivity between human resources and environmental issues (Department for International Development, 2000)].

Picture 6 Solar ovens being tested

At this stage, the socio-cultural impact on the Indonesian recipients and those from the broad spectrum of society who visited the project is difficult to discern. For some Indonesians, for whom acquisition of English language skills was a priority, the more casual workplace interconnectivity with volunteers was potentially more valuable than the ovens themselves, just as the better understanding and consideration of value systems was for both groups. In future, questionnaire design will seek to gather information on these aspects of the project in order to establish whether the core benefits of technology transfer has socio-cultural implications. Preliminary findings from the Earthwatch Volunteers indicate that this form of eco-tourism places the latter as a core benefit for them – a lesson that teachers should investigate for both themselves and for those for whom they interpret the curriculum. If, as Sir Crispin Tickell very recently warned us, "the constraining effects of an out of date curriculum ... excludes proper consideration of the environment" and interdisciplinarity is purged by testing (Tickell, 2000), then these preliminary finding of routes to broader understandings through two-way developmental education in design technology may be seen as one way forward.

Picture 7 Food for thought - the explicit benefits of the Earthwatch project

Endnotes

1 Peter D'Sena would like to thank Wendy Nuttall, Head of School, for supporting his work on the Earthwatch project 'Indonesian Sun Cooking' in the summer of 1997 and the Earthwatch Institute for allowing him access to Volunteers' Final Reports.

2 The Earthwatch organisation operates over 120 projects worldwide; the intention of each is to contribute to a variety of conservation issues. For further details contact Earthwatch at 57 Woodstock Road, Oxford OX2 6HJ.

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