Generic green skills: Can they be addressed through Technology Education?

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One of the ancient scripts tells the story of a traveller who met three people on the road and asked them what were they doing? One answered – turning stones, another, - earning money and the third one replied that he was building a church. Although all of them were doing the same job, their intentions were different.

Introduction

The close link between education and economic development established by the 1980s was viewed by governments as a way to increase the relevance of education for economic purposes. A number of measures taken by governments to ensure this link included the introduction of technology education (across all levels of schooling) into the academic curriculum and the increasing presence of vocational courses at the secondary level. As the introduction of technology education sits within this economic imperative (although it performs its emancipatory functions as well), it is argued here that the development of technology education needs to be in line with economic changes.

Current economic restructuring with the purpose of attaining a cleaner, more climate-resilient, efficient economy that preserves environmental sustainability and provides decent work conditions is visible on the global scale. These economic changes require removal of some existing jobs, establishment of new jobs and a change in the nature (or greening) of others. The Asia Business Council Report predicts that the number of new or refashioned green jobs created by 2030 could reach 100 million worldwide, which is estimated at 2% of the future workforce. Although green growth is a relative new-comer as a driving force for employment and training, it has become clear over the last few years that many jobs are changing as green skills are introduced. Technology education need to catch up with these economic changes, therefore it is important to understand what kind of skills, capabilities and attitudes we are targeting as there is an important role for technology education learning within this greening agenda.

Economic development and the greening of economies

It is essential to acknowledge that differences in the level of economic development and in the drivers behind skills change will influence the ways technology education could address the green agenda. Often, economic development is described through three stages: factor-driven economies (stage 1), efficiency-driven economies (stage 2) and innovation-driven economies (stage 3) with a transition phase between each stage. This classification is based on the measurements of national economic competitiveness that provides comparative statistics for 'evidence-based' policy development, including education.

Commonly recognised drivers of skills and occupational change associated with green economic restructuring include: i) changing natural or built environments; ii) policy and regulation; iii) technology and innovation; and iv) markets for green industries and consumer habits (ILO/ CEDEFOP, 2011). These four drivers have different influences on greening of the economies of countries that are at different stages in their development.

Countries characterised by factor-driven growth face the main economic challenges of using land, labour and capital efficiently. Competitiveness derives from low-cost production and ease of access to external markets. Manufacturing is related to the production of low-value-added goods and services. For them, the first two drivers may play a greater role than the others.

Countries characterised by efficiency-driven growth build their economies on export manufacturing and outsourced service exports. Production is focused on high-value-added goods and services. Competition relates to high quality production based on imported technology. For them, the first two and the last drivers are more significant for greening their economies. Not clear

Countries characterised by innovation-driven growth generate a high rate of innovation, adaptation and commercialisation of new technologies, designing products and services at the global technological frontier. These countries are influenced of all four drivers, and particularly, the technology and innovation drive.

Although a number of drivers might be present in each particular country, some of them can have more impact than others. Therefore, the technology and innovation drive is more influential within innovation-driven economies such as Korea; markets for green goods and policy regulations influence the economy in China at its efficiency-driven stage of development; changes in natural environment drive changes in Bangladesh (a factor-driven economy). Within the global economy the process of greening could also be stimulated by the rules and regulations of other countries. The economic development of the Asia-Pacific region, for example, is very much dependent on exports, particularly to the EU, therefore, the production of green goods and provision of green services will be stimulated by the EU laws and regulations.

Australia's economic development is leading to the innovative-driven model that shapes specific requirements for skills development. Introduction of technology education was justified through the opportunity to develop such 'skills' as problem-solving capabilities, team work, creativity, use of technologies through the context of designing and making. The emergence of green economic restructuring puts additional demands on the composition of skills addressed through technology education in each country model/type.

Technology education and employability skills

Opportunities to develop problem-solving capabilities, team work, creativity and the use of technologies within the context of designing and making are mentioned as goals in many technology education syllabuses around the world. Although they are not called employability skills, that is, the ones that are included in vocational training programs and variously referred to as core, employability, generic, key or life skills/competencies, they

are very closely related to them. These 'generic technology education skills' play a significant role in ensuring that young people have the necessary skills/competencies to enter and participate in the workforce.

In Australia, for example, the Australian Chamber of Industry and Commerce and the Business Council of Australia define these skills as *employability skills*, "skills required not only to gain employment, but also to progress within an enterprise so as to achieve one's potential and contribute successfully to enterprise strategic directions" (2002, p.3). This framework identifies eight main employability skills that have a broader application as they are relevant to a variety of tasks in personal, social and work contexts. These skills can also help individuals to cope with change. Other countries in the region have followed a similar pattern. In 2006, the Singapore Workforce Development Agency identified ten foundational skills that are applicable across all industries. Since then, courses targeting these areas are being included in learning programs, particularly for those who do not have any formal qualifications. Since 2001, qualifications in the Philippines have been based on three types of competencies: basic (generic work skills), common (industry specific) and core (occupation specific). Some examples of basic competencies are: leading workplace communication, leading small teams, developing and practising negotiation skills, solving problems related to work activities.

The importance of these core/generic competencies have been demonstrated by Australian employers' requiring employees who are creative problem-solvers, and innovators and able to update their knowledge and expertise on a continuing basis. Employers are looking for employees who are adaptable and who have skills beyond the technical; 33.1% of employers consider employability skills to be the most important factor when employing graduates. Their multi-dimensional nature being comprised of "know-how, analytical, cultural and communication skills, and common sense". [These] can help to provide an active and reflective approach to life for the employees. Therefore, the importance of developing these generic capabilities through technology education to increase chances of school leavers in adjusting successfully for lifehoods and employment should not be underestimated.

Technology education is not the only academic subject that responds to economic development needs. A comparative study between Scotland, Germany and Poland examined prevocational models applied in these countries aimed at achieving a better understanding of the world of work and providing students with experiences and learning within 'near-work' environments. A pre-vocational curriculum was identified as a range of competences covering the broad economic and business environment, firm specific knowledge and a range of *core competencies and general skills*. The curriculum was offered as a *separate* subject area within the school (Scotland) or *integrated* within existing subject areas (Germany and Poland). The pre-vocational curriculum was integrated with the Civic Education (Poland) and within Social Sciences and Geography-Economics-Politics (Germany).

The study identified a match between different types of economies (the liberal market economy - Scotland, the coordinated market economy – Germany, and the mixed market economy – Poland) with the structure of the syllabus and the competitive core competences identified for each of the countries. In the case of Scotland, the emphasis of

the pre-vocational curriculum was on *general and transferable personal skills* as per a core competencies model. Self and social competencies as internal locus of control, risk-taking, communication ability and team ability were most important. In Germany, the wider *economic and market environment* and *social and collective competencies* prevailed over competencies in business. These competencies were knowledge-based in the field of trade and globalisation, teamwork abilities and communication competencies (the role of enterprises within the debate on economic restructuring and globalisation and the new developments of new technologies). In Poland, the priority was given to the *wider market economy*, including aspects of the labour market and industrial relations. The most dominant competencies were: labour market, communication ability, monetary system, government policies, income, and indicators of the economy. Self-competencies and competencies related to the level of individual firms gained very little attention in Poland. In each country there was a very weak link between the prescribed and the taught curriculum within the schools as teachers had decided to prioritise certain aspects of the curriculum and exclude others (Scotland and Germany) or the teachers were not trained adequately enough to teach the subject area and/or had insufficient resources to do so within an already overcrowded curriculum (Poland). The results of this study demonstrate the importance of the cultural and economic contexts in identifying and influencing the nature of pre-vocational education, including employability skills development. Therefore, although many technology education syllabuses state similar things in terms of development of students' capabilities and skill, learning in technology education classes should be culture and context-specific. In the Australian liberal market economy an emphasis on general transferable personal skills needs to be addressed in technology education.

Technology education and Education for Sustainable Development

How does the need to address economic development issues in technology education relate to SD? I have argued elsewhere that SD is the most appropriate framework for curriculum development in technology education and that two essential bases for ESD pedagogy in technology education are:

- weak anthropocentrism as the ethics behind ESD that focuses on human well-being to be achieved in harmony with nature; and
- a combination of value change and technical fix approaches

Throughout the history of humanity, the relationship between humanity and nature has been one of the most important existential and philosophical issues. In traditional cultures the unity of humanity and nature has been presented within an overall perception of the world; some indigenous cultures still preserve this view. Through historical development, particularly in the West, technological development and an increase in technocratic ideology, linked with the expansion of human power through technical control (Habermas, 1968/1971), has greatly contributed to environmental and social problems and, as a consequence, to the emergence of a discourse about SD.

The differences in views of the relationship between humanity and nature are partly rooted in different philosophical and moral conceptions of appropriate ways to conceptualize these relationships. On the opposite sides of the debate are ***ecocentric***

environmental ethics and 'deep ecology' (which attribute *intrinsic* value to nature and suggest that humans should live according to nature), and ***anthropocentric or technocratic environmental ethics*** (which attribute *instrumental* value to nature and suggest that humans should use and manage nature wisely).

Weak anthropocentrism, the environmental ethic that promotes the mutual flourishing of human and non-human nature (for a full discussion see Pavlova, 2009), characterizes the founding principle formulated in the 'Caring for the Earth' strategy of IUCN, UNEP and WWF (1991) Among the nine principles for Sustainable Living formulated in the strategy, one provides the ethical base for all the others : Respect and care for the community of life, meaning duty to care for other people and other forms of life now and in the future.

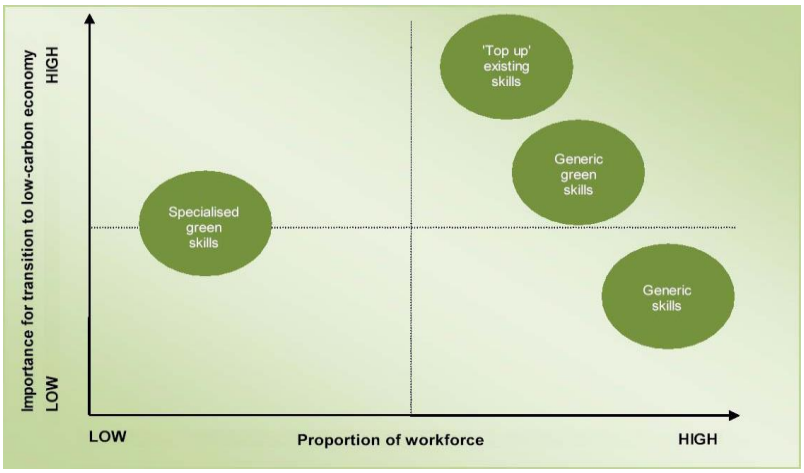
Therefore, a conceptualization of sustainable development within a framework of weak anthropocentrism which involves valuing of the 'other' (human and non-human), can provide a basis for the development of pedagogical approaches within ESD in technology education.

Green economic development could be narrowly interpreted as industrial ecology that does not represent a sufficient response to the challenge of the modern world, because reductions in the environmental impacts of national economies do not necessarily translate into improvements in the quality of life for all. This narrow approach (a 'technical fix') might treat only the symptoms, not the disease and root causes. Rather, to achieve changes towards sustainability, a 'value change' is required. A fundamental change in underlying values and attitudes that would characterize a radical shift in our thinking is part of the transformative journey for achieving sustainability. Technology education is well positioned to apply both approaches (technical fix and value change) framed by the ethics of weak anthropocentrism. This approach defines the types of green skills to be included in technology education and the ways of inclusion.

Green skills for greening economies

In many countries job creation in renewable energy, retrofitting of existing buildings, mass transportation, wastewater management and environmental conservation is in progress. So, multiple initiatives are in place to train for greener jobs. However, different level of economic development and other factors influence the ways green skills are interpreted and developed. Figure 1 presents the relative importance of specialised; 'top-up' and generic skills for greening economies. The CEDEFOP (2010) study suggests that the retraining required for workers to convert to an occupation in an entirely different, greener industry will not occur on a massive scale. The majority of skills development responses are related to up-skilling, or adding to existing core skills to enable a person to fulfil a new occupation. Topping-up skills could be firm or industry specific for structured economies and job-specific for informal and non-formal economies and could be addressed through existing education and training system.

Figure 1. Green skills and their importance for transition to low-carbon economy.



CEDEFOP, 2010

Generic green skills are required in almost any occupation to understand and appreciate the issues and demands of green growth. Specialised green skills that relate to new green occupations are deemed to be country specific, as what is in one country may be topping up on existing skills but could be the development of new training packages for newly established occupations in other countries. In some countries occupations related to renewable energy, waste management, green business management could be new.

Education priorities for green skills development will vary depending on the stage of economic development of the country. For factor-driven countries a large proportion of non-formal green skills training and entrepreneurial training could be appropriate. However, to stimulate efficiency improvement, some training at a higher level is required (e.g. skills development in the renewable energy sector in Bangladesh). For efficiency-driven countries the development of low-level vocational skills required by skilled workers should be balanced by the higher level green skills required for technicians. Innovation-driven countries need to put more emphasis on the high skills required by engineers and scientists to stimulate development of new green technologies, so a well-developed higher education system will be linked to research (e.g., EU countries are putting a special emphasis on STEM – science, technology, engineering and mathematics).

This paper argues that generic green skills should become a part of generic/employability skills, then these 'enriched' employability skills could help to address successfully economic needs of greening.

Technology education and generic green skills

What is the nature of generic capabilities for Australian technology education within a green agenda when technology and innovation are the main drivers for economic

development and a liberal market economy is prevailing? Why is it important for technology education to address this call for green skills development? What type of skills should be addressed?

Currently discussions on greening skills are mainly related to vocational education and include both generic and specific skills. This paper argues that generic green skills need to be addressed in TE as they constitute new, 'enriched' employability skills. A green economy requires the development of generic green skills (among other skills) that are in demand in almost any occupation (Pavlova, 2011). These generic green skills help to prepare the future workforce to understand issues of green growth (including environmental, social and economic aspects), to interpret environmental legislation, to increase energy and resource efficiency to enable the processes involved in greening the economy. Several generic green skills are presented below as candidates for the generic green skills list, however, research is required to shape the list more accurately (adjusted from Pavlova, 2011):

- Environmental awareness and attitudes and willingness to learn about sustainable development, issues and challenges of SD;
- Coordination and management skills for holistic and interdisciplinary approaches towards design solutions to meet economic, social and ecologic objectives;
- Entrepreneurial skills to seize the opportunities of low-carbon technologies;
- Innovation skills to identify opportunities and create new strategies to respond to green challenges;
- *STEM skills:* general understanding of the role of the science, technology, engineering and mathematics' contribution to the process of greening economies and societies;
- *Analytical thinking skills*: As business and industry move towards a genuinely sustainable model it will be necessary to understand the thinking behind a closed-loop economy and how this differs from the traditional linear model of economic development.

These generic green skills will enrich employability skills currently addressed through technology education. They will also operationalize ideals of sustainable development. The re-orientation of individual values towards greener development empowers technology education students with new visions of reality and the means to achieve them. Technology education could provide important means to focus on human agency to develop green skills by effectively changing awareness, perceptions, attitudes, understandings and behaviours relating to the natural and social environment and in developing responsibility and connections with the natural, social and economic settings.

Summary

If we go back to the ancient story stated at the beginning, TE moved away from MA (turning stones) to TE that addresses employability skills (economic imperative, competitiveness and increase in earnings). Now, the next move is required towards TE with enriched (green) employability skills, the one that has a vision of a better world where multiple initiatives are in place to enhance green growth.

A new national curriculum in Australia is taking shape and sustainability is an important consideration for organising the curriculum. Development of generic green skills shaped by the ethics of weak anthropocentrism together with government initiatives aimed at green growth will help to achieve aspirations to move towards a greener economy. However, skills development for greening needs to be carefully planned at the country level to account for differences in economic and social conditions. For Australia, generic green skills could be linked with employability skills that need to be addressed through a number of subjects including technology education.

The inclusion of generic green skills into TE curriculum will help to address economic needs of countries and to stimulate personal developments of students. Environmental awareness, challenges of SD, holistic approaches to design, innovation and analytical skills, STEM skills compacted in green employability skills to be developed in the context of designing and making. Social, technological, economic and environmental aspects of design addressed through technology education will help countries to address challenges of transformation to a greener economy.

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