Margarita Pavlova

TECHNICAL AND VOCATIONAL EDUCATION AND TRAINING SERIES

10

# Technology and Vocational Education for Sustainable Development

## *Empowering Individuals for the Future*

UNESCO UNEVOC INTERNATIONAL CENTRE for Technical and Vocational Education and Training

Springer

# TECHNOLOGY AND VOCATIONAL EDUCATION FOR SUSTAINABLE DEVELOPMENT

**UNESCO-UNEVOC Book Series**
**Technical and Vocational Education and Training:**
**Issues, Concerns and Prospects**

# Volume 10

# Technology and Vocational Education for Sustainable Development

## Empowering Individuals for the Future

*by*

MARGARITA PAVLOVA

*Griffith University, QLD, Australia*

Springer

UNESCO UNEVOC INTERNATIONAL CENTRE for Technical and Vocational Education and Training

Margarita Pavlova
Griffith University
Griffith Institute for Educational Research
Mt Gravatt Campus
176 Messines Ridge Road
Mt Gravatt, Queensland 4122
Australia
m.pavlova@griffith.edu.au

ISBN: 978-1-4020-5278-1 e-ISBN: 978-1-4020-5279-8

DOI 10.1007/978-1-4020-5279-8

Library of Congress Control Number: 2008938359



Printed on acid-free paper

9 8 7 6 5 4 3 2 1

springer.com

# Introduction by the Series Editor

This is an important book on an important subject and so I am delighted that this volume appears in the UNESCO-UNEVOC Technical and Vocational Education and Training (TVET) Book Series, published by Springer (the Netherlands).

The researcher Dr Margarita Pavlova, a leading scholar in the field of technology and vocational education, argues a convincing case in support of the importance of technology education as a key contributor to vocational education. Dr Pavlova believes that the inclusion of technology education in courses of vocational education, particularly at the secondary school level, can be a major facilitator of student empowerment both within the immediate learning environment and beyond. She also argues that technology education has much to contribute to education for sustainable development (ESD).

This book provides a valuable contribution to the development of technology and vocational education in terms of theory and practice. There are several bases for claiming this.

First, this book challenges a number of assumptions that are visible to me through my international work in TVET, namely:

(A) *The often antagonistic relationship between technology and vocational education*: As is rightly argued by Dr Pavlova, technology education is a very effective way to achieve the vocationalisation of secondary schooling and in so doing contributes significantly to the aims and objectives of vocational education by increasing the employability of students.
(B) *The perception of values as a single concept*: Often in the literature on values in TVET, all values are considered as being of equal importance, however, the author argues for a priority for moral values that provides a basis for responsible behaviour and care for others.
(C) *The interpretation of SD in terms of three pillars of sustainability*: This constitutes only one dimension for conceptualising sustainable development whereas Dr Pavlova argues for the inclusion of another two, namely, the ethics of weak anthropocentrism *and* the nature of the proposed responses towards SD issues: 'value-change' versus 'technical fix'.

The thoughtful reflections and analyses presented in the book help identify and challenge such assumptions and in doing so, the book raises some stimulating intellectual matters for the reader to consider.

As well as providing a new, coherent approach towards conceptualising SD and ESD, this book presents a number of examples on how it has been or could be applied in practice. These include teaching strategies in Chapters 3 and 4; and a model for the re-design of teacher training programmes to incorporate ESD, in Chapter 6.

This book is based on theoretical analysis and research projects conducted by the author in different parts of the world that add additional credibility to the arguments presented in the book. A further important attribute of the book is its contribution to the literature on empowerment, a very important topic for UNESCO since the empowerment of people often helps bring about positive changes that are clearly required in many regions of the world.

Aesthetics of sustainability and aesthetics for sustainability are two fresh concepts introduced in the book. These are related to consumerism, identity construction and challenges that teachers have to address when dealing with SD issues in their classrooms. Aesthetics and how it can serve SD is an important new theme that has not been addressed in TVET discourses on sustainable development and is examined in the book.

Having established a well developed conceptual framework, the author goes on to illustrate the ideas and concepts presented in the first part of the book through an enlightening, well argued case study of the complex interrelationship between technology education, vocational education and education for sustainable development as part of the process of modernisation of the education system in Russia. The case study demonstrates the importance of context. This includes TVET histories and traditions, SD discourses, political structures of the country, intellectual traditions and various important other factors. Although ESD is not fully addressed in TVET in Russia, the case study identifies a huge potential in its ability to include ESD. One additional benefit relates to the presences of general studies in vocational education. Two types of theories inform conceptualisation of SD in Russia: a theory of biological stabilisation and a concept of noosphere presents an original thinking that can be used by the other countries to inform their ESD development.

This book is of interest for both technology education and TVET researchers, practitioners and education policymakers since it presents powerful arguments and discussions that are applicable for technology and vocational education contexts. Furthermore, it shows the links between them that are beneficial for the individual's development and empowerment.

Director of the UNESCO-UNEVOC International Centre for Education,
Bonn, Germany

Rupert Maclean

# Contents

# List of Figures

# List of Tables

# Introduction

Empowerment is the overarching idea used in this book. The term has a variety of meanings in different sociocultural and political contexts, including "self-strength, control, self-power, self-reliance, own choice, life of dignity in accordance with one's values, capable of fighting for one's rights, independence, own decision making, being free, awakening, and capability" (The World Bank, 2002, p. 10). However, the World Bank report observed that most definitions focus on issues of "gaining power and control over decisions and resources that determine the quality of one's life" (p. 10). This interpretation of empowerment provides a useful starting point for the development of the series of interconnected arguments explored here. Establishment of the basis for understanding, identifying and developing strategies through education necessary for individuals to be able to make choices that influence the quality of their lives is the main aim of this book.

There are a number of assumptions and boundaries that frame this analysis. First, the book focuses on "agents"; however, empowerment is often conceptualised in terms of relationships between agency and structure (e.g., Alsop, Bertelsen, & Holland, 2006). Agency could be defined as "an actor's or group's ability to make purposeful choices – that is, the actor is able to envisage and purposively choose options" (p. 11). As argued by Alsop, Bertelsen and Holland, "in terms of both measurement of and action to enhance empowerment, a person's or group's agency can be largely predicted by their *asset endowment*" (p. 11). Assets are understood as the human capacities to exploit opportunities – economic, social or political – to engage robustly in productive activity (Moser, 1998; Swift, 1989). There are a number of assets one might explore within the concept of human agency. However, only the limited assets such as psychological, informational and human are explored here, as they are more central to the argument advanced in the book; this is the second limitation. Third, only the vehicle of education as the means for developing individuals' assets is considered in this book. The ways education can raise individuals' levels of consciousness, so they are able "to translate their assets into choices" (Alsop *et al.*, 2006, p. 11), are explored in this volume. Therefore, this book is focused on agency, on empowering individuals through developing their assets, expanding their freedom of choices and transformative actions, by the means of education.

However, answering questions such as: How do we determine choices? How to act? What is the direction for transforming realities? How to define the quality of

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_1, © Springer Science+Business Media B.V. 2009

life? – requires a clear vision of a desirable future. An effective way of constructing this vision is advanced through the concept of sustainable development (SD). Notions such as survival, fairness, nature preservation and other issues of SD frame our vision of a sustainable future and of a suitable quality of life. This book proposes three bases for conceptualising SD that can be used in different contexts to establish a vision of a desirable future and the ways to achieve it.

It is also argued that education for sustainable development (ESD) developed on the basis of this conceptualisation could propose strategies to empower individuals for the required transformative actions that are the result of changes in their mindset and worldviews. Through the concept of empowerment, a vision and purpose of education that helps students to develop a particular set of capabilities and moral values that determine the quality of their life is explored. They are all aimed at developing particular capabilities to help students to achieve confidence in their ability to:

- Take effective and appropriate action;
- Explain their actions and motivations;
- Live and work effectively with others; and
- Continue to learn from their experiences as individuals and in association with others, in a diverse and changing society (Stephenson, 1992).

These abilities could be accomplished within the framework of ESD that is argued to be the main principle in changing the educational paradigm to one that is required for SD. The proposed strategies emphasise capability development and promote responsibility and investment in developing the whole person by emphasising moral values and care for the "other". They include student-centred learning in which students are actively involved in identifying directions for their activities, active methods of learning through projects and discourses aimed at formulating a vision of the future and each person's role in achieving this by transforming realities. Capability development underpinned by moral values "results in people learning to interact in dynamic balance with the various environments in which they live and work so that they can fulfil their potential, expand their work challenges, take responsibility for their choices and contribute to sustainability, relationship building and resilience within their organisations" (Staron, Jasinski, & Weatherley, 2006, p. 46). This book explores the ways in which capabilities of people can be expanded to increase their well-being and security within the paradigm of SD. It is acknowledged that strategies to empower people vary depending on the political, institutional, cultural and social contexts; they also change over time. Chapters 4, 5 and 6 propose a number of strategies for technology and vocational studies.

Technology and vocational education are the main contexts for the analyses presented in the book. Examination of the *relationships between technology education and vocational education* is one of the conceptual bases for this book. It relates to the issues of the vocationalisation of secondary schooling and to the increased emphasis on the development of key competencies and other abilities together with values through vocational education. The importance of vocational education to "empower people to contribute to environmentally sound sustainable development

through their occupations and other areas of their lives" is outlined in UNESCO's recommendations on TVET (UNESCO and ILO, 2002, p. 9) as among the central goals of vocational education and it is acknowledged in these chapters.

This book consists of two parts. The first explores the opportunities that ESD can provide to empower individuals in the context of technology and vocational education; it examines a number of concepts from different areas of knowledge including philosophy, pedagogy, psychology, politics, comparative education and science. This multifaceted approach is adopted to develop a comprehensive understanding of the ways SD, ESD and empowerment are related. Concepts such as capability, vocationalisation of schooling, moral values, aesthetics, design, consumption, a new paradigm of education, social and cultural context, sustainable development and education for sustainable development, when brought together, provide an opportunity to reflect on and develop further theory and practice on ESD approaches in technology and vocational education. A number of practical strategies are proposed for meeting young people's needs and to help develop their social responsibility.

The second part of the book explores how some general issues addressed in Part One are reflected in local norms, values and behaviours within the Russian context. Russia was chosen as an example of a country in transition that does not have an established capitalist society and has a long-standing intellectual tradition concerning global issues. The case study is included in the book to illustrate the importance of understanding the political and sociocultural context of a country in order to develop empowerment strategies that work for that particular society as they reflect specific local histories, values and traditions.

The main ideas developed in this book have been explored through a number of research projects supported by grants from UNESCO-UNEVOC and the Forum for European-Australian Science and Technology Cooperation (FEAST); they have also been tested through conference presentations and seminar discussions over the last four years. This book is a manifestation of the idea that an appropriate education for sustainable development is empowering. Particular assets developed through education empower individuals so they can contribute to the sustainable development of humanity and to the quality of their lives. This book discusses how ESD can be enhanced through a specific context of technology and vocational education.

## References

Alsop, R., Bertelsen, M. F., & Holland, J. (2006). *Empowerment in practice: From analysis to implementation*. Washington, DC: The World Bank.

Moser, C. (1998). The asset vulnerability framework: Reassessing urban poverty reduction strategies. *World Development*, *26*(1), 1–19.

Staron, M., Jasinski, M., & Weatherley, R. (2006). Life based learning: A strength based approach for capability development in vocational and technical education. Sydney: TAFE NSW International Centre for VET Teaching and Leaning.

Stephenson, J. (1992). The Concept of Capability and its Importance in Higher Education. In J. Stephenson & S. Weil (Eds.) *Quality in learning: A capability approach in higher education* (pp. 1–14). London: Kogan Page.

Swift, J. (1989). Why are rural people so vulnerable to famine? *IDS Bulletin, 20*(2), 8–15.
UNESCO, & ILO. (2002). *Technical and vocational education for the twenty – first century: ILO and UNESCO recommendations*. Paris: UNESCO and Geneva: ILO.
The World Bank. (2002). *Empowerment sourcebook*. Draft, May 1. Retrieved March 25, 2008, from http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTPOVERTY/EXTEMPOWERMENT/0,,contentMDK:20260036~isCURL:Y~pagePK:210058~piPK:210062~theSitePK:486411,00.html

# Chapter 1
# Technology Education as an Effective Way of Providing Vocational Education Within Secondary Schooling

This chapter provides an initial analysis of technology education and of vocational education and explores their similarities in terms of their capacities to develop students' generic competences/capabilities. These are examined across both developed and developing countries. On the one hand, technology education and vocational education are considered as two separate domains that provide different learning environments for students. They are also considered to be different in terms of the concepts they employ and develop as well as their goals. To highlight conceptual differences between vocational and technology education, studies by a number of researchers who have examined technology education or carried out research to measure the changes that occur in teachers' practices within technology education are examined. This research is based largely on the assumption that concepts such as "using technology to solve problems and satisfy needs and wants" and "using problem-solving skills" are implicit conceptualisations of "technology education". Similarly, implicit conceptualisations of vocational education are related to skill in using tools and machines (Sanders, 2001). Stevenson (2003) identified a number of dichotomies in these underlying assumptions. These include: general knowledge versus specific knowledge; theoretical knowledge versus practical/functional knowledge; conceptual understanding versus proficiency in skills; creative abilities versus reproductive abilities; intellectual skills versus physical skills; preparation for life versus preparation for work. Stevenson argues that these dichotomies are used to set up technology education as opposed to vocational education.

On the other hand, the vocationalisation of secondary schooling as a way of improving the vocational relevance of education could bring technology and vocational education together. Usually, vocationalisation means the introduction of practical and/or vocational subjects, industry visits, vocational guidance, and more applied methods of teaching general education subjects. While this is an explicit goal in many systems, the main purpose of education remains general education and qualifying students for higher academic studies (Lauglo, 2005). Traditionally the vocationalisation of secondary education has been seen as an effective measure for developing human resources. Although it is regarded as being appropriate for both developed and developing countries, the politics of vocationalisation of secondary education has determined that it has developed differently in the two contexts. As suggested by McLean and Kamau (1999), the

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_2, © Springer Science+Business Media B.V. 2009

policy shift in developing countries during the 1990s was consistent with the changing priorities, from pre-vocational courses to initiatives to strengthen general education, formulated by, among other organisations, the World Bank (1991). For developed countries with well-functioning and well-resourced secondary school systems that enrol the great majority of young people, vocationalisation is seen as an appropriate initiative (Lauglo, 2005). Studies carried out in both developed (e.g., Coombe, 1988) and developing countries (e.g., Lauglo, 2005) have shown that economic goals were one of the main motives for introducing pre-vocation education, practical subjects and a curriculum more orientated to work. In African countries, for example, "the issue at the heart of policy debate on vocationalisation has undoubtedly been 'economic relevance' … the hope has been that students would more easily find work when they leave school, and become more productive and trainable" (Lauglo, 2005, p. 7).

Although the rationale for technology education was developed within a philosophy strongly opposed to the aims and objectives of vocational education, this chapter discusses why technology education can be an effective way to provide vocational education at the secondary school level and why it provides an essential component in achieving the goals of vocational education at that level. Technology education is thus considered as the main educational context used in this book, and development of empowering strategies within education for sustainable development is specific for this context. This chapter focuses on the analysis of the vocationalisation of secondary education in developed countries; however, vocationalisation via technology education can be also viewed as an appropriate way of strengthening general education in developing countries.

## Vocationalisation of Schooling

In the modern world the economy is closely associated with technologies that have changed the nature of industry. Since the 1960s it has become widely accepted that technological change has influenced the patterns of everyday life, restructuring work and leisure. Technology is playing an important role in the life of society. The changing context led governments to reconsider the relationship between liberal education and vocational preparation and to be "more responsive to the changing labour market needs of nations" (Taylor, Rizvi, Lingard, & Henry, 1997, p. 4). This demanded revision of educational policy and in particular, a reconsideration of the goals of education.

The wave of educational reform movements at the end of the 1980s and beginning of the 1990s illustrate the attempts to re-configure educational systems of developed countries into what is described by Cowen (1996) as a "late-modern model". Studies undertaken by a number of researchers (see for example, Ball, 1994, 1997, 1998; Marginson, 1993; O'Neill, 1995; Taylor *et al.*, 1997) identified an increasing colonisation of educational policy by economic policy imperatives in Western countries.

A shift from the "Welfare State" to the market-oriented or "Competition State" has occurred during that period. This has been accompanied by a shift in social expectations where the person, socialised into the national culture, is being replaced by a person able to live and work in the market-oriented state. The emphasis, however, in this competition state, is on the development of the strongest ideological pairing between education and knowledge/competition within the international economy. These late-modern models of education are very different from the modern models of education which emphasised equality of educational opportunity, had a strong ideological pairing with the citizen formation, and stressed the domination of political and civic imperatives over economic imperatives (Cowen, 1996).

Ball (1998) further argued that contemporary education policies "tie together individual consumer choice in education markets with rhetoric and policies aimed at furthering national economic interests" (p. 122). O'Neill (1995) identifies "the new orthodoxy" in the relationship between politics, government and education, where two of the five main elements thus identified are: improving national economics by tightening a connection between schooling, employment, productivity and trade; and enhancing student outcomes in employment-related skills and competencies (p. 9). Education is considered as playing a key role in stimulating growth and restoring economic competitiveness and a socially acceptable level of employment together with "promoting the development of the individual and the values of citizenship" (Commission of the European Communities, 1993, p. 117). Therefore, for the late-modern models of education, future employment and work-related qualities became the main concern of secondary education as well as of vocational education.

## Vocational Education

Traditionally, direct preparation for work was the main goal of vocational education. It was perceived as providing specific training that was reproductive and based on teachers' instruction, with the intention to develop understanding of a particular industry, comprising the specific skills or tricks of the trade. Students' motivation was seen to be engendered by the economic benefits to them, in the future. School practice demonstrates that these interpretations are applicable to a greater or lesser extent depending on the country. The introduction of vocational courses in secondary schools usually involves very practical courses that can lead to the lowest level of certification. Certificate 1 in areas such as construction, furnishing, engineering and drawing give students practical skills and knowledge against very detailed descriptions of the required outcomes. Competency-based training was chosen by most governments in Western societies as a model for vocational education (VE). For example, training packages introduced in Australia specified competency outcomes, assessment guidelines and national qualifications, in accordance with workplace skill requirements. Explicit

emphasis on observable outcomes in vocational education has been criticised by a number of authors. Stevenson (2003) argued that competency-based approaches to vocational education are not in accord with industry demands, as the competency-based model of vocational education is in conflict with realities of living and working in a rapidly changing world.

Changes associated with innovations in science and technology and the requirement to prepare knowledge workers, together with the demands imposed by the changing nature of the working world, posed challenges to vocational education. Changing patterns of economic competition and work organisation have led to a greater call for soft skills such as teamwork, work ethic, and a preparedness to be flexible and to embrace change (Curtis & McKenzie, 2002). The flexibility and adaptability that is required by industry is not developed by current vocational education courses in schools. The introduction of vocational courses in secondary schooling has not been able to meet the needs of vocationalisation: to provide students with a better preparation for their vocational life. As the limited role of vocational courses in the vocationalisation of secondary education has been recognised internationally, broader approaches to vocationalisation have been trialled around the globe.

## *Pre-vocational Courses*

A number of initiatives in different countries attempted to establish prevocational courses in secondary schooling, which were aimed at blurring the distinction between education and training "as education becomes more vocationalised and as training requires the (sic) broader educational base" (Pring, 1995, p. 23). Pre-vocational courses are referred to as contributing to the "life-preparation" tradition, which is implicitly critical of both the academic and vocational traditions. The importance of the pre-vocational courses was supported by the argument that it is crucial to develop general capacities: the processes of learning, of problem solving, of co-operating and of enquiring. The emphasis in this new approach is not on the content to be covered, as in the traditional academic model, nor on specific competences, as in the vocational tradition. These general capacities or generic competencies are oriented towards the increasing employability of students.

## *Key Competencies*

Debates about competency-based training (CBT) started at the beginning of the 1990s and became "one of the most important changes in education for many years" (Marginson, 1993, p. 143). The concept of the key competencies was introduced in the debate as a move towards the growing "convergence" between vocational education and general education, based on individual development.

In a sense, the introduction of key competencies provided some response to industry demands. In Australia for example, the *Finn Report* (AEC, 1991) identified "key areas of competence" essential to the "employability" of all young people, and then the *Mayer Report* (Mayer, 1992) took up where Finn left off and developed a national "standards framework" which described "the nature of each key competency at a range of levels of performance" (p. 2) which are essential for effective participation in the emerging patterns of work.

The definition of competence adopted by the committee recognised that performance is underpinned not only by skills, but also by knowledge and understanding, and that they involve "both the ability to perform in a given context and the capacity to transfer knowledge and skills to new tasks and situations" (Mayer, 1992, p. 4). The competencies are meant to be applied within any vocational setting, and move beyond conventional discipline and subject boundaries. They include: collecting, analysing and organising ideas and information; expressing ideas and information; planning and organising activities; working with others and in teams; using mathematical ideas and techniques; solving problems; and using technology (Mayer, 1992, pp. 8–10). It is claimed that these competencies are essential for effective participation in any area of work. They are general, rather than specific to a particular occupation. Their inclusion in the mainstream curriculum would be beneficial for the education of an abstracted worker able to bring general competencies to any vocation. "If these capacities can be successfully taught, the chance of their being put to use are much greater than in the case of occupation-specific skills" (Lauglo, 2005, p. 47).

The technological key competence, for example, "focuses on the capacity to use technological processes, systems, equipment and materials and the capacity to transfer knowledge and skills to new situations" (Mayer, 1992, p. 8). Further development of key competencies was made by the Australian Chamber of Commerce and Industry (ACCI, 2002). It specified both personal attributes and key competency skills which could be developed through VE courses and programmes and that contribute to a person's employability:

- Communication skills that contribute to productive and harmonious relations between employees and customers;
- Teamwork skills that contribute to productive working relationships and outcomes;
- Problem-solving skills that contribute to productive outcomes;
- Initiative and enterprise skills that contribute to innovative outcomes;
- Planning and organising skills that contribute to long-term and short-term strategic planning;
- Self-management skills that contribute to employee satisfaction and growth;
- Learning skills that contribute to ongoing improvement and expansion in employee and company operations and outcomes;
- Technology skills that contribute to effective execution of tasks. (ACCI, 2002, p. 5)

The acceptance of the value of generic skills is important to the process of vocationalisation of secondary schooling.

## *Work Education*

More systematic ways of introducing vocational learning into schools had begun to inform the curriculum development process some time ago. In Australia, there were a number of state and national initiatives related to vocational learning and work education. In the *Coordinating Diversity Report* (1996, referred to in QSCC, 2002) the recommendation was made to investigate ways of including work education within the core curriculum from Years 1 to 10. The *Partnership for Growth Report* (MCEETYA, 1999, referred to in QSCC, 2002) set up principles to guide the provision of vocational learning for students, particularly in years 9 and 10, with the emphasis on explicit integration of vocational education across the curriculum. It is stated in the document that vocational education should be an essential element of the curriculum for these years and be accessible for all students, regardless of their current perceptions about their immediate post-school destination. Another document developed in 2000 (MCEETYA, 2001) established a new framework for vocational education in schools and was recommended by the Ministerial Council for Education, Employment, Training and Youth Affairs for implementation.

A position paper on work education published in 2002 in Queensland (QSCC, 2002) was designed to incorporate different recommendations specified in these reports and develop a vision of how work and education for work could be included in school curricula. It identified three inter-related components: *learning for work* (work-related knowledge, practices), *learning about work* (settings and conditions), and *understanding the nature of work* (socio-cultural, economic and political forces that influence work), that should be the focus of work education. It was stressed that work education should not be considered as a separate programme and should be addressed through key learning areas. The outcomes of such an education were that students should be able to demonstrate work-related key competencies in a range of settings (such as working with information, communications skills, planning and organising skills, solving problems, using technology, using mathematical ideas and techniques, working with others); positive attitudes towards different types of work and personal characteristics (such as self-confidence, commitment, initiative, flexibility); and entrepreneurial skills.

## *Profile Education*

Another approach to the general issue of vocationalisation of secondary education is the approach taken in Russia which is called “Profile Education” and was introduced for the last two years of schooling (Years 10 and 11). The intention was that profile education would provide students with the opportunity to study a chosen area in depth, usually one that would be related to their further study, and would lead to work in the future. The Concept of Profile Education (Ministry of Education, Russian Federation, Russian Academy of Education, 2002) has been trialled in several regions in Russia. Within the concept, the following profiles – science,

socio-economic, humanity, technology – were suggested as examples only (schools can design their own profiles). As students need to make important decisions after Year 9 relating to their further study and work, a new strategy called Before Profiling Preparation was also introduced in 2002 (Ministry of Education, Russian Federation, Russian Academy of Education, 2002). This Year 9 programme consists of a total of 100 study hours (3 hours per week). Two hours per week should be used for two types of courses: subject courses (to deepen knowledge and understanding in particular study areas) and orientation courses (to help students to choose an educational profile in Years 10 and 11). One hour per week should be used for information courses. These cover information about the local educational institutions, rules of enrolment and other practical details (Ministry of Education, Russian Federation, 2003). Thus, this preparation programme includes (in Australian terminology), learning for work (work-related knowledge, practices) and learning about work (settings and conditions) components. Currently, discussion about the value of starting Before Profiling Preparation in Years 7 or 8 is occurring.

The above initiatives illustrate a number of attempts to soften the rigid nature of vocational courses at school by putting individuals' needs in the centre of each initiative. Recent research on vocational education (see for example Staron, Jasinski, & Weatherley, 2006) highlighted the same idea. The report argued that *life-based learning* (not work-based learning) was required for vocational education, focusing on capability development and consideration of the learner as a whole person. According to Staron *et al*., life-based learning is a "win-win" situation with benefits to both employee and employer, subject to employees taking personal responsibility for their learning, and employers providing "rich learning environments" (p. 49) for "performance, growth and opportunity". It is, according to Staron *et al*., learning that is "adaptive, self-facilitated, based on reflexive practice and uses any strategy appropriate to the task" (p. 49). This broad interpretation of learning views vocational education as "a knowledge-based industry, where knowledge is its core business" (Staron *et al.*, 2006, p. 24).

In the current period of rapid change where new ways of working and living are required, a focus on the learner as a whole person and the acceptance of the importance of generic skills provides a basis to propose that technology education is not opposed to vocational education at the level of secondary schooling, but the opposite: that is, technology education can be an effective means to develop personal qualities and the generic skills required to achieve better employment outcomes. It provides an essential component in support of the vocationalisation of secondary schooling by relating curriculum to "real life" in an effective manner.

## Technology Education

The rationale for technology education and approaches to its teaching have been developed within the context of globalisation. On the one hand, international circulation of ideas through social and political networks brings common elements

to approaches and curriculum documents of different countries, and on the other hand, there are also specific, conceptualised characteristics and emphases in the ways in which the policy is realised in specific national settings.

## *Introduction of Technology Education*

Changes in educational policy and the existence of different practical courses in school curricula provided the background for including technology education in the curriculum of comprehensive schools, internationally. This learning area opens the opportunity to deal with some issues raised above in the framework of general education, for as Marginson (1993) explains, "technological change promotes demand for education, and education promotes technological change. Technological change leads to economic competitiveness and economic growth. Therefore, education is associated with these factors" (p. 47). This assumption was drawn from human capital theory, in which "human beings are measured in terms of their monetary value" (Marginson, 1993, p. 31). The close association between education and the economy raised technology education as an important area of discussion in many reports produced by educational authorities in different countries. Technology education as a field of study was widely recognised by the end of the 1980s, although the debate about including *Technology* in school curricula started in the 1960s. Since the mid-1960s several educational projects have looked for different ways of introducing technology as a school subject (for example, Project Technology, Design and Craft Project, the Design Project in the UK, and the Maryland Plan in the US).

In particular, certain assumptions were made about the goals of technology education – to be relevant to the economic needs of the nation and to prepare students for work and life in society. Technology education was seen as a means for developing knowledge, skills, attitudes, and values that allow students to maximise their flexibility and adaptability mainly for their future employment, but also to other aspects of life as well. However, it is claimed (e.g. ITEA, 1996) that technology education is a part of general education.

For example, in the UK, the former Secretary of State for Education, Kenneth Baker, announced that Technology as a subject was considered to be "of great significance for the economic well-being of this country" (cited in Barnett, 1992, p. 85). In Australia, *A Statement on Technology for Australian Schools* explained: "Technology programmes prepare students for living and working in an increasingly technological world and equip them for innovative and productive activity" (Curriculum Corporation, 1994, p. 4). In the US, it was announced that technology education was "vital to human welfare and economic prosperity" (ITEA, 1996, p. 1).

Various government and industry reports have argued that Australia must strengthen its technological and manufacturing base to improve its economic competitiveness. For example, in the report *Technological Change in Australia* it is stated that the committee recognised and accepted "the relations between

technological change and economic growth" (Committee of Enquiry into Technological Change in Australia, 1980, p. 168) and that there is a need "to exploit the economic benefits of technological change by fostering domestic innovation and by adapting imported technology to Australian needs" (p. 169). In the same report a concern was raised that only a small proportion of students took technologically oriented subjects in the last years of their secondary schooling. Thus, there is a need to prepare young people in a way that enables them "to benefit from the opportunities arising from the newly emerging technologies" (p. 90).

Internationally, the development of technology education has not occurred in a uniform way. This lack of uniformity also reflects the debates on technology at the theoretical level. Although theorising of technology began much earlier than the mid-1960s, the intensive debates on the nature and social impact of technology started around that time. Laudan (1984) argued that technological change, as the main characteristic of technology, involves cognitive, social, organisational, economic and other factors. Different disciplines, each of which had a different objective in analysing technological change, did not consider "technological change *tout court*, . . . [but] divide the problem, and hope to conquer it by this means" (Laudan, 1984, p. 2). Technology and technological change as an essential component of economic development became the primary interest of economists who analysed the economic impact of technological change. Scholars from different disciplines were examining the other aspects of the phenomenon:

> Sociologists and anthropologists may be looking for changes in the social structures and cultural practices and mores due to this phenomenon. Historians may tend to concentrate on chronicling the cumulative nature of technological change in the making of industrial civilizations. Philosophers concentrate on the moral and ethical implications of technological change and progress, and develop methodological tools for technology assessment. (Parayil, 1991, p. 293)

Indicators of the growing importance of technology include an increasing number of people involved in the discourse on technology, the appearance of published series, and the establishment of organisations related to technology. There has been constant disagreement on what comprises the nature of technology, and what should be done to manage it. In the mid-1980s new features of the discourse appeared, including a stronger emphasis on the growing uncertainties and environmental hazards and the request for sustainable development.

Therefore, for the establishment of technology education, this previously one-dimensional discourse did not provide a firm and systematic basis for development of the new learning area/subject. Presentation of technology in a multidimensional, holistic way was made by Mitcham (1978) and then further developed by a number of researchers and theorists (see for example Custer, 1995; Frey, 1989; de Vries, 1997). On the basis of the concept of functional distinction, Mitcham (1978) examined technology modally and generically. He provides the opportunity to look inside the phenomenon by analytical differentiation of parts, and to study the interrelations between them. Four modes of technology identified by Mitcham are *technology-as-object* (utilities, tools, machines, cybernetic devices),

*technology-as-knowledge* (maxims, rules, theories and engineering knowledge), *technology-as-process* (making, designing, maintaining, using), and *technology-as-volition* (motive, need, intention). Through volition, technology is explicitly connected with culture and society. This understanding of technology provides a four-dimensional analytical tool for examining approaches to technology education adopted by different countries.

Technology education internationally developed both from practice and theory and has been closely related to the context of particular countries. By 1996, the following principle perspectives on implementing technology education in practice were identified on the basis of the results of the Second Jerusalem International Science and Technology Education Conference. In summary, they made the following points:

- a "technical skills" approach, seeking emphasis on materials and control systems;
- a "craft" approach, emphasizing cultural and aesthetic values;
- a "technical production" approach, seeking emphasis on modern mass production;
- an "engineering apprentice" approach, focusing on the preparation of future engineers;
- a "modern technology" approach, which looks to the nature of "work" in the next century;
- a "science and technology" approach, in which these two subjects are closely associated;
- a "design" approach, with a concentration on design, seen by some as central to the study and practice of technology;
- a "problem solving" approach, focusing on the need for cross-disciplinary approaches;
- a "practical capability" approach, which emphasises personal and active involvement; and
- a "technological innovation" approach, with a driving force for social change. (The British Council, 1997)

These different ways of thinking of technology education demonstrate that internationally there is no widely accepted framework for the development of the field. Diversity of the socio-economic and cultural conditions in countries and availability of resources play an important role in the orientation of the subject. Different aspects of technology are selected and considered as a basis for curriculum development, for example, object (craft approach); knowledge (modern technology approach); process (design, technical product approaches); and volition (technological innovation approach). Some courses in the field are based on the "technical" characteristics of the phenomenon, some on the development of the child, others on cultural and aesthetic values, and some emphasise either modern or traditional technology, technical skills or problem-solving.

Pavlova (2001) examined the establishment of technology education in four countries – US, Australia, UK, and Russia. In these countries technology education was placed within the academic curriculum, among other subjects/learning areas in the

framework of the essentialist tradition. The "theories" or sets of assumptions concerning the purpose of technology education in school curriculum emerge from the general proposition that each child should be familiar with technology to be able to function adequately in society. The study found that through the process of establishing technology education within these four countries, its rationale, objectives, and teaching methods were opposed to those in vocational education and in a sense technology education was conceptualised in opposition to the school vocational subjects that at that time were narrowly focused on the development of specific skills.

The rationale of the subject has largely been connected to the ideology of economic rationalism; however technology education had been included as "a new basics" in the school curriculum. Over time, industry has increased its demand for multiskilled workers with generic competencies. Technology education has for some time had the capacity to play an important role in developing these required qualities in students. On that basis, Stevenson (2003) made the radical suggestion that vocational education should transform itself into technology education.

## *Technology Education in Specific Contexts*

The specificity of the ways in formulating rationale for technology education analysed below are presented in curriculum documents developed in Australia, Russia, US and UK over the period 1989–2000. The following themes – preparing students for the world of work, aims of technology education, programmes of study, and students' activities and methods of teaching – have been chosen to guide the analysis.

### Preparing Students for the World of Work

Preparing students for the world of work is seen among the main roles of technology education in Western countries and considered as the only role of technology education in Russia. For the UK and Australia, technology education is required to provide general skills and understandings that help students to prepare for the world of work. In Australia, they include the following:

- Skills of analysis and problem-solving;
- Skills of information processing and computing;
- An understanding of the role of science and technology in society, together with scientific and technological skills;
- An understanding of, and concern for, balanced development of the global environment; and
- A capacity to exercise judgement in matters of morality, ethics and social justice. (Curriculum Corporation, 1994, p. 4)

Similar requirements are stated in the "Terms of Reference" for the Design & Technology subject in the UK:

- to work in teams;
- to understand the importance of efficiency, quality, appearance and marketability;
- to understand the importance of working within financial and technical constraints;
- to use informational technology. (DES/WO, 1989, p. 93)

In these two countries, general skills and understanding are specified, not knowledge as such. However, it is accepted that knowledge underpins all activities. For example, the goal of technology education in Australian schools is to help students "to respond to the current and emerging economic and social needs of the nation, and to provide those *skills* [italics added] which will allow students maximum flexibility and adaptability in their future employment and other aspects of life" (Curriculum Corporation, 1994, p. 4). "In upper secondary school many technology programmes may be targeted towards work and further education" (AEC CURASS, 1992, p. 5). The strong influence of the generic competencies approach to education is reflected in those documents.

Among the aims of technology education in Russia are the development of work-related specific and generic skills; knowledge about modern and future technologies, economics, and enterprise; as well as the need to study the world of different occupations, to be involved in those industrial work experiences that could be the basis for future careers (Lednev, Nikandrov, & Lazutova, 1998).

Preparing for work is considered in the US literature as an individual need that should be met through technology education. Attention is drawn to the requirement for all workers to possess "both the skills to use products and the ability to identify and remedy simple malfunctions", and for workers such as engineers, designers, architects and the like, who are directly responsible for technological change, to have an "understanding and ability to assess and forecast the impacts of their actions" (ITEA, 1996, p. 8). General abilities such as problem-solving, analysis and the ability to synthesise information are also identified in the US Rationale. The importance of knowledge is not emphasised in the part concerning preparation of students for work. This is, however, stated and comprehensively categorised elsewhere in the "*Standards*".

Differences in beliefs about what is most important in preparing students for work became evident during the analysis of the documents. General skills and understanding in Australia and the UK, strong emphasis on knowledge and skills in Russia, and general abilities as well as knowledge in the US, are the main features to emerge.

*Market awareness* and consumerism as an important economic characteristic are emphasised by all countries through the main orientation of technological activity: to meet human needs (produce the product which is marketable). In the US document (ITEA, 1996), it is specified that students also have to be prepared to be consumers: "Consumers need to make decisions about the purchase, use, and disposal of appliances, information systems, and comfort-enhancing devices. From entertainment to medical decisions, everyday life requires a basic technological literacy" (p. 8). In the Russian *Standards*, among the particular aims of technology education is an awareness of the market. Students must "learn how to choose those products for making, which could be easy to sell" (Lednev *et al.*, 1998, p. 249). Thus, across four

countries students are required to examine consumption from both consumer and producer perspectives.

## Aims of Technology Education

The aims of technology education are explicitly stated in the documents through the concept of competencies. Different levels of competencies are required in each country: creativity, capability, literacy. The starting point for the analysis below is the proposal made by Todd (1991) in which he develops the taxonomy of technological competencies given in Table 1.1.

**Table 1.1** Taxonomy of technological competencies

| Level | Type of knowledge | Competence |
|---|---|---|
| 1 Technological awareness | knowledge that | understanding |
| 2 Technological literacy | knowledge that | comprehension |
| 3 Technological capability | knowledge that and how | application |
| 4 Technological creativity | knowledge that and how | invention |
| 5 Technological criticism | knowledge that, how, and why | judgement |

(after Todd, 1991, p. 271)

Each competence is underpinned by knowledge. The distinction between the required knowledge is made as follows: knowledge that, knowledge how and knowledge why. Is this understanding close to that accepted in the analysed documents? In each country the aims are different.

- to develop design and technology capability (UK);
- to provide technological literacy (US);
- to develop knowledge, capability and skills (Australia);
- to develop creativity (Russia) – specified as one of the aims.

Does this mean that the level of expectations for the students' achievement is higher in Russia compared to America? Does it mean that capability is strongly separated from knowledge and skills? And how do different aims influence the concept of knowledge? These questions are addressed below.

### Australia

A definition of capability is not presented. This concept is not a central one as it is in the UK *Order* (DFE/WO, 1995). Literacy is not mentioned at all. Capability is stated together with knowledge and skills (in the other countries knowledge and skills are included in the concept of capability) and it is specified only for the students of secondary school to Year 10. Therefore it is possible to assume that capability is considered as a competence which requires some time to be developed and is substantially different from knowledge and skills; its meaning is unclear.

Russia

Categories of capability and literacy are not specified in the *Standards* (Lednev *et al*., 1998), thus the level of the competencies which should be achieved for three out of four aims of technology education is not clear:

- polytechnical development of the students (be aware of modern and future technologies; master common working skills);
- mastering of general life skills (good behaviour and non-conflict communication) in the process of *working activity* [italics added];
- self-reflection, study of the world of work, acquiring practical work experience and on this basis choosing a career (p. 248).

The fourth aim proposes creativity as the level of competence:

- creative and aesthetic development of students.

Creativity in Russian schools should be developed mainly through design projects that have an allocation of 25% of the classroom time. Thus, it can be assumed that the competencies required from Russian students are effectively not intended to be on a higher level than those in the UK. In Russia, a creative approach also means the use of child-centred methods of teaching, when the student is more active and responsible for his or her learning.

UK

Design and technological capability should cover "effective use, critical appraisal and improvement of existing artefacts and systems; the rectification of faults; and the design and making of new ones [artefacts and systems]" (DES/WO, 1988, pp. 76–77). It is a central concept in the document A *Statutory Order* (DFE/WO, 1995). At the beginning of the programme of study for each key stage it is stated: "Pupils should be taught to develop their design and technology capability" (DFE/WO, 1995, pp. 2, 4, 6, 10). Capability is a process-oriented concept. Considering these descriptions it is possible to suggest that to some extent, the required level of competence in the US (literacy) is even higher than in the UK (capability).

USA

In the US documents literacy is described as a lower level of competence compared to capability. The gap between technological *capability* which is necessary for the *developers* and the basic level of use, management, and understanding of technological *literacy for all* (ITEA, 1996, p. 6) is pointed out. However, the description of a technologically literate person, given in the ITEA document, includes a large number of different competencies. The technologically literate person:

- is a capable problem-solver who considers technological issues from different points of view and in relationship to a variety of contexts;
- appreciates the interrelationships between technology and individuals, society and environment;
- understands that technology involves systems which are designed to achieve goals;
- has the ability to use concepts from other subjects;
- uses a strong system-oriented approach to think about and solve technological problems;
- can assess and forecast results of implementing their solutions;
- understands major technological concepts;
- is skilled in safe use of technological process; and
- understands and appreciates the importance of fundamental technological development, etc. (ITEA, 1996, p. 11)

The above analysis demonstrates that although in the documents the wording is different, the levels of competence for "Russian creativity", "British capability" and "American literacy" are very close in their requirements for students' performance. In the case of Russia and the US, in addition to requirements in terms of students' performance, more systematic knowledge is required. The only country where the competencies are developed in detail is the US. It is also evident that creativity, capability and literacy in curriculum documents have less consistent interpretations than proposed by Todd's taxonomy (1991) and they could not be considered as different levels of technological competencies. Different words such as capability, literacy, creativity as used in different countries reflect political debate around education, and the need for technology education to fit in a political agenda.

The "highest" competence from Todd's taxonomy (1991) is judgement (critical thinking). This is required in curriculum documents of all Western countries. They do not specify to what degree critical thinking should be developed. In a "strong" sense critical thinking leads to reformist attitudes when the values of the person are opposed to common values; in a "weak" sense it is a problem-solving activity (technical rationality). Adaptability and critical thinking are two aspects of the one process: preparing students to function in society and preparing them to change it. However, critical thinking does not automatically lead to a reformist perspective. Technical rationality and value-driven attitudes include very different types of knowledge that can, nevertheless, overlap.

The above discussion demonstrates that there is commonality in aims of technology education across four countries. However, the required competencies are content rich in the US and Russia, whereas in the UK and Australia competencies are more focused on process. They are associated more with the use of knowledge, but do not contain knowledge.

**Programmes of Study**

In all countries a similar structure is employed: the description of major learning elements is made at different levels for the whole period of schooling.

*Australia*: Four levels (Bands) and four Strands (designing, making and appraising; information; materials; systems). *Standards* identify detailed (but not content specific) description of students' activities (for example, students should be able to organise and carry out production processes).

*Russia*: Includes three levels (primary, secondary and high school) and eleven content modules (mechanical sciences and technology of resistant materials; electronics, electrical engineering, radio electronics, automatic machinery, computing; informational technologies; graphics; house culture, food and textile technologies; building technologies (painting and maintenance work); artistic development of materials, technical creativity, artistic construction design, artistic-decorative creativity; the branches of industry and career guidance; manufacturing and environment; home economics and the basics of entrepreneurial activity; choosing of career [there is a separate standard on this]).

In the Russian *Standards*, "content" means knowledge, and it is presented for each module in very specific terms (for example, "types of equipment used in the industry, classification of equipment on the basis of their function", "the principle of functioning and maintenance of the house water system").

*UK*: Four levels (Key Stages) and two notions (designing and making skills; knowledge and understanding). They are described in general, non-specific terms (for example, "to match materials and components with tools, equipment and process").

*US*: Four levels and nine dimensions (the history and nature of technology; design; develop and produce products and systems; use and manage technology; assess the impact and consequences of technology; technological connections; physical technology; chemical and biological technology; informational technology) categorised under two unifying concepts (unifying knowledge and process and unifying context). In Dimensions, it is specified what students should understand and be able to do. It is a detailed description of rather specific knowledge (for example, students will understand that "system-oriented thinking involves an understanding of how each part relates to others, as well as to the whole") (ITEA and TAA, 1998, p. 118).

In the documents from the UK, the US, and Russia, required knowledge is separately identified but it is presented with different levels of specificity.

### Students' Activities and Methods of Teaching

Students' activities and methods of teaching proposed in the documents were aimed to achieve different levels of competencies in technology. As was noted above, it is assumed in each country that knowledge plays its role in each competency. Thus, activities and methods of teaching presented in the documents could be considered inter alia as possible ways to acquire knowledge.

*Australia*: "Highly structured and directed activities with fixed outcomes were being replaced by more flexible, collaborative and open-ended approaches.

Many different teaching and assessment strategies were also being introduced" (Curriculum Corporation, 1994, p. 7). Students should experience *designing, making and appraising*. "The tasks and activities in technology programmes assist students to identify questions to explore, to synthesise ways to put ideas into practice, and to implement plans" (p. 6). Students have "to work with others and on their own" (Curriculum Corporation, 1994, p. 8).

*Russia*: Participating in *project activity* was specified as one of the teaching methods – students could spend 25% of their time engaged in projects. Other methods are not indicated, as the intention of the document was to present only minimal content and learning outcomes. Teachers have to choose the methods by themselves. Usually there is a theoretical explanation at the beginning of the lesson, then instructions on how to use particular tools or equipment followed by practical exercises in making objects.

*UK: Designing and making* products, *focused practical tasks* and *product analysis* (investigate, disassemble, and evaluate) are the main activities. "It is essential that pupils actively engage in the processes of design and technology. Practical involvement is fundamental" (DES/WO, 1988, pp. 74–75). "To work independently and in teams" (DFE/WO, 1995, p. 6) is also important.

*US*: The abilities of the students are developed "through experiences in designing, modeling, testing, troubleshooting, observing, analyzing, and investigating" (ITEA, 1996, p.18). "*Designing, making, developing, producing, using, managing and assessing* technological systems and products" (ITEA and TAA, 1998, p.17) are the main activities. A more practical orientation appeared through making products, but it also could be a design on a computer or writing an essay (ITEA and TAA, 1998, p. 7). It is stated that "experiences and activities that enhance and promote hands-on and minds-on based learning including problem-based learning in order to extend the learning potential of all students" (ITEA and TAA, 1998, p. 36) have to be used. The proposed ways of acquisition of knowledge in the *Standards* are active learning by engaging students in the design of products, systems, and environments in the elementary school and through providing active learning situations in the middle school. Reference is made to the research results from cognitive science that demonstrate that the process of critical thinking and creative activity "can help children construct what they are learning into more meaningful knowledge structure" (ITEA, 1996, p. 36).

Thus, it is mainly active methods of teaching oriented to results in the UK and Australia, mainly didactic methods in Russia, and active methods of teaching oriented to practical results as well as "cognitive" methods (for example, essays) in the US.

Therefore the findings of the analysis of the introduction of technology education across four countries could be summarised as follows:

- In the countries studied, technology education was introduced into general education for the same reason – to improve economic competitiveness of the country; however, for the Western countries its role goes beyond preparing

**Table 1.2** Technology education in curriculum documents – comparison between four countries

| | Australia | UK | US | Russia |
|---|---|---|---|---|
| **Role of technology education** | To prepare students for living and working in technological world and to equip them for innovative and productive activity | To operate effectively and creatively in the made world and increase competence in the indeterminate zone of practice | To function effectively in their roles of consumers, voters, workers, employers, family members | To prepare students for an independent working life and the attainment of proficiency in the mass occupations |
| **Aims** | Skills, knowledge, capabilities | Capability | Literacy | Creativity (specified for one aim out of four) |
| | Similar requirements in part of students' performance | | | |
| | | | Additional emphasis on knowledge | |
| **Content** | Description of students' activities | Description of designing and making skills + knowledge and understanding (in general terms) | Specified knowledge and skills | 11 modules presented (knowledge in very specific terms) |
| **Knowledge from other areas** | Applied science, engineering, business & commerce | More emphasis on knowledge from academic subjects: math, humanities, science | | |
| **Possible ways of acquisition of knowledge** | Designing, making, appraising | Designing and making; focused practical tasks; design analysis | Designing, making, developing, producing, using, managing and assessing technological systems and products | Designing and making activities (25% of time); products manufacturing; theory classes |
| | Emphasis on active methods | | | |

students for the world of work. In Russia this constitutes the only role of technology education.

- Preparing students for the world of work is one of the main goals of technology education. Ways of achieving this goal are different in the countries studied: through putting emphasis on general (generic) skill and understanding in the UK and Australia; through acquiring knowledge and specific skills in Russia; and through development of general abilities of problem-solving,

analysis, and so on plus acquisition of knowledge in the US. Thus, knowledge per se is important in Russia and the US, and application of knowledge in the UK and Australia.
- Although the aims of technology education are described through different competencies (creativity in Russia, capability in the UK, literacy in the US, capability, knowledge and skills in Australia) there are similar requirements for students' performances in all countries. The difference is that in the US and Russia technological performance of students is not the only aim of technology education – a systematic knowledge is also required.
- Theory plays an important role in Russia and the US; practical application is emphasised in the UK and Australia.
- It is acknowledged in all countries that knowledge drawn from other subject areas is used in technology education.
- The emphasis is placed on active methods of learning in the UK and Australia which is based on a belief in an experience-based approach to knowledge construction. In the US and Russia the formal (didactic) methods of acquisition of knowledge are also required.

Approaches to establishment of technology education examined in this chapter support the argument that the nature of technology education provides an effective basis for the vocationalisation of secondary schooling. General capabilities/competencies stated in vocational education are very similar to capabilities stated in technology education. The reason is, as Stevenson (2003) explains, that people in workplaces need to understand technologies and be able to solve complex problems, either individually or by working with others. To cope with changing personal and workplace situations and to contribute effectively to the activities in their working environments, people require well-developed social and personal skills. In that sense, technology education could be seen as an appropriate way of vocationalising secondary schooling, both in developed and developing countries, as it is aimed at the development of the general capabilities of students.

## Conclusion

The vocationalisation of secondary schooling is the tendency that is proceeding around the globe. In developed countries a number of initiatives have been used to introduce the idea of making school education more relevant to the needs of the economy and the workplace. The introduction of vocational courses, pre-vocational courses, use of key competencies, and the development of systematic approaches towards work education are the evidence of attempts in this direction.

This chapter has argued that technology education is among the effective ways of vocationalising secondary schooling. Changes associated with innovations in science and technology; requirements to prepare knowledge workers, and the changing nature of the working world, all pose challenges to vocational education that could be successfully met by technology education.

By the end of the 1980s technology education had been introduced as a learning area/subject in the general education of many countries. At a political level, the importance of technology education in schools has been justified by the concepts of "economic efficiency" and "economic advantages" accruing from national competitiveness in the high technologies. It became widely accepted that technology plays an important role in the life of society. The assumption for introducing technology education in schools rests on the goals of education – to be relevant to the economic needs of the nation and to prepare students for work and life in society. Technology education is seen as a means for developing knowledge, skills, attitudes and values that allow students to maximise their flexibility and adaptability to their future employment. The development of generic capabilities through technology education means that it is very close to meeting the requirements of vocational education. Therefore technology education could provide the ways of empowering individuals through the development of their capabilities and providing them the opportunity to orient and adapt for the work environment or to further studies, develop a sense of identity and particular values. Technology education can also provide a good opportunity for developing countries to strengthen their general education and help students to be better prepared for economies.

## References

ACCI (The Australian Chamber of Commerce and Industry). (2002). Employability skills – an employer perspective: Getting what employers want out of the too hard basket. Retrieved March 15, 2004, from http://www.acci.asn.au/text_files/issues_papers/Employ_Educ/ee21.pdf

AEC (Australian Education Council. Review Committee). (1991). *Young people's participation in post-compulsory education and training*. Report of the Australian Education Council Review Committee. Canberra: Author.

AEC CURASS (AEC Curriculum and Assessment Committee). (1992). *Technology for Australian schools: Interim statement*. Canberra: Australian Government Publishing Service.

Ball, S. J. (1994). *Educational reform: A critical and post structural approach*. Buckingham: Open University Press.

Ball, S. J. (1997). Policy sociology and critical social research: A personal review of recent education policy and policy research. *British Educational Research Journal, 23*(3), 257–274.

Ball, S. J. (1998). Big policies/small world: An introduction to international perspectives in education policy. *Comparative Education, 34*(2), 119–130.

Barnett, M. (1992). Technology, within the National Curriculum and elsewhere. In J. Beynon & H. Mackay (Eds.), *Technological literacy and the curriculum* (pp. 84–104). London: Falmer Press.

The British Council. (1997). *Technology education in core curriculum*. International seminars in Britain.

Commission of the European Communities. (1993). *Growth, competitiveness, employment. The challenges and ways forward into the 21st century*. Luxembourg: Office for Official Publications of the European Community (Bulletin of European Communities. Supplement. 1993, 6).

Committee of Enquiry into Technological Change in Australia. (1980). *Technological change in Australia* (Vol. 1). Canberra: Australian Government Publishing Service.

Coombe, C. (1988). *Survey of vocationally-oriented education in the Commonwealth*. London: Commonwealth Secretariat.

Cowen, R. (1996). Editorial. *Comparative Education, 32*(2), 149–150.
Curriculum Corporation. (1994). *A statement on technology for Australian schools*. Carlton, Victoria: Author.
Curtis, D., & McKenzie, P. (2002). *Employability skills for Australian industry: Literature review and framework development*. Canberra: Australian Council for Educational Research.
Custer, R. L. (1995). Examining the dimensions of technology. *International Journal of Technology and Design Education, 5*(3), 219–244.
DES/WO. (1988). *Summary of interim report of the National Curriculum Design and Technology working group*. London: Author.
DES/WO. (1989). *Design and technology for ages 5 to 16. Proposals of the Secretary of State for Education and Science and the Secretary of State for Wales*. London: Author.
de Vries, M. J. (1997). Science, technology and society: A methodological perspective. *International Journal of Technology and Design Education, 7*(1/2), 21–32.
DFE/WO. (1995). *Design and technology in the National Curriculum*. London: HMSO.
Frey, R. E. (1989). A philosophical framework for understanding technology. *Journal of Industrial Teacher Education, 27*(1), 23–35.
ITEA (International Technology Education Association). (1996). *Technology for all Americans. A rationale and structure for the study of technology*. Reston, Virginia: Author.
ITEA and TAA (International Technology Education Association and Technology for All Americans Project). (1998). *The standards for technology education: Content for the study of technology (third draft)*. Blacksburg, VA: ITEA.
Laudan, R. (1984). Introduction. In R. Laudan (Ed.), *The nature of technological knowledge. Are models of scientific change relevant?* (pp. 1–26). Dordrecht, Holland: D. Reidel Publishing Company.
Lauglo, J. (2005). Vocationalised secondary education revisited. In J. Lauglo & R. Maclean (Eds.), *Vocationalisation of secondary education revisited* (pp. 3–49). Springer: Dordrecht.
Lednev, V. S., Nikandrov, N. D., & Lazutova, M. N. (Eds.). (1998). *Uchebnue standartu shkol Rossii. Gosudarstvennue standartu nachalnogo obstchego, osnovnogo obstchego I srednego (polnogo) obstchego obrazovanija. Kniga 2. Matematika I estestvenno-nauchnue distsiplinu* [Learning *Standards* for Russian Schools. State *Standards* for primary, secondary education. Book 2. Mathematics and Science]. Moscow: Sfera, Prometej.
Marginson, S. (1993). *Education and public policy in Australia*. Cambridge: Cambridge University Press.
Mayer, E. (The Mayer Committee). (1992). *Employment-related key competencies: A proposal for consultation*. Melbourne: Australian Education Council and Ministers for Vocational Education, Employment and Training.
MCEETYA (Ministerial Council for Education Employment, Training and Youth Affairs). (2001). New framework for vocational education in schools. *A comprehensive guide about pathways for young Australians in transition. Policy directions*. Curriculum Corporation on behalf of the Ministerial Council on Education, Employment, Training and Youth Affairs: DETE Publishing, Retrieved April 15, 2008, from http://www.curriculum.edu.au/verve/_resources/policy_file.pdf
McLean, G. N., & Kamau, D. G. (1999). *Human resource development and vocational and technical education in Kenyatta University, Kenya*. Paper presented at the European Conference on Educational Research, Lahti, Finland. Retrieved March 15, 2004, from http://www.leeds.ac.uk/educol/documents/00001203.htm
Ministry of Education Russian Federation. (2003). [Recommendations for the organising before profile preparation of students in the secondary school]. Attachment to the Ministry letter dated 20.08.2003 N 03–51–157/13–03
Ministry of Education Russian Federation, Russian Academy of Education. (2002). *Kontseptsija profilnogo obuchenija* [Concept of profile education]. Retrieved March 15, 2004, from http://www.profile-edu.ru/content.php?cont=19
Mitcham, C. (1978). Types of technology. *Research in Philosophy and Technology, 1*, 229–294.

O'Neill, M. H. (1995). Introduction. In D. S. G. Carter & M. H. O'Neill (Eds.), *International perspectives on educational reform and policy implementation* (pp. 1–11). London: Falmer Press.

Parayil, G. (1991). Technological knowledge and technological change. *Technology in Society, 13*, 289–304.

Pavlova, M. (2001). *Theorizing knowledge in technology education: Policy analysis of four countries*. Unpublished PhD thesis, La Trobe University, Australia.

Pring, R. A. (1995). *Closing the gap: Liberal education and vocational preparation*. London: Hodder & Stoughton.

QSCC (Queensland School Curriculum Council). (2002). *Work education: Position paper*. Retrieved March 15, 2004, from http://www.qsa.qld.edu.au/publications/1to10/files/worked.pdf

Sanders, M. E. (2001). New paradigm or old wine? The status of technology education practice in the United States. *The Journal of Technology Education, 12*(2), 35–55.

Staron, M., Jasinski, M., & Weatherley, R. (2006). *Life based learning: A strength based approach for capability development in vocational and technical education*. A report on the research project "Designing professional development for the knowledge era". TAFE NSW: Darlinghurst, NSW.

Stevenson, J. C. (2003). Examining cognitive bases for differentiating technology education and vocational education. In G. Martin & H. Middleton (Eds.), *Initiatives in technology education – Comparative perspectives. Proceedings of the American forum* (pp. 194–206). Gold Coast, Australia: TFA and CTER.

Taylor, S., Rizvi, F., Lingard, B., & Henry, M. (1997). *Educational policy and the politics of change*. London and New York: Routledge.

Todd, R. (1991). The changing face of technology education in the United States. In J. J. Smith (Ed.), *DATER 91. Papers and poster abstracts of the Fourth National Conference in Design and Technology Educational Research and Curriculum Development* (pp. 270–278). Loughborough, UK: Department of Design and Technology, University of Technology.

World Bank. (1991). *Vocational and technical education and training: A World Bank policy paper*. Washington: The World Bank.

# Chapter 2
# Conceptualising Values in Technology Education and Formulating Bases for Empowerment Strategies

In the previous chapter it was argued that technology education is an effective way of vocationalising schooling. This is understood as developing students' capabilities required for employment. It was also argued that the process of vocationalisation of schooling is applicable for both contexts of developed and developing countries and that technology education could provide opportunities to empower individuals by developing their general capabilities/competencies. Technology education was established within the economic imperative paradigm by the end of the 1980s.

This chapter raises the question of whether it is possible to continue to develop technology education within the same paradigm. What is required now to prepare students adequately for future life and employment? This chapter explores critiques of education and requests for new paradigms of education in general and in technology education in particular. Specifically, the chapter is focussed on unpacking values within the technology education context. It is argued that priority should be given to moral values as the way of guiding teachers' and students' practice and for policy formulation. Development of teachers' and students' responsibilities is considered as a future-oriented vision for technology education. This understanding provides a basis for the development of the next argument on establishing education for sustainable development (ESD) as the most appropriate framework for addressing moral values in technology education. ESD is also considered among the most important strategies for empowerment of individuals in terms of increasing their well-being and security and of achieving the required capabilities.

## Critical Approach to Education

Scientists from different fields warn humanity that the current trajectory of capitalism is leading towards environmental and cultural decline (e.g., EarthTrends, 2008; Population Action International, 2008; WorldWatch Institute, 2008) and that urgent measures are required to deal with the current and emerging issues. Traditionally, education played a significant role in society, therefore it could be considered as one of the important means to address these issues.

M. Pavlova, *Technology and Vocational Education for Sustainable Development*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 10, DOI 10.1007/978-1-4020-5279-8_3, © Springer Science+Business Media B.V. 2009

It is possible to distinguish between two major ideological beliefs about the purposes of general education. Is education designed to broaden minds and develop all students in the creation of a better society? Or is it really about training students to live and work in a market-oriented state, to be "productive" in seizing the opportunities of the market? Are we educating children to be creative and able to challenge the status quo, or to "fit in"? Or is the answer that we want a bit of both?

The importance of re-orienting education towards the development of responsibility has been argued by critical theory educators (e.g., Gatto, 1991; LeFay, 2006). Schooling, however, is being criticised for programming students to act uncritically:

> The core lessons being taught in our school today are individualism, consumerism, careerism and anthropocentrism. And along with this we are programmed with an unerring faith in the dazzling achievements of technological advancement and the intrinsic value of economic progress. (LeFay, 2006, p. 39)

When describing a portrait of an American high school student, DiMaggio (2000), a high school teacher from California, stated that they are "disillusioned with a system that encourages them to earn more and obtain more material goods than their parents. … To earn and obtain more and consume more? Young people sense this conflict – a manifestation of the system they operate within" (p. 75). Educational systems, he argues, are producing graduates "who are increasingly effective at exploiting the resources of the natural world [and] continue to operate under the archaic premise that resources are unlimited" (p. 76). Snook (ACSA, 2005, p. 10) quoted research on young people over the period 1995–2000 that revealed an emergence of a "new consumer culture group that had high levels of consumerism, did not value social life and undertook individual recreation" (p. 10). Such consumer orientation expects from students a constrained exercise of personal power. "Whereas the consumer is an individual, separated from other individuals and rarely able to control the producer, the citizen – in theory at least – is able to band together with other individuals and exercise collective sovereignty over the government" (Marginson, 1993, pp. 78–79). Such reduction of power limits students' ability to be critical and to be able to change the status quo. According to Gatto (1991), there is a "hidden curriculum" that programmes students to act uncritically and maintain the capitalist consumer culture. Corporate sector messages to schools are based on omission, and their overriding message is that "chemicals and technology solve our problems, over-consumption is [our] birthright, and what's good for business is good for everybody" (Selkraig, 1998, p. 63).

Educational theory and practice predominantly serve the role of social reproduction rather than transformation, and the ability of education to change society is limited largely by the degree of change that is already occurring in society. A conflict between moral values and rationality/effectiveness takes us back to the period characterised as the era of the Scientific Revolution. In that era an organic view of the world was replaced with a mechanistic one. Enlightenment-based rationality led to the construction of a world that we could manipulate, exploit and

control. The human being was separated from, and superior to, nature (Plumwood, 2002). This mechanistic paradigm influenced every facet of the Western world, including people's consciousness and, importantly, institutions such as education (Tarnas, 1991).

Critical approaches question the economic rationalist view of education and argue that instead of reforming existing institutions we should be building new learning organisations out of an ecological worldview that moves away from the metaphor of the machine towards a metaphor of a living organism (LeFay, 2006). Different visions of society, such as "eco-effective welfare society" as it is termed in Finland (Finnish National Commission on Sustainable Development, 2006), or "noorsphere vision of the future" as it is conceptualised in Russia (Vernadsky, 1945), can help to re-orient education (the Russian approach is discussed later in the book).

Educational research (e.g., Parker, Ninomiya, & Cogan, 1999) has attempted to tailor the principles for curriculum development to anticipated social needs. Some global studies have been undertaken to establish consensus among experts across different regions, on a framework for curriculum development that is "multinational in origin, perspective, and aim and that … [are] responsive to a crisis-laden, interconnected world" (Parker *et al.*, 1999, p. 120). These studies examined undesirable trends and forecasted social realities, and the competencies that help citizens to deal with these trends and the pedagogical means that could help teachers to develop particular qualities in students. Among the major findings of these studies is a proposal to consider *ethical development as a core business of education*. In the research by Parker *et al.*, 182 scholars, practitioners and policy leaders from four geopolitical regions were involved. The authors proposed to develop curriculum on the basis of six ethical questions that should be considered as the core subject matter: equity and fairness, privacy and access to information, environmental stewardship and human prosperity, population growth and child care, universalism and particularism and power relations. Together with related concepts, skills and attitudes, they constitute four components of the proposed curriculum. Ethical questions "support the teaching of subject matter in a manner that encourages children to think critically" (p. 131). Another study that focused on visions of a desirable future for Australian society and curriculum that would help to achieve it (Campbell, McMeniman, & Baikaloff, 1992) involved 125 experts including from within education and policy making. The results identified seven major goal sets. At the top of "the goal-value" system were: intrinsic valuing of persons, international and ecological responsibility and development of individuals within an overarching concern with moral responsibility.

The above and similar studies, as well as critical discourses in education, emphasise the importance of particular values. These are not values related to an economic rationalism imperative, but related to valuing of the other person, moral responsibility and establishing of a non-mechanistic relationship with nature. Responsibility for oneself and humanity can be seen as a key for developing empowering strategies and values are seen as an important basis for its development. The sections below examine what is currently happening within technology education in terms of values positioning and presents an argument about those aspects where change is required.

## Values as They Are Presented in Technology Education Literature

An emphasis on moral values was identified as a required change in the teaching paradigm for vocational education by participants of an international virtual conference on TVET and sustainable development in 2007. The conference attracted more than 100 participants from 50 countries from all UNESCO regions (Pavlova, 2007). An example of the non-government organisations, (NGO) work in Nigeria illustrates this urgent need:

> I can remember when after three years of developing and implementing projects to help alleviate poverty and improve people's academic/vocational education, it suddenly dawned on us one day that a lot of the dictators and corrupt practitioners in Nigeria, as in most other countries, did not have the word "dictators" or "corrupt practitioners" written on their faces when they were young or, for some of them, when they started out very poor. But that after they became empowered (one way or the other) and grew out of poverty, became adults, got into positions of power, they had no clue how to handle the temptations of life and they end up destroying their societies, their people and themselves. Suddenly we realised that even if we were able to give someone the best food, best clothing, best shelter, best academic/vocational education etc, unless we help him/her to also develop and abide by sound moral principles, we have not done much good for the person. So, as a matter of urgency, we quickly developed and introduced ethics and character development project tagged "Be a Life model" [a copy of the handbook is available on www.sdnetwork.kabissa.org/ethics.htm] which we are introducing to communities and schools wherever and whenever we can, and we now have the habit of making ethics and character development a feature of any project that we are implementing, whether it's ICT, agric or vocational skills development etc.
>
> (Michael, UK, in Pavlova, 2007)

Values are seen by many as an important area to consider in technology education. From the early stages of introducing and developing technology education as a compulsory learning area throughout the world, values have been acknowledged as an important part of the curriculum. In the English interim report (DES/WO, 1988) the distinction had been made between "intrinsic values – considerations such as efficiency of resource use, value for money; and contextually related values – considerations such as health and safety, user preferences and ecological benignity" (DES/WO, 1988, p. 76). It is also specified that design and technology activity should involve pupils in making various judgements, such as technical, economic, social, aesthetic and so on, judgements that can be increasingly refined as the pupils' capabilities increase.

Following this acknowledgement, the importance of exploring values in technology education has been argued by a number of authors (Barlex, 1993; Breckon, 1998; Holdsworth & Conway, 1999; Layton, 1991; McLaren, 1997; Prime, 1993) as a vital aspect of a comprehensive technology curriculum. The main argument supporting the importance of values education in technology is related to the provision of a basis for "value-based decision in the designing, implementing and evaluating of technology, in situations that are ethically complex" (Prime, 1993, p. 34). Value judgements were considered as "the individual decisions or choices

which make the values of people explicit" (Holdsworth & Conway, 1999, p. 206) and which were closely connected to personal integrity and personal identity. Values were considered as providing a basis for choice, decision making and action in a wider context. Value judgements were viewed as relative to a particular situation. The majority of authors have classified values in technology education under headings related to the proposed areas of judgement making: "economic, aesthetic, moral, environmental, technical, spiritual and so on" (Layton, 1991, p. 6).

A justification of this typology was proposed by Prime (1993) on the basis of categories developed by Schwartz and Bilsky (1987, 1990). Those categories include (a) values that relate to the biological needs of individuals, (b) values as "requisites of co-ordinated social interaction" and (c) "survival and welfare needs of groups". Thus, the main theoretical assumption for categorising values was that values in technology education are related to *human needs*. All values identified were treated equally; no hierarchy was proposed within the discourses. However, a limited number of studies conducted at the school level demonstrated that at the practical level, teachers prioritise values in a particular way that includes: technical, aesthetical, economic, environmental, social, cultural, moral and political (Holdsworth & Conway, 1999). The conclusion drawn by the Holdsworth and Conway study was that some teachers did not view certain values as relevant to technology education.

On the basis of Schwartz's (1992) interpretation of values, Prime (1993) argued that values have both cognitive and affective components: "developing values through technology education must … address the cognitive component, by exposing children to all the relevant knowledge, as well as engaging their feelings by placing technology in a human or social context that is meaningful and real" (p. 32). The cognitive component is the underlying beliefs in which values are grounded. Through the cognitive component values are connected to knowledge. The affective component relates to the feelings and attitudes towards the object of value. This affective component distinguishes values from beliefs and the teacher has to place a special emphasis on it. Another component of values is a behavioural one. It is not widely acknowledged in technology education literature but it is analysed in the psychological research. Values that are activated may lead to action (Rokeach, 1973). Therefore, decisions made during technological activities will lead to actions. It is argued that all three components of values should be dealt with by technology education teachers.

However, the assumption was made in technology education discourse that teachers could deal with values only in a very limited manner, mainly through the cognitive component of values. The teachers' role was seen as raising awareness and increasing understanding of "social, ethical, environmental, economic values and issues involved in design in order that pupils can attempt to make informed, considered and sensitive value judgements" (McLaren, 1997, p. 259). Through this approach it was assumed that it is possible to change students' behaviour.

This examination of the discourses on values in technology education (Pavlova, 2002) that were reflected in the academic literature demonstrated that the typology

of values developed in technology education and the reasons why these values were claimed to be important, presented a limited view on the nature and role of values in this area. Value judgements were considered to be relative to a particular situation. The challenge was with weighting all relevant contextual factors and "to be guided by the values deemed to be more important in that situation" (Prime, 1993, p. 32). Thus, a relativistic approach to the nature of all decisions was acknowledged and no general guidelines for decision making were given to teachers or to students.

To examine the dynamics of the discourses in technology education, a further analysis was conducted in 2006 (Pavlova, 2006). A snapshot of values interpretations in technology education was undertaken based on a special issue of the *International Journal of Technology and Design Education* (issue 15, 2005) that focuses on values. A number of similarities and differences were identified compared to a previous examination. A different approach towards values categorisation was proposed by Coles and Norman (2005): (a) internal values (such as perceived societal values; perceived identified stakeholder values; perceived economic system values; designer's personal values; meta-values that relate to the order of designer's priorities); (b) external values (such as societal values; identified stakeholder values; economic system values; values embedded in design). The starting point for this classification was not the person as such, nor human needs, but a *design process*. In the earlier literature, a person's values were analysed and then their application to technology education was considered. In the more recent literature the authors analysed the ways in which a person is involved in design and then develops a set of values that facilitate the process. All values are again firmly related to decision making in design. The cognitive basis of values (knowledge base) was emphasised again by a number of authors (de Vries, 2005; Pavlova, 2005). Education for sustainable development (Elshof, 2005) and appropriate technology as a way of empowering individuals in Africa (Tungaraza & Sutherland, 2005) that appeared in that issue, could be seen as indicators of the new development in discourses on values in technology education. Three issues identified through this analysis are:

- the importance of prioritising values,
- active involvement of students in value development (such as debating, not just increasing awareness) and
- the importance of relating values to the global issues of sustainable development.

This "value" situation in technology education theory and practice does not respond to the request to develop a critical approach to education that requires prioritising particular values. The position proposed in technology education literature to "use" values that are more important in a particular situation can be explained by situation-specific types of psychological theories (Feather, 1975) discussed later in the book. There is a need in technology education to develop different ways for categorising values within technology education, to propose a specific approach towards hierarchy of values in the area and to develop guiding principles for teachers' and students' practices.

## Moral Values

The concept of value has been explored widely by researchers from different fields: sociology, political sciences, education, anthropology, social psychology, history and philosophy, to name a few. Many detailed theoretical discussions analysed and defined values (e.g., Albert, 1968; Feather, 1975; Kohlberg, 1969; Parsons, 1968; Rokeach, 1968, 1973; Scheibe, 1970; Schwartz, 1992, 1994). Rokeach's contribution to the literature deserves special attention due to his systematic, broad and longitudinal research. Rokeach indicates that there are two distinctively different ways the value concept has been used: with its focus upon the values that a person has, or upon the values that an object has (the person is engaged in valuing and the object that is being valued). This section explores personal values.

A quick Internet search identifies numerous definitions of personal values. Below are some examples used for different research projects and the development of school programmes:

- Beliefs of a person or social group in which they have an emotional investment (either for or against something); "he has very conservative values";
- General guiding principles that govern all activities;
- Our sense of identity;
- Relatively firmly held and socially shared positions or expressions about what is good or right; they are abstract and normative and are considered to be somewhat stable;
- Those qualities of behaviour, thought and character that society regards as being intrinsically good, having desirable results and worthy of emulation by others;
- What people think is right and wrong, good and bad, desirable and undesirable;
- The moral principles or standards of a person or group of people; literary texts often describe conflicts over values;
- (Core Values/Best Practices): the guiding principles and behaviours that embody how the school and its staff are expected to operate. They guide decision making amongst staff, helping the school to accomplish its mission and attain its vision in an appropriate manner;
- "Judgements of worth", moral principles or standards which should have a certain weight in the choice of action;
- Principles, standards or qualities considered worthwhile or desirable by the person who holds them;
- Assumptions, convictions, or beliefs about the manner in which people should behave and the principles that should govern behaviour.

The following definition of value provided by Rokeach (1973) is regarded as appropriate in terms of its application to technology education:

> A value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence. A value system is an enduring organisation of belief concerning preferable modes of conduct or end-states of existence along a continuum of relative importance. (p. 5)

There are a number of points here that should be noted. Although values are not completely stable and they may change in a person's lifetime, they are stable enough to provide continuity to personal and social existence. Values are defined in terms of one's beliefs about the desirable. A value (or belief about the desirable) involves some knowledge about the means or ends considered by the person to be desirable; it involves affection or feeling and a behavioural component. Rokeach (1973) stresses that a value is a preference as well as a conception of the desirable. Preferences are choices that people make when confronted by a set of alternatives, where the alternatives involve a particular mode of conduct or end-state of existence. Another important point is that the beliefs defining values may refer to modes of conduct or to end-states of existence (to means or to ends). Rokeach suggests that the distinction is between *terminal* (referring to "end-states of existence") and *instrumental* (referring to "modes of conduct") values. A similar distinction is proposed by Jarrett (1991) who argued for distinction between *intrinsic* (good in itself) and *instrumental* (a means towards an end) kinds of values. According to Rokeach, *terminal values* include concepts such as comfort, excitement, a sense of accomplishment, a world of beauty and equality, freedom and happiness, inner harmony, self-respect and social recognition, true friendship and wisdom. *Instrumental values* encompass traits or characteristics such as ambitious, open-minded, capable, helpful, honest, imaginative, intellectual, logical, responsible and self-controlled. Although most researchers acknowledge a functional relationship between instrumental and non-instrumental values, they see a conceptual advantage in this distinction. The same is true for the analysis of values within technology education. The distinction between two kinds of values provides a broad framework for thinking about values in technology education. The previous typology proposed by Prime (1993) does not make the distinction between instrumental and non-instrumental values. Personal values, for example, can be intrinsic or instrumental, social values can be intrinsic or instrumental and so on. Through problem-solving, which is one of the main activities in technology education, teachers and students mainly deal with instrumental values. Therefore, the development and careful consideration of instrumental values during the process of formulating and reaching the goals of technological activity are particularly important for the educational process. As stated by Jarrett (1991), "in education the means one uses to reach one's ends are themselves going in some measure to determine the nature of those ends" (p. 9). Terminal values are also important as they are related to visions of a desirable future.

Rokeach (1973) distinguishes between two kinds of instrumental values (modes of conduct, means towards an end): there are those that have a *moral* focus and there are those related to *competence* or *self-actualisation*. According to Rokeach, moral values refer to those "that have an *interpersonal focus* which, when violated, arouse pangs of conscience or feelings of guilt for wrongdoing" [italics added] (p. 8). Moral values refer to modes of behaviour and "do not necessarily include values that concern end-states of existence" (p. 8). Competence or self-actualisation values refer to a *personal focus*, for behaving logically and intellectually. Moral and competence kinds of values could be roughly related to the "ethical thesis" required by critique of education and the capabilities required by economic imperative in education.

Chapter 1 examined the second kind of values and noted that competence values are well established in rationales for technology education. Critiques of education suggest that moral values are desirable, but these particular values are not given any priority in discussions about values in technology education.

According to Rokeach, values provide standards that guide behaviour in a particular way. For most people, values are ordered hierarchically in terms of their relative importance (Rokeach, 1973; Schwartz, 1992, 1994). As demonstrated above, values related to competence (technical, aesthetic, economic) have a priority among technology teachers above moral values (Holdsworth & Conway, 1999), although one can draw on Habermas (e.g., 1974/1963), Oser (1994) and on critical approaches to education to argue that the case should be the opposite. That is, the values of responsibility, duty and obligation towards humanity and nature should provide the impetus for all technological activities and should be at the top of the values hierarchy among technology teachers and students.

In philosophy, Habermas (1974/1963) contrasted rational values (effectiveness and economy) to moral values (commitment). He argued that rationality "cannot itself be placed on the *same* level with all the other values" (p. 259) or prevail above them. He cited Albert who suggested that such criteria as the satisfaction of human needs and the avoidance of unnecessary human suffering should be used to assess the validity of ethical systems. Such criteria should be established in the same way as "the criteria of scientific thought" (Habermas, 1974/1963, p. 280). In theories of postmodern society, a clearly articulated argument relates to the importance and diminishing of "moral capacity and, in effect, the re-moralization of human space" (Bauman, 1995, p. 192). Therefore, philosophers on the one hand argued for the importance of moral values; on the other hand, they are pointing out the "re-moralization of human space". Almost without exception, participants of the Campbell *et al*. (1992) study, referred to at the beginning of the chapter, argued that the world needed to be changed:

> It is time to undergo a "paradigm shift" (Kuhn, 1970) with respect to thinking about a desirable future … for, to plagiarise Albert Einstein a little, the thinking which has brought us to our present state is incapable of taking us beyond it. At the centre of the new vision are caring, just, morally responsible, compassionate and ecologically aware individuals who are committed to collaborative action in order to achieve desirable futures. (p. 38)

Often in research, moral values and ethics are used interchangeably; however, it is important to note that the moral (or morality) is considered as an aspect of the ethical that particularly concentrates

> on obligation, the ought and ought-not, on duty and conscience and human virtues, where the ethical will also include consideration of the good life, happiness, well-being, admirable conduct over and above the call of duty, and the place in life for such kinds of value as the aesthetic, cognitive, *et al*. (Jarrett, 1991, p. 14)

Moral values relate to "consideration for the welfare of others, or requirements of our duty" (Jarrett, 1991, p. 14); rationality and effectiveness (or such values as

technical, economic) must be framed by moral considerations. According to Rokeach (1973) the important function of values is to provide standards that guide behaviour. The whole question of the interrelationships between behaviour and values is very complex. What is clear from psychological research (Feather, 1962, 1982) is that actions do not relate to general values alone. The precise situation in which a behaviour occurs should be considered as an important factor. In other words, the classroom situation or the psychological environment plays an important role in influencing students' behaviour. One can conceptualise conditions under which values lead to action within the context of "expectancy – value theories".

Theoretical underpinning for expectancy – value theories is embedded in the interactionist approach to the analysis of behaviour (Feather, 1962). This approach is neither situation-specific (as in Prime's [1993] case) nor person-specific. "The focus is upon cognitive models that relate action to the perceived attractiveness or aversiveness of expected consequences" (Feather, 1982, p. ix). As argued by Feather (1975), this approach "attempts to account for a person's behaviour in terms of both the particular situation to which he [sic] is exposed and the relatively stable personality characteristics that he brings with him to the situation" (p. 12). Expectancy-value theories conceive "of motivated behaviour in terms of the situationally elicited *expectations* that a person has concerning the implications of his [sic] actions and the subjective *values* … that he assigns to the possible outcomes of alternative actions" (Feather, 1975, pp. 12–13). The expectations that the individual holds about outcomes, the subjective values of these outcomes, are applied to the individual's responses. Application of expectancy-value models may be more appropriate under conditions where there is a realistic hope for a better solution and where there is sufficient time to search and deliberate (Mann & Janis, 1982). Mann and Janis suggest that under these conditions the person is more likely to consider alternatives and objectives thoroughly, to evaluate consequences carefully, to engage in research and plan for implementation. These conditions could be provided in technology education classrooms; however, values promoted and expectations developed are greatly dependent on teachers' values and attitudes.

## Professional Morality of the Teacher

*Dear Teacher*,
*I am a survivor of a concentration camp. My eyes saw what no man should witness*:
*Gas chambers built by learned engineers.*
*Children poisoned by educated physicians.*
*Infants killed by trained nurses.*
*Women and babies shot and burned by high school and college graduates.*
*So I am suspicious of education.*
*My request is: Help your students become more human.*
*Your efforts must never produce learned monsters, skilled psychopaths, educated Eichmanns.*

*Reading, writing and arithmetic are important only if they serve to make our children more human.*

(the principal's letter cited in Pring, 2001, pp. 111–112)

The classroom environment is the forum where students are enabled to explore what it is to be human; "that is why teaching should be regarded as a moral practice" (Pring, 2001, p. 112). Teachers then should see their obligation not only in developing competence/self-actualisation values, but also the moral ones. This position provides a basis for the theory of the professional morality of the teacher that starts from the assumption that no professional action should be guided only by "functional criteria of means and ends relations under the perspective of functional success" (Oser, 1994, p. 60). This concern is similar to that expressed by Habermas (1974/1963). Höffe (1984), an education philosopher, identified three norm levels at which teachers work, spanning from the lower instrumental and functional values such as economy, concentration, punctuality, orderliness to the higher ethical values and norms such as protection of other people's lives, care for weaker people, tolerance in cases of differences of opinion, justice in situations of exchange and settlement of conflicts. Höffe warns of the danger of displacement within the hierarchy of values. As Oser (1994) argued,

> A responsible professional action must be informed by a structure of moral values that enables the actor to estimate positive and negative consequences that concern human beings immediately or indirectly. The relationship between success and care in regard to consequences is the core criterion of this theory. (p. 60)

Oser (1994) provided a useful model for conceptualising different approaches to teaching on the basis of the relationship between effective and responsible teaching that can guide technology education teaching practice. He proposed four types of possible connections: (a) interpretive, (b) additive, (c) complementary and (d) correlation or regulative. These models constitute a hierarchical structure of increasing knowledge of how to solve the conflict between aspects of effectiveness and responsibility.

*The interpretive model* starts with the assumption that good intention is implicitly a moral aspect. "The danger of this model is that people view *effectiveness* [italics added] as a moral good in itself" (Oser, 1994, p. 62). Training to pass the test, technical function and economic success of the product are important. According to *the additive model*, one should, in general, be success oriented, but in some cases reflections on ethical issues are required. "The danger of the additive model is the absolute separation of two realms [ethical and instrumental] that are, in fact, dependent on each other" (p. 62). In *the complementary model*, responsibility and effectiveness are seen as interdependent. In this context, to be responsible means "to measure effectiveness from the point of view of good intentions, estimated consequences, and experienced needs" (p. 62). Each technical act must be reflected. However, this reflection is not structured. "There is not yet a communicative technique for having a professional moral knowledge systematically related to successful professional actions" (p. 62). *The regulative model* is based on the idea of limiting the aspects

of effectiveness by the aspect of responsibility. In this view, professionals have to know "how to solve problems involving effectiveness conflicts and how to estimate outcomes by balancing important moral issues" (p. 63). Any teaching act has a moral core. This approach is more time consuming, challenging and demanding, but it will result in feelings of "obligation, shared norms, and engagement" (p. 63).

The current approach to values in technology education that is presented in much of the literature correlates with the additive model (reflections during product analysis, classroom discussions or case studies). In most publications it is assumed that teaching moral content (knowledge concerning norms, rules, justice matters, etc.) is valuable in itself because it "helps students to develop a moral point of view and helps teachers themselves to understand what morality can contribute to interpersonal life" (Oser, 1994, p. 90). The complementary model had been identified as another model used by teachers (author's observations and interviews in Russia, 1999–2001). Teachers believe that morality and responsibility are learnt more on the action level, through models such as teachers.

In this chapter, it is suggested that the regulative model should be used by technology and vocational teachers as the basis to build their practice. It can provide guidelines for teachers' practice where the classroom environment and the process of designing and making should be primarily viewed as "a moral enterprise but as serving functional purposes" (Oser, 1994, p. 103). It is important that teachers' attention is focused on moral values and on the inclusion of students as real discourse partners in ethically problematic situations. Within the regulative model, Oser (1994) distinguishes two approaches: the relational approach and the discourse approach. *The relational approach* focuses on establishing interpersonal relationships. Morality refers to communicative connections in terms of general caring and relational attitudes. Teachers must create a caring setting and not just be caring. As Clark (1990) says, "the aim of good teaching is to give the game away to the learners" (p. 26). The main focus is how students become relational, caring and responsible. Teachers provide a precondition by developing a caring attitude themselves. The relational approach fulfils a number of criteria of a good concept of professional responsibility, including its nature – it is procedural. It starts from students' needs, from decision making and justification of decisions. It can be "translated into educational aim of developing students' responsibility" (Oser, 1994, p. 103).

*The discourse approach* addresses the conflict between effectiveness and responsibility directly. A discourse is understood by Oser (1994) as a form of dealing "communicatively with differences concerning needs, rules, and principles in the sphere of professional action" (p. 103). Oser refers to realistic discourse, which has its own procedural, moral structure. At the first level it is important to recognise a situation as being ethically problematic. At the second level, an individual decides if it is his/her duty to intervene or not. At the third level, achieving a balance between justice, caring and truthfulness is the focus. It is difficult for the teacher to be just, caring and truthful at the same time, particularly to each person involved. As Oser (1994) explains:

> Being just towards all students in the class may mean treating them equally, which may be incompatible with being caring toward weak learners. Caring for each particular student

> may mean hiding certain negative feelings and hence not being truthful; caring for one student may mean hurting another. Taking responsibility in regard to the required subject matter may mean not caring toward the slow learner but being effective in the eyes of the parent. In any ethically problematic situation, such a confrontation of values can be expected. (pp. 104–105).

The discourse approach to learning must be constructed step by step; it cannot be simply proclaimed. In this situation teachers must be creators and participants, facilitators and actors: "they must encourage the sharing of responsibilities and display a fundamental responsibility for the people concerned and for their needs, thus making the discourse realistic" (Oser, 1994, p. 108). If the results of discourse present the best possible outcome among those possibilities in a given situation "it is in itself already moral" (Oser, p. 108). The difference between Prime's (1993) and Oser's approaches is that the former is based on individual judgements, while the latter is based on discourse and requires collaborative engagement. Teacher training programmes need to include experiences directly related to the development of moral responsibility and evaluations of how these experiences may influence classroom practice. This regulative model of teachers' professional morality can create a classroom environment that could be described in expectancy-values terminology; the morality that values particular outcomes and that develops moral values in students. The professional responsibilities of teachers are the key component in developing empowering strategies for students. "To have a moral method means not so much to be a moral person but to construct day by day, a moral journey as a way of life" (Oser, 1994, p. 117) for the students in one's class.

## Students' Moral Judgements

Classroom environments that cultivate responsibility will stimulate students to put moral values first. They will not be considered as one category of values among the others but as a reference point for all technological decisions. On the basis of research, Oser (1994) concludes that this model is not used by teachers very often: "seldom does a teacher state that he or she must set conditions that allow the students to take responsibility; to understand the meaning of being just, caring, and truthful themselves; and to show commitment for their schoolmates" (p. 62). The nature of technology education provides a rich context that can be easily moved beyond the concept of effectiveness. The discussion of values that is presented in technology education literature at the moment must be replaced by a discussion about moral values as the starting point for students to make judgements (e.g., about the type of projects students choose; the needs they address through their design) through the process of discourse to accommodate critical approaches to education.

Teachers' and students' actions must be informed by a structure of moral values that enables them to estimate positive and negative consequences of technological development that concern human beings immediately or in the future. The relationship between success and care in terms of the consequences of particular actions is

the core criterion for the development of an appropriate classroom environment. Will it be easy to achieve?

One recent example of an attempt to deal with values in education is the *National Framework for Values Education in Australian Schools* (DEST, 2005) endorsed by all state and territory education ministers and by the national Minister for Education, Science and Training; it was sent to schools, along with a poster, which specified the nine values for Australian schooling:

- care and compassion (care for self and others);
- doing your best (seek to accomplish something worthy and admirable, try hard, pursue excellence);
- fair go (pursue and protect the common good where all people are treated fairly for a just society);
- freedom (enjoy all the rights and privileges of Australian citizenship free from unnecessary interference or control and stand up for the rights of others);
- honesty and trustworthiness (be honest, sincere and seek the truth);
- integrity (act in accordance with principles of moral and ethical conduct, ensure consistency between words and deeds);
- respect (treat others with consideration and regard, respect other persons' point of view);
- responsibility (be accountable for one's own actions … contribute to society and to civic life, take care of the environment);
- understanding, tolerance and inclusion (be aware of others and their cultures; accept diversity within a democratic society).

It stated that all Australian schools need to promote values education in a planned and systematic way, in particular, "developing student responsibility in local, national and global contexts and building student resilience and social skills" (ACSA, 2005, p. 6). The values were elaborated in action/"doing" terms and no priority was indicated by the list order. Across these nine values, five can be classified as moral values: care and compassion; integrity; respect; responsibility; understanding, tolerance; and inclusion. These values provide a useful framework for students' development; however, it will be a long journey for many.

This list of values does not identify "the goal-value" system as developed by the project, which explored visions of a desirable future for Australian society (Campbell *et al.*, 1992). Students who were invited to the 2005 National Values Education Forum (ACSA, 2005) to discuss the document considered "care and compassion" and "respect" as the most important values, because for them these values were directed specifically to themselves and not to others: will the teacher care about me? Will she respect me? Only a very small number of students mentioned responsibility as an important value.

At the 2005 forum, the issue of developing a framework that works was discussed. It was considered important that "schools reconciled their theory with their practice so that values were made explicit and guided teaching and administrative practice across the school and the classroom" (ACSA, 2005, p. 7). It was acknowledged that the greatest challenge for schools is to incorporate values into practical action.

For the TVET sector, within the context of developing countries, one of the major concerns expressed by participants of the international virtual conference on TVET and SD (Pavlova, 2007) was the need to change the perception that vocational education is aimed at developing technical skills alone. The participants argued that there is a need to influence students' behaviour through their vocational studies. A participant from India stated, "More emphasis should be given on *developing attitudes and knowledge skills rather than technical skills*" [italics added]. This change to the teaching paradigm brings TVET closer to general education, whereby education includes broader elements such as values and attitudes. Participants presented a number of examples to support their arguments. They identified a danger in simply preparing students for employment and "forgetting that the same person would have to interact with nature and people in other complex/dynamic aspects of living" (participant from UK).

The notion of developing students so they are capable of being involved in the creation of a better society, by developing their responsibility and orientation towards "others", is closely related to the concept of sustainability that is concerned about humanity and its future, and of the quality of life for further generations. In the next chapter it will be suggested that ESD could provide such a framework for technology education. ESD could become the basis for policy formulation that identifies empowering strategies for students' development.

## Conclusion

This chapter concludes that current approaches to values developed in technology education do not address the critique of education, utilise psychological conceptualisation of values, or support a request to develop responsibility in teachers and students. Current approaches also do not present an appropriate approach that teachers may use to guide their practice. It has been noted that in technology education classes, teachers and students deal mainly with instrumental values that can be classified as moral and competence based. Although competence values currently receive ultimate attention from technology teachers, this chapter has argued that values should provide a basis for all technological activities and should be at the top of the values hierarchy for technology teachers and students.

Another point is that three components of values have to be taken into account: cognitive, affective and behavioural. The cognitive component leads to an awareness of the different values and the reasons moral values should be put first. The affective component establishes links between the technological task and students' feelings by situating technology in a meaningful context. The behavioural component gives students the opportunity to act in accordance with their moral values.

To deal with values effectively, the teacher has to develop an appropriate classroom environment that will help students to recognise a situation as being ethically problematic and that will enable students to have a voice and express their feelings and thoughts and collectively find a solution that serves the best interests of all

concerned. So, students have to be aware of the effectiveness-responsibility framework and use it in their activities.

The notion of developing students' moral judgement, so they are capable of being involved in the creation of a better society by developing their responsibility, is closely related to the concept of sustainability that is concerned with the future of humanity and the quality of life for current and further generations. An implicit message incorporated into the Brundtland Commission's definition of SD (World Commission on Environment and Development, 1987) is an ethical one. According to Smyth (2006), "the assurance of inter-generational equity, which has to be integrated globally, not just locally" (p. 254), is a deep ethical issue. ESD can be a useful framework for developing learning activities in technology education. It provides an opportunity to develop students' responsibility, put moral values first, care about the future through development of their products and approach capitalist views of the world critically. Therefore, strategies for empowerment of individuals within technology education could, and should, be developed within the framework of ESD and this will be discussed in the next chapter.

## References

Albert, E. M. (1968). Value systems. In D. L. Sills (Ed.), *International encyclopedia of the social sciences*. New York: Crowell Collier and Macmillan.

ACSA (Australian Curriculum Studies Association). (2005). *Values education in perspective. 2005 National Values Education Forum, 2–3 May 2005, Report*. Canberra: Commonwealth of Australia.

Barlex, D. (1993). The Nuffield approach to values in design and technology. *Design and Technology Teaching, 26*(1), 42–45.

Bauman, Z. (1995). *Life in fragments. Essays in postmodern morality*. Oxford: Blackwell.

Breckon, A. (1998). National curriculum review in design and technology for the year 2000. *The Journal of Design and Technology Education, 3*(2), 101–105.

Campbell, W. J., McMeniman, M. M., & Baikaloff, N. (1992). Visions of a desirable future Australian society. *New Horizons in Education, 87*, 17–39.

Clark, C. M. (1990). The teacher and the taught: Moral transactions in the classroom. In J. I. Goodlad, R. Soder, & K. A. Sirotnik (Eds.), *The moral dimensions of teaching* (pp. 251–265). San Francisco: Jossey-Bass.

Coles, R., & Norman, E. (2005). An exploration of the role values plays in design decision-making. *International Journal of Technology and Design Education, 15*(2), 155–171.

Department of Education, Science and Training (DEST). (2005). *The national framework for values education in Australian schools*. Canberra: Author.

DES/WO. (1988). *Summary of Interim Report of the National Curriculum Design and Technology Working group*. London: Author.

de Vries, M. (2005). The nature of technological knowledge: Philosophical reflections and educational consequences. *International Journal of Technology and Design Education, 15*(2), 149–154.

DiMaggio, M. (2000). Educating for sustainability in American high school. In K. A. Wheeler & A. P. Bijur (Eds.), *Education for a sustainable future: A paradigm of hope for the 21st century* (pp. 73–81). New York: Kluwer Academic/Plenum Publishers.

EarthTrends. (2008). Environmental information. Retrieved January 15, 2008, from http://earthtrends.wri.org/

Elshof, L. (2005). Teacher's interpretation of sustainable development. *International Journal of Technology and Design Education, 15*(2), 173–186.
Feather, N. T. (1962). The study of persistence. *Psychological Bulletin, 59*, 94–115.
Feather, N. T. (1975). *Values in education and society*. New York: Free Press/London: Collier Macmillan.
Feather, N. T. (1982). *Expectations and actions: Expectancy – value models in psychology*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.
Finnish National Commission on Sustainable Development, Sub-committee for Education. (2006). *Strategy for education and training for sustainable development and implementation plan 2006–2014*. Helsinki: Author.
Gatto, J. T. (1991). *Dumbing us down: The hidden curriculum of compulsory education*. Gabriola Island, BC, Canada: New Society Publishers.
Habermas, J. (1974). *Theory and practice* (J. Viertel, Trans.). Boston: Beacon press. (Original work published 1963)
Höffe, O. (1984). Umrisse einer praktischen Philosophie der Erziehung [Outlines of as practical philosophy of education]. In E. Benedikt *et al.* (Eds.), *Philosophische Aspekte im Unterricht der AHE* (pp. 23–45). Wien: Vorausdruck ohne Verlagsangabe.
Holdsworth, I., & Conway, B. (1999). Investigating values in secondary design and technology education. *The Journal of Design and Technology Education, 4*(3), 205–214.
Jarrett, J. I. (1991). *The teaching of values: Caring and appreciation*. London: Routledge.
Kohlberg, L. (1969). Stage and sequence: The cognitive-developmental approach to socialization. In D. A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 347–480). Chicago: Rand McNally.
Kuhn, T. S. (1970). *The structure of scientific revolutions*. Chicago: University of Chicago Press.
Layton, D. (1991). *Aspects of National Curriculum: Design and technology*. York: National Curriculum Council.
LeFay, R. (2006). An ecological critique of education. *International Journal of Children's Spirituality, 11*(1), 35–45.
Mann, L., & Janis, I. (1982). Conflict theory of decision making and the expectancy-value approach. In N. T. Feather (Ed.), *Expectations and actions: Expectancy-value models in psychology* (pp. 341–365). Hillsdale, New Jersey: Lawrence Erlbaum Associates.
Marginson, S. (1993). *Education and public policy in Australia*. Cambridge: Cambridge University Press.
McLaren, S. (1997). Value judgements: Evaluating design – A Scottish perspective on a global issue. *International Journal of Technology and Design Education, 3*(3), 259–278.
Oser, F. K. (1994). Moral perspectives on teaching. *Review of Research in Education, 20*, 57–127.
Parker, W. C., Ninomiya, A., & Cogan, J. (1999). Educating world citizens: Toward multinational curriculum development. *American Educational Research Journal, 36*(2), 117–145.
Parsons, T. M. (1968). On the concept of value-commitments. *Sociological Inquiry, 38*, 135–159.
Pavlova, M. (2002). "Teaching" values in technology education: A critical approach for the theoretical framework. In H Middleton, M. Pavlova, & D. Roebuck (Eds.), *Learning in technology education: Challenges for the 21st century*, Proceedings of the 2nd Biennial International Conference on Technology Education Research (pp. 96–102). Brisbane: Griffith University.
Pavlova, M. (2005). Knowledge and values in technology education. *International Journal of Technology and Design Education, 15*(2), 127–147.
Pavlova, M. (2006). Do we value values in technology education? Keynote address for *The 4th International Conference on Technology Education Research* December 7–9, Gold Coast, Centre for Learning Research, Griffith University.
Pavlova, M. (2007). *Two pathways, one destination: TVET for a sustainable future*. Conference report for the UNESCO-UNEVOC virtual conference, 22 October–10 November. Retrieved January 14, 2008, from http://www.unevoc.unesco.org/
Population Action International. (2008). Retrieved January 14, 2008, from http://www.populationaction.org/

Prime, G. M. (1993). Values in technology: Approaches to learning. *Design and Technology Teaching, 26*(1), 30–36.
Pring, R. (2001). Education as a moral practice. *Journal of Moral Education, 30*(2), 101–112.
Plumwood, V. (2002). *Environmental culture: The ecological crisis of reason*. London: Routledge.
Rokeach, M. (1968). *Beliefs, attitudes and values: A theory of organization and change*. San Francisco: Jossey-Bass.
Rokeach, M. (1973). *The nature of human values*. New York: Free Press.
Scheibe, K. E. (1970). *Beliefs and values*. New York: Holt, Rinehart & Winston.
Schwartz, S. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In M. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 25, pp. 1–65). New York: Academic Press.
Schwartz, S. (1994). Are there universal aspects in the structure and contents of human values? *Journal of Social Issues, 50*, 19–45.
Schwartz, S., & Bilsky, W. (1987). Toward a universal psychological structure of human values. *Journal of Personality and Social Psychology, 53*, 550–562.
Schwartz, S., & Bilsky, W. (1990). Toward a theory of the universal content and structure of values: Extensions and cross-cultural replications. *Journal of Personality and Social Psychology, 58*, 878–891.
Selkraig, B. (1998). *Reading, 'riting and ravaging: The three Rs, brought to you by corporate America and far right*. San Francisco, CA: Sierra Club Magazine.
Smyth, F. C. (2006). Environment and education: A view of a changing scene. *Environmental Education Research, 12*(3–4), 247–264.
Tarnas, R. (1991). *The passion of the western mind:Uunderstanding the ideas that have shaped our world view*. New York: Ballantine Books.
Tungaraza, F., & Sutherland, M. (2005). Capturing the minds of a lost and lonely generation. *International Journal of Technology and Design Education, 15*(2), 187–198.
Vernadsky, V. I. (1945). The biosphere and the noosphere. *American Scientist, 33*, 1–12.
World Commission on Environment and Development (The Brundtland Commission). (1987). *Our common future*. Oxford: Oxford University Press.
WorldWatch Institute. (2008). Vision for a sustainable world. Retrieved January 14, 2008, from http://www.worldwatch.org/taxonomy/term/109

# Chapter 3
# Sustainable Development and Education

In the previous chapter it was argued that moral values could provide the basis for theorising technology education. What then might a framework look like that helps us to address moral values? This chapter examines the ways in which sustainable development (SD) and education for sustainable development (ESD) can be conceptualised as well as the place of values within these models. The ways by which SD and ESD are interpreted influence the approaches, content, pedagogy and learning processes in the classroom. This chapter argues for a particular way of understanding SD and ESD.

The nature of education for sustainable development proposed here provides the basis for developing ESD approaches for technology and vocational education that could help to develop specific strategies to empower students. It is argued that education for sustainable development could be viewed as a framework for understanding and developing technology education, as it provides a set of clear priorities for teaching and learning.

## Sustainable Development

The concept of sustainability has been a part of international discourse since the early 1980s. Government and non-government organisations around the globe have become aware of, and are expressing concern about, the future of humanity and the quality of life for future generations. The emergence of the issue has been motivated by a number for reports that suggest that humankind is living beyond the carrying capacity of planet Earth. Footprinting studies that measure the environmental impacts of different lifestyles (e.g., WWF, 2006) indicate that globally we began to live beyond the earth's carrying capacity in 1987. Over the last three decades the earth's biological diversity has declined by approximately 30%. This global trend suggests that we are degrading natural ecosystems at a rate unprecedented in human history (WWF, 2006): we have become "future eaters" (Flannery, 2002). Due to the impact of the developed countries, the accumulated "ecological deficit" is about 20–30% beyond what the planet can sustain (Hales & Corvalan, 2006; Vitousek, Mooney, Lubchenko, & Melillo, 1997). The accumulating scientific evidence of these catastrophic developments supports the need for a strong international response.

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_4, © Springer Science+Business Media B.V. 2009

Continued degradation of the global environment has stimulated discussions that question technological progress, development and economic growth. If, in the late 1970s, the word sustainability was only occasionally employed and in most cases to refer to ways in which forest resources should be used, currently it is one of the most widely used words in the scientific field as a whole and in the environmental sciences in particular (Leal Filho, 2000).

The concept of sustainable development that argues for simultaneous resolution of the vast and complex issue of environmental deterioration and the equally vast and complex issue of human development and poverty reduction was explored in the Brundtland report (World Commission on Environment and Development [the Brundtland Commission], 1987) as a way forward. The same report introduced the most common definition of sustainability: development that refers to "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Chapter 2.1). The aim of sustainable development was endorsed by 149 countries at the UN conference on the environment and development, held in Rio de Janeiro in 1992. This conference agreed upon Agenda 21 (United Nations, 1992), a global action plan for sustainable development that puts human beings at the centre of concerns for sustainable development: "They are entitled to a healthy and productive life in harmony with nature" (Principle 1). The programme areas that constitute Agenda 21 are described in terms of the basis for action, objectives, activities and means of implementation. Agenda 21 is a dynamic programme that covers social and economic dimensions, conservation and management of resources for development and strengthening the role of major groups. It is designed to be carried out by the various actors according to their different situations and the capacities and priorities of countries and regions. The plan is based upon 27 principles contained within the Rio Declaration.

The term "sustainable development" means so many different things to different people and organisations. Therefore, it has been criticised as ambiguous and open to a wide range of interpretations, many of which are contradictory (IUCN, WWF, UNEP, 1991). As argued by Leal Filho, Manolas and Pace (in press, 2009), at present the expression "sustainability" is treated as being synonymous with terms such as "long-term", "durable", "sound" or "systematic", among others. Different definitions of SD are used by different organisations, taking into account their political perspectives and institutional aims. Robinson (2004) argued that "the lack of definitional precision of the term sustainable development may represent an important political opportunity" (p. 374). Forum for the Future (2006), for example, defined sustainable development as "a dynamic process, which enables all people to realise their potential and improve their quality of life in ways which simultaneously protect and enhance the Earth's life support systems".

Hill, Wilson and Watson (2004) relate sustainability to ways of thinking about the world and forms of social and personal practice that lead to:

- Ethical, empowered and personally fulfilled individuals;
- Communities built on collaborative engagement, tolerance and equity;

- Social systems and institutions that are participatory, transparent and just; and
- Environmental practices that value and sustain biodiversity and life-supporting ecological processes.

Although differences in definitions suggest differences in meaning, a common ground does exist. Leal Filho *et al.* (in press, 2009) summarised a set of multi-meaning references to sustainable development. They conclude that:

a) Sustainability refers to long-term prospects with ecological, political, economic and societal implications;
b) Sustainability is a dynamic process, whose implementation depends on due consideration of social processes of which individual engagement and participation are essential elements;
c) In order to be implemented on a global level, sustainability depends on concerted efforts and cannot be based on action by a few countries or local actors.

However, as there is no common definition of sustainable development, there is also no single model of a sustainable society (Robinson, 2004). An analysis of tensions in current political interpretations of sustainable development may help to understand the differences across the various models. Tensions are present at different levels: international, national and local. The most significant one is the tension between international and national interests at the *international level* in both interpretation and action concerned with sustainable development. International discourses were stimulated by the process of globalisation, in particular, by the increasing inter-dependence between the world's regions. Held, McGrew, Goldblatt and Perraton (1999) argued that the concept of globalisation implies, principally, "a stretching of social, political and economic activities across frontiers such that events, decisions and activities in one region of the world can come to have significance for individuals and communities in distant regions of the globe" (p. 15). On an international level, sustainable development is used to refer to two broad areas. The first relates to efforts to limit major disasters such as greenhouse gases and the threat of global warming and rising ocean levels, the destruction of the world's forests and expansion of the deserts, outbreaks of war and mass migration. These are examples of economic and environmental tensions. The second area relates to the promotion of national interests. The tensions here are between justice and equity and economic prosperity. Tensions at the international level are the most visible. A prominent example is when a number of countries did not sign the Kyoto protocol due to the higher priority placed on economic prosperity within their internal politics.

The tensions at the *national level*, such as those between economic, socio-cultural and environmental aspects of sustainable development, are sometimes overlooked. The balance between the national aspects of SD in terms of priorities for developments that maintain and improve the quality of life for both present and future generations is different for individual countries. In some developed countries, sustainable development is largely interpreted in terms of environmental issues. For example, the Forum for the Future criticised the concept of the triple bottom line of economic, environmental and social sustainability: "Whilst this concept is useful,

we feel it is limited by giving equal weighting to each of the three bottom lines. We believe that environmental sustainability is pre-conditional, because without it the other bottom lines can't exist!" (Forum for the Future, 2006).

For Western societies it is important to place particular significance on the environmental bottom line. Unsustainable patterns of production and consumption in developed countries "threaten the fragility of the natural environment and intensify poverty elsewhere" (UNESCO, 2005, p. 9). The model of sustainable development described by the Forum for the Future (2006) presupposes that the carrying capacity of the ecosystem (environmental limits) defines and envelops the extent of human action. The economy is tailored to work within this ecosystem's capacity. People in rich countries have much higher levels of unsustainable production and consumption; however,

> they are able to make choices which the poor, trapped in a cycle of deprivation and vulnerability, are unable to make. While the rich are able to adopt patterns of sustainable development, they frequently are reluctant to do so – the poor have few if any options but to make use of their immediate environment. Poverty is linked to environmental degradation as the poor have no choice but to seek and avail themselves of scarce natural resources such as fuel, wood and water. (UNESCO, 2005, p. 10).

Problems of over-consumption and over-development are key factors in addressing environmental conservation and protection. In developing countries the emphasis on economic and social issues might be seen as particularly important. For example, participants of the virtual conference on TVET and sustainable futures (Pavlova, 2007) agreed that for developing countries, social sustainability is a priority compared to environmental sustainability. A participant from India stated that, "so far [through our discussion] we have a clear indication that environmental issues are nice, but not a priority, social sustainability might be a priority". Another participant, from South Africa, had this to say:

> From having worked in very poor areas (rural and urban), where people are most concerned about whether they will eat and have a shelter that protects them from the elements, I know that *environmental concerns are not a priority, but rather a 'nice-to-have'*. This is the conundrum of policy implementation in a way that is meaningful to the majority of people [italics added].

Then she referred to technical and vocational training:

> I do agree with you that environmental aspects unfortunately is not a priority and whatever training is being done today, I believe is highly focused on skills related to new technologies and new emerging economical sectors. Sometimes, it is a pity to note that it is too late when we realise our adverse effect on our environment, while the principle of sustainable development requires us as individuals and as a society to think through decisions about how we live our lives, about development and social advances by considering all the consequences of our actions and along trying to come up with solutions. (Pavlova, 2007)

Thus, in general terms there could be major distinctions between the developed and developing countries in terms of a possible prioritising of particular aspects of SD. In addition, further differences in priorities are visible at the national level.

At the local level, the concept of sustainability can again be approached in different ways. For one particular community, conservation of water might be the main issue, for another, maintaining traditional dancing might be seen as an emerging concern. Therefore, it is important to understand the basis for conceptualising SD to identify which principles could be more appropriate for the type of technology and vocational education discussed in Chapter 2.

## Theoretical Perspectives on Sustainable Development

Theoretical perspectives on sustainable development will be considered here under three major topics: value position, nature of proposed responses and structure of proposed responses towards SD issues.

### *Value Position: Anthropocentric–Ecocentric*

Literature on sustainable development (e.g., Robinson, 2004) suggests that the concept of SD emerged in the early- to mid-1980s as an attempt "to bridge the gap between environmental concerns about the increasingly evident ecological consequences of human activities and socio-political concerns about human development issues" (Robinson, p. 370). The emergence of sustainability agenda was an extension of arguments within the environmental literature of the 1960s, 1970s and early 1980s (Robinson, p. 371). Throughout history the relationship between humanity and nature has been one of the most important existential and philosophical issues people have attempted to address. In traditional cultures the unity of humanity and nature was presented within an overall perception of the world and some indigenous cultures have preserved this view to the current period. As argued by Morrison and Carmody (1996), within Aboriginal groups in Australia the worldview is:

> that the land and its resources don't exist in isolation from the people. The two are intimately linked, where people are spiritually part of the land, and the land is maintained and cared for by the people. It is not a world view that sees land as a saleable commodity for exploitation, but rather one where the land and the people are one and the same. (p. 2)

Another example comes from the indigenous people of the Far North of Russia. The nation of Sakha has a number of "rules" related to respect and protection of spirits and nature:

> Don't spoil fire.
> Don't pollute water; keep it clean.
> Don't dig up the earth.
> Keep air clean.
> Don't break stones into pieces…
> Do not trample down the green grass.
> Do not damage a tree.
> Protect animals and birds.
>
> (Shamaeva, Semenova, & Sitnikova, 1995, p. 69)

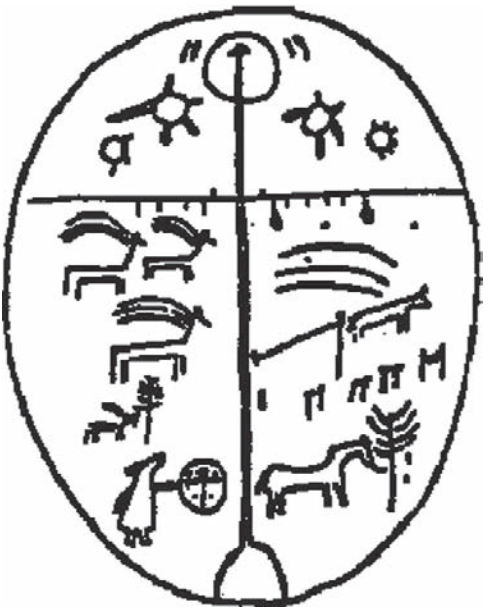

Fig. 3.1 A symbolic map of the universe. The central, cross-like figure represents the "Spirith-Master of the drum". It is a highly stylised figure of the "man": with round head, two small legs etc. Of course it is not a "world tree", but it is a symbol of the same importance.
The space of the picture is divided into two important zones: above you see the sky (Upper World) with stars. Below the horizontal line there is a human world (Middle World). In the left part, the shaman, holding the drum. Above him – mountain rams. In the right part: The horse beneath the tree, this animal is ready to be sacrificed. Above, the same animal after being sacrificed. Its skin is attached to a special ritual construction called Tayilga. (Sagalaev, 1997)

Symbolic representation of these relationships can be found in traditional art. Figure 3.1 presents a universe as it was seen by the native tribes in Siberia. It is a copy of the picture on a shaman's drum.

The narrative presented by the picture proposes a particular view of the world. "It presents an exceptionally viable cognitive template that can be readily tested against the dominant Western notions of the acceptability of the endless exploitation of natural and human resources" (Frank, 2006). As summarised by Huckle (2005),

> People are part of ecological relations (members of a biological species, dependent on ecological resources and services to supply their needs) yet partly independent of such relations as part of social relations (they have powers of language and technology that enable them to transform their own nature and that which surrounds them). (p. 15)

The historical development of humanity, particularly in the West, led to the accumulation of technically exploitable knowledge that has become a threat to the existing

authority of cultural traditions (Habermas, 1968/1971). Technological development and an increase in technocratic ideology, interested in the expansion of human power in the form of technical control, has greatly contributed to environmental and social problems and as a consequence, to the emergence of a discourse about SD.

The differences in views about sustainable development are rooted partly in different philosophical and moral conceptions of appropriate ways to conceive of the relationship between humanity and nature. On the opposite sides of the scale are *ecocentric environmental ethics* (that attribute *intrinsic* value to nature and suggest that humans should live according to nature) and *anthropocentric or technocratic environmental ethics* (that attribute *instrumental* value to nature and suggest that humans should use and manage nature wisely). Both positions are flawed. As argued by Huckle (2005),

> ecocentrism can be criticised in that it romanticises a nature outside society and fails to recognise that only humans can value things. Strong anthropocentrism/technocentrism can also be criticised in that it sanctions the exploitation and oppression of nature by treating it instrumentally or merely as a means to human ends. (p. 16)

So, in interpreting SD, the central basic question is: should we put more emphasis on nature or on culture/human beings? Or can we create an appropriate balance?

The third group, those adopting a non-anthropocentric or ecocentric position on the appropriate relationship between humanity and nature, argue for a new way of relating to the natural world, a new ethic and a new set of values. In the words of David Suzuki: because we are so dependent on natural systems, we must learn to regard the planet as sacred (Suzuki & McConnell, 1997). Two positions that advocate a particular approach in finding the balance pay a special tribute to human consciousness: the first in Vernadsky's (1945) ''noosphere'' and the second is Bonnett's (2002) ''frame of mind''. Both will be considered before proposing weak anthropocentrism as a means to begin conceptualising sustainable development.

## Nöosphere

Russia has a long-standing tradition of thought that is congruent with current ideas regarding sustainability. At the beginning of the 20th century the Russian scientist Vernadsky advanced a conceptualisation of the idea of harmonising the interrelationships between the environment and the world community. He stated that man is

> indivisible from the biosphere. And this inseparability is only now beginning to become precisely clear to us. In reality, no living organism exists in a free state on Earth. All of these organisms are inseparably and continuously connected—first and foremost by feeding and breathing—with their material-energetic environment.… Mankind, as living matter, is inseparably connected with the material-energetic processes of a specific geological envelope of the Earth—its *biosphere*. Mankind cannot be physically independent of the biosphere for a single minute. (Vernadsky, 1945, p. 2)

Vernadsky's concept of nöosphere or the "sphere of wisdom" (tsarstvo razuma) is grounded in his research into the physical sciences and stages in the development of

the planet (Vernadsky, 1945) as he recognised evidence of the distinction between human and non-human living processes. The method that he applied relates to the geological evidence which shows life to be a universal principle on Earth. Accordingly, both life and consciousness are essential features of the earth's evolution. The emergence of human consciousness has fundamentally transformed the biosphere. Vernadsky characterised the noösphere as a new stage of development of the earth, in which humankind emerged as the increasingly dominant "geological force" in the biosphere:

> …the whole of mankind put together represents an insignificant mass of the planet's matter. *Its strength is derived not from its matter, but from its brain* [italics added]. If man understands this, and does not use his brain and his work for self-destruction, an immense future is open before him in the geological history of the biosphere. (Vernadsky, 1945, p. 5)

That force is defined not simply by the biological metabolism of the human population (such as its nutrition, excretion and muscular effort) but by the much larger flows of matter and energy, which are connected with the physical-economic activity of human society:

> Mankind taken as a whole is becoming a mighty geological force. There arises the problem of the *reconstruction of the biosphere in the interests of freely thinking humanity as a single totality*. This new state of the biosphere, which we approach without our noticing, is the *nöosphere* (Vernadsky, 1945, p. 5)

Vernadsky believed that nöosphere is the last stage in the evolution of the biosphere in geological history. This concept of nöosphere supports his belief in human consciousness, cognitive power and wisdom and it provides a useful contribution to the formation of a new global and holistic worldview. He argues that all components of human nature such as our mind (through appropriate information and knowledge), heart (through feelings and emotions) and spirit (through the highest human aspirations and morals) should be reached and moved in this process and that they should guide human creativity.

Vernadsky's (1945) theory of the biosphere and the nöosphere has provided a theoretical basis for conceptualisations about sustainability in modern Russia. In the conception of Russia's transition to SD (Ukaz, 1996), it is argued that this movement "ultimately would lead to the emergence of the sphere of wisdom (the nöosphere) foreseen by Vernadsky, when the spiritual values and knowledge of humankind, existing in harmony with the environment, will become the criterion of national and individual wealth" (p. 5). According to Shelehov (2002), the sphere of wisdom that was discussed in Vernadsky's work represents a "philosophically rethought image of our desirable future, the one that we now call sustainable development" (p. 9). The transition to nöosphere requires profound changes in the values and actions of humankind and in that sense, it is closely related to the current concept of sustainability as a frame of mind advocated by a number of researchers (Bonnett, 2002; Huckle, 2005).

**Frame of Mind**

Bonnett (2002) refers to some aspects of the Western intellectual tradition that make greater demands on consciousness and require "an increasing extension and depth of sympathy/empathy towards the flourishing of things beyond ourselves, which, arguably, amounts to a *qualitative* change of outlook and ultimately may lead to a transformation of what we take ourselves to be" (p. 13). In putting this case, Bonnett quoted Mathews, who argued that:

> The thesis that we, as human selves, stand in a holistic relation – a relation of 'oneness' – with the cosmos itself, promises more than a list of ethical prescriptions. It promises a key to the perennial questions of who we are, why we are born, what is our reason for living, etc. In short it promises to throw light on the *meaning of life*. (Mathews, 1994, p. 147)

An important feature of Bonnett's view is that it locates the essence of sustainability in the nature of human consciousness itself – that is, "in the very event of being conscious at this level – and thus differs both from conventional anthropocentrism and eco-centrism" (p. 18). He emphasises the special position that human consciousness has in "the greater scheme of things" and suggests that sustainability seeks and requires an openness to nature:

> The issue of sustainability as a *frame of mind* [italics added] is not simply the issue of our attitude towards the environment, but represents a perspective on that set of the most fundamental ethical, epistemological and metaphysical considerations which describe human being; a perspective which is both theoretical and practical in that it is essentially concerned with human practices and the conceptions and values that are embedded in them. (Bonnett, 2002, p. 14)

Sustainability as a frame of mind involves "respect for human and non-human nature seeking their own fulfilment through a process of co-evolution that people can encourage with appropriate technology (tools, institutions and ideas)" (Huckle, 2005, p. 18). Both positions (Vernadsky's and Bonnett's) focus on human consciousness and refer to the "intrinsic valuing of persons" and harmony with nature as the superordinate goals. Their approaches can be positioned within the concept of weak anthropocentrism, the environmental ethic that promotes the mutual flourishing of human and non-human nature. The underlying idea is that

> while humans are the only source of value, they are not the only bearers of value. An essential part of human consciousness is to recognise the value of the 'other' and so be capable of deep respect for things non-human, that are not perceived as serving primarily human purposes. (Huckle, 2005, p. 16)

The "Caring for the Earth" *Strategy* published by the International Union for Conservation of Nature and Natural Resources and the World Wide Fund for Nature (IUCN, WWF, UNEP, 1991) identified nine principles for sustainable living, and argued that one foundational principle provided the ethical base for the other eight: "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". This fully corresponds with the findings of studies referred to in Chapter 1. Criteria proposed to achieve this ethical principle include:

- Improve the quality of human life (enable people to realise their potential, lead lives of dignity and fulfilment);
- Conserve the earth's vitality and diversity; minimise depletion of non-renewable resources (use less, re-use, recycle, switch to renewables where possible);
- Keep within the earth's carrying capacity (including human population and level of consumption). (in Heselink & Goldstein, 2000, p. 127)

The *Strategy* suggested sustainable development be used to mean "improving the quality of human life while living within the carrying capacity of supporting ecosystems" (IUCN, WWF, UNEP 1991, p. 10). It places an emphasis on "sustainable living" and sustainable society, relating sustainable development to an individual's life and personal choices.

Therefore, it is argued that a conceptualisation of sustainable development within the framework of weak anthropocentrism, nöosphere wisdom and the frame of mind paradigm, promotes valuing of the other (human and non-human) and can provide the basis for development of approaches for ESD in education and in technology education in particular.

## *Nature of Proposed Responses*

Robinson (2004) suggests that since the early 1970s the debate about the relative importance of technology and individual human responsibility has been an emerging theme in the environmental literature: individual attitudes towards nature as opposed to more pragmatic and collective approaches oriented towards efficiency gains and improvements in technology. Robinson identified "technical fix" and "value change" as descriptors that could be used to label two major approaches to SD (see Table 3.1).

Conservation and preservation perspectives on natural management revealed the distinction between a romantic approach that favoured the preservation of natural areas in undeveloped form and a conservationist position that favoured the protection of natural areas for later human use. These distinctions focus on potential responses rather than on value positions (anthropocentric versus ecocentric). When Robinson (2004) analysed the Brundtland report in terms of the two responses proposed in

**Table 3.1** Forms of environmental response

| | Technical fix | Value change |
|---|---|---|
| Natural area management | Conservation (utilitarian) | Preservation (romantic) |
| Pollution and resources | Technology (collective policies) | Lifestyles (individual values) |
| Preferred language | Sustainable development | Sustainability |

Table 3.1, he suggested that the focus of the report be "on collective institutional responses, efficiency gains, and social responsibility" (p. 373). The report calls for greater improvements in technology and efficiency and there is no mention of spiritual values, or individual responsibility.

> In the end, these underlying debates turn on a difference between a primarily utilitarian focus on human well-being and a more spiritually-oriented focus on our relation with the natural world… the rhetoric of sustainable development is about achieving sustainability for human purposes and ultimately conveys faith in the ability of humans to solve environmental and social problems through the application of reason. (Robinson, 2004, p. 376)

Often, sustainable development is associated with economic growth and due to this reason there is a debate about the preferred terminology. In this book the terms sustainability and sustainable development are regarded as interchangeable. In each case it should be understood to be inclusive, that is to say it includes the issues on both sides of Table 3.1.

In the previous chapter the importance of value change for education and for the creation of a better society was established. The prioritising of moral values was advanced. What then is the role of technical fix in achieving SD? Although technology has been playing an increasingly important role in the life of humanity, the philosophy of technology has not been considered as a source for theorising SD. In the environmental literature a number of statements highlight the role technology could and should play in SD. The next section examines technology from the perspective of the philosophy of technology, with the aim of understanding the extent to which technical fixes provide possible/effective ways to achieve SD.

## Technical Fix

Technical fix is seen by a number of authors as a primary means of achieving SD (Benyus, 1997; Commoner, 1991; Hawken, Lovins, & Lovins, 1999; World Commission on Environment and Development, 1987). However, it is important to assess technology critically. Ellul (1987/1990) has set the tone of critical discussion on technology. Many authors describe his position as "technological gridlock"; it is as maddeningly frustrating and obscure (see for example, Hickman, 1990, p. 146). Ellul does not agree with these characteristics and in his book *The technological bluff*, he stated that his warning nowadays is as it was in his previous book in 1954: "to alert people to the future potential of technique and to the risks entailed by its growth so that they might be able to react and to master it, lest otherwise it escape their control" (p. xiii).

It is important to highlight a number of points here in relation to Ellul's (1987/1990) argument about the nature of technology. He writes about the total dependence of our lives on technology, arguing that "a new model of humanity is emerging in the West" where people and society are integrating into the technical world. This integration has not yet been achieved, but the gap between society and the technical system, between individuals and technology, is constantly narrowing. "Everything now depends on technique. We live incontestably in a society that is

totally made by it and for it" (Ellul, p. 12). This negative trend of *integration of people and society into the technical world* closely relates to the role *technical knowledge* plays in the technical world. For Ellul, the example of Technopolis (which was invented by the Americans in the 1930s in California and then in the famous Silicon Valley between 1950 and 1960), provides the perfect picture of a technical world: "Technicians control research, they correspond with industrial technicians (dealing with the economy, analyzing needs, etc.), and the major function of the university henceforth is to provide technicians. Studies no longer have any justification unless they serve a useful purpose" (p. 28). The problem is that the technocrats are blind to the complex realities of the world. Their knowledge and narrow specialisations prevent them from exploring or incorporating questions outside their field, but they are absolutely sure how the world will look tomorrow, so education must prepare the children for this particular world. They create a specific ideology, the ideology of applied science and ignore most of what constitutes the world. Those who have technical knowledge have power and Ellul is very critical of the technocratic exploitation of such power.

*Uncertainty* is another issue Ellul explores (1987/1990). He analysed three broad areas—the ambivalence of technical progress, the unpredictability of development and the double feedback—to support his argument. Ellul's analysis of *ambivalence* brought him to the following conclusions:

- All technological progress has its price;
- At each stage it raises more and greater problems than it solves;
- Its harmful effects are inseparable from its beneficial effects; and
- It has a great number of unforeseen effects.

A particular technology could be developed for a purely positive purpose; however, there is always the potential that it could be exploited for a different purpose. A classic example is gunpowder. With respect to the *unpredictability of development*, Ellul's argument was that "technical progress does not know where it is going. This is why it is unpredictable, and why it produces in society a general unpredictability" (Ellul, p. 39). In his analysis Ellul particularly distinguishes between an intrinsically dangerous technology which contributes to environmental degradation and a technology which creates problems through dangerous individual choices. He also criticises the tendency to consider every problem—social, political, human or economic—as a technical problem (a position adopted by technical fix supporters). The third area of Ellul's analysis concerns what he terms *double feedback*. For Ellul, technology is a system with a feedback mechanism that influences its development. For example, the relationships between politics and technology have a "positive" feedback that stimulates technology development. Politicians are provided with extraordinary means to achieve their goals. Technology also improves the means of control. Ellul claims that we have been told repeatedly that developing technique will solve the crisis—whether it be in productivity, unemployment or the balance of trade. Positive feedback that stimulates technological development can develop only through technical improvements. Negative feedback tends to put limits on technical growth: research is increasingly expensive; many projects have become international.

Although technique makes economic growth possible, it demands such enormous funding that "the economy reacts by putting a brake on it through forcing it to make choices" (Ellul, p. 105). Both negative and positive feedback increase uncertainty.

Ellul's (1987/1990) point about the *absurdity of technology* relates to the absurdity of the inexorable constraint of technical growth. He argues that we produce things that we do not need. We do this because technology opens this possibility and we have to exploit it. The absurdity is that we have to follow this direction. The same absurdity is that we use things that we do not need. Ellul argues that once an advanced technical product is created, technical progress "demands" that consumers use it, even though they have no interest in it. Another argument relates to the point that in a wholly artificial world no reflection, choice, or deliberation is possible. The multiplication of invading images creates an environment filled with noise and images.

> [It] is so invasive that we cannot continue to live in a distant, mediate, and reflective way, but only in an immediate, obvious, and hypnotically active way.… I cannot say that human beings are absurd in themselves, nor that society is absurd in itself.… But we are certainly in the process of becoming absurd.… This is a totally new experience in human history. (Ellul, 1987/1990, p. 215)

Ellul concludes that in the technical milieu "the possibility is the necessity and the necessity is our only possibility.… This is real absurdity. But it is an absurdity from which we cannot escape" (p. 219). He presents a critical view of technology and raises important issues such as the integration of people into the technical world, uncertainty, growth of technical culture, the absurdity of technology and unpredictability of technical progress, as well as the dominance of practical intelligence and consumerism. His analysis supports the argument that technical fix as the major way for SD is questionable and even an unrealistic approach towards achieving sustainability.

Although technology has its positive features that can be used for SD, its major aim is profitability, opening up markets and seeking future expansion rather than investing for the benefit of humanity, as Beck (1997, p. 117) argues. Dolata (1992, cited in Beck, 1997) also argued:

> the central problem is that this type of entrepreneurial development of consumption and planned innovation does not normally happen as a response to social sensitivities and articulations of interest but in advance of them, thus largely uninfluenced by democratic debates on the future outlines of technological development and oriented only to the Standard of business efficiency and profitability criteria. (p. 118)

Beck calls for the need to "disabuse technology of its old habit of copying economic necessities and military purposes in order to make it autonomous" (p. 116). This could be possible because one of the "sources of inspiration" in the field of technology is the "technical work itself"; the others are economic utility, effectiveness, functionality.

The nature of technology described by Skolimowski (1966), "to produce more and more diversified objects with more and more interesting features, in a more and more efficient way" (p. 375), might appear to be a positive transition towards SD (e.g., spend less energy for production), however, this brings us back to the

economic imperative paradigm. Technical fix might treat only the symptoms, not the disease. Even if the potentially appropriate approaches like industrial ecology, dematerialisation, eco-efficiency, biomimicry and others turn out to be correct, these approaches, as argued by Robinson (2004) will not themselves "represent a sufficient response to the challenge of sustainability, even in the short term" (p. 79). The reason is that achieving reductions in the environmental impacts of economic activity

> [do] not necessarily translate into improvements in the quality of life for all. It is easy to imagine cases where the gains from such approaches are appropriated disproportionately by those who already are well-off, leaving those at the bottom of the socio-economic pyramid as badly, or worse, off as before. (Robinson, 2004, p. 379)

An analysis of technology demonstrates that technology cannot fix the problems of the modern world and it is in fact dangerous to believe that this might be the case. There are a number of suggestions on how to regulate technological development. Beck (1997) cited Dolata (1992) who proposes four cornerstones as an alternative way of regulating the technoscientific revolution:

- on the general recognition and implementation of a socially responsible slowness and caution in dealing with new risk-fraught technologies;
- on a research and technology policy that takes up social problems, corrects technological misdevelopments and actively encourages alternative paths of technological development;
- on taking on a deep-seated ecologically sensitive restructuring of those industrial sectors with production or products that are laden with unacceptable risks; and
- on a thoroughgoing democratization and decentralization of patterns of economic and political decision-making. (p. 120)

However, to achieve these changes a fundamental transformation in underlying values is required. Therefore, value change could be considered as a leading force in achieving SD. SD is an issue of human behaviour and negotiation over preferred futures. SD is an inherently normative concept, "rooted in real world problems and very different sets of values and moral judgements" (Robinson, 2004, p. 380). The argument developed in Chapter 2 also established that a radical shift in our thinking is required to achieve the desired change. For example, the anti-globalisation movement represents a shift in debate from a focus on explicitly environmental or social causes to a more generalised critique of some of the characteristics of modern industrialised society (Klein, 2005). Therefore, technical fix is important but it should be based on a value change.

## *Structure of Proposed Responses – Three Pillars of Sustainability*

Sustainable development that is locally relevant and culturally appropriate could include several common goals or themes. The International Implementation Scheme

for the United Nations Decade of Education for Sustainable Development (DESD) (UNESCO, 2005, p. 14) identified key areas of the concept as:

- Society: an understanding of social institutions and their role in change and development, as well as the democratic and participatory systems which give opportunity for the expression of opinion, the selection of governments, the forging of consensus and the resolution of differences.
- Environment: an awareness of the resources and fragility of the physical environment and the effects on it of human activity and decisions, with a commitment to factoring environmental concerns into social and economic policy development.
- Economy: a sensitivity to the limits and potential of economic growth and their impact on society and on environment, with a commitment to assess personal and societal levels of consumption out of concern for the environment and for social justice.

These three elements assume an ongoing and long-term process of change – sustainable development is a dynamic concept, with the recognition that human society is in constant movement. These three areas are interconnected through the dimension of culture, which UNESCO (2005, p. 15) defines as "ways of being, relating, behaving, believing and acting that differ according to context, history and tradition.… practices, identity and values – the software of human development – play a big role in setting directions and building common commitments". Important concerns and challenges that must be addressed in the effort to achieve sustainability can be formulated as perspectives. Fifteen strategic perspectives are formulated by the DESD International Implementation Scheme (UNESCO, 2005), encompassing:

- *Socio-cultural perspectives*: human rights; peace and human security; gender equality; cultural diversity and intercultural understanding; health; HIV/AIDS; governance.
- *Environmental perspectives*: natural resources (water, energy, agriculture, biodiversity); climate change; rural development; sustainable urbanisation; disaster prevention and mitigation.
- *Economic perspectives*: poverty reduction; corporate responsibility and accountability; market economy.

These perspectives summarise important issues that should be addressed in technology and vocational education through a technical fix response as well as a value change response by positioning "the other" at the centre of concern. How these perspectives might be addressed in technology education will be discussed in the next chapter.

## Education for Sustainable Development

Theoretical perspectives that include value position, the nature of proposed responses and the structure of proposed responses provide a clear interpretation of SD: weak anthropocentrism together with an emphasis on value change and a range of issues

across socio-cultural, environmental and economic perspectives could help to develop a particular view on education for sustainable development (ESD). Whatever way sustainable development has been conceptualised, there is a general agreement that education plays an essential role as we move towards more just and sustainable relationships and hence world order. ESD/education for sustainability (ES) is seen as a major contributor towards achieving sustainable futures through promoting an awareness of the issues at all levels, developing particular values and influencing behaviours. Agenda 21, the Rio Declaration recognises education as a key tool of sustainable development. Chapter 36, on education, awareness and training, states:

> Education is critical for achieving environmental and ethical awareness, values and attitudes and behaviour consistent with sustainable development and for effective public participation in decision-making. Both formal and non-formal education are indispensable to sustainable development. (United Nations, 1992)

Since the Rio conference on SD, there has been increasing recognition of the critical role of education in "promoting sustainable consumption and production patterns in order to change attitudes and behaviour of people as individuals, including as producers and consumers, and as citizens carrying out their collective activities" (UNESCO, 2001b, p. 3). Education should provide not only the scientific and technical skills required, it should also provide "the motivation, justification, and social support for pursuing and applying them. Education increases the capacities of people to transform their visions of society into operational realities" (UNESCO, 2001a, p. 1). This transformative nature of ESD closely relates it to the notion of developing students' moral values and critical, responsible views of the world.

As governments, industry, NGOs and the general public become more aware of the urgency of SD, the pivotal role of education in learning and teaching towards sustainability is also becoming more evident. The nations of the world, through the UN General Assembly, unanimously adopted the resolution to establish a Decade of Education for Sustainable Development (DESD) from 2005–2014. The decade seeks to "to integrate the values inherent in sustainable development into all aspects of learning to encourage changes in behavior that allow for a more sustainable and just society for all" (UNESCO, 2005, p. 5). The proposed DESD objectives are to:

1. give an enhanced profile to the central role of education and learning in the common pursuit of sustainable development;
2. facilitate links and networking, exchange and interaction among stakeholders in ESD;
3. provide a space and opportunity for refining and promoting the vision of, and transition to, sustainable development – through all forms of learning and public awareness;
4. foster increased quality of teaching and learning in education for sustainable development; and
5. develop strategies at every level to strengthen capacity in ESD. (UNESCO, 2005, p. 26)

ESD has gradually become an important issue for many educators internationally. Different local and global initiatives in education, such as the inclusion of ESD in pre-service and in-service courses, the reform of curricula and teaching programmes at different levels, sustainable school and university movements and many other activities indicate an increasing commitment towards an ESD agenda in education.

There is almost universal agreement that there is no single model of SD. At the international level and within different national contexts, tensions between social, economic and environmental dimensions are different, thus the argument can be made that approaches to ESD can also be different across different countries, disciplines and levels of education. For example, Huckle and Sterling (2005) argue that it is impossible to have one universal definition of ''education for sustainability'':

> EfS is a process that develops people's awareness, competence, attitudes and values, enabling them to be effectively involved in sustainable development at local, national and international levels, and helping them to work towards a more equitable and sustainable future. (p. 1)

The DESD pursues a global vision of ESD:

> The vision of education for sustainable development is a world where everyone has the opportunity to benefit from quality education and learn the values, behaviour and lifestyles required for a sustainable future and for positive societal transformation. (UNESCO, 2005, p. 26)

Both definitions set "a sustainable future" at the heart of our common human endeavour, but this purpose will be expressed differently in the variety of socio-cultural contexts where positive societal transformation needs to be achieved.

As stated in the DESD *Strategy* (UNESCO, 2005), the underlying values which ESD must promote include:

- Respect for the dignity and human rights of all people throughout the world and a commitment to social and economic justice for all;
- Respect for the human rights of future generations and a commitment to intergenerational responsibility;
- Respect and care for the greater community of life in all its diversity which involves the protection and restoration of the Earth's ecosystems; and
- Respect for cultural diversity and a commitment to build locally and globally a culture of tolerance, non-violence and peace. (UNESCO, 2005, p. 16)

Therefore, the underlying values relate to valuing the other where the transformative power of education could bring about the fundamental changes demanded by the challenges of sustainability. Progress towards sustainability depends on developing more caring relationships between humans and the natural world and facilitating the creative exploration of more environmentally and socially responsible forms of development.

The results of the global studies highlighted in Chapter 1 (Parker, Ninomiya, & Cogan, 1999) indicated that students must develop eight competencies identified as

essential for the citizens who are dealing with undesirable trends and encouraging desirable ones. These include the:

- Ability to look at and approach problems as a member of a global society;
- Ability to work with others in a cooperative way and to take responsibility for one's roles/duties within society;
- Ability to understand, accept, appreciate and tolerate cultural differences;
- Capability to think in a critical and systematic way;
- Willingness to resolve conflict in a non-violent manner;
- Willingness and ability to participate in politics at local, national and international levels;
- Willingness to change one's lifestyle and consumption habits to protect the environment; and
- Ability to be sensitive towards and defend human rights (e.g., rights of women, ethnic minorities).

These abilities are strongly related to values identified in the DESD *Strategy*:

> The development of strong positive values in learners – about themselves, learning, the world around them and their place in it – are a key part of what educators seek to foster in learners: developing as a whole person, becoming active and responsible citizens, discovering a love of lifelong learning, realising their strengths and potential. (UNESCO, 2005, p. 17)

This type of personal learning is more oriented towards adopting a vision rather than studying particular content. This learning also must lead to active participation in seeking and implementing new patterns of social organisation and change, trying to find structures and mechanisms that will reflect the vision of SD.

Educational change that is needed to accommodate these demands requires a paradigm shift, as discussed in Chapter 2. Sterling (2001) believes that education cannot promote sustainability while it remains dominated by modern forms of knowledge and pedagogy. A number of academics advocate the position that a "new generation" of environmental studies is needed, "one that begins with social issues and stimulates critical thinking in relation to human conflicts of interest" (Argyris & Schön, 2004, p. 65). These new studies should lay the groundwork for a "change in the values of theory-in-use" and for educating active, constructive and oppositional citizens who can question the basis of the existing system (Sterling, 2004, p. 65). In line with this perspective, where critical theory could be one of the points of departure, education should be analysed not only in terms of how it reproduces existing social practice, but also in terms of "its potential to nurture moral courage and constructive opposition" (Lundegård & Wickman, 2007, p. 2).

ESD focussed on sustainability as a frame of mind, would implement non-instrumental conceptions of nature/human relationships and so run counter to much, but not all, modernity philosophies. "It would reveal the motives shaping dominant instrumental ways of thinking and so render itself unacceptable to many" (Huckle, 2005, p. 15). But Bonnett (2002) insists that such ESD is more likely to be productive in the long term than ESD as an aspect of policy, arguing that pupils must be encouraged

to engage in "those kinds of enquiry which reveal the underlying dominant motives that are in play in society; motives which are inherent in our most fundamental ways of thinking about ourselves and the world" (p. 19). He argues,

> That such a metaphysical investigation will be discomforting for many seems unavoidable, but it promises to be more productive in the long term than proceeding on the basis of easy assumptions about the goals of sustainable development as though it were a policy whose chief problems are of implementation rather than meaning. (p. 19)

The above approach supports the vision that weak anthropocentrism as a way of conceptualising SD provides an opportunity to formulate a descriptor for conceptualising ESD in terms of *improving the quality of human life within earth's carrying capacity and conservation of the earth's vitality and diversity*. What sets this statement apart from an anthropoentric position is that the need to preserve nature is explicitly stated. The difference with the eco-centric position is that it highlights the quality of human life as the main focus. In addition it is not your individual life, it is also the life of the "other". Thus, sustainable development is viewed as a fundamentally social phenomenon (Carmichael, 2003). Our decisions determine "our own welfare and the welfare of others "(United Nations, 2001, p. 1). This understanding should be at the centre of teaching and learning activities.

In the formal education sector, ESD should not be seen as one more subject in an overcrowded curriculum but as an

> holistic or 'whole school approach' where sustainable development is seen as a context for delivering existing aims of education and not as a competing priority. Weaving ESD as a thread through the learner's journey through the educational system – from pre-school to higher education institution – will maximise its impact" (UNESCO, 2005, p. 24).

For the required change the importance of teachers' values were established in Chapter 2. Thus, capacity building of teachers is an important condition for implementing the DESD aims. Some models for empowering teachers are considered in Chapter 6.

## Conclusion

This chapter advanced a particular way of conceptualising SD. The ethics of weak anthropocentrism as an appropriate basis for theorising SD is argued to offer a framework for developing ESD approaches. The emphasis on moral values (argued in Chapter 2) provides a basis for value change within an SD paradigm. Value change has been identified as a priority in achieving the goals of SD. In this chapter the role of technical fix (technical solutions) is also acknowledged as technology is able to solve some SD issues, if it is underpinned by moral values. The three pillars of sustainability have been identified as structural elements for consideration, and the role ESD as a key tool for SD has been established. The next chapter explores the possible nature of ESD within a technology education context.

## References


Argyris, C., & Schön, D. A. (2004). Organizational learning II: Theory, method and practice. In W. Scott & S. Gough (Eds.), *Key issues in sustainable development and learning: A critical review* (pp. 63–68). London: Routledge Falmer.

Beck, U. (1997). *The reinvention of politics: Rethinking modernity in the global social order*. Cambridge: Polity Press.

Benyus, J. (1997). *Biomimicry*. New York: William Morrow.

Bonnett, M. (2002). Education for sustainability as a frame of mind. *Environmental Education Research, 8*(1), 9–20.

Brown, L. (1981). *Building a sustainable society*. Washington, DC: Worldwatch Institute.

Carmichael, C. (2003). *A primer on sustainable technology and development*. Retrieved November 25, 2004, from www.istd.gatech.edu.

Commoner, B. (1991). Rapid population growth and environmental stress. *International Journal of Health Services, 21*(2), 199–227.

Ellul, J. (1990). *The technological bluff* (G. W. Bromiley, Trans.). Grand Rapids, Michigan: W.B. Eerdmans. (Original work published 1987)

Flannery, T. (2002). *The future eaters: An ecological history of the Australian lands and people*. Sydney: Grove.

Forum for the Future. (2006). Retrieved September 5, 2007, from http://www.forumforthefuture.org.uk/aboutus/sd_page170.aspx

Frank, R. M. (2006) *Parts of the true story of a world picture*. Retrieved March 7, 2008, from http://www.nbi.dk/natphil/Siberian.html

Habermas, J. (1971). *Toward a rational society* (J. J. Shapiro, Trans.). London: Heinemann. (Original work published 1968)

Hales, S., & Corvalan, C. (2006). Public health emergency on planet Earth: Insights from the millennium ecosystem assessment. *EcoHealth, 3*(3), 130–135.

Hawken, P., Lovins, A., & Lovins, L. H. (1999). *Natural capitalism: Creating the next Industrial Revolution*. New York: Little, Brown and Company.

Held, D., McGrew, A., Goldblatt, D., & Perraton, J. (1999). *Global transformations: Politics, economics and culture*. Cambridge: Polity Press.

Heselink, F., & Goldstein, W. (2000). The role of IUCN – the World Conservation Union – in shaping education for sustainability. In K. A. Wheeler & A. P. Bijur (Eds.), *Education for a sustainable future: A paradigm of hope for the 21st century* (pp. 123–141). New York: Kluwer Academic/Plenum Publishers.

Hickman, L. A. (1990). *John Dewey's pragmatic technology*. Indianapolis: Indiana University Press.

Hill, S. B., Wilson, S., & Watson, K. (2004). Learning ecology – A new approach to learning and transforming ecological consciousness: Experiences from social ecology in Australia. In E. O'Sullivan & M. Taylor (Eds.), *Learning towards ecological consciousness: Selected Transformative Practices* (pp. 47–64). New York: Palgrave Press.

Huckle, J. (2005). *Education for sustainable development: A briefing paper for the Teacher Training Agency*. Retrieved April 4, 2006, from http://john.huckle.org.uk/publications_downloads.jsp

Huckle, J., & Sterling, S. (2005). Education for sustainability: An invitation to join a debate. Retrieved April 4, 2006, from http://john.huckle.org.uk/publications_downloads.jsp

IUCN, WWF, UNEP (International Union for the Conservation of Nature, World Wildlife Fund, and United Nations Environment Program). (1991). *Caring for the Earth: A strategy for sustainable living*. Switzerland: IUCN.

Klein, N. (2005). *Fences and windows: Dispatches from the frontlines of the globalization debate*. London: Harper Perennial.

Leal Filho, W. (Ed.). (2000). *Communicating sustainability*. Verlag Peter Lang, Frankfurt.

Leal Filho, W., Manolas, E., & Pace, P. (in press, 2009). Education for sustainable development: Current discourses and practices and their relevance to technology education. *The International Journal of Technology and Design Education*.

Lundegård, I., & Wickman, P-O. (2007). Conflicts of interest: An indispensable element of education for sustainable development. *Environmental Education Research, 13*(1), 1–15.

Mathews, F. (1994). *The ecological self*. London: Routledge.

Morrison, J., & Carmody, M. (1996). Working within the framework of Aboriginal culture: Indigenous initiatives for sustainable development through Landcare. In P. Austin (Ed.), Proceedings of the Sixth International Permaculture Conference & Convergence. *Designing for a sustainable future*. Perth & Bridgetown, Western Australia, September 27 to October 7.

Parker, W. C., Ninomiya, A., & Cogan, J. (1999). Educating world citizens: Toward multinational curriculum development. *American Educational Research Journal, 36*(2), 117–145.

Pavlova, M. (2007). *Two pathways, one destination: TVET for a sustainable future*. Conference report for the UNESCO-UNEVOC virtual conference, 22 October–10 November. Retrieved January 14, 2008, from http://www.unevoc.unesco.org/

Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics, 48*, 369–384.

Sagalaev, A. M. (1997). Siberian world picture. Retrieved March 7, 2006, from http://www.nbi.dk/natphil/Siberian.html

Shamaeva, M. I., Semenova, V. D., & Sitnikova, N. V. (1995). Didakticheskii material 'Natsional'no–regionalnuj component na urokah anglijskogo jazuka" [Teaching materials "National – regional component for English lessons']. Yakutsk: Bitchik.

Shelehov, A. M. (Ed.). (2002). *Osnovnue polozhenija startegii ustoichivogo razvitija Rossii* [Main fundamentals of the Strategy of sustainable development of Russia] Retrieved May 9, 2004, from http://www.duma.gov.ru/sustainable/strategy.htm

Skolimowski, H. (1966). The structure of thinking in technology. *Technology and Culture, 7*, 371–383.

Sterling, S. (2001). *Sustainable education, re-visioning learning and change*. Dartington: Green Books.

Sterling, S. (2004). Linkingthinking. Crief: WWF http://www.wwf.org.uk/core/about/scotland/sc_0000001453.asp

Suzuki, D., & McConnell, A. (1997). *The sacred balance: Rediscovering our place in nature*. Vancouver: David Suzuki Foundation and Greystone Books.

Ukaz. (1996). Ukaz prezidenta RF "O kontseptsii perehoda Rossiskoi Federatsii k ustoichivomu razvitiyu" [The decree of the President of the Russian Federations "About the concept of moving of the Russian Federation towards sustainable development"]. *Rossiiskaya Gazeta*, 9 April, p. 5.

UNESCO. (2001a). *Education – Key to a viable future*. Retrieved November 20, 2003, from www.unesco.org/education/esd/english/education/role.shtml

UNESCO. (2001b). *Beyond basic education to education for sustainable development*. Retrieved November 20, 2003, from www.unesco.org/education/esd/english/education/beyond.shtml

UNESCO. (2005). *United Nations decade of education for sustainable development 2005–2014. International Implementation Scheme*. Draft, January 2005. Paris: UNESCO. Retrieved November 19, 2006, from http://unesdoc.unesco.org/images/0013/001399/139937e.pdf

United Nations. (1992). *The UN conference on environment and development: A guide to Agenda 21*. Geneva: UN Publications Service.

United Nations. (2001). *Indicators of sustainable development. CSD Theme Indicator Framework: Social*. Retrieved November 20, 2003, from http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm

Vernadsky, V. I. (1945). The biosphere and the nöosphere. *American Scientist, 33*, 1–12. Reprinted by Executive Intelligence Review, February 2005. Retrieved March 7, 2008, from http://larouchepub.com/other/2005/site_packages/vernadsky/3207bios_and_noos.html

Vitousek, P. M., Mooney, H. A., Lubchenco, J., & Melillo, J. M. (1997). Human domination of Earth's ecosystems. *Science, 277*(5325), 494–499.

World Commission on Environment and Development (the Brundtland Comission). (1987). *Our common future*. Oxford: Oxford University Press.

World Wildlife Fund. (WWF). (2006). http://www.panda.org/news_facts/publications/key_publications/living_planet_report/index.cfm

# Chapter 4
# Technology Education and ESD

The previous chapter advanced three bases for conceptualising SD: (a) value position, (b) the nature of proposed responses and (c) the structure of proposed responses to the demands of SD. These three bases were argued to be the cornerstones for the development of ESD strategies. It was also established that a coherent, cross-curricular approach towards ESD is required in schools, and that each subject should be involved. This chapter focuses on technology and vocational education as possible contributors towards ESD and explores the ways in which the three bases above could be addressed through technology/vocational education.

The importance of addressing ESD through technology education has been argued by a wide range of researchers (e.g., Elshof, 2003; 2005; Miller & Pitt, 2000; Wicklein, 2001); it appears increasingly in curriculum document statements (Huckle, 2005; QCA, 2007a,b; Queensland Studies Authority, 2003a, 2007); and some resources have been developed for use by teachers (e.g., www.sda-uk.org; www.stepin.org; http://www.sustainableliving.com.au/competition/). However, when the concept of sustainability is discussed within technology education, focus shifts towards the ecological design of products (eco-design), with a major emphasis on limiting the environmental impacts of those products (Elshof, 2003; Martin, 2003). Tools that are used to measure environmental impact (e.g., Life Cycle Analysis) are rarely applied to examine the underlying causes of environmental problems which, it is argued here, often have a social nature. Even when the social aspects are addressed within technology education discourse, they often have a limited interpretation. For example, Elshof (2003) places emphasis on justice and equity when researching the social aspect of sustainability. Concerns such as cultural diversity and intercultural understanding are omitted from his research. A similar situation is evident when the economic aspects are considered. These often consist of a one-sided examination of economic issues, mainly in negative terms and in relation to developed countries only. These typically include: implications of short-term economic thinking, the growing wealth gap, consumption and consumerism, unintended "revenge" cost of technology and "perverse" economic subsidies (Elshof, 2003). Economic issues that relate to poverty reduction, corporate responsibility, price formation mechanisms or alternative models of economy are not discussed. Some curriculum resources available for teachers seem to be more balanced in terms of

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_5, © Springer Science+Business Media B.V. 2009

addressing all three pillars of sustainability in a multifaceted manner (e.g., www.sda-uk.org; www.stepin.org; http://www.housing.qld.gov.au/initiatives/smarthousing/). However, they do not yet take a full-scale approach to ESD.

Therefore, currently, the single cornerstone addressed in technology education discourse is the three pillars of sustainability and even then, it is presented in a limited way. Another two cornerstones have not been systematically explored. As a result, guidance for technology education teachers concerning what to teach, how to teach and how to assess student learning, is not coherent or comprehensive. In terms of *value position* the basic principle of *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* needs to be interpreted for technology education. How could technology education learning improve the quality of human life within earth's carrying capacity and conservation of the earth's vitality and diversity? In terms of the *nature of the proposed response* towards SD demands, the question is: how to achieve a value change on the basis of moral values and to make this a priority within the classroom environment?

Technology education uses technological contexts for setting up learning as the means to achieving value change. The power of technology has been acknowledged in the Decade for Education for Sustainable Development (DESD) *Strategy* (UNESCO, 2005). It states that technology provides people with the tools to change their situation through learning and application:

> Technology should also be regarded broadly to include traditional use of materials and application of knowledge as well as manufactured items. Technology must be applied consistently with goals of sustainability; misapplication of science and technology can undermine efforts to simultaneously protect the environment and provide for people's economic and personal needs. (UNESCO, 2005, pp. 18–19)

The nature of technology education discussed in Chapter 1 could provide a rich learning context within which the current emphasis on economic and technical values supported by a majority of technology teachers (Holdsworth & Conway, 1999) could and should be moved beyond the narrow concept of effectiveness. It is argued in Chapter 2 that the classroom environment needs to cultivate responsibility and stimulate students to put moral values first. In terms of the position advanced in this book, a nöosphere wisdom/frame of mind approach could help to establish the primary reference point for the analysis undertaken and decisions made during technology classroom activities. SD context used as a framework for developing learning activities within a frame of mind paradigm requires teachers to consider technology as a "branch of moral philosophy" (Goodman, 1970). Care for other people and other forms of life could serve as a guiding principle for selecting learning activities. In the following section some samples of activities are proposed but they should not be used in the classroom in isolation or as one-off activities. The specific ways they could be incorporated within a curriculum will be discussed in Chapter 5.

## Learning Activities Within an ESD Context

### *Low-Cost Products to Help People*

Design projects as one of the important means for teaching and learning in technology education provide an excellent opportunity for realising ESD. Design projects involve students in the process of formulating tasks, undertaking research and the development and evaluation of ideas, their presentation and realisation. The hands-on, minds-on nature of the projects, as well as their role in development of critical thinking identified by Parker, Ninomiya and Cogan (1999) as the most highly recommended educational strategies, could serve as a way of developing ESD through technology education. The creation of low-cost products, designed to make life better for people where the primary concern for the students is the social aspect of sustainability, could provide an important emphasis for students' activities. Some real life examples of socially sustainable products collected by Alex Marashian (2006) highlight a range of possibilities:

– Solar-powered housing units built from ready-made, re-used shipping containers. This design relates to a mid-term need for housing after any disaster. "Tent cities have their limitations, particularly in terms of sanitation, and re-building can be excruciatingly slow", according to Australian architect Sean Godsell (cited in Marashian, 2006, p. 136). Thus, shipping containers are an ideal universal building module – the infrastructure to handle them exists pretty much everywhere, so it is easy to truck the house, assemble it, use it and then truck it out again until the next need arises. It is designed to make life better for refugees.
– The Hippo Water Roller, a rolling 90-litre drum made of lightweight, durable polyethylene and pushed by a simple handle (designer Pettie Petzer). A simple and elegant idea, this is yet "another powerful reminder that 'better living through design' is a notion that extends to everyone [that is including poor people]" (cited in Marashian, 2006, p. 136).
– An under $100 wind-up computer designed by Media Lab from the Massachusetts Institute of Technology. The MIT wind-up is expected to be produced on a scale of 15 million units per year. The designer Nicholas Negroponte was inspired by his visit to a Cambodian village where he saw children working with donated laptops.

These and other examples could be used as prompts to stimulate students' thinking. They could also be used for a product analysis activity. When exploring the social dimension of sustainability a product analysis can address questions such as: is the product really needed; how does the product make life better for people; is it culturally acceptable for people who use it; does it build on the traditional wisdom and technology of the community; what is the impact on social relations; does it bring people together in a friendly way; will it enhance or diminish cultural diversity; does it have a long-term impact on future generations; if so, is this impact positive or negative? A number of resources are available on the web which address such issues (e.g., Practical Action, n.d.; Sustainable Design Award, 2004).

Whether similar product analyses can be used to demonstrate interconnectedness or to develop a vision of our common future and influence students' behaviour, needs to be established by the teacher. Sometimes, teachers report that students are not interested in social issues and that "foreign" contexts are too remote from their everyday lives. However, this is more likely to be the case when SD is considered just once or twice a year and where students' values and attitudes have not been affected through teaching and learning.

## *Production Practices*

Together with low cost product design, another aspect of "social sustainability" is the production practices for designed objects: have they been manufactured under fair and just operating conditions; are people paid properly at all stages of the supply chain; are the working conditions safe? Social sustainability as an important issue in the globalised economy could be discussed with students through examples provided by industry. A key feature of the economy now is outsourced production with many companies having very complex supply chains, often involving the employment of workers in developing countries where industrial and environmental standards are lower than in a company's home base, but where opportunities for investment and employment to enhance human development are considerable.

However, traditional ways of handling such issues, for example by codes of conduct and factory inspections, are not working well (Maclean, 2007). Thus, much effort is now going into management and employee training with an emphasis on assisting workers to know their own rights and being able to protect themselves, as well as training in dispute resolution and communications. As the 2006 UNESCO-APEID report on the corporate sector and ESD argues, "These types of skills are entirely consistent with the skills required for engaging in the challenges of sustainable development" (p. 24, in Maclean, 2007, p. 10). A number of transnational textile, clothing and footwear companies operating in China and Vietnam are world leaders in this field.

For example, Garco10 is a company employing 7,500 workers across 13 factories in six provinces of Vietnam and has a turnover of US$85 million. Garco10 manufactures clothing for companies such as Perry Ellis, Colombia, J. C. Penney, Gap, Van Heusen, Walmart and K-Mart. Since Vietnam joined the World Trade Organisation, Garco10 has recognised the need to obtain certificates in quality and management, environment protection and social responsibility for employees. Education is considered by the company as an important means for achieving the standards required. Garco10 runs its own training academy for 500 new employees each year, with social and environmental responsibility as part of the core curriculum.

Reebok organises training workshops in its worldwide network of factories on issues such as strengthening compliance with standards for non-discrimination, acceptable working hours, no forced or compulsory labour, fair wages, no child

labour, freedom of association, non-harassment and safe and healthy working environments. Outside experts and NGOs are commissioned to help worker representatives understand their rights and to improve their communication and problem solving skills.

Adaro Envirocoal's mining and port activities in South Kalimantan are supported by a community education and development programme that includes equipping schools and hospitals, staff training and scholarships for high school, agricultural college and university study. Adaro also provides training and loans to support the establishment of farming and plantation activities, aquaculture, automotive and light engineering and local cooperatives. These are supported by a procurement policy optimising the use of local goods and services, thus ensuring market viability in the initial phases of development (Maclean, 2007).

Through similar examples, students can discuss how sustainability is being interpreted by industry. There are, however, a limited number of cases that illustrate a truly integrated approach towards social, economic, environmental and cultural perspectives, with the majority of them focusing on the single dimension of the natural environment. The lack of a common understanding of terms, principles, underlying concepts and visions for the future within different companies can provide a basis for challenging classroom discussions that might stimulate the development of ideas for projects that could help students to understand issues of SD in real world situations.

## *Green Product Design*

A number of criteria for sustainable products have been developed by designers internationally. For example, Datschefski (2008) identified the world's "Top 40 Greenest Products" on his biothinking site. The E-Cloth (a microfibre cloth for cleaning household surfaces without cleaning fluids), vegetable-based paint, finger toothbrush, the Remarkable Recycled Pen (made from a single plastic coffee cup; lasts four times longer than most other ballpoints), Clothes Drying Racks (kinder to your clothes and saves masses of energy), the cardboard coffin (suitable either for burial or cremation, the final act of recycling), a library book or rental video (used by many more people than if they were privately owned, so maximising the utility of the materials consumed in their manufacture) – these examples could inspire students to find greener solutions for real needs. These products present a personal selection by Datschefski from the thousand or so products he has studied over the years. They are chosen mainly because they are significantly better than "standard" products that do the same things. They are also in production, available for sale and have excellent functional performance.

Datschefski (2008) also argues that there are five design requirements for sustainable products. The first three mimic the way plant and animal ecosystems work, the fourth requirement is based on the need to maximise the utility of the resources and the fifth recognises that all companies have an impact on the people

who work for them and the communities within which they operate. The requirements for products include:

1. *Cyclic*: made from organic materials and is recyclable or compostable, or is made from minerals that are continuously cycled in a close loop;
2. *Solar*: the product uses solar energy or other forms of renewable energy both during use and manufacture;
3. *Safe*: non-toxic in use and disposal and its manufacture does not involve toxic releases or the disruption of ecosystem;
4. *Efficient*: less materials, energy, water;
5. *Social*: manufactured under fair and just operating conditions for the workers involved and the local communities. (http://biothinking.com/pd.htm)

These principles could be used in different ways at the stage of product design: ideas development, research, evaluation of ideas, during product analysis and so on.

Real life problems are important starting points for student projects. The example below is taken from Maclean (2007). The construction industry in the North Rhine Westphalia region of Germany recognises the challenges posed by looming energy shortages, climate change and the need for energy efficiency in buildings. It also recognises the business opportunities in responding to the fact that 75% of Germany's building stock was built before 1949 and is therefore, highly energy inefficient. The industry association includes over 500 companies who have adopted a popular German slogan: the "3-litre house", that is, a house that consumes three litres of oil per cubic metre of the house space per year. Currently, an average German residence consumes 18 litres of oil per cubic metre per year. As a result, the construction industry has set up a goal of "Sustainable development education for every apprentice, trainer, expert and member company". Thus, it is now compulsory for all in the industry to understand:

- How to use the "right" materials in order to avoid unnecessary energy consumption;
- How to behave and work to minimise energy consumption;
- How to identify, source and use new, more efficient materials to save energy.

Technology students could propose their own solutions to the above challenges.

The environmental impact of existing and developing products can be assessed using such methodologies as Life Cycle Analysis (LCA) (http://www.pre.nl/life_cycle_assessment/default.htm) and Design for Environment (http://www.pre.nl/ecodesign/default.htm). When a LCA, for example, is applied in the classroom situation, such issues as energy or water consumption, toxic emissions, transport implications and the health and safety of workers as well as of users can be discussed.

> LCA is a process of evaluating the effects that a product has on the environment over the entire period of its life thereby increasing resource-use efficiency and decreasing liabilities. It can be used to study the environmental impact of either a product or the function the product is designed to perform. LCA is commonly referred to as a 'cradle-to-grave' analysis. (http://www.agrifood-forum.net/practices/lca.asp)

This type of analysis primarily focuses on dealing with the symptoms of the problems, seldom making connections between environmental issues and social, cultural and economic concerns. This could create the basis for dysfunctional and incoherent approaches towards ESD.

The development of green products should be put in a broad context of SD that is aimed at helping to care about people and environment. As argued in this book, social sustainability and caring about the other should be considered as the basis for discussions in technology education classrooms. Local examples could also be used to learn about the different aspects of social sustainability. For example, a product analysis of a plastic slide for children made from high-density poly (ethylene) HDPE components, could contribute towards social sustainability. For the workers who are transporting it and positioning it on the ground it provides better working conditions (it is lighter than a slide made from metal); for the local community it makes a playground an attractive place to spend time with children as it is colourful; for the children it provides a place to be active and healthy.

## *Green Problem-Solving Strategies*

A number of specific problem-solving strategies could be specifically used to facilitate a "green design". As argued by Turner (in press, 2009), ASIT (Advanced Systematic Inventive Thinking) is an effective tool to be used in technology education classroom. ASIT is a method of problem solving that provides the user with a series of systematic tools with which to analyse problems and solutions alike. The "five idea-provoking tools" (Horowitz, 2001) are:

- *Unification*: Solve a problem by assigning a new use to an existing component;
- *Multiplication*: Solve a problem by introducing a slightly modified copy of an existing object into the current system;
- *Division*: Solve a problem by dividing an object and reorganising its parts;
- *Breaking Symmetry*: Solve a problem by turning a symmetrical situation into an asymmetrical one;
- *Object Removal*: Solve a problem by removing an object from the system and assigning its action to another existing object.

One of the examples that Turner refers to is Biolytix Wastewater Treatment Technology. The Biolytix (2007) waste management system draws from the solutions of the natural world to solve the problem of disposing of sewerage solids and liquids and meets several principles of sustainable design by creating a more eco-friendly solution. Biolytix designers and engineers explored the "natural" solution to the problem in the environment where solid compost is continually being broken down – that of the forest floor. The Biolytix system mimics the natural processes that occur on the forest floor by turning the solid organic matter, which is the problem in the first place, into a very sustainable solution. "The fine humus produced is structured by soil invertebrates into a sponge-like porous filter medium" (Biolytix).

Due to the efficient manner in which worm farm technology performs it is not necessary to add large aerating pumps or chemicals. This in turn, reduces the daily running costs, the negative costs to the environment and any ongoing maintenance costs such as sludge removal. Overall, this is a win-win situation for the consumer and the environment.

Turner (in press, 2009) analysed this solution as an application of the *Division Rule*, in terms of choosing an object, identifying its parts and thinking about all kinds of ways to "reorganise" these parts. Turner divided the forest floor ecosystem up in two ways: (a) parts of the forest floor ecosystem – including organic matter (leaves etc.) moisture, temperature, insects etc.; and (b) parts of the insect population that live within the forest floor ecosystem. Then he chose the *division* to focus on: The forest floor ecosystem could be divided into the environmental elements (including moisture, temperature, oxygen, etc.), the organic matter and the insects population and could be reorganised in space or time. After this analysis a designer could focus on idea generation. The division tool acts as a magnifying glass revealing a world full of sub-objects with specific connections and relationships. It is suggested by Turner that the nature of the ASIT problem-solving methodology is fully related to the principles of green design as all strategies it proposes seek to solve design problems from within the problem/situation itself. Using the division rule in the way ASIT did, students could look for solutions within the system, so there is no need for new resources or energy.

## *Traditional Technologies*

Caring about cultural diversity is an important aspect of sustainability. When we buy traditional products from fair trade organisations such as Oxfam, we support fair trade internationally and develop an opportunity to discuss with students artefacts originating from different cultural contexts. Traditional technologies are another important basis for technology education activities. The relationships between technology and the environment in a specific context can provide a rich source of knowledge and understanding on how to live in harmony with the natural environment. For example, Carolina Lasambouw from Indonesia (Pavlova, 2007) proposed an analysis of culturally rooted decisions that could be explored through educational programmes:

> We need to deeply research and consider any available wise 'cultural' habit/regulation etc. which used to exist in the relevant society. It's like Bottom Up ways in developing strategic 'SusDev'. Currently most of the way was Top down.… Developing countries learn from developed country, or given from donor country to the recipients countries. Sometimes without we realised, we influenced others to used and implement our parameter which we think 'good' or 'best'.

She provides an example of an approach to fishing. Many Indonesian tribes have their own cultural regulations that include what would now be identified as SD.

One such example is a law implemented in Maluku (Eastern Indonesia) aimed at protecting fish. For the first six months of the year the tribe priest announces the "closing of the sea" (known as Tutup Sasi). Fishing is prohibited. The underlying reason for this law is to allow fish species to grow. Then for the next six months, the high priest announces the "opening of the sea" (Buka Sasi). So people could start fishing again and catch bigger fish that also bring more economic value. People who break the law have been penalised by the high priest and announced to the community. This cultural law has been implemented from generation to generation. "But the more generations become 'educated' and off course 'cleverer', the more this kind of cultural law is questioned" (Carolina Lasambouw in Pavlova, 2007). This environment-oriented fishing technology also helps to sustain communities. Traditional technologies of producing culturally specific products could also be studied by students. For example, technologies such as *hohloma*, a metal-like finish for wooden products, or *gzhel*, a particular type of china, are specific to the Russian context and studied in Russian schools.

## *Appropriate Technologies*

The concept of appropriate technology is closely related to traditional technologies; it is designed for a particular community and it accounts for the environmental, cultural, social and economic aspects of that community. Appropriate technologies are "technologies with a human face", aimed at enabling people to earn a sustainable living. The concept of appropriate technology gained impetus with Schumacher's book *Small is Beautiful* (1973), where eight criteria were formulated for assessing technology:

1. Appropriate technology best suits the needs and lifestyle of the people using it.
2. Appropriate technology should not damage the environment and ecosystem and should be sustainable.
3. Appropriate technology should keep costs within the economic means of a community.
4. Appropriate technology should use locally available resources as far as possible.
5. Appropriate technology should enable local workers to earn a living.
6. Appropriate technology should increase self-reliance.
7. Appropriate technology should use renewable sources of energy wherever possible and should be economical in its use of non-renewable resources.
8. Appropriate technology should fit with its social and cultural environment.

These principles consider the social, environmental and economic sustainability of technologies. Appropriate technology explores what appropriate indigenous practices and technologies exist regionally, by developing and adapting these and by incorporating new ideas. Low cost solutions to local problems could be found without resorting to expensive and often inappropriate imported technologies. Regional appropriate technology organisations in Africa (http://www.approtechafrica.com/),

Asia (http://www.atasia.org.uk/ata.aspx) and Australia (http://www.icat.org.au/) develop technology to empower people. They formulate their own interpretations of appropriate technology. For Appropriate Technology, Asia (ATA), appropriate technology is characterised as follows:

- Is sustainable and has minimal negative impact on the environment;
- Is a technical or knowledge-based solution that uses techniques, equipment, resources and ideas that are suitable and fitting for both the local people and their natural environment;
- Considers cultural and religious factors; and
- Contributes to human development and the growth of social capital. (http://www.atasia.org.uk/ata.aspx)

Examples from the websites of these organisations could be used by technology teachers to discuss and develop appropriate design solutions. The Passive Solar Architecture from the ATA (2008) website provides a useful example of using passive solar power. Two basic approaches to the utilisation of solar energy in buildings – active systems and passive systems – are discussed there. Active systems are generally those that are visible, with collectors on roofs, pumps, plumbing, control systems and storage tanks – in other words, systems that are expensive to finance and which may be difficult to maintain. Passive systems are defined as those where the heat moves by natural means. Passive solar technology uses sunlight to provide a renewable source of energy for space heating. The technology works in three stages: the collection of solar energy, the storage of the heat collected and the subsequent release of this heat in a useful way. The realisation of these three aims depends on understanding and exploiting a number of physical factors. These include the convection properties of the air within the building, the absorption qualities of dark colours and building materials, the heat storage properties of these building materials and the poor heat conductivity of insulating materials. Taking these factors into account during the design of the building can allow the heating needs of the occupants to be fulfilled by solar radiation, at no cost. Because most cold winters are characterised by low rainfall and clear skies, passive solar technology is ideally suited to the areas where ATA works and provides an important means of improving local housing (taken from ATA, 2008). Drum oven and low stoves developed in Australia provide fuel-efficient, robust, low maintenance solutions for outdoor cooking (http://www.icat.org.au/). In Africa they propose relevant, reliable and cost effective solutions to producing equipment for small business (http://www.approtechafrica.com/).

On the websites of these organisations the problems caused by the use of inappropriate technologies are examined. When traditional technologies were ignored for a period of time, problems have often occurred. For example, agriculture practiced in many mountain areas in Asia is increasingly influenced by Western agricultural techniques, leading to a gradual introduction of monoculture cropping techniques. These practices reduce resistance to pest damage and increase evaporative water losses from the soil. In many mountain areas, where water availability is a severe limiting factor, this has significant effects on overall productivity. ATA seeks to develop new interpretations of traditional practices, to develop integrated,

sustainable farming systems that meet the aspirations of local communities (http://www.atasia.org.uk/ata.aspx).

The examples of learning activities presented above could help students to grasp different contexts, human needs and the ways technology could serve humanity in a better way.

## Classroom Environment

### *Curriculum Statements – An Example from Queensland, Australia*

The request to address sustainability is increasingly presented in technology education curriculum documents internationally. Two current syllabuses that are used in Queensland, Australia are the Technology Years 1 to 10 Syllabus (Queensland Studies Authority, 2003a) and the Technology Studies, Senior Syllabus (for Year 11 and 12 students) (Queensland Studies Authority, 2007). Both have statements that require teachers to implement some elements of ESD. The Year 1–10 Syllabus represents the interwoven nature of technology education through a model of working technologically (the term working "technologically" has replaced the term "design"). Through the experiences of working technologically, students develop a range of knowledge, practices and attitudes. The Year 1–10 syllabus is considered to be an intersection between *appropriateness, context, management* and four *strands* (technology practice, information, materials, systems).

The intention in the syllabus is that the first three inputs into the system should be addressed through different strands. It is stated, for example, that students should consider different aspects of appropriateness before making judgements about sustainability of:

- design ideas,
- processes and products, and
- the possible impacts of these on users or environments.

In particular, they should "consider, and make judgements about, aesthetic, cultural, economic, environmental, ethical, functional and social appropriateness" (Queensland Studies Authority, 2003a, p. 2). There are no further guidelines on how to apply this principle; however, it is an important statement which presents some possible inroads for teachers to begin addressing ESD. It is also stated in the syllabus that students should understand "that people must consider issues related to appropriateness, contexts and management if they are to develop products that not only meet people's needs and wants but are also socially just and economically and environmentally sustainable" (Queensland Studies Authority, 2003a, p.2).

Unfortunately, concepts that relate to appropriateness are not specified in the outcomes, thus no assessment mechanism is proposed to measure the extent to which teachers include these concepts in their practice and to what extent students consider these issues when they are making judgements. No specific guidelines to help teachers

to incorporate appropriateness into their working programmes are proposed in the initial in-service materials (Queensland Studies Authority, 2003b) that were developed to support implementation of the syllabus by teachers. Furthermore, the examples (case studies) that are included in the sourcebook (Queensland Studies Authority, 2003c) demonstrate that the meaning of appropriateness is very limited. Appropriateness is considered in terms of the particular local context (not a combination of local, national and international) and only within the current situation (not a future one).

In summary, the current technology education syllabus in Queensland is one that includes "non-technical" aspects of technology and considers the relationship between technology and society, technology and nature and also technology and person. However, although the "right" statements are made in the content of technology education, they are not included in the learning outcomes. Thus, it is possible to assume that in the context of the outcomes-based assessment, the majority of teachers would not pay a great deal of attention to this aspect of the syllabus. In addition, the examples of design projects included in in-service materials (Queensland Studies Authority, 2003b) do not include the description of how appropriateness/sustainability could be taught.

A recent development in Queensland's education policy is the new Queensland Curriculum, Assessment and Reporting (QCAR) Framework (http://www.qsa.qld.edu.au/assessment/qcar.html). This framework aligns curriculum, assessment and reporting and gives teachers valuable resources to support their everyday work and to help improve student learning. The QCAR Framework has five components that are designed to work together:

- *Essential Learnings*, to identify what should be taught and what is important for students to have opportunities to know, understand and be able to do.
- *Standards for the Essential Learnings*, to provide a common frame of reference and a shared language to describe student achievement.
- *Assessment Bank*, to support the everyday assessment practices of teachers through access to a range of quality assessment tools.
- *Queensland Comparable Assessment Tasks* (QCATs), to provide information on what students know, understand and can do, in a selection of Essential Learnings. QCATs are intended to promote consistency of teacher judgements across the state.
- *Guidelines for Reporting*, to support consistency of reporting across the state.

Essential Learnings is a core component of the framework. It describes the knowledge, understanding and ways of working that students need for ongoing learning, social and personal competence and participation in a democratic society. The Essential Learnings provide clear guidelines for teachers on what to teach to assure that the essential elements of each key learning area, valued by the wider community, are being addressed in all Queensland schools. While the Essential Learnings are the part of the curriculum that is to be common across all schools, schools continue to have the flexibility to organise their curriculum in ways that meet the needs of their students.

The Essential Learnings are identified on 4 levels: Year 3, 5, 7 and 9. For technology education, under the heading knowledge and understanding, the section on

*technology as a human endeavour* states that technology influences and impacts on people, their communities and environments. Some elements of sustainability are stated at all levels (e.g., energy efficient products, appropriateness and cultural protocols) although the word sustainability is only used at Year 7 level (http://www.qsa.qld.edu.au/downloads/assessment/qcar_el_technology_yr7.pdf). Students need to know and understand that:

– Design and development of products are influenced by societies' changing needs and wants and include artefacts, systems, environments and services, e.g., telephone technologies continue to develop as lifestyles change and demand more time-efficient practices.
– Product design and production decisions are influenced by specifications, constraints and aspects of appropriateness including functions, aesthetics, ethics, culture, available finances and resources and *sustainability*, e.g., menu design is influenced by type of cuisine, cultural theme and cost.
– Decisions made about the design, development and use of products can impact positively or negatively on people, their communities and environments, e.g., food packages can be designed and developed using recycled materials.

However, although the term sustainability is included in the Essential Learnings, it does not provide much sense of what it is.

In the Technology Studies Senior Syllabus (Years 11–12), sustainability is listed as an area of study among the other foundations of technology. Suggested subject matter includes systems to ensure sustainability, eco-footprint, recycling, lifecycle analysis and principles of sustainable design (Queensland Studies Authority, 2007, p. 12). However, sustainability is defined as "the ability to maintain an ecological balance of the environment by exploiting natural resources without destroying the ecological balance of a particular area" (p. 37).

All the critiques of the status quo of ESD in technology education presented at the beginning of this chapter are well illustrated by the Queensland syllabuses. The need to broaden the approach beyond the environmental aspect is evident. Content or subject matter described in the documents constitutes a very small part of an holistic approach toward ESD. The situation in England analysed by Pitt and Lubben (in press, 2009) is similar: "There were only minimal references to sustainable development in official curriculum documents. It was something that teachers could introduce if they wished, but it was not mandatory".

## *Rethink Emphasis*

A set of principles referred to in Webster (2004) could be used in the classroom to direct discussions and activities:

- Rethink
- Refuse
- Repair

- Reduce
- Reuse
- Recycle.

The most important from the perspective of this book is the rethink principle, although currently the recycle principle is the main theme when sustainability is addressed in technology education. However, psychologically, recycling can be a way to justify more consumption (Hamilton & Denniss, 2006). All principles need to be revisited on a regular basis to provide an opportunity for teachers to have a coherent approach towards classroom discussions. Through numerous examples of "successes" and "failures" of technological solutions in terms of sustainability, a particular frame of mind could be developed. As argued by Webster (2007), the emerging practices appear to be an understanding that sustainable development is "business as usual" but "greener" and "fairer". This notion represents a form of progress but does not address the systematic cause of unsustainability, offering only some prolongation of the existing state of affairs (Brennann, 2003). An emphasis solely on developing green products or on recycling in technology education classrooms is not sufficient.

One way to use a rethink approach is to discuss alternative economic models proposed by different researchers and country leaders. Examples such as a "natural" model based on "living systems with an emphasis on feedback loops" (Webster, 2004, p. 37), or the "Buddhist economy" (Schumacher, 1973) which is based on the idea of "enoughness", appreciating both human needs, limitations and appropriate use of technology, should be discussed as they provide a particular framework for product design. For example, Schumacher's model is based on the idea that notions of "growth is good", "bigger is better" and gross national product (GNP) as measures of human well-being are not appropriate. He emphasised that the aim ought to be to obtain the maximum amount of well-being with the minimum amount of consumption.

> It is clear, therefore, that Buddhist economics must be very different from the economics of modern materialism, since the Buddhist sees the essence of civilisation not in a multiplication of wants but in the purification of human character. Character, at the same time, is formed primarily by a man's work. And work, properly conducted in conditions of human dignity and freedom, blesses those who do it and equally their products. (Schumacher, 1973, p. 53)

Schumacher's idea has been developed through the Sufficiency Economy model by the King of Thailand, which presents an alternative approach to development in its current Western form. This approach requires little capital investment and no assistance from outside international agencies. It is an advisable alternative to consumerism and unsustainable development and could use a Gross National Happiness indicator to measure positive development changes (Nowakowski, 2007). The philosophy behind the model stresses the "middle" path as the overriding principle for Thai people's conduct and way of life at the individual, family and community levels. The Sufficiency Economy philosophy framework comprises three components and two underlying conditions (Piboolsravut, 2004). The three components are: *moderation* and *the middle path* (ability to limit desires, which

goes against the Western definition of economics; "control of greed and desire must be a value ingrained in the next generation" (Suwanwela, 2007); *reasonableness* (being aware of what you are doing and why); and *requirement for a self-immunity system* (the ability to cope with shocks from internal and external changes). Two underlying conditions necessary to achieve Sufficiency Economy are *knowledge*, "cultivating one's brain to the highest possible level. Knowledge may be of two types: indigenousness, local wisdom or modern technological advances" (Calkins, 2008, pp. 7–8); "knowledge can serve as immunity against exploitation and can provide people with the capacity to cope with change" (Suwanwela, 2007); and *morality* (relating to humans' soul and values in society. It is an underlying basis for applying moderation, reasonableness and self-immunity components).

Sufficiency Economy requires breadth and thoroughness in planning, as well as care in applying knowledge and the implementation of those plans. As for the moral/ethical condition, Sufficiency Economy enforces the conditions that people are to possess – honesty and integrity – while conducting their lives with perseverance, harmlessness and generosity. The Sufficiency Economy philosophy serves as a guide for the way of living/behaving for people of all levels and is scalable with universal domain applicability, including business organisations (Piboolsravut, 2004). A number of empirical studies of Thai businesses support the effectiveness of using a Sufficiency Economy philosophy to sustain business performance (Kantabutra, 2006; Kantabutra & Avery, 2005; Nuttavuthisit, 2005). This is an example of how a rethink principle could be applied on a large scale. These examples can be discussed in the classroom to examine the kind of economic model the students' designed products might fit into.

Another angle for the rethink approach is an examination of the impact of economically developed nations on the world's sustainability. Case studies could be used to progress this and to discuss the need for the holistic approach in searching for sustainable solutions. An example from Heselink and Goldstein (2000, p. 128) is presented here.

## *The Dutch Example*

The Dutch contribute, in global terms, a high proportion of GNP to development assistance (approximately 1%) and to environmental aid. Yet in this simplified example from the Netherlands we can see the complexity and impact of economically developed countries on those less economically developed and why we have to deal with equity issues to achieve progress. Dutch beef is raised on crops grown in South East Asia and Brazil. In many cases the production of these cash crops led to clearing of forest and rainforest. The beef, produced with European and Netherlands agricultural subsidies, could be exported to western Africa and sold more cheaply than locally grown beef. As the price was low, it was not worthwhile for a local farmer to kill his cattle for market, so the cattle were kept and the herds grew, causing over grazing and contributing to threats of desertification. (Meanwhile Dutch aid is directed at stemming desertification and saving rainforests!). Communication,

education and advocacy are required amongst Europeans – decision makers, farmers and so on – to change subsidies and policies to stop beef dumping and so assist the West African farmers. Indeed the subsidies that permitted this beef dumping have been reviewed.

This example arises from a study conducted by the Netherlands National Committee for IUCN called "The Netherlands Impact on the World Ecology". The intention here is not to target the Dutch specifically, for if other nations had also examined their impact on world ecology it would have been possible to use their example too.

## *Students' Behaviour*

Developing behaviour in students that is supportive of a sustainable future is a crucial component of learning in technology education. One of the methodologies that could be used to achieve this is a classroom environment is Neuro Linguistic Programming (NLP). It claims to be able to increase an individual's awareness of personal values and to change behaviour (O'Connor, 2001). NLP consists of many techniques concerned with individuals' understanding of themselves. One of the techniques, "perceptual position", helps individuals to observe situations from different perspectives (O'Connor, 2001), and to reflect on their values and challenge them in respect to that situation. Four key perceptual positions have been described (Hoag, 2005; O'Connor, 2001): (a) your own position where you evaluate your relationship with the object from the perspective of your own reality; (b) the other's person position, where you put yourself in the place of the other person and then, looking back at yourself in the first position, you reflect on how the other feels in response to your feelings in position one; (c) in a detached position, you observe the dynamics occurring between the first and second positions and new possibilities may arise; and (d) the wholly "objective" detached position, you as an independent observer to clarify what has been learnt from the first and third positions (the bigger picture). Following this line of discussions and reflections on visual images, a teacher can raise a number of issues related to sustainability to explore the issue:

- What is your interpretation of what you are viewing? (a)
- How do you feel about what you are viewing; how are you connected with what is shown in the image? (What it has to do with you?) (a)
- Putting yourself in the position of the persons affected by the issues shown in the image, how do you think they would feel about your role in the problem and its solution? (b)
- Now looking objectively, what is your opinion of your own position and the position of the persons affected by the issue shown in the image? Have your feelings about your personal relationship to what the image portrays altered in any way? (c)
- Do you wish to substitute your feelings at Position 3 for your feelings at Position 1 (d)? (O'Connor, 2001)

Visual images used by the teacher could include people from developing countries using low-cost products or someone from the developed world over consuming.

## Conclusion

All examples of activities discussed in this chapter are capable of being used to address all three cornerstones that were put forward in Chapter 3 as the bases for conceptualising SD. All methods and tools discussed above, such as case studies, product analysis, design projects, debates on particular solutions, cross-cultural learning, students' research and analysis of SD issues and approaches towards solving these issues, should be planned in a coherent manner to be used within technology education classrooms. The examples of activities provided can be used in curriculum development to achieve a balance in the issues addressed and in the ways they are addressed. The nature of projects proposed to students, the ways in which different activities could support students' work within projects and how teachers can help them to identify problems, are the subject of careful planning. A coherent, systematic frame of mind approach argued in Chapter 3, also called "education through sustainable development" by Pitt and Lubben (in press, 2009), is required.

How to achieve this? How can we plan a systematic ESD approach to technology education in the curriculum? The next chapter proposes a framework for planning teaching and learning activities that could facilitate the achievement of this goal.

## References

ATA (Appropriate Technology, Asia). (2008). *The passive solar architecture*. Retrieved March 7, 2008, from http://www.atasia.org.uk/ata.aspx

Biolytix. (2007). Biolytix Wastewater Treatment Technology. Retrieved November 17, 2007, from http://www.biolytix.com/detail.php?ID=16

Brennann, T. (2003). *Globalisation and its terrors*. London: Routledge.

Calkins, P. (2008). *The sufficiency economy at the edges of capitalism*. Retrieved June 13, 2008, from the web http://www.sufficiencyeconomy.org/en/

Datschefski, E. (2008). Biothinking. Retrieved March 7, 2008, from http://biothinking.com/top 40.htm

Elshof, L. (2003). Teacher's interpretation of sustainable development. In J. Dakers & M. J. de Vries (Eds.), *PATT-13 International Conference on Design and Technology educational Research* (pp. 45–51). Glasgow, UK: Faculty of Education University of Glasgow.

Elshof, L. (2005). Teacher's interpretation of sustainable development. *International Journal of Technology and Design Education, 15*(2), 173–186.

Goodman, P. (1970). *New reformation: Notes of a neolithic conservative*. New York: Random House.

Hamilton, C., & Denniss, R. (2006). *Affluenza: When too much is never enough*. London: Allen & Unwin.

Heselink, F., & Goldstein, W. (2000). The role of IUCN – the World Conservation Union – in shaping education for sustainability. In K. A. Wheeler & A. P. Bijur (Eds.), *Education for a sustainable future: A paradigm of hope for the 21st century* (pp. 123–141). New York: Kluwer Academic/Plenum Publishers.

Hoag, J. (2005). Perceptual positions. Retrieved October 20, 2006, from http://www.nlpls.com/articles/perceptualPositions.php.

Holdsworth, I., & Conway, B. (1999). Investigating values in secondary design and technology education. *The Journal of Design and Technology Education, 4*(3), 205–214.

Horowitz, R. (2001). From TRIZ to ASIT in 4 steps. *TRIZ Journal*. Retrieved August 24, 2007, from http://www.triz-journal.com/archives/ 2001/ 08/ c/ index.htm.

Huckle, J. (2005). *Education for sustainable development: A briefing paper for the Teacher Training Agency*. Final draft Retrieved December 20, 2005, from http://john.huckle.org.uk/publications_downloads.jsp.

Kantabutra, S. (2006). Relating vision-based leadership to sustainable business performance: A Thai perspective. *Leadership Review, 6*, 37–53.

Kantabutra, S., & Avery, G. C. (2005). Essence of shared vision: Empirical investigation. *The New Zealand Journal of Human Resources Management, 5*, 1–28.

Maclean, R. (2007). Education for sustainable development: Lessons from the private sector. The keynote address for the 12th International Business Forum 2007: *Business and the Millennium Development Goals: Business Engagement for Governance*. Washington, 8–10 October, 2007

Marashian, A. (2006). Design for life. *Another Magazine for Men and Women, 10*, 136.

Martin, M. (2003). Significance of sustainability issues for design and technology education: Rhetoric, reality and resources. In J. Dakers & M. J. de Vries (Eds.), *PATT-13 International conference on design and technology educational research* (pp. 165–169). Glasgow, UK: Faculty of Education University of Glasgow.

Miller, C. & Pitt, J. (2000). *Live well, live wisely! Technology for sustainable development*. London: Intermediate Technology Publications.

Nowakowski, L. (2007). Thai university graduate and undergraduate involvement in a participatory development project in Tak, Thailand. In proceedings of *Reinventing Higher Education: Toward Participatory and Sustainable Development*, The 11th UNESCO-APEID International conference, 12–14 December 2007, Bangkok, Thailand (CD, session 6.D.3).

Nuttavuthisit, K. (2005). Applying Sufficiency Economy Philosophy in Business Organizations: A Case of Pranda Jewry. Unpublished manuscript, Sufficiency Economy Unit, Office of National Economic and Social Development Board, Thailand.

O'Connor, J. (2001). *The NLP workbook. A practical guide to achieve the results you want*. London: Thorsons.

Parker, W. C., Ninomiya, A., & Cogan, J. (1999). Educating world citizens: Toward multinational curriculum development. *American Educational Research Journal, 36*(2), 117–145.

Pavlova, M. (2007). *Two pathways, one destination: TVET for a sustainable future*. Conference report for the UNESCO-UNEVOC virtual conference, 22 October–10 November. Retrieved January 7, 2008, from on: http://www.unevoc.unesco.org/

Piboolsravut, P. (2004). Sufficiency economy. *ASEAN Economic Bulletin, 21*(1), 127–134.

Pitt, J., & Lubben, F. (in press, 2009). The social agenda of education for sustainable development within Design & Technology: The case of the sustainable design award. *International Journal of Technology and Design Education*.

Practical Action. (n.d.). *Sustainable technology education project*. Retrieved February 2, 2005, from www.stepin.org

QCA. (2007a). *New secondary National Curriculum*. Retrieved October 21, 2007, from http://www.qca.org.uk/libraryAssets/media/D-and-T_KS3_PoS.pdf

QCA. (2007b). *GCE AS and A level subject criteria for design and technology (September 2006)*. Retrieved October 21, 2007, from http://www.qca.org.uk/libraryAssets/media/qca-06–2845_design_technology.pdf

Queensland Studies Authority. (2003a). *Technology Years 1 to 10 Syllabus*. Brisbane: Author.

Queensland Studies Authority. (2003b). *Technology: Initial in-service materials*. Brisbane: Author.
Queensland Studies Authority. (2003c). *Technology: Years 1 to 10 Sourcebook*. Brisbane: Author.
Queensland Studies Authority. (2007). *Technology Studies Senior Syllabus*. Brisbane: Author.
Schumacher, E. F. (1973). *Small is beautiful: A study of economics as if people mattered*. London: Blond & Briggs Ltd.
Sustainable Design Award. (2004). Retrieved January 30, 2006, from www.sda-uk.org.
Suwanwela, C. (2007). Roles of universities in sufficiency economy. In proceedings of *Reinventing Higher Education: Toward Participatory and Sustainable Development*, The 11th UNESCO-APEID International conference, 12–14 December 2007, Bangkok, Thailand (CD, session 6.D).
Turner, S. (in press, 2009). TRIZ/ASIT – Problem solving strategies for education and sustainable design. *International Journal of Technology and Design Education*.
UNESCO. (2005). *United Nations Decade of Education for Sustainable Development 2005–2014. International Implementation Scheme*. Draft, January 2005. Paris: UNESCO. Retrieved November 19, 2006, from http://unesdoc.unesco.org/images/0013/001399/139937e.pdf
Webster, K. (2004). *Rethink, refuse, reduce …. Education for sustainability in a changing world*. Shrewsbury: Field Studies Council.
Webster, K. (2007). Hidden sources: Understanding natural systems is the key to an evolving and aspirational ESD. *Journal of Education for Sustainable Development, 1*(1), 37–43.
Wicklein, R. (Ed.). (2001). *Appropriate technology for sustainable living. 50th yearbook of the Council on Technology Teacher Education*. VA: ITEA.

## Online Resources

**Sustainable Award/sustainable design**
www.sda-uk.org

**Practical Action's Education unit** offers a range of support services for teachers and young people looking to address sustainable development within their teaching and learning: http://practicalaction.org/?id=education

**ESD Resources, K3&4**
http://www.dep.org.uk/bookshop/New%20Res%20List%20PDFs/ESD%20KS3&4%20Laurel%20Cottage.pdf

**SmartHousing initiative**
http://www.housing.qld.gov.au/initiatives/smarthousing/learningtoolsgames/learning_object.htm
http://www.phm.gov.au/education/ecologic/resources.htm
http://www.sustainableliving.com.au/competition/

**Examples of appropriate technologies**
http://www.villageearth.org/pages/Appropriate_Technology/ATSourcebook
http://en.wikipedia.org/wiki/Appropriate_technology
http://journeytoforever.org/at_house.html

**Appropriate Technology Asia**
http://www.atasia.org.uk/ata.aspx

**Appropriate Technology Africa**
http://www.approtechafrica.com/

**The Centre for Appropriate Technology, Australia**
http://www.icat.org.au/

**Green product design**
http://biothinking.com/pd.htm

**LCA**
http://www.pre.nl/life_cycle_assessment/default.htm

**Design for environment**
http://www.pre.nl/ecodesign/default.htm

# Chapter 5
# Curriculum Development for ESD Through Technology and Vocational Education

In Chapter 4 a variety of learning activities were presented. This chapter proposes a framework for curriculum development that would help teachers to use these activities in a systematic way. There is an increasing commitment towards an ESD agenda in education that is evident through different local and global initiatives in education, such as the inclusion of ESD in pre-service and in-service courses, the reform of curricula and teaching programmes in many countries, the establishment of sustainability education awards, the sustainable school movement and many others. However, there remains an urgent need to develop teaching strategies and approaches that can be used by technology and vocational education teachers to achieve effective classroom practices in ESD.

Studies conducted by Pavlova (2004a, 2006a; Pavlova & Lebeame, 2004) in France, Australia and Russia and summarised in Pavlova (in press) examined technology teachers' perceptions of sustainability and school practices and the inclusion of sustainability issues in technology education syllabuses. To identify teachers' views and levels of understanding of sustainability and sustainable development, two instruments comprising of a survey and an interview were used. They were initially developed in English and then translated into French and Russian. Data were collected among both pre-service and current teachers of technology education who worked in schools with established technology education programmes in different socio-economic areas.

This research found that in France, Russia and Australia, technology teachers were not really involved in ESD. Most pre-service teachers and practicing teachers in the three countries were not familiar with what sustainable development or ESD means. The exceptions were teachers who were personally engaged in activities relevant to sustainable development outside their work, or those who had studied environmental sciences at university. These studies demonstrate that changes at the level of practice in technology education have been quite slow. A request for clear guidelines on how to address ESD through learning and teaching were emphasised by teachers as a crucial condition for ESD development and implementation (Pavlova, 2008).

Other research specifically focused on vocational education across a number of the Baltic states, including Latvia, Lithuania and Russia, identified a similar situation (Pavlova, 2006c). For example, St Petersburg's TVET teachers (focus group discussion, January 2007) indicated that they were interested in including

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_6, © Springer Science+Business Media B.V. 2009

sustainable development issues in their teaching but felt the need for some structure or framework to develop their teaching approaches and materials, along with professional development to do so.

This chapter addresses the issues raised by practitioners internationally and proposes a framework that can help teachers and curriculum developers to plan ESD teaching and learning activities. The framework is developed from ideas explored earlier by Pavlova (2004b) and is based on the integration of two types of theories: one that relates to the nature of society (Bauman, 1995; Habermas, 1981; Lash, 2001) and the other to the structure of proposed responses to sustainable development issues (described as the three pillars of sustainability by UNESCO, 2005). This chapter initially explores the first dimension of the framework (the second dimension was examined in Chapter 3), then proposes the framework, followed by discussion of three examples of challenges that could influence curriculum planning in cognitive, practical and aesthetic spheres, namely: sustainable consumption, the ethics of aesthetics and the nature of artefacts.

## Nature of Society

The first dimension of this framework includes cognitive, practical and aesthetic components. Philosophers and sociologists (Bauman, 1995; Habermas, 1981; Lash, 2001) have identified these components as important spheres of the life of any society. Historically, all three spheres were closely inter-related; however, Habermas (1981) argued that the theoretical, practical and aesthetic spheres of cultural modernity attained autonomy from one another from the end of the 18th century. Then, from around the middle of the 19th century, the gradual autonomisation of the aesthetic dimension in the life of society led to the domination of this sphere over the others in westernised societies. This has caused tensions among the cognitive, practical and aesthetic spheres that are currently reflected in different areas of human activities.

To understand how this first dimension could be applied within the proposed framework for teaching and learning, it is important to consider the inter-relationships between all three components and the ways in which each component might influence the development of teaching and learning practices. The arguments below help to establish these relationships.

### *Colonisation of the Cognitive and Moral Spheres of Human Life by the Aesthetic Realm*

The appearance of formalised design at the particular time in the history of humankind reflected deep changes in the nature of society and in the understanding of what it meant to be human. Around the middle of the 19th century the autonomy of the aesthetic sphere achieved a momentum not seen before. Habermas (1981) described

the situation as one where "the talented artist could lend authentic expression" to their own de-centered subjectivity, "detached from the constraints of routinized cognition and everyday action" (p. 9). As he explained, the extravagant art programmes of the 20th century had attempted

> to level art and life, fiction and praxis, appearance and reality to one plane; … to remove the distinction between artefact and object of use, between conscious staging and spontaneous excitement; … to declare everything to be art and everyone to be artist, to retract all criteria and to equate aesthetic judgement with the expression of subjective experiences. (Habermas, 1981, p. 10)

The gradual emergence of the aesthetic dimension in the life of society has led to the domination of this area over the other spheres. Bauman (1995) argues that in the current era, features that belong to the aesthetic space tend to submerge and colonise the social space and become the principal tools of social spacing. Bauman makes a clear distinction between a cognitively spaced world and an aesthetically spaced world. The cognitively spaced world

> is the play of ends-and-means relevances, of matching means against appointed ends and ends against available means. The cognitively spaced world is the yield of goal-pursuit and attendant calculation, but it is also, though secondarily, the testing ground of the limits of the capacity to act, and to act effectively. (Bauman, 1995, p. 123)

The aesthetically spaced world is the mosaic of experiences, of novel experiences and is characterised by more intense experiences than ever before. Thus, modern individuals have found themselves in the position of goods-consumers, "lived as the role of a pleasures-collector – or, more exactly, a sensations-gatherer" (Bauman, 1995, p. 115). In such a world the person keeps open all possibilities and has "no fixed identity that could be threatened by disappointment, humiliation or loss" (Dreyfus, 1998, p. 116). There is no distinction between the relevant and the irrelevant, the significant and the insignificant – everything becomes equally interesting and equally boring (Dreyfus, 1998). Interesting and boring are the only qualitative distinctions between these experiences.

In the aesthetically spaced world the value of truth and justice is determined by judgements of taste and the "terror of the beautiful" are capable of resisting capture by "the deceiving world of science and morality" (Habermas, 1982, p. 25). This shift from cognition to perception increases the importance of experiences and as Lash (2001) argued, reduces the role of epistemology in the meaning of contemporary "being". Our knowledge is obtained not through the abstraction of judgement, but through experience. We are experiencing things by being in the life-world with them. "Through being no longer above things, but in the world with things, we come to grips, not with epistemology and appearance, but deeper ontological structures" (Lash, 2001, p. 107).

As humans, we tend to make sense of the world through designed objects and systems. To some extent, in this world things became the measure of the human being. Many people construct their identities through products, and so they are not fixed. For, example, Nike spends millions of dollars each year to create brand

consciousness and desire: “A pair of Nikes represents a competitive edge, glamour, rebellion, status, and the intricacies of coolness” (Petrina, 2000, p. 219). Young men’s identities are linked to Nike shoes via the images the company presents. Consumers are guided now by aesthetic rather than ethical interests, and so the aesthetics of consumption prevails over the work ethic. If ethics accord supreme value to duty well done, aesthetics places a premium on sublime experience (Bauman, 1998).

All images in the aesthetically spaced world are structured by “the relevances of attractiveness, pleasure-potential, interest-arousal” (Bauman, 1995, p. 150). In this world images are more real than reality; “where everything is a representation and thus the difference between representation and what is represented can no more be made” (Bauman, 1995, p. 150). Advertising objects or commodities are frequently equated with ideas or values:

> a brand of cigarettes with virility, beer with manhood and athletic prowess, a soft drink with being young and vigorous. Equal time and equal weight can be given and are given to the trivial and the profound. In this way, too, many of the increasing services and products of the consumer-oriented society fulfill artificially created rather than genuine need. (Shore, 1985, p. 38)

In the aesthetically spaced world the culture of consumption (which provides the basis of modern economic models) is closely related to the cultivation of desire that is used as a way of manipulating people. In order to make people “want” things they had never previously desired, business leaders have had to create “the dissatisfied consumer”, they had to “create the wants the business seeks to satisfy” (Rifkin, 1995). This process of cultivation of the dissatisfied consumer provides a rationale for the processes of designing new products and services. In the aesthetically spaced world “the value of truth and justice is determined by judgements of taste” (Habermas, 1982, p. 26). Consumerism is focusing on economic and productivity goals where advertising creates a fantasy world that is dependent on material means for personal self-expression. Consumerism is closely related to the disappearance of the work ethic in the contemporary world.

## *Disappearance of the Work Ethic*

In post-traditional, modern societies, work was the main factor determining social placement and identity for the majority of males. Work, as the main orientation point, was a phenomenon that planned and ordered all other aspects of life. Work provided meaning on a daily basis, and was central to an individual’s sense of identity and well-being. For post-traditional, modern societies, work brought together all modern arrangements, such as individual motives, social integration and systematic reproduction. The work ethic was considered as “the moral duty, mission and vocation of all members (more exactly, all its male members)” (Bauman, 1998, p. 19). In that society the work ethic called people to choose a life devoted to labour.

It was an instrument to force working people to work in the name of the ethical nobility of working life.

According to Bauman (1998) the work ethic is a mainly European invention. He argues that in America the spirit of enterprise and the desire for upward mobility rather than the work ethic lubricated the wheels of American industry. In the struggle over a greater share of the surplus, wages began playing a central role in America. Work was seen as the means to become richer and thus more independent, ultimately overcoming the need to work for others. Gradually this tendency spread throughout Western countries. The fact that economic benefits became the only indicator of the ambitions for autonomy and self-assertion has had a "profound influence on the whole course of development of modern, industrial society … as it moved from a society of producers to that of consumers" (Bauman, 1998, pp. 21–22). Work was no longer considered as "a road to a morally superior way of life"; it became a means to earn more money.

Because of that change in contemporary society, the work ethic is *not* playing its central role in the regulation of social order. It was "slowly demoted from its function of supreme regulatory principle" (Bauman, 1998, p. 37). Work has lost its privileged position; it no longer serves as the basis for self-constitution and identity-building. Boring work provides a source of material comfort, the ability to consume. Another characteristic of work is its non-permanent nature. Currently, a continuous, logically coherent and tightly structured working career is no longer a widely available option. The majority of new vacancies tend to be fixed term and part-time (Rifkin, 1995). Thus, only in relatively rare cases can a permanent identity be defined through the job performed. The shift in emphasis from the older type of modern society (that engaged its members *primarily* as producers) to its present late-modern, second-modern or post-modern stage (where society engages its members – again *primarily* – in their capacity as consumers) impacts greatly on almost every aspect of life, society and culture.

## *Consumption*

In a society of consumers, identity is constructed through the marketplace, with the individual now charged with the task of self-construction. Two fundamental elements of a consumer culture are the use of goods for both social positioning and as a symbolic means of self-expression. Consumption relates to lifestyle, subculture and neo-tribalism; it is an essential activity that is coupled with the status hierarchy of society that works through material symbols of prestige (Gottdiener, 2000). In a consumer society, the consumers have a right to enjoy, not a duty to suffer. It is "a wanting society, not a waiting society" (Bauman, 1998, p. 31). Consumption is an individual activity. The more freedom of choice one has, the higher up one is placed in the social hierarchy and the closer one comes to the "good life" idea. As Bauman (1998) argued, the prime significance of wealth and income is in the stretching of the range of consumer choice.

These changes represent deep shifts in the meaning of existence for the people in the contemporary world. The increasing role design plays in consumption is closely connected to the appearance of the aesthetically spaced world. The role of design in the current era is to create this aesthetically spaced world that has the following distinctive characteristics:

- The cognitive and moral spheres of human life are colonised by the aesthetic realm.
- The role of experiences in the life of the sensation-gatherer is increasing.
- Designed objects are used as the means for obtaining existential meaning.
- People are manipulated through the cultivation of their desires (Pavlova, 2005).
- There is a shift of emphasis from engaging society members primarily as producers to engaging society members primarily as consumers.

These brief characteristics of the modern society demonstrate that a number of current trends do not fit within the requirements for SD and ESD, as outlined in the previous chapters. This creates an additional challenge to an effective introduction of ESD. A cognitively and morally based approach towards SD and ESD, that is required, is not aligned with the nature of the consumer-based society in Westernised countries. Therefore, on the one hand, the need for a rethink approach towards the ways we are living, examined in the previous chapters, is paramount. On the other hand, the role of aesthetic in influencing the identity of young people and its role in society should be acknowledged and incorporated in teaching practices. This tension highlights the importance of developing teachers' understanding on how to address SD issues in the classroom that would find a positive response with students.

## The Framework

The first dimension of the proposed framework that includes cognitive, practical and aesthetic components and which relates to the nature of society, presents a challenge for teachers. On the one hand, all three components expressed the nature of consumer society. On the other hand, they could also present the nature of sustainable society underpinned by the cognitive power of humanity/human consciousness (frame of mind/nöosphere wisdom); practical sphere (technical fix as a way to achieve sustainable solutions); and aesthetics of sustainability (e.g., appropriate technology, green products). These and the other concepts discussed in Chapters 3 and 4 could be used by teachers to address the first dimension of the framework. This first dimension also presents the tension between the current situation, analysed in the first part of this chapter and the desirable future analysed in Chapters 2–4. For example, an undesirable consumer culture could be counteracted by the aesthetics of sustainability, by the ethics of weak anthropocentrism and by the moral values to be developed in students. Some examples of challenges are discussed in the next section of this chapter.

It should also be noted that developing countries could not be described in the same consumer society terms. As a consequence, there is a huge variation in the importance accorded to aesthetics within different societies. That is, aesthetics might not be related to consumerism, or different societies might be at a different crossroads in their move towards a consumer society. The specific contexts in particular countries would require an adjustment of this framework in terms of how the concept of aesthetics is interpreted in each particular developing country.

The second dimension of the proposed framework draws from the three pillars of sustainability and includes the social, environmental and economic aspects which were discussed in Chapter 3. These aspects are contextualised to a particular area of TVET training or towards design and technology in the case of technology education. It is important to remember that the ethics of weak anthropocentrism and moral values need to underpin both dimensions, as they are the starting points for curriculum development.

The proposed framework for developing a systematic approach towards planning ESD is presented in Table 5.1. Although these categorisations are very schematic, the cross-sections of these dimensions provide an opportunity to systematic curriculum planning as they highlight a number of areas that need to be addressed through learning and the foci for particular activities that relate to ESD.

Table 5.1 can help technology and vocational education teachers to plan different learning activities that focus on one or more aspects of sustainability. Each TVET area should identify ESD aims that could be addressed through particular curricula. For example, the aims of technology and design education identified by Pavlova are as follows:

- To know and understand sustainable development problems/issues;
- To contribute towards the promotion and increasing awareness of ideas of sustainable development through projects and activities;
- To design and make products in accordance with eco-design principles;
- To work with sustainable development practices (Pavlova, 2006b);
- To discuss and appreciate the relationships between aesthetics and ethics for sustainability;
- To consider aesthetics as a powerful feature of product design closely related to sustainable consumption (Pavlova, 2008).

The above aims are related to the components stated in the first dimension of the proposed framework. The cognitive sphere (aims 1 and 2) relates to knowledge and understanding the principles of sustainable design, understanding what sustainable development is and why it should be addressed. The practical sphere of social life (aims 3 and 4) is addressed through designing and making products, systems and the

**Table 5.1** Systematic approach for the ESD curriculum planning (Pavlova, 2008)

| | Social | Environmental | Economic |
|---|---|---|---|
| Cognitive | | | |
| Practical | | | |
| Aesthetic | | | |

environment. Aesthetics (aims 5 and 6) relates to the appreciation of aesthetics for sustainability (current style, appearance of the product) and reflects the important role it plays in influencing the identity of young people. The realisation of these aims can be achieved through addressing economic, environmental and social contexts.

Some examples of activities considered in Chapter 4 could illustrate the use of this planning framework. When a teacher uses a life cycle analysis (LCA) of a particular product (green product) and discusses such issues as the use of energy or water, toxic emissions or transport implications, the focus of the learning activity could be on the cognitive and moral/ethical aspects that relate mainly to the protection of the environment. However, economic and social issues could also be part of the learning activities.

The learning activity that is focused principally on the social aspect of sustainability could be a product analysis activity. The purpose of this analysis can be to understand how the product could "improve the quality of human life within earth's carrying capacity and conservation of the earth's vitality and diversity" (United Nations, 2001). This analysis can address questions, some of which are noted in Chapter 4: is the product really needed; how does the product make life better for people; is it culturally acceptable for people who use it; does it build on the traditional wisdom and technology of the community? (see Practical Action, n.d.). The activity can be focused on cognitive, social and ethical aspects with some consideration of aesthetic. Again, *an emphasis on moral values should underpin all activities*.

Some projects, for example could include a number of foci as they consist of several activities. For example, for the project "Sustainable House" where students are asked to design and make a sustainable house for the country of their choice, the activities shown in Table 5.2 could be organised within the project.

Through the process of planning, only the main emphasis for each activity is indicated. After considering a number of different choices, the teacher needs to use those

**Table 5.2** Sustainable house project: Examples of activities

| | Social | Environmental | Economic |
|---|---|---|---|
| Cognitive | Research traditional and existing houses, materials used, their impact on social, environmental and economic sustainability of a particular community. | | |
| Practical | Design and make a number of model houses that could belong to people with different social status | Design and make a model of the house that fits a specific natural environment | Calculate minimum required materials and resources for your house |
| Aesthetic | | Discuss the relationships between aesthetic and the house design | Use a LCA to establish the links between aesthetic and economic issues; does the project become more expensive due to some additional aesthetic elements? How could a balance be achieved? |

that will fit within a global aim for the project within the programme and to maintain the overall balance between components over two dimensions of the framework.

In a similar way, a number of activities appropriate for the particular TVET area can be analysed and developed using the proposed framework (e.g., a life cycle analysis of construction materials; an energy/waste audit of an industrial site; an analysis of the social impact of eco-tourism on a particular community; the development of technological processes that will reduce resource consumption). Therefore, an analysis of the ESD aims for a particular TVET area, together with the framework, can help the teacher to develop teaching approaches and learning activities for students. This holistic manner will contribute towards a systematic approach towards ESD, where all aspects of sustainable development are addressed, not just the environmental issues.

In some TVET areas such as the construction industry, landscape design, product development and similar occupations, the role of the aesthetic can take on a more central role. One way in which sustainability might be accomplished is by making sustainable products that are more aesthetically appealing, so people will willingly make appropriate choices. In other TVET areas such as auto mechanics, electrical fitting or refrigeration mechanics, the role of the aesthetic would be more limited and because of that, an understanding of how the aesthetic relates to personal experiences and to the collective perception of what is interesting and appealing, should be developed to stimulate sustainable consumer choices among young people. In that case, the aesthetic component of sustainability could be studied more at a cognitive than a practical level within a particular programme.

These examples are used to illustrate an overall approach towards ESD planning. Also in their planning the teachers need to thoroughly consider the nature of current society and a society that is considered desirable. In the next section three issues of sustainable consumption, an ethic of aesthetics and the nature of the artefacts are considered as examples.

## Nature of Society – Challenged

Each component of the first dimension of the framework that needs to be addressed through ESD provides a challenge for both students and teachers. Sustainable consumption (cognitive), the ethic of aesthetics (aesthetic) and the nature of artefacts (practical) are examples of how the nature of current society examined at the beginning of the chapter could be challenged.

### *Sustainable Consumption*

The need for sustainable consumption has become an important concern of the global community. Over-consumption creates a large burden for the environment. “The switch from ‘*production to pleasure*’ has meant, for example, that the growth in mobility and household comfort since 1973 has raised energy use almost as

much as improved design has bought efficiency gains" [italics added] (Schipper, 1994, cited in Robins, 1999, p. 8). Currently, sustainable consumption has grown far beyond the green consumer movement of the late 1980s and early 1990s. At that time the emphasis was on providing eco-products using eco-labelling as a marketing tool (Robins, 1999). After a decade of dialogue and dispute, sustainable consumption has now become a global policy priority. UNESCO (1997) relates sustainable consumption to different consumption patterns (public transport, food produced locally, products with a long life span, etc.) and to responsible consumer choices and behaviour. As Robins points out, many of the solutions to consumption problems lie in collective choices. The United Nations Development Programme has outlined a seven point agenda for action (UNDP, 1998) where all points in the agenda are related to ethical issues that develop a wider sense of corporate responsibility. This checklist for sustainable consumption is:

- Ensure minimum consumption requirements for all;
- Develop eco-efficient goods and services;
- Remove perverse subsidies and restructure incentives;
- Strengthen public action for consumer protection;
- Strengthen international mechanisms to manage consumption's global impact;
- Build strong alliances between consumer, poverty and environment movements; and
- Foster synergies between civil society, the private sector and government.

Patterns of consumption for developed and developing countries will be different. As Robins (1999) argued, the question is

> …. how developing countries can develop hybrid cultures of consumption that combine eco-efficient technologies with traditional ethical approaches to nature and society. For the North, where traditional values of frugality and caring for nature have been more thoroughly replaced by the current consumer culture, the task of reinvention is much greater. (p. 14)

Current consumerism lies at the heart of a modern economy in the Western world and it could be challenged by teachers through discussion, analysis, and actions relevant to sustainable consumption. In the current culture of consumption the role of aesthetics is well explored in the literature (see sections above). However, the role of the aesthetic in *sustainable consumption* has not been widely discussed, although its importance is clearly projected from the above analysis. It is argued that the aesthetic becomes a "social attractor", in the sense that it orients the choices of a multiplicity of individuals, so it is interpreted "as the faculty of collective experiences" (Maffesoli, 1991, p. 9). The *aesthetics of sustainability* is partly addressed below.

## *The Ethic of Aesthetics*

The ethic of aesthetics plays a special role in the aesthetics of sustainability. Maffesoli (1991) has taken up the concept that Kant gave to *aesthesis*: "the accent being

placed less on the artistic object as such than on the process that leads one to admire that object" (p. 9), to establish a link between ethics and aesthetics. Aesthetics represents the way in which values of a particular historical period take form. Aesthetics is connected to ethics in a sense "that no true, profound aesthetic renewal can occur without being based on a value system" (Manzini, 1994). Aesthetic today is defined as the "attempt to understand our experiences of and the concepts we use to talk about objects that we find perceptually interesting and attractive" (Smith, Simpson, & Ralph, 1991, p. 18).

Recognition of aesthetic as a popular, expressive mode of communication that reflects in our lifestyle is acknowledged by Maffesoli (1996) and summarised by Hetherington (1998): "a collective, shared lifeworld that is denied its expressive outlets within the institutions of modern society, floods out through the sociality of everyday life in the combination of ethical and aesthetic forms of communication" (p. 64). These relationships between ethics and aesthetics were formulated by Maffesoli (1991) as "the ethic of aesthetics". The relationships between values and aesthetics can be illustrated by simple examples. When you see a glossy, "perfectly shaped" apple and compare it to an apple that is unevenly shaped with some black spots, which one do you choose? If you value that the apple was naturally grown with no chemicals and sold by local farmers, you would choose the second apple, if not, you would choose the first. Appropriate technology is another example of products that could be seen as aesthetically pleasant (even if the shape and finish are not perfect) when they are ethically valued. Classroom discussions on relationships between ethics and aesthetics could be used to help students to understand and interpret their experiences.

Maffesoli (1991) argued that the relationship between form and its importance to a particular group is an important factor that unites people. Maffesoli stated that forms, from an aesthetic point of view, have a relative autonomy "in the sense that every form which is significant for one group may be insignificant for another" (Maffesoli, 1991, p. 17). Thus, the social aspect of aesthetic, when a person recognises a sign by "recognising it with others" also explains what unites her/him to others. This social aspect of aesthetic could be used in developing an aesthetics of sustainability as "aesthetics in the widest sense is able to take on the functions of aggregation and reinforcement" (Maffesoli, 1991, p. 19).

The power of aesthetics in the current times is appreciated by organisations that address "world problems". For example, Memefest, the International Festival of Radical Communication "born in Slovenia and rapidly reaching a critical mass worldwide" (http://www.memefest.org), announced its seventh annual competition in 2008 with the theme: *Radical Beauty*. In the context of communication, the concept of "radical beauty" is defined thus:

> Beauty is a cultural creation that expresses dominant values. In the 21st century beauty is often extremely commercialized. Radical beauty is a cultural creation that expresses the *desire of a change in society* [italics added]. Radical beauty is about changing dominant values through action and creation. Grassroots projects are often the vectors of these changings. They experiment new practices and express new values. (http://www.memefest.org/2008/en/)

Radical Beauty is defined in terms of content, process and aesthetic:

- content: poetic dialogue and action between the world and grassroots projects or processes that are existing or yet to be realized;
- process: empowering relations between people;
- aesthetic: evoking a strong feeling of affection or love. (http://www.memefest.org/2008/en/)

Through this concept Memefest challenges the contemporary ways of social construction of beauty and channels "the concept of radical beauty in to specific problems/issues". Memefest is trying to contextualise the problem within the local context of everyday life. This festival is just one example of how aesthetics is conceptualised as a way to address problems of the modern world and how it relates to radical/socially responsible communication. These grassroots approaches could help teachers to establish the concept of the aesthetics of sustainability with their students. Although similar initiatives have become more and more popular an understanding of what is a sustainable society "has not yet 'taken form' and the aesthetics of sustainability has yet to be born" (Manzini, 1994, p. 42). Moreover, in a transition towards sustainable development there is a real need for an aesthetic of sustainability. There is a need to understand the interdependence of the ethical and aesthetical components of sustainability in terms of their relationships, as well as the relationships with social and economic aspects of product design.

Addressing the aesthetic aspect of sustainability in technology education programmes requires shifts in teachers' perception that are characteristic of systematic thinking about sustainability – from a mainly ecological emphasis to consideration of the whole, from aspects to relationships, and from specified content to patterns that expose the complexity of the relationships between different aspects. Teachers need to distinguish between two ways that aesthetics could be used in ESD learning activities, firstly, using the current aesthetic styles for sustainable product design. The elevation of aesthetic reasoning in the life of consumer society could help students to understand how to "manipulate" consumer choices in a positive way through their product design. Secondly, the aesthetics of sustainability that explores the close relationship between aesthetics and ethics relates to the cultivation of particular desires associated with sustainable development. As argued by Rokeach (1973) value is a preference and a conception of desirable. Therefore, when a sustainable object is being valued then there is a suitable basis for developing the aesthetics of sustainability. Students need to experience colour, texture, shapes and images that can be associated with sustainable development. Although aesthetics relates to personal experiences, it is also related to the collective perception of what is interesting and appealing and in the end, what products are advertised and in what ways.

Greene (1971) articulated very well the significance of aesthetic education:

> Aesthetic education involves arousing our students, as well as ourselves, to the great, unsettled questions, to the need to choose. This individual takes a risk … once he becomes aware of the nameless possibilities in himself.… An awareness of this kind becomes a call to action and choice.… He is likely to catch a glimpse of what some might call his true self, his own ways of seeing and feeling, his inner time. But this can occur only if the aesthetic

> posture is made self-conscious, if it is related to questioning, to choosing, to learning – to the changing of a life. (pp. 40–41)

Teachers are dealing with "*homo aestheticus*" (Maffesoli, 1991, p. 19), so they need to plan carefully so as to include the aesthetic aspect as a part of their teaching and particularly, the aesthetics of sustainability; it has a huge potential to influence students' behaviour that has not been considered before in technology and vocational education.

## *Nature of Artefacts*

An analysis of sustainable consumption and the ethic of aesthetics illustrates the challenges of addressing the aesthetic and cognitive spheres in curriculum planning. The third sphere is practical. For technology and TVET education it is closely related to the design and production of artefacts, services and environments. Learning about production and manufacturing technologies and developing students' practical capabilities are among the major emphases in technology education and TVET syllabuses. However, some aspects of the practical sphere are not widely applied. A strong link between human's practical capability and the appearance of artefacts is an example. As analysed by Ryan (1996), "design has constantly altered ideas about aesthetics and form; as our technical ability to manipulate materials and form has improved, so 'appearance' has become more of a complex and multi-dimensional issue" (p. 9). Therefore the importance of learning about materials, their characteristics, manufacturing processes and finishing techniques is also related to the aesthetic of the product and to the issue of aesthetics of sustainability when students are designing and making artefacts.

Another aspect of the practical component that is not often studied in the classroom is the meaning of the artefact; again this is closely related to appearance. Appearance reflects cultural values, identity and status and "all other human desires of consumers, appealing to the emotions and the sensorial qualities of touch, smell, colour and tactility" (Ryan, 1996, p. 9). The cultural meaning of artefacts is important to unpack (Alexander, 1992). A teacher might specifically choose products that have existed in human societies for millennia and are still made and used today. Walker (2006) argued that attention to such objects will help us to learn about our relationship with material things and our contemporary efforts to tackle sustainable issues in product design and manufacturing. (p. 20). When students are designing products, teachers need to raise fundamental questions about the meaning and place of products in our lives, their contribution to what might be called the human endeavour.

The meaning of products relates to human values that are expressed through desires. As argued by Simpson (1995), our capacities and desires for communication, health, transportation, nourishment, security, entertainment, shelter, comfort and so on constitute "the hermeneutic grid in terms of which we can understand the point of any technology" (p. 13). The significance of a particular artefact derives from our nature and values. In this sense, Simpson argues, "though technology may

generate possibilities that we have not envisioned, its significance derives ultimately from our nature and values" (p. 13) Therefore, our desire to live in a more sustainable way, and our understanding of why is it important, help students to generate sustainable solutions for the design challenges that could lead us to a more sustainable world.

Designing and making artefacts, that is, technological production, has historically been closely related to gender and with male power in society. A range of feminist analyses focus on the symbolic meaning of technology and the way technology enters into gender identity. Feminist scholars are trying to see "the ways in which gender has been encoded in material objects and how the material objects and technical artefacts have in turn (re) constructed gender relations and representations" (Oldenziel, 1996, p. 66). Wajcman (1995) argues that "a gendered approach to technology cannot be reduced to a view that treats technology as a set of neutral artefacts manipulated by men to women's detriment" (p. 203). Technology is always the product of social relations.

Feminist authors argue that Western technology itself embodies "patriarchal values and that its project is the domination and control of women and nature" (Wajcman, 1995, p. 189). Appropriation of the physical and mental know-how is an integral part of male gender identity that positions women as technologically ignorant and incompetent (Wajcman, 1995, p. 201). Cockburn (1991) argues that control of technology is one of the key characteristics of male power, which leads to power in society. Women are almost excluded from technology and from the political decision that shape it. Technological knowledge at the professional level is a sharp differentiator between men and women. The production and use of technology is thought to have been established by male power and interest (Wajcman, 1995).

The technical artefact in Western understanding is the centre of what constitutes technology. A genealogy of machines has often been used to organise and narrate the history of technology. The idea that the history of engineering provides an exclusive guide for technological change was adopted. Such focus is criticised by feminist writers as problematic because engineering has been the most male-dominated profession (Oldenziel, 1996, p. 59) and the division between productive (engineering work) and non-productive labour (household work) has removed household technology from the discussion. Taxonomies of technological development often carry "implicit gender coding" (Oldenziel, p. 58). As argued by Rothschild (1983) in the culture of production the presumed inventor, user, thinker in technology has been a male. Nowadays when consumption is taking a larger part in the life of individuals and society, women appear suddenly present, visible and alive. Consumers produce frames of meanings for products. Companies learn this and invest much in sales departments and advertising agencies compared to the actual manufacturing of products. Companies aim to produce the "proper frame of meaning" for their product and women are included as a targeted market. Limited access to technology, the male values embedded in it and the gender division of labour are also important topics to discuss in the classroom. These issues relate to social aspect of sustainability in both developed and developing countries.

Examples of challenges that need to be addressed in ESD planning demonstrate a close relationship between the cognitive, aesthetic and practical spheres. The aesthetics of sustainability, for example, which is a big challenge not only for teachers but also for the broader community, including professional designers, combines elements of ethics (through the underlying values) and practical component (availability of particular materials, manufacturing processes and the meaning of the artefacts).

## Conclusion

This chapter has proposed a framework that could help technology and vocational education practitioners to develop an ESD curriculum in a systematic manner, in a way that provides an holistic approach for ESD in their teaching area. The framework proposed is based on two sets of theories: the nature of society and the nature of proposed responses to SD issues reflected in what are termed the three pillars of sustainability. It is suggested that the aims for ESD developed for particular teaching areas and the framework proposed in this chapter provide an opportunity for teachers to plan and address a number of sustainable development issues through the teaching process. The technology education examples illustrate one way of applying this framework.

Specific attention is given here to one component of the framework that has not previously been considered by academics in education in relation to ESD. That component is aesthetics. In this chapter it is argued that since the introduction of formalised design in Western countries, the moral and cognitive spheres of society have been dominated by the aesthetic sphere. It is argued that if aesthetics has such a strong influence on society it should be possible to use this position to assist the transition to a more sustainable society. One way in which this might be accomplished is by making sustainable products that are more aesthetically appealing. In this way people will willingly make appropriate choices. Another way is to develop the aesthetics of sustainability, so people can make conscious decisions related to their values. Aesthetics can play an important role in the ESD curriculum, as it increasingly influences the identity and behaviour of young people.

This chapter unpacks a dilemma: that, on the one hand, due to the nature of modern societies in Westernised countries, the aesthetically spaced world is playing an increasingly important role in framing youth identity; on the other hand, as argued in Chapters 2 and 3, values and in particular moral values that are closely related to the “cognitive power” of humans, should provide a basis for SD, ESD, teaching and learning. This contradiction of what is desirable and what is happening in developed countries and Westernised societies creates real challenges for teachers and curriculum developers. In this context it is particularly important to link aesthetics and ethics.

## References

Alexander, J. C. (1992). The promise of a cultural sociology: Technological discourse and the sacred and profane information machine. In R. Munch & N. J. Smelser (Eds.), *Theory of culture* (pp. 293–323). Berkeley: University of California Press.

Bauman, Z. (1995). *Life in fragments. Essays in postmodern morality*. Oxford: Blackwell.

Bauman, Z. (1998). *Work, consumerism and the new poor*. Buckingham: Open University Press.

Cockburn, C. (1991). The gendering of technology. In H. Mackay, M. Young, & J. Beynon (Eds.), *Understanding technology in education* (pp. 41–61). London: The Falmer Press.

Dreyfus, H. L. (1998). Education on the Internet: Anonymity vs. commitment. *The Internet and Higher Education, 1*(2), 113–124.

Gottdiener, M. (2000). Approaches to consumption: Classical and contemporary perspectives. In M. Gottdiener (Ed.), *New forms of consumption: Consumers, culture, and commodification* (pp. 3–31). Boston: Rowman &Littlefield Publishers.

Greene, M. (1971). Teaching for aesthetic experience. In B. Reimer (Ed.), *Towards an aesthetic education* (pp. 21–43). Washington, DC: Music Educators National Conference Proceedings

Habermas, J. (1981). Modernity versus postmodernity. *New German Critique, 22*, 3–14.

Habermas, J. (1982). The entwinement of myth and enlightenment: Re-reading dialectic of enlightenment. *New German Critique, 26*, 13–30.

Hetherington, K. (1998). *Expressions of identity: Space, performance, politics*. London: SAGE Publications.

Lash, S. (2001). Technological forms of life. *Theory, Culture and Society, 18*(1), 105–120.

Maffesoli, M. (1991). The ethic of aesthetics. *Theory, Culture and Society, 8*(7), 7–20.

Maffesoli, M. (1996). *The time of tribes: The decline of individualism in mass society* (D. Smith, Trans.). London: SAGE. (Original work published 1988).

Manzini, E. (1994). Design, environment and social quality: From 'existenzminimum' to 'quality maximum'. *Design Issues, 10*(1), 37–43.

Oldenziel, R. (1996). Objections: Technology, culture and gender. In W. D. Kingery (Ed.), *Learning from things: Method and theory of material culture studies* (pp. 55–69). Washington: Smithsonian Institution Press.

Pavlova, M. (2004a). Sustainable development: Is it an educational priority for French students? In H. Middleton, M. Pavlova, & D. Roebuck (Eds.), *Learning for innovation in technology education* (Vol. 3, pp. 36–45). Proceedings of the 3rd International Conference on Technology Education Research: Centre for Learning Research, Griffith University.

Pavlova, M. (2004b). Sustainability: Towards a systematic approach for its conceptualisation in technology education. In J. Lebeame (Ed.), *Purposes and assessments within technology education*. AEET Conference, Paris, March 2004. Retrieved May 10, 2007, from http://membres.lycos.fr/aeet/ (English and French translation).

Pavlova, M. (2005). Social change: How should technology education respond? *International Journal of Technology and Design Education, 15*(3), 199–215.

Pavlova, M. (2006a). Technology education for sustainable futures. *Design and Technology Education: An International Journal, 11*(2), 41–53.

Pavlova, M. (2006b). Education for sustainable development: The nature of the issue in the multicultural world. In P. Ruohotie & R. Maclean (Eds.), *Communication and learning in the multicultural world* (pp. 377–397). Hameenlinna: University of Tampere Press.

Pavlova, M. (2006c). *Education for sustainability through design and technology education: Some issues for a research agenda*. Presented at the 2nd European Fair on Education for Sustainable Development, Hamburg, Germany 13–15 September, 2006.

Pavlova, M. (2008). Technology and vocational education: A framework for the development of teaching approaches and resources for Education for Sustainable Development. In J. Fien, R. Maclean, & M.G. Park (Eds.), *Work, learning and sustainable development: Opportunities and Challenges,* (pp. 455–464). Dordrecht: Springer.

Pavlova, M., & Lebeame, J. (2004). Challenges for introducing the concept of sustainable development in French and Australian secondary schools. In H. Middleton, M. Pavlova, & D. Roebuck (Eds.), *Learning for innovation in technology education* (Vol. 3, pp. 46–56). Proceedings of the 3rd International Conference on Technology Education Research: Centre for Learning Research, Griffith University.

Petrina, S. (2000). The political ecology of design and technology education: An inquiry into methods. *International Journal of Technology and Design Education, 10*, 207–237.

Practical Action. (n.d.). Homepage. Retrieved May 10, 2007, from http://www.sda-uk.org;%20 www.stepin.org.

Rifkin, J. (1995). *The end of work: The decline of the global labor force and the dawn of the post-market era*. New York, NY: Putnam Books.

Robins, N. (1999). Making sustainability bite: Transforming global consumption patterns. *The Journal of Sustainable Product Design, 10*, 5–16.

Rokeach, M. (1973). *The nature of human values*. New York: Free Press.

Rothschild, J. (Ed.). (1983). *Machina ex dea: Feminist perspective on technology*. Oxford: Pergamon.

Ryan, C. (1996). Life cycle analysis and design – A productive relationship? Conference paper. Retrieved July 6, 2003, from http://www.cfd.rmit.edu.au/outcomes/papers/LCA-CR.html

Simpson, L. C. (1995). *Technology, time, and the conversations of modernity*. Great Britain: Routledge.

Smith, R. A., Simpson, A., & Ralph, A. (1991). *Aesthetics and arts education*. Illinois: Illinois Press.

Shore, H. (1985). Culture, development and human values. In E. László & I. Vitányi (Eds.), *European culture and world development* (pp. 35–53). UNESCO Joint Studies for the European Cultural Forum. Oxford: Pergamon Press.

United Nations. (2001). *Indicators of sustainable development. CSD theme indicator framework: Social*. Retrieved November 20, 2003, from http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm

UNDP (United Nations Development Program). (1998). *Human development report*. New York: UNDP.

UNECSO. (1997). *Educating for a sustainable future: A transdisciplinary vision for concerted action*. Retrieved March 7, 2002, from www.unesco.org/education/tlsf/theme_a/mod01/uncom01t05s01.htm

UNESCO. (2005). *United Nations Decade of Education for Sustainable Development 2005–2014. International Implementation Scheme*. Draft, January 2005. Paris: UNESCO. Retrieved November 19, 2006, from http://unesdoc.unesco.org/images/0013/001399/139937e.pdf

Wajcman, J. (1995). Feminist theories of technology. In S. Jasanoff, G. E. Markle, J. C. Petersen, & T. Pinch (Eds.), *Handbook of science and technology studies* (pp. 189–204). Thousand Oaks, CA: SAGE.

Walker, S. (2006). Object lessons: Enduring artefacts and sustainable solutions. *Design Issues, 22*(1), 20–31.

# Chapter 6
# Teachers' Capacity Building

In the previous chapter a possible framework for planning education for sustainable development (ESD) curriculum was proposed. Together with activities examined in Chapter 4 and sustainable development (SD) interpretation presented in Chapter 3, we are now in a position to plan and implement ESD in technology and vocational education. The successful implementation of a frame of mind approach for ESD requires responsible, accountable leadership by teachers. Capacity building of teachers is among the crucial conditions for implementing the crucial conditions for implementing the United Nations Decade of Education for Sustainable Development (DESD) aims:

> the level of knowledge and enthusiasm of the educator will be a key factor in stimulating the learners' interest and appreciation of issues of sustainable development. The attitudes and methods which the educator employs must reflect the values of sustainable development as well as the highest standards of pedagogical practice. (UNESCO, 2005, pp. 30–31)

The important role of teachers is highlighted at different levels. The participants of an international virtual conference on TVET and sustainable development (Pavlova, 2007) stressed the important role the TVET teacher could play in bringing the required change relevant to SD. Therefore an improvement of the quality of TVET teacher training was identified as a priority. As a participant from Trinidad and Tobago observed:

> There is this saying that goes: 'no educational system can rise above the level and quality of its teachers'. It therefore follows, that, no TVET teacher or practitioner can do better or bring a change that he or she has not experienced, received or tested. What is happening with regards to TVET in some developing countries are typical evidences of backwardness, poverty, lack of orientation and lack of attaching values to educational development. Changes could come: If the agents of the change themselves are changed. (in Pavlova, 2007)

Academic research on the role of teachers (e.g., Benedict, 1999) has similarly found that the "competence to implement" (p. 436) high quality education for sustainability (achieved through pre- and in-service teacher education and school planning) is necessary for achieving changes in classroom practice. Hill and Elshof's (2007) ongoing research with technology teachers in two Canadian provinces also found that from the teachers' perspective, one of the main barriers

M. Pavlova, *Technology and Vocational Education for Sustainable Development*,
Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_7, © Springer Science+Business Media B.V. 2009

to the introduction of more ESD activities in their classrooms is a lack of appropriate professional development support. As a result, teachers bring some environmental thinking into their classrooms, but they do not employ a systematic and comprehensive approach.

The critical approach to education advocated in Chapter 2 that could help students to construct alternative futures that empower them through critical and ethical development need to be at the centre of attention through teacher education for sustainability. The professional morality of the teacher, also discussed in Chapter 2, highlights the importance of responsible professional action to create classroom environments that provide students with the opportunity to explore "what it is to be human". In-service and pre-service training are two models of human resource development for teachers. For successful introduction of ESD, both in-service and pre-service training play a crucial role. Through pre-service training, concepts, principles and methodologies are discussed and studied and then new teachers step into their jobs with ESD as part of their expertise. Through in-service training, teachers reshape existing programmes by drawing on their new knowledge, previous expertise, understanding of the educational system and their networks of contacts. Pre-service training is more cost effective than re-training so it is very important to re-orient pre-service teacher education to include ESD. Teacher education institutions are ideally situated to play central roles in ESD reform and teacher educators are the key agents of change.

Two cases below are used to demonstrate the ways a SD interpretation and an ESD planning framework could be used for training teachers. They exemplify positive results achieved through in-service and pre-service courses in terms of developing teachers' positive attitudes towards ESD in technology education. However, both examples illustrate only the first steps in developing teachers who will be able to use a frame of mind approach towards ESD.

## Pre-service Training

Considering the importance of pre-service training, an example of introducing ESD into a Bachelor of Technology Education (BTechEd) programme is examined here. It demonstrates the ways in which the principles, examples of learning activities and planning framework have been applied in the particular setting. The BTechEd programme in question is an undergraduate teacher training programme at Griffith University, Australia, that provides opportunities for students to study technical, pedagogical, vocational, design and graphics courses. Throughout the four-year programme, students are involved in developing their technical, pedagogical and vocational skills, designing and making products and developing teaching resources for their future employment. Since 2004, a systematic approach towards re-designing a number of courses within the programme to focus on different aspects of education for sustainability has been undertaken. As a result, a developed model presents a comprehensive approach towards the introduction of SD into a university programme. A number of starting points for its development include the three

bases for conceptualisation of SD that were presented in Chapter 3, the curriculum planning framework presented in Chapter 5 and the eight principles for sustainable university practices described below.

The eight principles for sustainable university practices have not been discussed; however, they were used to adjust the approach for university settings. The principles summarise a number of structural requirements for achieving sustainability of the structure (university/faculty/programme) and curriculum requirements. The higher education sector is increasingly being considered as one of the important components in the movement for education for sustainability (ES). Universities' multiple roles in preparing graduates for sustainable economies and lifestyles, as well as generating knowledge about sustainable solutions and visions, provide them with a unique opportunity to incorporate sustainability into their programmes. Since 1990 more and more universities have signed The Talloires Declaration which explicitly specifies a university's commitment to support sustainability efforts (University Leaders for a Sustainable Future, 2001). As of May 2007, 342 universities from 48 countries had signed the declaration.

The proposed framework includes some general considerations applicable to the majority of university teacher training programmes, such as (a) the humanity – nature relationships, (b) curriculum planning framework, (c) the eight principles for sustainable universities and some features specific to technology education considerations, such as (d) ESD aims for technology education and (e) sustainable product design as one of the main learning activities.

## The Model and Its Development

### *General Starting Points*

#### Theoretical Perspectives on Sustainable Development: The Humanity – Nature Relationships

The frame of mind approach advocated earlier and the nature and structure of proposed responses towards sustainability issues have been used as the basis for the development of teaching and learning approaches. It was agreed that students should be familiar with the technical fix and value change approaches and that they should formulate their own opinion as to what the balance between these two should be. Through classroom activities and assignments, students have an opportunity to formulate their understandings of the relative importance of technology and individual human responsibility: individual attitudes towards nature versus more pragmatic and collective approaches oriented towards efficiency gains and improvements in technology. The three pillars of sustainability were integrated in the content of courses. Their links were also a point of discussion for students. Moral values were accepted as the underpinning for all learning activities. Students had an opportunity to reflect on their values and consider responsibility as an important factor to be accounted for and act upon.

**Curriculum Planning Framework: Nature of Knowledge**

The curriculum planning framework discussed in Chapter 5 was applied at the level of courses within the programme. At the programme level, the *nature of knowledge* in the current era was used to integrate cognitive, practical and aesthetic components of the planning framework. On the level of knowledge generation, the discourse on what knowledge is and what is worthwhile knowledge, was employed to explore the concept of university knowledge. The arguments in the philosophical and sociological literature demonstrate the ways in which new forms of economic, political and cultural relations influence the production and dissemination of knowledge and on understanding of its changing nature. Disputes over what constitutes knowledge (see for example, Connell, 1995; Dewey, 1933; Habermas, 1968/1994; Lyotard, 1979/1984; Stehr & Ericson, 1992; Toulmin, 1972, 1995; Young, 1971) are important standpoints for both modern and postmodern discourses. Modernist theories of knowledge aim to prevent interests, desires and values from influencing the objective outcomes. Objectivity is obtained through carefully controlled scientific methods, which lead to a unified system of knowledge. Therefore, progress is generally viewed as "movement toward a single, absolute truth by revealing universal principles obtained by a unified method of science" (Connell, 1995, p. 2).

Postmodernity is not an alternative to modernism: It is rather a critique of it (Coulby & Jones, 1995; Green, 1994). The concept of postmodernity is very diverse, eclectic and non-systematic. It is a body of ideas, which demonstrate a scepticism "towards the 'Enlightenment meta-narratives' of universalism, unity, reason and progress" (Green, 1994, p. 68). One powerful aspect of a postmodernist critique concerns knowledge. "No truth system is seen as being superior. Individual taste and discrimination are encouraged, eclecticism prized and all canons subjected to furious attack … modernist knowledge … no longer carries any widespread legitimacy" (Coulby & Jones, 1995, p. 37).

As argued by Pavlova and Maclean (2007), the dichotomies presented in this discourse, such as universal versus particular, formal versus experience-based, value-neutral versus value-laden, bounded versus unbounded, search for truth versus utilitarian and context-free versus context-dependent, position university knowledge much more closely to the individual than the discipline, to *person's subjectivity, needs and experiences*. The pedagogy that combines elements of both modernism and postmodernism was described by Huckle (1996) as the one that should draw on:

> modernity's concern for the enlightened subject and its insistence that we link memory, agency and reason to the construction of a democratic public sphere. This need not mean a commitment to master narratives or universal rationality, knowledge and values, but it does mean rejecting total relativism and accepting that it is possible to judge one validity claim against another in specific circumstances. (p. 115)

In the modern world the emphasis is on "personal responsibility for learning through the provision of rich learning environments" (Staron, Jasinski, & Weatherley, 2006, p. 49). Therefore, in the established framework, students, not the disciplines, are at the centre. Students construct their knowledge and understanding as a

result of multiple experiences they have through learning different courses within the programme and their experiences outside the programme. Experiential learning is therefore a central element of the pedagogical approaches within the programme. Students' agentic actions shape their engagement in the learning processes. Agentic action refers to "acts done intentionally" (Bandura, 2001, p. 6). Through agentic action students create learning strategies that enable them to realise desired outcomes. "The core features of agency enable people to play a part in their self-development, adaptation, and self-renewal with changing times" (Bandura, 2001, p. 2).

### Eight Principles

The third starting point for conceptualising ESD reform for the BTechEd programme is the criterion for assessing the sustainability performance of a university, developed by the University Leaders for a Sustainable Future (ULSF), which is a network of university academics and administrators who work cooperatively to implement a sustainability agenda. As they have argued, they have a responsibility to increase awareness, improve knowledge, create technologies and impart the moral vision that lead to a sustainable future and a high quality of life for future generations (Bekessy *et al.*, 2003, p. 4). They identified seven criteria for assessing sustainable performance. A report on ESD in Australian and some international universities (Bekessy *et al*., 2003, p. 15) has developed the criteria further and added one more criterion. A number of characteristics that reflect a mature university approach towards sustainability as defined in that report (Bekessy *et al*., 2003) are as follows:

- Articulation of social responsibility in the institutional mission and structures;
- Integration of social, economic and environmental sustainability across the curriculum;
- Academic research on sustainability and consideration of social, economic and environmental sustainability issues in all other research;
- Outreach and services, including the development of partnerships with schools, government, non-governmental organisations and industry;
- Sustainable institutional operations, including effective monitoring and reporting;
- Staff development and rewards;
- Student opportunities; and
- Cultural inclusivity.

These criteria present some structural requirements that can be viewed as appropriate at the programme levels as well. Thus, they were considered as the points to account for in the ESD programme re-design and evaluation of results.

## *Programme Specific Starting Points*

Both specific starting points relate to the curriculum planning framework.

### Aims of Technology Education in Relation to SD

The first consideration specific to technology education (TE) relates to its aims. TE is a multifaceted learning area that is interpreted differently by different teachers: some of them put more emphasis on technical aspects of technology, some on its social or environmental impact, some on its engineering side and some on product design. Discussion about the nature of TE is presented in Chapter 1. Students in the BTechEd programme are encouraged to formulate their own philosophy of TE; the author's definition is as follows:

> Technology education is a learning area that provides an opportunity for students to understand the nature of technology and its relationships with society and the environment, and to design and make artefacts in accordance with the principles of sustainable development which take into account different dimensions of development such as social, economic and environmental.
>
> Through their studies students are encouraged to explore human needs and respond by using technology to transform materials, information and energy. Student-centred teaching strategies help students to develop personal qualities, such as responsibility towards the current world and further generations, the ability to solve problems, demonstrate initiative and acquire required skills and knowledge. Technology education is inherently interesting.

In this definition sustainability and sustainable design both assume an important position. The aims of TE used for the model development and stated in the previous chapter informed teaching and learning across a number of courses. The aims are:

- To know and understand SD problems/issues;
- To contribute towards the promotion of, and increasing awareness about, ideas of sustainable development through projects/activities;
- To design and make products in accordance with eco-design principles;
- To work with sustainable development practices;
- To discuss and appreciate the relationships between aesthetics and ethics for sustainability; and
- To consider aesthetics as a powerful feature of product design closely related to sustainable consumption.

### Sustainable Design

The second consideration specific to TE is the nature of sustainable design, which spans a number of the eight university principles as one of the main learning activities. Research into sustainable product design identified a number of practical approaches established within the profession, some of which were discussed in Chapter 4. Professional designers developed the notion of appropriate technology into the sustainable design principles for their profession. For them, the key aspect of "sustainable product design" is the "addition and balancing of social and ethical issues, alongside environmental and economic issues, into the product design process" (Charter & Chick, 1997, p. 5). Categories such

as economic, environmental, social and ethical/moral aspects of design – have been the topic of discussion in relation to corporate social responsibility since the 1970s and have gradually been incorporated into an agenda for the design profession. These principles were discussed with BTechEd students through a number of courses.

## Case Study – The Model Implementation

Five starting points for the model development presented above provided a broad approach for the programme re-design on the basis of ESD. It was accepted that students should be familiar with theoretical perspectives on SD and that, through classroom activities and assignments, students should formulate their understandings and attitudes towards SD issues and their application to TE. Economic, environmental and social aspects of SD were considered in the programme with moral values underlying all teaching. It was also accepted that knowledge developed by the students has a closer association with students' subjectivity, needs and experiences than with university disciplines, thus, cross-disciplinary and cross-courses approaches should be used to address sustainability through the programme, through a number of pedagogical and workshop-based courses as well as active methods of learning including research on SD issues. Eight university principles were used as a checklist for the introduction of the ESD changes and for evaluation of the results. Two specifics to the TE area are ESD aims of technology education and sustainable design. These were used to formulate the goals for specific learning activities and in developing criteria for assessing students' design. This comprehensive approach towards programme re-design is presented in Fig. 6.1.

### *Analysis of Some Introduced Changes*

Some changes introduced to the programme are analysed below under the eight criteria for evaluating ESD performance of the programme.

#### Articulation of Social Responsibility in the Institutional Mission and Structures

Articulation of social responsibility has been formulated through a description of the graduate capabilities developed by the programme, in particular, capabilities relevant for understanding design and the nature of technology and TE. Another measure is the introduction of learning activities that are specifically focused on the social responsibility of the teacher and school and the introduction of assessment items through a number of the courses that stimulate students' reflections on the philosophy of education, the role of the teacher and ESD in technology education.

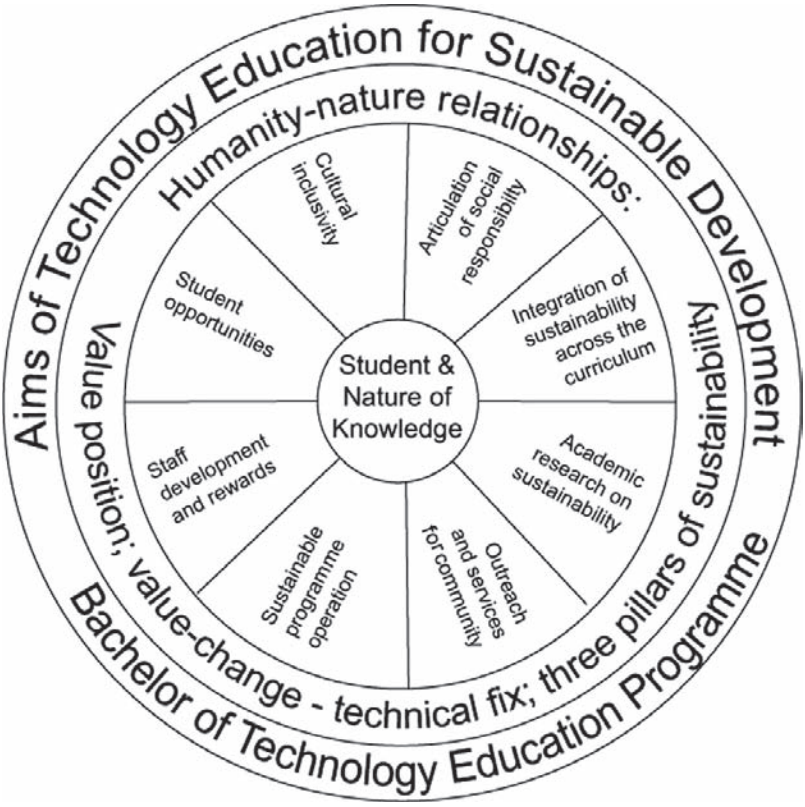


**Fig. 6.1** A model for incorporating ESD in a university teaching programme (Pavlova, in press, 2009)

### Integration of Social, Economic and Environmental Sustainability Across the Curriculum

The notions of SD and ESD have been introduced through the pedagogical courses such as: *Technology Education: The Professional Context; Technology Education: Curriculum Development; Issues in Technology Education*; and some workshop-based courses including *Product Design (Wood); Product Design (Plastics)*; and *Major Project*. For example, ESD is the major focus for *Product Design (Plastics)*, one out of six major research themes for *Issues in Technology Education* and one out of three contexts for design in the *Major Project*. All three aspects of ESD are addressed through these courses. Moral values and weak anthropocentrism as an ethic of SD are also examined.

In the *Product Design (Plastics)* course, students are asked to design and make a board game for children of a particular age over a period of 13 weeks. Students are expected to design and manufacture all of the game components including a container to package the game. The emphasis is on both the development of designing

and making skills and on learning about eco-technologies and the broad concepts of sustainable development. Through lectures a wide range of topics including plastics for a sustainable future, recycling, product analysis, properties and uses of plastics and board game design are covered as well as manufacturing techniques, design and safety issues.

Through the process of teaching, the lecturer observed students' reactions to the issues discussed and the approaches students used in their designs. This provided the basis for classroom reflections and discussions. A number of students were also interviewed to clarify their perspectives on SD, their approaches to the task, reflections of their learning experiences, satisfaction with the task and how a board game as a project may be used to develop awareness about SD issues (Pavlova & Turner, 2007). Students were selected on the basis of the differences in their approaches to the task as observed by the lecturer. The two types of beliefs about the way to achieve SD (technical fix and value change) could be clearly identified among the students interviewed. In the subsequent course, *Issues in Technology Education*, students are asked to research sustainability and education for sustainability to reflect on both positions and to research social, economic and environmental aspects of sustainability.

### Academic Research on Sustainability and Consideration of Social, Economic and Environmental Sustainability Issues in all Other Research

A research group has been established within the Faculty of Education Research Centre at Griffith University that includes academics from technology, vocational and mathematics education, to focus on the conceptualisation of ESD and ESD research at primary and secondary school levels in order to provide case study materials and other resources for university students and staff. Research Honours students have been involved in faculty research as well as with their Honours research projects. The research projects have been focused at regional/national and international levels. The results of these studies have been taken back into the BTechEd programme.

### Outreach and Services, Including the Development of Partnerships with Schools, Government, Non-government Organisations and Industry

Academic staff involved in the BTechEd are working closely with local schools. On a number of occasions academic staff have been approached by local schools for joint development and delivery of ESD projects, monitoring students' and teachers' involvements, attitudes and learning. On one occasion a school asked for help with their ESD project for Year 7 students. Another example is the programme links established with the Queensland Museum. In 2006 two fourth year students, through their *Major Project* course, designed and constructed a model of a sustainable house appropriate for the South East Queensland environment and developed teaching materials to be used with this model. Currently any Queensland

teacher can book this kit through the museum website and use it in the classroom. In 2007 another student designed a mechatronics kit that is also used to address sustainability issues and is currently on trial at schools. A further example is the author's participation in the work of the Queensland Studies Authority in revising the Technology Studies Syllabus for Year 11–12 high school students. Sustainable development issues were included as foundation knowledge required for this course and in assessment. Another service to the community is in-service training on ESD for technology teachers during the annual conference of the Queensland Industrial Technology and Design teachers association of Queensland (INTAD). These examples illustrate a variety of partnerships developed with schools and government agencies.

### Sustainable Institutional Operations, Including Effective Monitoring and Reporting

At the programme level the main issues that could be addressed through this criterion are supply and use of materials (wood, metal, plastic, etc.) and components. For example, students are always advised to minimise the use of materials through their design solutions and modelling procedures and through efficient preparation of materials. The latest technologies in 3D modelling provide the opportunity for our students to fix the majority of design problems prior to making their products. Thus, errors and wasted materials are minimised. Recycling practices are also in place in the workshops.

### Staff Development and Rewards

Through staff meetings, approaches to the formulation and implementation of the ESD framework were discussed. Opportunities to be involved in research, publishing and presenting at conferences were created.

### Student Opportunities

Students have the opportunity to receive a sustainable design award for their final project. In 2006 the award was presented to students for the design of a dismountable foundation and building slab made from concrete, the mixture as well as the structure of which were re-designed to achieve two major benefits: the structure can be re-used again and again (due to the collapsible nature of the structure, the foundation of the existing building could be dismantled and used for a new building) and due to the arched shape of the blocks making up the floor slab, the amount of concrete required and the percentage of cement in it were dramatically reduced. Another example of a students' award project (in 2007) is the design of a portable hydraulic device to assist farmers in removing star pickets from inaccessible terrain.

That device also removes pickets without damaging them so they can be re-used. Current removal techniques damage pickets and require tractor access. This solution saves energy and materials and applied a re-use principle.

**Cultural Inclusivity**

Through the learning activities, examples of design solutions from different cultures and for different cultures have been analysed with students. For some students these were eye-opening activities. These activities are mainly focused on the social aspect of sustainability through product analysis. The purpose of this analysis can be to understand how the product can *improve the quality of human life within earth's carrying capacity and conservation of the earth's vitality and diversity* (United Nations, 2001). This analysis can address a number of questions. Some of them were exemplified in Chapter 4, such as: is the product really needed; how does the product make life better for people; is it culturally acceptable for people who use it; does it build on the traditional wisdom and technology of the community; what is the impact on social relations; does it bring people together in a friendly way; will it enhance or diminish cultural diversity (Sustainable Design Award, 2004).

The case study presented here is an example of a coherent approach towards ESD university programme changes. This comprehensive programme re-design influenced a number of changes in students' attitudes and understandings of SD and ESD in TE, as illustrated by the results of the student survey outlined below.

## *Results of Student Survey*

In 2007, 22 fourth-year students were surveyed at the end of Semester 1. The aim of the survey was to identify the ways students learn about SD and their intention and readiness to implement ESD in their future teaching. The results highlighted the important role of the university in increasing awareness of sustainability for the students: the majority of students (16) found out about sustainable development from the university, 2 from their family, 2 from the building industry and 2 from the media. Fourteen students found out about SD in the second and third years of their university studies. Thus, the important role of the university in introducing a sustainability agenda to students' studies is apparent (Pavlova, in press, 2009).

For 14 students the concept of sustainable development did not attract their attention the first time they found out about it. However, when the students responded to the question "Do you see SD as an issue important for you now?", 21 responded "yes", while 22 responded "yes" to the question "Do you see SD as an issue important for your students in your forthcoming employment?". Nineteen students believed that they would be able to incorporate SD in their teaching, one respondent said "maybe", one responded "no" and one did not respond.

These results suggest that through the programme, the vast majority of students changed their neutral or uninformed attitude towards sustainability and now considered it an important issue for themselves and their future professional activity.

Students described SD in a number of ways. Some examples of their definitions were:

- "Energy and material preservation, manufacturing a product that has long useful life and can be recycled to allow for future generations to develop".
- "The ability to exist without creating further difficulties for future generations".
- "I see SD as an important part of current and future technology".
- "Obtaining needed resources and materials in a sustainable way".
- "Projects/activities/work programmes in applicable subject areas that promote the process of using materials that are/or can be recycled and/or materials or processes that conserve energy and make persons aware of sustainability in products and living. Conservation of Earth's resources with thought to pollution and future impact".
- "The way we are stewarding the world resources".
- "SD is the way in which products/processes are created to maintain the environment, social and economic justice. Or at least limit the negative impacts on these things".
- "A global effort to solve the problems caused by the past generations". (Pavlova, 2009)

These interpretations of SD highlight students' positions as they tried to find a balance between the technical fix and the value change approaches. Changes achieved through the programme and students' responses to the survey, identified the effectiveness of the measures taken in shaping graduates' intentions to address sustainability through their professional life as technology teachers. A coherent and multidimensional approach for introducing ESD is identified as the major contributing factor. This survey did not specifically focus on identifying ethical principles students would address through ESD in their teaching. There is the possibility then, that not all students would develop and implement a frame of mind approach. More should be done through the programme to address the values basis of SD. However, the results of this survey show that it is possible to influence students' attitudes towards ESD and that this could provide a basis for developing students' further understanding, conceptualisation and implementation of ESD.

## In-Service Training

Research suggests that technology teachers emphasise technical and economic values in comparison with moral values (e.g., Holdsworth & Conway, 1999). However, a number of international initiatives demonstrate that well focused teacher training provides very promising results. For example, Pitt and Lubben (in press, 2009)

analysed the effectiveness of the intervention project that provided professional development for teachers in England and Wales through the Sustainable Design Award (SDA) project. Their results distinguished between three types of teachers and the authors argued for different types of in-service training for each group:

> The uncommitted teachers (surfers) need clear guidance as to how sustainability can be related to curriculum requirements. This argues for working on policy makers to ensure that such requirements are explicitly stated in programmes of study. The teachers will then 'need' teaching materials that are easy to use in order to 'deliver' the knowledge to support sustainable development policy: they will be teaching *about* sustainable development.
>
> Teachers who are searching for a coherent philosophy for teaching D&T (the seekers) find a training and resources package such as the SDA [Sustainable Design Award] both stimulating and supportive. But they need further support in two areas: in identifying and dealing with clients with a coinciding sustainability agenda, and in finding ways of bringing the cultural, traditional and human rights aspects of the social dimension into the lives of their students. If this support is unsuccessful they will fall back on the environmental aspects of sustainability.
>
> Those teachers already committed to sustainability (the devotees) are supported by the SDA package, but it is important that CPD [Continuous Professional Development] providers make it clear that the social dimension is essential and that it can provide an overarching perspective. Some of these teachers reach some sort of a threshold in terms of their personal commitment.

The results of a research project conducted by Pavlova (2006) in Russia in 2005 are briefly examined here. There were no ESD resources or training programmes available for TE teachers at that time. Thus, it was the first attempt to identify possible ways of introducing ESD into technology teacher professional development in that country. A focus group of 20 TE teachers involved in an in-service training programme in Nizhny Novgorod was chosen for that study.

The purpose of the focus group was to reflect on SD concepts and issues introduced at the training seminar, reflect on their current practices, identify activities that meet the aims of ESD and develop ideas for new activities that could be used in TE classrooms and across the curriculum. Half the teachers were experienced technology teachers who were going through continuous in-service training and action research on the implementation of a design-based approach to TE within the Russian context. The other teachers were new in-service trainees who had just started to develop an understanding of what design means in TE. Although "experienced" teachers led the discussions, newcomers were fully involved and contributed their ideas.

A two-day seminar in August 2005 focused on the concepts of SD, issues associated with ESD and the ways it could be addressed via TE (some materials from the Sustainable Design Award (2004) website were used for the seminar). After the seminar, teachers were asked to reflect on these key issues and trial some of the activities. In November 2005, during a three-day seminar, teachers from the focus group were asked to reflect on their practice, to define ESD and to identify activities that could be used in TE to address SD concerns.

The analysis of data (Pavlova, 2006) demonstrated that the majority of participants defined ESD as developing moral values and responsibilities and changing the way people think. Examples of responses include:

> Teaching the students the notion of interdependence of all aspects of life on our planet: the link between technological innovations with the consequences of their impact on economic, environmental, moral and other changes in the life of further generations. *Developing moral issues and responsibility* for their lifestyle and for what they produce.
>
> Teaching to live not only today, but also *think* how future generations will live.
>
> ESD means developing your own decisions on the basis of obtained knowledge while teaching various technologies of making products. Feel joy and satisfaction; understand your own responsibility in the process of doing tasks. Evaluate the consequences of human activities and look for solutions. [Consider] sustainable and unsustainable technologies. *Developing students' social responsibility*.
>
> Education that *creates a way of thinking* that provides harmonious resolution of contradictions in various spheres. It makes it possible to improve the situation in economy, industry, environment and relationships between various nationalities.

Another group of responses demonstrated teachers' beliefs that technology could solve problems (such as the "technical fix" approach proposed by Robinson (2004)), although other humans' welfare should still be at the centre of the technological process. Again, as among pre-service teachers, both positions were represented.

When proposing the types of activities to be used or those that had been used in the classroom, teachers identified four major possibilities:

- Re-use products/packaging (students developed ideas on how to re-use plastic bottles. In their local context students can observe examples of bottle re-use);
- Use of industrial waste (timber, textile – patchwork, toys for childcare, metal) to design and make new products;
- Eco-technologies (alternative energy sources, interior design from natural forest materials);
- Social and cultural aspects of sustainability (re-birth of traditional crafts). (Pavlova, 2006)

All proposed activities were closely related to local contexts. Traditionally in Russia, "upbringing" (values development) has been seen as an important part of education. Therefore, teachers accepted the ideas of ESD with enthusiasm and saw them as already closely related to their practice. The teachers in their classrooms had used projects from each category, although they did not explicitly use the "frame of mind" or Vernadsky's (1945) approach to underpin all their teaching. When the teachers were asked to describe the sort of understandings and beliefs about sustainable development they hoped students would gain as a result of their ESD teaching, they depicted a positive person knowing, believing and acting in accord with an educated vision of a sustainable future and caring for others. Some of these characteristics are closely related to the competencies identified by Parker, Ninomiya and Cogan (1999) (see Chapter 3). For example, one version proposed by a group of teachers was that the student must be:

- Well educated in various spheres;
- Literate in environmental issues and has environmental culture;
- Able to apply his/her knowledge about SD in practice;
- An optimist, not afraid of obstacles, learns how to overcome difficulties;
- Morally sustainable; and should
- Believe in what he or she knows about and does in accordance with SD.

In terms of planning, teachers were planning for progression for Year 5–Year 7/8 (the first stage of secondary school when TE is a compulsory subject). Thus, a number of activities were planned for each year (please note that there are different TE programmes for boys and girls in Russia):

*Year 5* – introduction to the issues of SD; discussion of sustainability of some technological products; projects *Patchwork* for girls and *Product Made from Timber Waste* for boys (both subjects introduce re-cycle and re-use concepts).

*Year 6* – use of games to teach basics of SD and environmental issues essential for life; comparative design analysis of environmentally sustainable and unsustainable products; projects *Product Made of Metal Waste* for boys and *The Interior of the House: Eco-Design* for girls.

*Year 7* – dispute on energy for the future (coal, hydro, nuclear); work on a wall newsletter or a poster on environmental topics; project *The Second Life of the Packaging*.

This research project demonstrated that the teachers involved in professional development had accepted ESD as a framework for TE and were able to try out their ideas for activities in classroom practices and achieve positive results. Teachers observed students' attitudes towards activities and reported at the second seminar that the majority of students were interested and positive towards SD ideas. Therefore, in-service training was an effective ESD for technology teachers. Of course, through an in-service programme consisting of just two seminars, teachers did not have a chance to develop a frame of mind approach. That is, they did not have an opportunity to completely re-think the ways they were teaching. They were only able to demonstrate their positive attitude towards the concept, and identify and try out a number of activities. This study does indicate, however, that through professional development it is possible to influence teachers' understanding and acceptance of ESD as an important value and a framework for teaching. Nevertheless, there is a big gap between the introduction of several ESD activities into the classroom and a full acceptance of ESD as a frame of mind to underpin all classroom activities and provide a basis for developing a responsible attitude towards the "other".

## Conclusion

This chapter has addressed the issue of how teacher pre-service and in-service training programmes can be used to develop teachers' understanding of SD issues and the ways they could be addressed in their practice. A model developed to introduce and monitor the ESD programme changes at the university level is based on the analysis of SD and ESD and includes the following aspects: (a)

humanity – nature relationships, (b) curriculum planning framework: the nature of knowledge, (c) the eight principles for sustainable universities; (d) ESD aims for technology education and (e) sustainable product design as one of the main learning activities. This model includes general and specific considerations and it is focused on increasing awareness of SD issues, developing teachers' own attitudes towards them and increasing the probability of applying them in their future professional practice. Changes achieved through the programme proved the effectiveness of the measures taken in shaping graduates' intentions to address sustainability through their professional life as technology teachers. A coherent and multidimensional approach for change, together with problem-solving learning activities, helped to bridge the gap between theoretical thinking and curriculum opportunities, between learning activities and professional practices in students' learning.

In-service training for teachers was also identified as an appropriate way to introduce ESD into school practice. Teachers' classroom experiences, their understanding of pedagogy, ownership of the newly introduced SD concerns and collaborative work during the training sessions helped them to adjust their teaching to include ESD and to trial new activities quickly. They also observed the results of their work almost immediately through students' reactions and involvement, which encouraged them to try more activities. This was a a real benefit of the in-service training – the ability to apply new knowledge immediately, to exchange ideas with colleagues at the training sessions and to reflect on their own practice and the practice of others. To be successful, the training programme should account for the context, resources available and educational traditions. The empowering strategies for pre-service and in-service teacher education examined in this chapter help future and current teachers to be well prepared for ESD implementation.

Chapter 6 is the last chapter of the first part of this book that develops theoretical approaches and frameworks for SD and ESD analyses and interpretations. Together with some examples explored and models developed, this part could become a guideline for teachers to develop curriculum design and help them make informed decisions about how to develop ESD for technology and vocational education both at school and at university levels. The second part of this book is focused on SD and ESD initiatives in Russia to illustrate particularities of the specific context.

## References

Bandura, A. (2001). Social cognitive theory: An agentic perspective. *Annual Review Psychology, 52*, 1–26.

Bekessy, S., Burgman, M., Wright, T., Leal Filho, W., & Smith, M. (2003). Universities and sustainability. The Tela series, Issue 11, Australian Conservation Foundation, Melbourne, Vic.

Benedict, F. (1999). A systematic approach to sustainable environmental education. *Cambridge Journal of Education*, 29(3), 433–446.

Charter, M., & Chick, A. (1997). Welcome to the first issue of the Journal of Sustainable product design. *The Journal of Sustainable product Design, 1*, 5–6.

Connell, J. (1995). Reconstructing a modern definition of knowledge: A comparison of Toulmin and Dewey. *Philosophy of Education. Yearbook*, 1–6. Retrieved August 4, 1998, from http://www.ed.uiuc.edu/EPS/PES-Yearbook/95_docs/connell.html

Coulby, D., & Jones, C. (1995). *Postmodernity and European education systems: Cultural diversity and centralist knowledge*. London: Trentham Books.

Dewey, J. (1933). *How we think: A restatement of the relation of reflective thinking to the educative process*. Boston: D. C. Heath and Company.

Green, A. (1994). Postmodernism and state education. *Journal of Educational Policy, 9*, 67–83.

Habermas, J. (1994). *Knowledge and human interests* (J. J. Shapiro, Trans.). Cambridge: Polity Press. (Original work published 1968)

Hill, A. M., & Elshof, L. (2007). Sustainable practices as an aspect of technological literacy: Research findings from secondary school teachers' and their classrooms. In J. Dakers, W. Dow, & M. de Vries (Eds.), *Teaching and learning technological literacy in the classroom: The PATT-18 International Conference on Design and Technology Educational Research* (pp. 241–250). Glasgow: University of Glasgow Print Unit.

Holdsworth, I., & Conway, B. (1999). Investigating values in secondary design and technology education. *The Journal of Design and Technology Education, 4*(3), 205–214.

Huckle, J. (1996). Teacher education. In J. Huckle & S. Sterling (Eds.), *Education for sustainability* (pp.105–119). London: Earthscan Publications.

Lyotard, J.-F. (1984). *The postmodern condition: A report on knowledge* (G. Bennington & B. Massumi, Trans.). Manchester: Manchester University Press. (Original work published 1979)

Parker, W. C., Ninomiya, A., & Cogan, J. (1999). Educating world citizens: Toward multinational curriculum development. *American Educational Research Journal, 36*(2), 117–145.

Pavlova, M. (2006). Technology education for sustainable futures. *Design and Technology Education: An International Journal, 11*(2), 41–53.

Pavlova, M. (2007). *Two pathways, one destination: TVET for a sustainable future*. Conference report for the UNESCO-UNEVOC virtual conference, 22 October–10 November. Retrieved January 7, 2008, from http://www.unevoc.unesco.org/.

Pavlova (in press, 2009). Conceptualisation of technology education within the paradigm of sustainable development. *International Journal of Technology and Design Education*.

Pavlova, M., & Maclean, R. (2007). *Vocational and higher education: Some reasons to be together* International conference in TVET. Casablanca, April 2007.

Pavlova, M., & Turner, S. (2007). It's never too early: Education for sustainable development. *The International Journal of Environmental, Cultural, Economic and Social sustainability, 2*(7), 69–76.

Pitt, J., & Lubben, F. (in press, 2009). The social agenda of education for sustainable development within Design & Technology: The case of the Sustainable Design Award. *International Journal of Technology and Design Education*.

Robinson, J. (2004). Squaring the circle? Some thoughts on the idea of sustainable development. *Ecological Economics*, *48*, 369–384.

Staron, M., Jasinski, M., & Weatherley, R. (2006). *Life based learning: A strength based approach for capability development in vocational and technical education*. A report on the research project "Designing professional Development for the Knowledge Era". TAFE NSW: Darlinghurst, NSW.

Stehr, N., & Ericson, R. V. (1992). The culture and power of knowledge in modern society. In N. Stehr & R. V. Ericson (Eds.), *The culture and the power of knowledge: Inquiries into contemporary societies* (pp. 3–19). New York: Walter de Gruyter.

Sustainable Design Award. (2004). *Sustainable design awards online*. Retrieved May 9, 2006, from www.sda-uk.org.

Toulmin, S. (1972). *Human understanding* (Vol. 1). Oxford: Clarendon Press.

Toulmin, S. (1995). Foreword. In R. F. Goodman & W. R. Fisher (Eds.), *Rethinking knowledge: Reflection across the disciplines* (pp. ix–xv). Albany: State University of New York Press.

United Nations. (2001). Indicators of sustainable development. CSD theme indicator framework: social. Retrieved November 20, 2003, from http://www.un.org/esa/sustdev/natlinfo/indicators/isdms2001/table_4.htm.

UNESCO. (2005). *United Nations Decade of Education for Sustainable Development 2005–2014. International Implementation Scheme*. Draft, January 2005. Paris: UNESCO.

University Leaders for a Sustainable Future (2001). Retrieved October 21, 2001, from http://www.ulsf.org/programs_talloires.html.

Vernadsky, V. I. (1945). The biosphere and the noosphere. *American Scientist, 33*, 1–12.

Young, M. F. D. (Ed.). (1971). *Knowledge and control: New directions for the sociology of education*. London: Collier-Macmillan.

# Case Study – Russia

*This page intentionally left blank*

# Chapter 7
# Modernisation of Russian Education

This chapter opens the second part of the book that presents Russia as a case study and illustrates a number of points argued in the first part of the book. This part consists of three chapters and focuses on the current processes of modernisation of Russian education, the ways sustainable development (SD) is conceptualised and the approaches taken towards education for sustainable development (ESD). Russia was chosen for this case study as an example of a country that has gone through a period of transition from one type of society to another. On the one hand, this transition provides more challenges in addressing issues of SD; on the other hand, it may provide more opportunities to change society to the path of SD and to empower individuals through capabilities development through ESD. Another reason for choosing Russia was its intellectual tradition of considering "global issues" (such as nöosphere) and producing original scientific theories in the natural sciences. This chapter provides a background to the Russian educational system and describes recent changes in its structure, content and management, with some examples from technology and vocational education. It identifies some opportunities for ESD within the system.

## Educational Policy of Russia in the Period of Transition

After the revolution of 1917 there was a strong belief that transmission of a universal curriculum was a route to liberty, equality and fraternity. These ideas found their roots in the French revolution. The underlying value of the educational policy of the French Third Republic was that:

> the nation as a whole was supposed to win its freedom through the spread of new domains of knowledge to the population.… The State resorts to the narrative of freedom every time it assumes direct control over the training of the 'people', under the name of the 'nation', in order to point them down the path of progress. (Lyotard, 1979/1984, p. 32)

The same relationship between education and the state characterised Soviet Russia. Central control of the school curriculum became the main managing principle throughout the Soviet era and beyond. All students had to follow the same school

M. Pavlova, *Technology and Vocational Education for Sustainable Development*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 10, DOI 10.1007/978-1-4020-5279-8_8, © Springer Science+Business Media B.V. 2009

curriculum. The main objectives and the content of each subject were also the same. This approach implied uniformity of students' achievement and school quality. The process of learning was mainly focused on the acquisition of systematic knowledge. The knowledge base of education was formulated within an encyclopaedist tradition, established on the ideas of Comenius, with the belief that all students should acquire as much knowledge as possible about all valid subjects appropriate to their age. "Pansofia", or general wisdom, was considered as the broad aim of education.

All educational reforms in the Soviet Union were formulated through "top down" orders. They attempted to change the educational system and to keep society stable. At the end of the 1980s, educational institutions were among the first to react to the stagnation in Soviet society. The reforms of 1984 and 1988 did not bring a desirable result; by the end of the 1980s the need for a more radical educational reform became evident. The content of education and the life of every school remained ideologically controlled, with power concentrated at the state level. Neither parents, students nor employers could contribute to the development of an educational system which was unable to react to the needs of the individual, society or the economy.

At that time a "root" movement called "Pedagogy of Cooperation" brought some fresh ideas. Progressive teachers from different parts of the Soviet Union (about 10 people) met on several occasions to develop the principles of a new pedagogy. The main ideas developed from their practice were to emphasise the active nature of learning and the need to put students at the centre of the educational process. At the All-Union Congress of Teachers in 1989 these ideas provided the basis for discussion of priorities for educational reform in the country. The breakdown of the Soviet Union in 1991 meant the establishment of a new educational system for the new Russia. President Yeltsin's first order was for the development of education. In June 1992, a law on education was passed through the parliament. The principles of a new educational policy were approved as part of the law. They included the "humanisation" (orientation towards students) and "humanitarisation" (including more humanity studies in the curriculum) of education, decentralisation, school diversification and reform of teacher training. The essence of the 1992 law was the move from a *political paradigm to a teaching paradigm* and from *totalitarian society to a civic society* (Russian Federation, Federal Law, 1996). Some amendments to the law were approved in 1996.

This law on education shared responsibility for curriculum development across three levels: federal, regional and local. Regional and school-based components of the curriculum were introduced to provide more flexibility for teachers and curriculum development. The federal (compulsory) component of the curriculum defined by the standards was viewed as a minimum level of education guaranteed by the state in order to maintain the quality of education (Ministry of Education of Russia, 1996a). Therefore the first step in reforming the content of education was related to the development of federal education standards. To define them, an open tender was announced. Six proposals were selected out of 150. For the first time in the history of Russian education a collegial decision was made.

On the basis of the educational law a federal programme of educational development was designed, again through an open tender process. The programme was

adopted in 1994 and focused on the transition to a balanced development of education in the new political and socio-economic conditions and on diversification of the content of education and the types of schools. Some progress was achieved by the end of 1995 (Ministry of Education of Russia, 1996b): different types of schools were established; national and regional programmes of development of education were being designed to take into consideration the specific contexts of different parts of Russia; educational management was decentralised (there were now four levels of decision making – the federal ministry, the main regional authorities within the Russian Federation, local educational authorities within cities and regions and individual school boards); and the various public interest groups were becoming increasingly involved in the development of the educational system.

However, in spite of these results, the main aims of the transition to balanced development and to overcoming the ongoing crisis in education, were not achieved (Ministry of Education of Russia, 1996b). A lack of funding was viewed as the major contributing factor. Carrying out the reform under the conditions of economic and political instability provoked conflicts inside the educational system. The instability of Russian society in all spheres of life, particularly after the 1998 crisis, questioned the possibility of stable development of education.

## The *Strategy* of Modernisation

The important role education plays in the life of society brought the agenda of educational reform back to the political discussions quite soon after the crisis. In 2000 the Government of the Russian Federation approved a *National Doctrine on Education* (Government of the Russian Federation, 2000) that stated a priority for education in the state policy and the main directions for its development. The process of educational modernisation (educational reform) occurred concurrently with a decade of intensive economic reform. Unlike the economic reforms which were implemented relatively unopposed (the need for a transition to a market economy was accepted by the majority), *the educational reforms have encountered a clash between two major groups*. Both groups claimed that the aim of educational reform was to adjust the education system to achieve socio-economic changes. However, they understood this "civilising" process differently, which implied radically different visions of the ways it could be achieved. The first group argued for a path based on the development of people in line with market values, which were new to the Russian education system. The second group suggested that the prior system that produced knowledgeable people was still relevant and therefore, should be taken into account in the process of any educational reform. A compromise between these views was reached in *The Strategy of Modernisation* (The Ministry of Education of the Russian Federation, National Fund for Personal Training, 2001), the document that formulated aims, objectives and directions for the action plan for Russian education development for the period until 2010. It was formulated in accordance with the National Doctrine on Education (Government of the Russian Federation, 2000).

The modernisation of Russian education started in 2001. *The Strategy of Modernisation* set up a number of aims for educational reform in Russia at the structural, legal and curriculum levels. It aimed to overcome the decline in the quality of education to achieve modernisation of the whole country. Four priorities for state policy were identified in the strategy:

- State guarantee of accessibility of education (e.g., free complete general education to the extent of the educational standards; introduction of the unified (the same across the whole country) exit school exam that would be used for university entrance as well);
- Increasing the quality of general education (e.g., orientation of education away from just knowledge transmission towards student development; values integration into the process of learning; restructuring of education and change of its content; consideration of 12 years of schooling);
- Increasing the quality of vocational education including VET and higher education (e.g., reform content and structure of vocational education in accordance with industry and economy demands, demands of culture and state employment system; increased flexibility; monitor changes in the market; share responsibility between the federal and regional governments in financing vocational institutions; develop an updated list of occupations; consider different models of integration between initial and secondary vocational education and secondary vocational and higher education);
- Development of effective financial relationships in education (e.g., increase of state's support; development of variety of models in financing educational institutions; tax deductions for educational activities; development of non-formal education).

At all levels of education the major aspect of reform was the modernisation of *curriculum content* as a way of reaching a compromise between traditional cultural values and educational traditions *and* the new demands of international economic development. In that sense, a mixture of modern and late-modern components was proposed within one educational system. As discussed in Chapter 2, the emphasis of the late-modern models of education is on the strongest ideological pairing between education and knowledge/competition of the international economy. The modern models of education emphasise equality of educational opportunity and have a strong ideological pairing with the development of citizenship and the domination of political and civic discourses over economic ones (Cowen, 1996). Two important concepts that represent the above tensions in general education are the introduction of culture-based key competencies and profile education.

## *The Shift from Science-Orientation to Culture-Orientation in the Modernisation of Russian Education*

The major premise of the *Strategy of Modernisation* (Ministry of Education of the Russian Federation, National Fund for Personal Training, 2001) for the Russian

educational system is that the content of education should be structured in terms of the different spheres of human activities that collectively constitute culture: the cognitive, civic-social, socio-working, household and culture-leisure spheres of activity. This represents a significant change from previous beliefs. Twenty years ago the aim of Russian school had been to provide systematic scientific knowledge and skills. Now, "education is the process of pedagogically organized socialization aimed at the interests of person and society" (Lebedev & Neupokojeva, 2001, p. 11). The person should be socialised into Russian culture. Before the strategy of modernisation was introduced, two equally important aims of education, namely, to educate and to nurture people, were separated. Now the current policy of modernisation points to socialisation via education. Socialisation, according to Lebedev and Neupokoeva, is understood as "mastering the culture of society, which provides a possibility for a person to be the subject of activity, to carry out different social roles" (p. 11). Mastering of culture is viewed as a basis for developing the capacity of a student to act.

The shift from understanding mastery in terms of science to understanding mastery in terms of culture is important and now constitutes the major focus of educational reform in Russia. Lebedev (2001) argues that the major goal of general education is not related to the accumulation of knowledge from different disciplines, but to the development of the universal ability to solve problems in any sphere of activity. The main emphasis in the modernisation of school content is on the development of the "cultural" person who would potentially be able to solve problems in different fields. Thus, a potential ability to solve problems is considered as a major goal of education.

*Competencies identified in Russia are full of particular knowledge and understanding*. They are considered to be suitable for the Russian educational tradition and to provide a structure for developing a systematic, scientifically based vision of the world and spirituality and to prepare students for involvement in appropriate social activities (The Ministry of Education of the Russian Federation, National Fund for Personal Training, 2001, pp. 4–5).

The structure of *key* competencies is as follows:

- Competencies in the sphere of cognitive activities (based on methods of mastering strategies for acquiring knowledge from different sources of information);
- Competencies in the sphere of civil-social activities (roles of the citizen, voter, consumer);
- Competencies in the sphere of socio-working activities (including the ability to analyse the situation in the labour market, evaluate personal professional abilities, orient to the norms and ethics of labour relationship, etc.);
- Competencies in the household sphere (including the aspects of health, family well-being, etc.); and
- Competencies in the sphere of culture-leisure activities (including choices in ways of using free of work time that culturally and spiritually enrich the person).

Within the strategy of the content modernisation of general education (The Ministry of Education of the Russian Federation, National Fund for Personal

Training, 2001), it is argued that this list of competences represents a systematic approach for competency development. They are broader than competencies related only to working life. Thus, they provide the major directions for the development of a "new generation of standards" for Russian schools that should include a re-orientation from the content-based approach to the activity-based approach in teaching and learning. Therefore, the outcomes of learning should be formulated through the patterns of activities.

## *Profile Education*

Profile education as an example of the vocationalisation of secondary schooling was briefly discussed in Chapter 1. It was introduced in 2002 and theorised in the *Concept of profile education* (Ministry of Education of the Russian Federation, the Russian Academy of Education, 2002). It is closely related to the notion of training students for the needs of the economy and it set up a clear opportunity to develop a modern system of lifelong vocational education. As students need to make important decisions after Year 9 that relate to their further study, a new strategy of the pre-profile education was introduced to help them make those choices. Profile education provides students with an opportunity to study a chosen area in depth, usually one related to their further study. The following profiles are suggested as examples (schools can design their own profiles): science, socio-economics, humanities, technology, universal (non-profile) profiles. Since the *Concept of profile education* was approved by the ministry in 2002, the trialling of this approach has progressed in many regions of Russia.

Profile education is oriented towards increasing opportunities for students to choose individual study trajectories. There is also a provision for individual pathways to be developed so students can combine study at different educational institutions (Government of the Russian Federation, 2004). The concept identifies the structure of profile education, which includes:

- Subjects compulsory for all profiles at the basic level of complexity (mathematics, history, Russian and foreign languages, physical education, integrated courses on social studies for non-humanity profiles and science for humanity profile);
- Profile subjects – in-depth studies that shape the profile (e.g., chemistry, physics, biology for the science profile; literature, Russian and foreign languages for the humanities profile; history, law, economics for the socio-economic profile);
- Electives – courses that supports the compulsory subjects of the profile or constitute a specialisation within the profile (e.g., ecology, chemical technologies for the science profile).

The approximate proportion of teaching time across these three components is 50:30:20. Profile subjects are compulsory for students who choose each particular profile. General and profile subjects are defined by federal standards. Electives are a response to differing regional needs, so schools or the regional education authorities decide on their content.

Different organisational models are proposed in the Concept to support profile education: one profile or multi-profile *main school model*s or *network models*. Two versions of the network models are proposed:

- A number of main schools select one "resource school" that can deliver a particular profile. All schools in the net deliver general and elective courses and some profile courses. The resource school delivers the remaining profile courses.
- The student has an opportunity to study profile in TVET institutions, non-formal education and through the system of distance learning.

Schools make the decision on what profile to deliver and whether it not to deliver the profile (it is possible to keep a general education approach). Profile education pushes students to make an important choice – a preliminary decision on the future directions (profile) of their vocational occupation.

## Educational System

The process of modernisation also influenced the structure of education. Compulsory education in Russia comprises nine years of schooling. Children commence school at the age of six or seven, attending primary school for four years. Secondary school (Year 5 – Year 11) consists of two components: Year 5 – Year 9 is compulsory (basic general education) and Year 10 – Year 11 is non-compulsory (complete general education). After Year 9, students decide to either leave the main secondary school and go to work or to study at different types of vocational schools, or to stay in the main school for another two years. The state guarantees free complete general education for all.

*Vocational education in Russia is structured at three levels and refers to any post-general education that provides training for a career*. The first level is initial vocational education. It is aimed to train skilled workers for all branches of the economy and social spheres. A traditional type of vocational school at this level is called professional – technical school (PTU). Students can study there for two to three years after graduating from Year 9 or study for one to two years after graduating from Year 11. A new type of institution established in recent years is the vocational lyceum. Students graduating from a lyceum receive a higher level of qualification compared to the PTU graduates. Over the last 10 years the number of students enrolled in initial vocational education has declined; however, it is still an important component of the educational system. It provides an opportunity for some disadvantaged students to receive vocational certificates and earn money as well as continue their general education. Before the Soviet Union collapsed, initial vocational education provided training in 1400 occupations. After a number of reforms, training is now conducted within 38 groups of professions for 280 integrated occupations. This re-organisation started after A *Concept of educational reform of the initial vocational education* was approved (Government of the Russian Federation,

1997). The revised list of occupations was approved in 1999 (Government of the Russian Federation, 1999) and new standards have been developed (Ministry of Education of the Russian Federation, 1999). Each standard includes occupational characteristics of the particular employment and a federal component of the vocational content.

The second level of vocational education is a secondary vocational education that provides training of mid-level specialists and technicians. It is organised on the basis of two main educational programmes – basic and advanced. After the basic level graduates receive the qualification of technician; after the advanced level (one additional year) that of chief technician. Every year 11% of Year 9 graduates and 23% of Year 11 graduates enrol in secondary vocational education (Review of vocational education development in 2001–2002). The content of education is regulated by the State *Standards* for second level vocational education and consists of two parts: federal and regional. Secondary vocational education is delivered by secondary and post-secondary vocational institutions and technical colleges. Colleges provide the next level of advanced training. One more year of training in colleges provides graduates with direct entry to the second year of higher education institutions. The second level of vocational education is equivalent, according to UNESCO's international standards classification, to practice-oriented higher education or pre-university higher education (The programme of vocational education development, 2004).

In 2002 a framework for secondary vocational schools to deliver a complete general education as part of secondary vocational education was developed by the Ministry of Education (Ministry of Education of the Russian Federation, 2002b). This applies to students who enrol in the system after Year 9. Similar to the main school, the compulsory part of the curriculum includes a federal component of 1632 teaching hours. This component guarantees the quality of education and the ability to move to further levels of education and it includes: philology/language (272 hours), mathematics (272), social science (340), science (408) physical education (204) and technology (136). It is recommended that 1404 hours of the federal component be covered in the first year and the rest in the second year. The total number of teaching hours in any year is 2106 (54 hours per week).

The component of general education in the secondary vocational schools can be organised within five profiles of general education: humanities, education, socio-economic, technical and science. Some variations in teaching hours across these profiles were proposed in the document (Ministry of Education of the Russian Federation, 2002b) (Table 7.1).

Ecology is not compulsory. However, it is included in all profiles as a subject in the science learning area with 39 hours allocated to it. Technology education is a compulsory area of study. This profilisation allows students to focus their general education on the areas that interest them more and that are related to the field of their vocational interest.

Another measure that brings vocational education closer to the needs of students is one proposed in the *Concept of profile education at the senior stage of general education* (Ministry of Education of the Russian Federation, the Russian Academy of Education, 2002). This measure allows students to choose an emphasis on

**Table 7.1** Proposed time spread between different profiles and learning areas (in hours)

| Learning areas and subjects | Humanities | Education | Socio-economic | Technical | Science |
|---|---|---|---|---|---|
| Philology/ language | 390 | 351 | 273 | 273 | 273 |
| Mathematics | 234 | 234 | 273 | 273 | 234 |
| Social science | 273 | 273 | 273 | 234 | 273 |
| Science | 273 | 351 | 351 | 390 | 429 |
| Physical education | 195 | 156 | 195 | 195 | 156 |
| Technology | 39 | 39 | 39 | 39 | 39 |
| Total | 1404 | 1404 | 1404 | 1404 | 1404 |

vocational or general studies while enrolled within a VET institution. The Concept highlights the need to change current approaches to the senior stage of vocational schooling. Traditionally, students' studies were based on two sets of standards: the general education and vocational standards. That led to an overcrowded curriculum and decrease in the quality of learning. The following model was proposed in the Concept for graduates of Year 9 who continue their study at the initial or secondary levels of vocational education:

Two compulsory modules of general education are:

- Main (profile oriented) module of general education (500–700 hours). This module includes a number of general subjects that help to understand better the specialised subjects and an integrated humanities course aimed at the general cultural development of students;
- Modules for developing general capabilities (300 hours). This module develops capabilities required to adapt successfully to the labour market.

After studies of the above two modules, students are divided into two groups on the bases of their interests and the results of their studies. Curriculum for these two groups differs in terms of the ratio between general and vocational education. In the first group, a majority of students continue to study vocational capabilities in depth. Later in their life they will have an opportunity to sit the standardised state exam and enter the university system after some additional training.

The second group includes students who successfully studied the major general module and who are planning to continue their studies in the higher education sector. They continue to study vocation skills towards a low level of certification and they study an additional general education module in preparation for the standardised state exam. They can study this module in vocational school or in the nearest main school. As a result of this model the whole length of study is not expanded for the student; however, school resources are used more effectively due to the clearly identified emphasis with two different programmes (two groups). The presence of a substantial part of the general education within the vocational education system is a specific characteristic of VET in Russia. Technology education as well as ecology,

forms part of general education. It is possible to apply a value-change approach to ESD through the general education component of vocational education. Another vehicle for doing this is the vocational courses that directly prepare students for future occupations. These courses could include a technical-fix approach that relates to technical solutions of the ecological problems.

The major difference between the first two levels of VET is the depth of study, which usually depends on the specialisation. For example, designers would be trained at the second level and tailors at the initial level of vocational education. The number of students who are enrolled in initial level vocational education has declined during the last 10 years by 17% (Vocational Education, 2003), whereas the number of students who are enrolled in second level vocational education has increased by 27% during the last five years (Russian Education by 2001: Analytical overview). Figures 7.1, 7.2, 7.3 and 7.4 show these trends in more detail. This demonstrates a trend towards higher levels of education and the re-establishment of the role of education in society in terms of career opportunities.

The third level of vocational education is higher education, with three types of institutions involved: universities, academies and institutes. These institutions (VUZ) also provide a post-university form of vocational education at the level of *Kandidat Nauk* degree (research degree that is accepted as PhD in other countries), then the PhD degrees and then the postdoctoral studies, as well as in-service

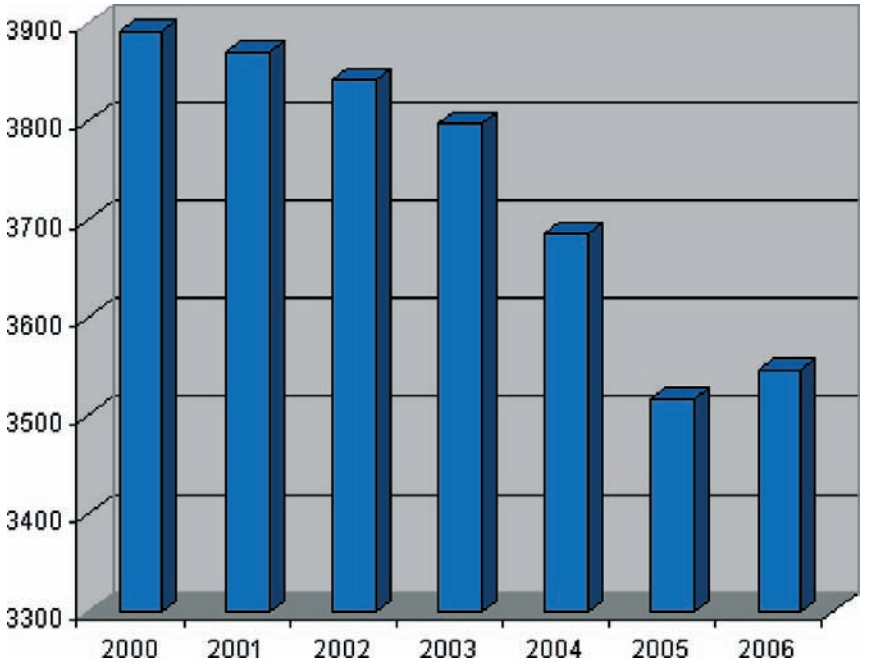


**Fig. 7.1** The number of initial vocational training schools (taken from Statistics of Education website http://stat.edu.ru/smi/graf8.shtml)

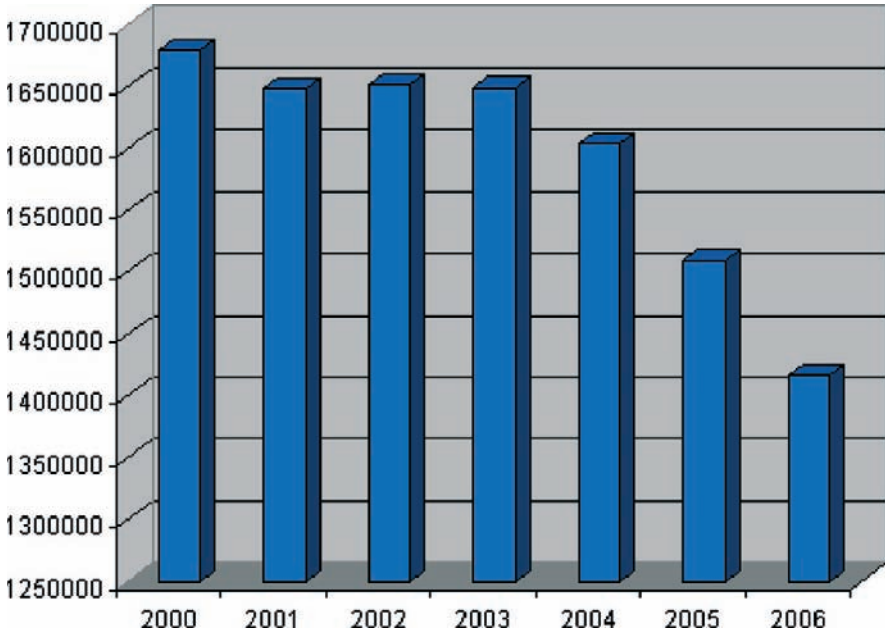


**Fig. 7.2** The number of students in the initial vocational training schools (taken from Statistics of Education website http://stat.edu.ru/smi/graf9.shtml)

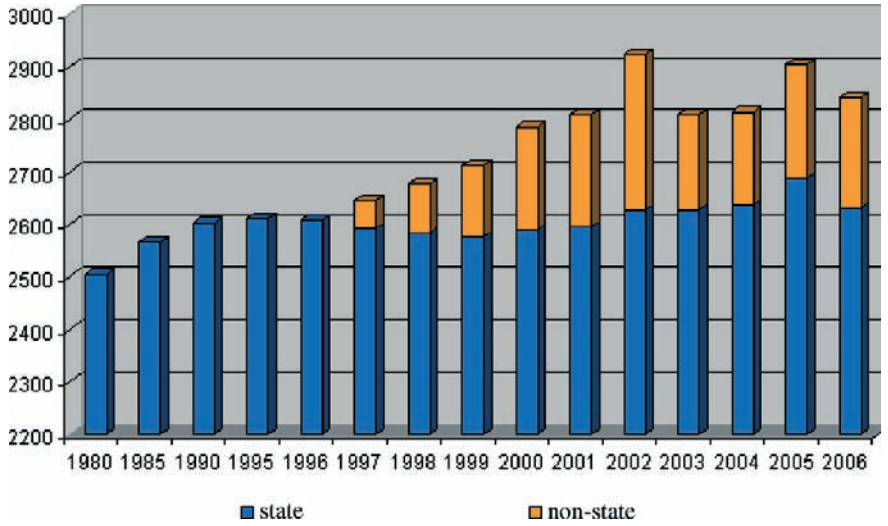


**Fig. 7.3** The number of the secondary vocational training schools (taken from Statistics of Education website http://stat.edu.ru/smi/graf10.shtml)

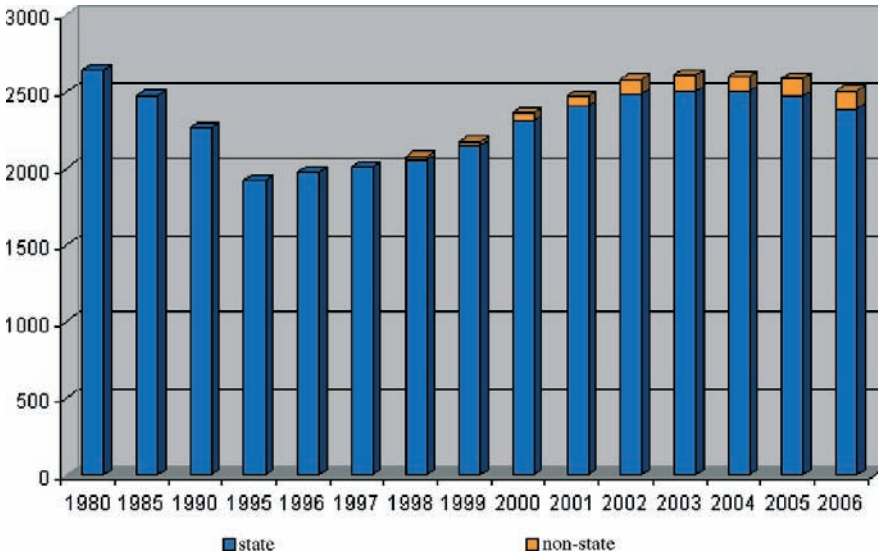


**Fig. 7.4** The number of students in the secondary vocational training schools (taken from Statistics of Education website http://stat.edu.ru/smi/graf11.shtml)

training for higher education staff. The content of educational programmes, number of teaching hours and requirements for graduates' qualities are specified by the state educational standards for higher education. Students can study full-time, part-time, or externally (a mixture of remote study and short on-campus intensive sessions).

After a decline in the number of students in higher education during the middle of the 1990s (in 1995 it was 189 students per 10,000 people), the number of students is now growing (see Figs. 7.5 & 7.6). In 2000 the number of students per 10,000 people was 327 (Statistics of Russian Education). In 2004 the system of higher education in Russia included 607 state and 358 non-state higher education institutions in which 4.7 million students were enrolled. The staff of the state universities, academies and institutes (VUZ) number around 265,000 academics. Higher education prepares students for more than 350 specialisations and 82 institutions are training technology education teachers (Statistics of Russian Education).

Staging education in multiple levels is a new model for higher education with the aim of integrating Russian higher education into the European system. In 1994 a decree of the Russian government established a general approach for the structure of the multilevel higher education sector (Russian Government, 1994). After the first level of higher education, which is two years in duration, students can receive a diploma. The second level is a four-year Bachelors programme. For education qualifications the content of professional training is framed by the state requirements for the minimum content and the level of competencies for the university graduates in a particular area. The third level of higher education can be one of two types – the Masters programme that lasts 2 years and prepares graduates for research

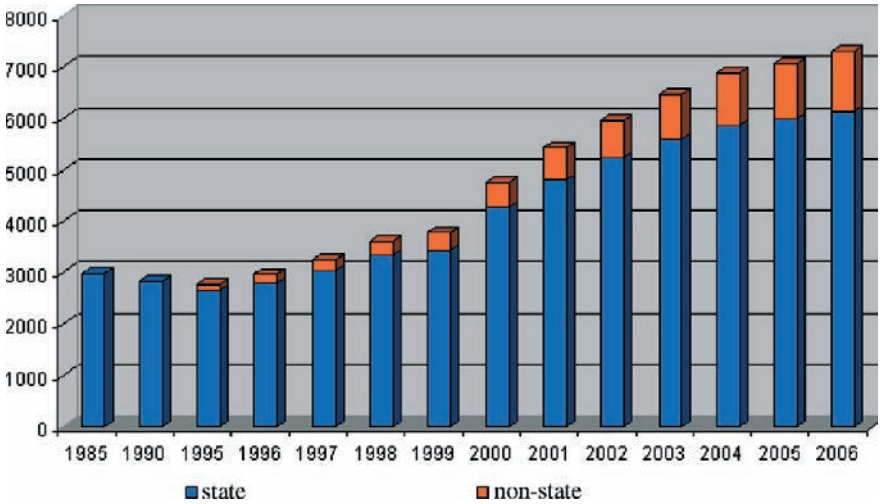


**Fig. 7.5** The number of students in the higher education institutions (in thousands) (taken from Statistics of Education website http://stat.edu.ru/smi/graf13.shtml)

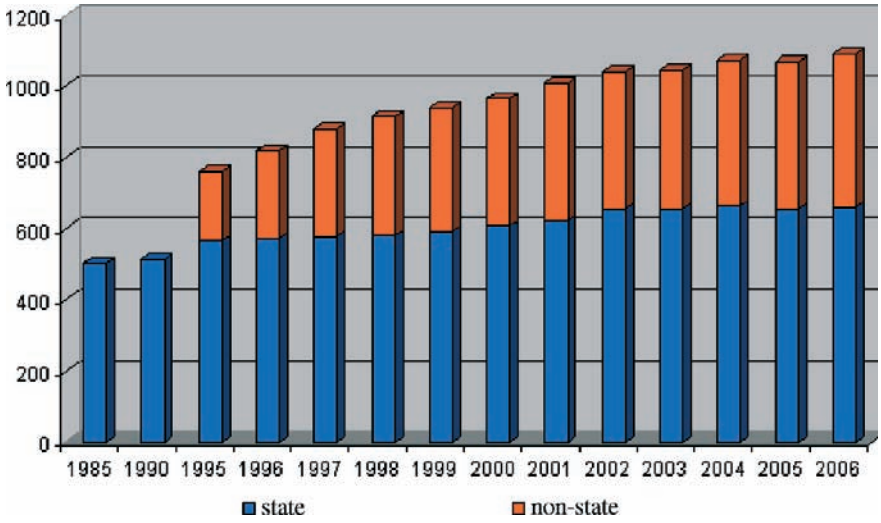


**Fig. 7.6** The number of higher education institutions (taken from Statistics of Education website http://stat.edu.ru/smi/graf12.shtml)

and/or research and teaching, or the one-year programme – *specialitet*, that prepares students to be a teacher, an engineer, economist and so on (traditional programmes). Therefore there is a mixture of new and old structures.

The agreement on the common higher education sector across Europe (signed in Bologna in 1999) started the process of integration of Russian higher education into the European system. Bachelor and Masters degrees are being gradually introduced in all areas of studies. Now graduates can receive the following qualifications: Bachelor Degree, specialist (for example, teacher, doctor and lawyer) and Masters Degree. The structure of study programmes can be continuous (5 to 6 years) or based on the levels. The number of students entering the first year of higher education is regulated by the federal bodies of executive power which are partly in charge of the institution's budget.

## Difficulties in Implementing Educational Reform and Measures to Overtake Them

On 4th November, 2004, the Collegia of the Ministry of Education and Science of the Russian Federation discussed priorities for the development of the educational system in Russia. The document examined during that meeting identified a number of problems in the implementation of educational reforms in Russia. Among the problems discussed was *the mismatch between the content of education/teaching strategies and the demands of the current society and economy*. In particular, it was noted that the labour market requires from a potential employee not specific levels of theoretical knowledge, but demonstrable, adequate levels of responsible behaviour, professional competence and communicative capacity (Ministry of Education and Science of the Russian Federation, 2004a, p. 6). The tensions between traditional interpretations of education and new demands for education are not easy to resolve.

> When nations have existed for a long and glorious time, they cannot break with their past, whatever they do; they are influenced by it at the very moment when they work to destroy it; in the midst of the most glaring transformations they remain fundamentally in character and destiny such as their history has formed them. (Kohn, 1955, p. vii).

The Collegia clearly stated that there are difficulties in changing the content and teaching methods in general education to more activity-based learning and more student-centred pedagogy. Unsatisfactory results achieved by Russian students through PISA testing in 2006 (Meshkova, 2008) support this conclusion. Changes in students' learning, achieved through the process of modernisation, are not substantial. The way it is explained in Russia is that PISA mainly tests the level of students' ability to apply school knowledge and skills in real life situations, but not the level at which they master school programmes, which remains in the minds of many teachers and academics as the main measure of success (Meshkova, 2008). However, the methodology and approaches used in designing PISA are close to the aims of the modernisation of Russian education, that is, the development of key

competencies to increase students' ability to solve problems. They are included in the federal component of the basic and complete general education (Ministry of Education of the Russian Federation, 2004).

## *Priorities for Educational Reform*

The Collegia reinforced the central role education plays in economic development, social stability and in the development of institutions of a civic society (Ministry of Education and Science of Russia, 2004b, p. 1) and decided at the meeting that at the current stage of modernisation of Russian education there are five priorities for educational reform (Ministry of Education and Science of Russia, 2004b, p. 4):

- To increase the quality of vocational education (VET and higher education);
- To increase accessibility and quality of general education;
- To develop a modern system of lifelong vocational education;
- To increase the investment attractiveness of the educational system (to attract non-state resources); and
- To move towards the principles of per head financing in education and develop an effective market for educational services.

These priorities were formulated through the action plan for the period up till 2010, a *Federal Targeted programme of educational development for 2006–2010* (Government of the Russian Federation, 2005). This programme includes the development of new vocational standards to which industry should contribute, new school standards more heavily based on contemporary pedagogical approaches, that is the ability to solve real life problems as an outcome of learning and new *Federal Law on Education* to integrate a legislative basis for all levels of education.

Another measure to promote effectiveness of the educational reform was announced by the president of the Russian Federation in September 2005. Education was among four national projects that received funds from the state budget.

## *The Priority National Project 'Education'*

This project supports innovative general schools and vocational schools at both initial and secondary levels; higher education institutions that introduce innovative strategies; best teachers; schools' connection to the Internet; the establishment of two big universities in Siberia and the Southern region of Russia; and regional educational authorities which develop a systematic approach for educational development in the regions. It also provides resources for talented youth.

For example, in 2007, 76 vocational schools received 1.8 billion roubles for establishing innovative training programmes; 6,000 schools of general education received one million roubles each in 2006–2007 to refurbish their laboratories, buy software and equipment and provide teacher training; 20,000 teachers were sup-

ported over the 2006–2007 period, each receiving 100,000 roubles (Working Group on the Priority National Project Education, 2007). This project is developing further and the schedule for considering and approving grant recipients for 2008 has been established. For example, in April 2008 a list of VET schools that are to receive grants in 2008 has been approved (Schedule, 2008).

## Technology Education

As argued in Chapter 1, technology education is one of the effective ways to vocationalise schooling. As we have seen in this chapter, technology education is a part of the general education component in vocational education in Russia. Therefore, a close link between technology and vocational education exists in Russia and in this section technology education will be used to illustrate some changes in the Russian general educational system. Technology was established as a new subject/learning area in 1993.

### *Technological Culture*

Its predecessor subject, Labour Training, was purely technical in orientation. When the process of humanisation of Russian education started with the educational reforms of the 1990s, the issue of developing a rationale for technology education was raised. At that stage, the concept of technological culture appeared as a way to incorporate broader issues within technology education. A number of documents (see, for example, the Order of the Minister, 19.05.98 [Ministry of General and Professional Education, 1998]; the Concept of technological education [Ovechkin & Simonenko, 1998]) stated that transmission of technological culture is considered to be the main aim of technology education in Russia. Technological culture is viewed as

> an important sphere of the general culture of humanity which is reflected in each historical stage… the aims, character and the level of the transformative, nature-friendly, creative activity of the people is realized on the basis of science and *tekhnik*, that is, the ethics of production relations. (Atutov, Kozhina, Ovechkin, Simonenko, & Khotuntsev, 1998, p. 5)

This approach is an attempt to establish a concept that is broader and more humanistic than just a technically oriented subject, as follows: "The main aim of technology education is the development of technological culture, that supposes the mastering of the system of methods and means for transformative activity [of the person] for the creating of material and spiritual values" (Atutov *et al.*, 1998, p. 7).

The inclusion of spiritual values highlights the need for transformative activities that are in harmony with nature. In the consultation materials on the concept

of technology education (Ovechkin & Simonenko, 1998), technological culture is defined as

> the transmission for the further generations' knowledge about technosphere, the ability to use its achievements in the interest of the person, taking into consideration the conformity with nature and culture. It defines the place of the person within nature and the limits of his safe interference with the natural processes. Techno-culture defines the *Weltanschauung* (world-outlook) and self-understanding of the modern person, unity and harmony of the material and spiritual culture of the society. (pp. 12–13)

The concept of techno-sphere that is introduced as a source of knowledge for the technological culture refers back to Vernadsky's theory (Kuznetsov, 1988). Techno-sphere is considered as a distinctive part of the planet's system, together with nature, person and society. Activities for designing and making material artefacts and the results of their influence on individuals, society and nature are organised within a global structure that is called the techno-sphere. It is both a result of, and the driving force for, the development of human society. Thus all technologies, socio-cultural issues and processes are included in the concept of technological culture and should be presented in technology education. The concept of technological culture places more emphasis on moral issues and values in society. It also includes the old craft traditions that constitute some of the cultural heritage of nations. This brings technology education in line with educational reforms.

De-codification of the meanings of this concept demonstrates that the nature of technological culture is presented within a humanistic paradigm approach to education. The technological culture highlights the importance of responsible action, informed by moral values, that enables the actor to estimate positive and negative consequences of concern to human beings immediately or indirectly (Oser, 1994).

## *Standards for Technology Education*

The first *Standards* for technology education was published in 1998 (Lednev, Nikandrov, & Lazutova, 1998) and was discussed in Chapter 1. A draft of the second *Standards* for technology education was developed in accord with the *Strategy of Modernisation*, published in 2003 and approved in 2004. The aims of technology education outlined in the second set of *Standards* (The Ministry of Education of the Russian Federation, 2004) are less oriented towards knowledge acquisition and more oriented towards the personal development of students: developing inquiring minds; technical thinking; spatial imagination, intellectual, creative, communicative and management skills; self-directed involvement in activities; *mastering a technological culture*; as well as orienting a pedagogy towards diverse activities aimed at creating personally and socially useful products. Also the concept of projecting (design) has been introduced. The *Standards* are less directly related to a particular type of work after school and more aimed at preparing students for life and work in general.

At the level of basic general education each student can choose (within the limits of particular schools) one of three directions: the technology of hand and machine manipulation with resistant materials, artistic development of materials, technology of textile and food, culture of the house; or technology of agriculture – mainly for rural schools. Each direction includes a module on modern industry and on VET. This module provides an opportunity to establish close links between technology and vocational education. Some study topics such as technological impact on nature, technologies and health introduce elements of ecology in the subject.

At the senior level the new *Standards* consists of two components: a *general technology component* and a *specialised component*. The first is compulsory for all students and the second consists of several options, from which students choose one. The g*eneral technology component* includes the following content: main technological concepts and types of activity; basis of transformative and design activities; technological and consumption culture and professional orientation (career guidance). This general technology component should be integrated with one of the *specialised components*: "directions" (technology of hand and machine manipulation with resistant materials; artistic development of materials; technology of textile and food; culture of the house; or technology of agriculture – for rural schools) or "areas" (the practical activities of humans: manufacturing industry, economics, education, medicine, building industry, transport, information technology, applied art and craft, office and secretarial studies, horticulture, animal husbandry and service industries). This structure provides more flexibility for students, particularly at the senior school level. On the one hand, all students study the basis of technological culture as an element of the general culture within all profiles (e.g., social-humanities, humanities-philology/language, science, physics and mathematics); on the other hand, they can choose a direction or an area that suits their vocational interests.

Currently, as the third generation of standards are being developed in Russia, technology education is moving further towards a pedagogical paradigm that focuses on activity-based learning and competency development approaches. The outcomes of learning will be mainly formulated through patterns of activities and the fulfilment of tasks by students as the real indicators of student achievement.

## *Technology Teacher Training*

Technology teacher training in Russia has been going through changes together with the whole system of higher education. It is regulated by the State Educational *Standards* for higher vocational education (The Ministry of Education of the Russian Federation, 2000). The *Standard* for Technology Teacher Training was put into force in 2000 and specified five years of full-time study after a completion of 11 years of schooling. The *Standard* also describes the qualities of the technology teacher graduate and of educational programmes. They include the disciplines regulated at state and university levels, the type of disciplines elected by students and special "facultative" disciplines (students usually choose to enrol in studies that

are not compulsory if they are interested in the particular topic). Elective courses in each cycle should supplement disciplines specified in the federal component of the cycle. The *Standards* establish the duration for training programmes of 260 weeks and 8884 hours. The programme should include the following cycle of disciplines:

- Humanities and socio-economic disciplines (1500 hours);
- Mathematics and science (1000 hours);
- General professional disciplines (1600 hours);
- Disciplines specific for the learning area (4334 hours);
- Facultatives (non-compulsory disciplines) (450 hours).

The training of technology teachers is undertaken through two approaches: a five-year programme and a multilevel programme. The flexibility of the programme is limited to 5% variation of the number of hours specified in the *Standards*.

Again, in accordance with the Pansofia approach, students receive a very broad education. Through the humanities and socio-economic cycle they study Russian history, culture, politics, law, philosophy, sociology, economics and foreign languages. Therefore, there is an opportunity to include general SD concepts within these courses. Ecology, as a one-semester course (72 hours), is included in the maths and science cycle to be studies by all students. General professional disciplines that relate to pedagogy and psychology also have the potential to address ESD through an understanding of the rationale and pedagogy of technology education relevant to ESD. Disciplines specific to the learning area (general technical disciplines) could address technical-fix solutions to environmental and social problems. Teachers' capacity-building strategies (explored in Chapter 6) could be used for introducing ESD within teacher training programmes in Russia.

Another opportunity to introduce ESD is through specialisations. Within technology teacher training programmes the specialisation is a 900-hour module. It should constitute a coherent programme that provides students with the opportunity to develop knowledge and skills that help them to work in the rapidly changing educational environment, as well as to have systematic training in a particular area. At the moment there are more than 28 specialisations within the technology teacher training programme. Some of these are: technic and technical creativity; culture of the house and applied art; peasant house and the family; building and maintenance of the individual dwelling; textile technology; food technology; design of household and industrial products; graphics and design, high-tech, applied economy; technology of agriculture; professional orientation (career guidance); foreign language in vocational education and labour training, to name a few. The number of specialisations offered in each institution varies, with some universities offering one while other institutions offer a number, up to a maximum in practice, of 10 (UMO, 2004b). Currently there is no specialisation that relates to ESD; however, it would be a relatively easy and quick process to introduce one.

Specialisation provides flexibility in the training system, allowing it to respond to the demands of educational practice. Specialisations can be approved quickly through the Learning – Teaching Methodology Union committee (UMO in Russian

abbreviation). UMO is a quality assurance establishment that coordinate the efforts of academic staff, industry and representatives of other institutions to maintain the quality and development of the content of higher education, as well as to forecast future directions and provide support for the process of training students. Among the aims of UMO are development of drafts of state education standards, provision of examples of study programmes and curriculum for higher education, approval of the list of directions and specialisations for higher education and the review of manuscripts of books and textbooks prepared for approval by UMO and the Ministry of Education (UMO, 2004a).

After graduation from a technology teacher training programme teachers can work in both general and vocational schools. There is a requirement that at least one student practicum is conducted at a vocational education institution.

## Conclusion

The Russian Federation announced education as a priority area of state policy. It is framed by the following main documents:

- The Law of Russian Federation "About Education" (ratified by Duma in 1992 and modified in 1996);
- National Programme of Development of Education 2006–2010 (ratified by Duma on the 23rd of December 2005) and developed in accordance with the *Concept of modernisation of Russian Education for the period till 2010*;
- Priority National Project "Education" (announced by the president of the Russian Federation on 5th September, 2005 among four other national projects).

The modernisation of Russian education started in 2001 and is considered one of the important forces in moving Russia forward. The benefits of educational reform to society, state and the economy were highlighted before modernisation took place. Official documents argued for the need of the educational reform to benefit *society* (especially in moving from an authoritarian to a student-centered approach and through this, supporting political, social and economic reforms), the *state* (in moving to diversification of education, orientated towards the individual and choice) and the *economy* (in that education is central to the national security of the country; only education can guarantee the quality of workforce in all areas) (Tkachenko, 1996).

A number of positive changes have been achieved through the process of modernisation. These include the diversification of education, gradual development of new standards, sharing of responsibility between states, regional and local educational authorities and multilevel curriculum design. Elements of modern and late-modern educational models that currently co-exist in Russia could be viewed as a positive feature of the system in terms of ESD introduction. Culturally based competencies provide an opportunity to develop an educational basis for a new model of civilisation development that is required by ESD (a nöosphere civilisation). The economy-related *profile education* as a way of vocationalisation of schooling also

could play an important role in ESD by developing some specific knowledge and practices that lead to SD. In that sense, value-change and technical fix approaches are both applicable through the educational system.

Technology and vocational education are closely related in Russia through the concept of profile education in the senior school and through the general component of education in VET studies. Traditional approaches for vocational education that include a substantial component of general education and a new focus in technology education on technological culture, personal development and activity oriented learning, provide an opportunity to introduce ESD ethics, concepts and activities. In teacher training programmes, again, the general component of education (e.g., philosophy, ecology, law and study of politics) provides the basis for introducing ESD for technology and vocational teachers. Specialised courses in VET and in higher education teacher training (through disciplines specific for the learning area) could address specific issues of SD. Possible tensions between the two strategies for ESD introduction – general and specific – could be overcome through collaborations between teachers involved in different areas of studies.

The next two chapters explore how SD and ESD are interpreted in Russia and to what extent opportunities identified in this chapter have been realised.

## References

Atutov, P. R., Kozhina, O. A., Ovechkin, V. P., Simonenko, V. D., & Khotuntsev, Y. L. (1998). Kontseptsija formirovanija tehnologicheskoj kulturu molodezhi v obstcheobrazovatelnoj shkole [The concept of developing technological culture of the youth in the general school]. *Shkola i proizvodstvo, 3*, 5–12.

Cowen, R. (1996). Editorial. *Comparative Education, 32*(2), 149–150.

Government of the Russian Federation. (1997). Decree #908, 21.06.97. О Концепции реформи рования системы начального профессионального образования. [A concept of educational reform of the initial vocational education]. Retrieved May 9, 2008, from http://www.informika.ru/text/goscom/dokum/doc/1749.html.

Government of the Russian Federation. (1999). *The Decree #1362, 08.12.99 Перечень профессий начального профессионального образования* [A list of occupations for the initial vocational education].

Government of the Russian Federation. (2000). The Decree #751, 04.10.00. *O natsionalnoj doctrine obrazovanija v Rossiiskoj Federatsii* [About National Doctrine on Education in the Russian Federation]. Retrieved February 2, 2008, from http://elementy.ru/library9/doctrina.htm?page_design=print.

Government of the Russian Federation. (2004). *Prioritetnue napravlenija razvitija obrazovatelnoj sistemu Rossijskoj Federatsii*. Approved 9.12.2004, #47, part 1. [The priority directions for development of the educational system of the Russian Federation]. Retrieved February 2, 2007, from http://mon.gov.ru/edu-politic/priority/napravleniya.doc.

Government of the Russian Federation. (2005). Decree #803, 23.12.05. *Федеральная целевая программа развития образования на 2006-2010 годы* [Federal targeted program of educational development for 2006–2010]. Retrieved May 9, 2008, from http://www.mon.gov.ru/dok/prav/obr/2048/.

Kohn, H. (1955). *Nationalism.* New York: Van Vostrand.

Kuznetsov, M. A. (1988). Utchenie V.I. Vernadskogo o noosfere: perspektivu razvitija chelovechestva [V. I. Vernadski's theory of nöosphere: Perspectives of mankind development]. *Voprosu filosofii, 3*, 39–47.

Lebedev, O. E. (2001). *Dvadtsat' let spustja: po sledam diskussij o problemach schkol'nogo obrazovanija* [Twenty years passed: Following discussions on problems of school education]. St.-Petersburg: Obschestvennuj Institut Razvitija Schkolu.

Lebedev, O. E., & Neupokojeva, N. I. (2001). *Tseli I rezul'tatu schkol'nogo obrazovanija: Metodicheskije recomendatsii* [The goals and results of the school education: Methodological recommendations]. St. Petersburg, Russia: Sankt Peterburgski gosudarsvennuj universitet pedegogicheskogo masterstva.

Lednev, V. S., Nikandrov, N. D., & Lazutova, M. N. (Eds.). (1998). *Uchebnue standartu shkol Rossii. Gosudarstvennue standartu nachalnogo obstchego, osnovnogo obstchego I srednego (polnogo) obstchego obrazovanija. Kniga 2. Matematika I estestvenno-nauchnue distsiplinu* [Learning Standards for Russian Schools. State Standards for primary and secondary education. Book 2. Mathematics and Science]. Moscow: Sfera, Prometej.

Lyotard, J.-F. (1984). *The postmodern condition: A report on knowledge* (G. Bennington & B. Massumi, Trans.). Manchester: Manchester University Press. (Original work published 1979).

Meshkova, T. A. (2008). Уроки PISA-2006: домашнее задание на завтра. [Lessons of PISA – 2006: homework for tomorrow]. *Vestnik mezhdunarodnuh organizatsii, 1*(16), 4–11.

The Ministry of Education and Science of the Russian Federation. (2004a). *Spravka po voprosu "O prioritetnuh napravleniajh razvitija obrazovatelnoj sistemu Rossijskoi Federatsii"* [Materials re issue "Priorities in development of the Russian education system"] for the meeting of Collegia of the Ministry of Education and Science of the Russian Federation, 4th of November 2004. Moscow: Government Printing Service.

The Ministry of Education and Science of the Russian Federation. (2004b). *Reshenia kollegii Minobrnauki Rossii* "O *prioritetnuh napravleniajh razvitija obrazovatelnoj sistemu Rossijskoi Federatsii*" [Decisions of the Collegia of the Ministry of Education and Science of the Russian Federation "Priorities in development of the Russian education system"] for the meeting of Collegia of the Ministry of Education and Science of the Russian Federation, 4th of November 2004. Moscow: Government Printing Service.

The Ministry of Education of the Russian Federation. (1996a). Informatsija o realizatsii Federal'noj programmu razvitija obrazovanija [Information about implementation of the Federal program of Educational development in Russia]. *Vestnik Obrazovanija, 4*, 3–13.

The Ministry of Education of the Russian Federation. (1996b). Spravka ob itogah rabotu Ministerstva Obrazovanija Rossijskoj Federatsii v 1995 godu I osnovnuh zadachah razvitija obrazovanija na 1996 god [Information about the results of the work of the Ministry of education of Russia in 1995 and the main directions of development of education in 1996]. *Vestnik Obrazovanija, 4*, 14–26.

The Ministry of Education of the Russian Federation. (1999). The Decree #86, 16.07.99. *О введении в действие государственных образовательных стандартов начального профессионального образования*. [About introduction of the state educational standards of the initial vocational education]. Retrieved October 21, 2006, from http://www.edu.ru/db/portal/nach/index.htm.

The Ministry of Education of the Russian Federation. (2000). *State Educational Standards for Higher Vocational Education. Speciality 030600 Technology and Enterprise, qualification: technology and enterprise teacher*. Author: Moscow.

The Ministry of Education of the Russian Federation. (2002b). *O recomendatsijah po realisatsii srednego (polnogo) obschego obrazovanija v obrazovatel'nuh uchrezdenijah srednego professional'nogo obrazovanija* [About recommendation on how to realise complete general education in the secondary vocational education]. The letter, 19.03.2002 #18-52-857ин/18–28

The Ministry of Education of the Russian Federation. (2004). *Федеральный компонент государственного стандарта* общего образования [The Federal Component of the State Standards for the General Education]. Retrieved March 7, 2008, from http://www.ed.gov.ru/ob-edu/noc/rub/standart/.

The Ministry of Education of the Russian Federation, National Fund for Personal Training. (2001). Strategija modernizatsii soderzhanija obschego obrazovanija [Strategy of modernisation of general education]. *Upravlenie shkoloj, 30*, 2–16.

The Ministry of Education of the Russian Federation, the Russian Academy of Education. (2002). *Kontseptsija profilnogo obuchenijana starshej stupeni obschego obrazovanija* [The concept of profile education at the senior phase of general education]. Retrieved March 25, 2004, from http://www.profile-edu.ru/content.php?cont=19.

The Ministry of General and Professional Education. (1998). *Ob utverzhdenii vremennuh trebovanij k objazatelnomu minimumu sdoderzhanija osnovnogo obstchego obrazovanija. Order #1236 from 19.05.98* [Temporary requirements for the compulsory minimum content of main education]. Moscow: Author.

Oser, F. K. (1994). Moral perspectives on teaching. *Review of Research in Education, 20*, 57–127.

Ovechkin, V. P., & Simonenko, V. D. (1998). *Kontseptsia technologicheskogo obrazovanija shkol'nikov v obstcheobrazovatelnuh uchrezdenijah Rossijskoj Federatsii: gumanitarno-politehnicheskij dejatelnostnuj podhod* [The concept of technological education of students in the institutions of general education in Russian Federation]. Bryansk: Bryansk University Press.

The program of vocational education development. Retrieved March 25, 2004, from http://www2.ed.gov.ru/prof-edu/sred/rub/.

Review of vocational education development in 2001–2002. Retrieved March 25, 2004, from http://www2.ed.gov.ru/prof-edu/sred/rub/.

Russian Education by 2001: Analytical overview. Retrieved March 25, 2004, from http://www2.ed.gov.ru/uprav/obzor/2.5.

Russian Federation. Federal Law. (1996). *O vnesenii izmenenij I dopolnenij v zakon Rossijskoj Federatsii "Ob Obrazovanii"* [The Amendments to the "Law about Education"]. Moscow: Novaja Shkola.

The Russian Government. (1994). *Order N 940 from 12.08.1994. About the approval of the State Educational Standard for the Higher Vocational Education*. Retrieved March 25, 2004, from http://www.edu.ru/db/portal/spe/docs/1994_940.htm).

Schedule. (2008). Retrieved May 9, 2008, from http://www.rost.ru/projects/education/now/now.shtml.

Statistics of Russian Education. Retrieved December 4, 2004, from http://stat.edu.ru/stat/vis.shtml.

Tkachenko, E. V. (1996). Otchetnuj doklad "Ob itogah rabotu sistemu obrazovanija v 1995 godu I zadachah razvitija otrasli na 1996 god" [Report "The results of the work of educational system in 1995 and the aims of its development for 1996"]. *Vestnik Obrazovanija, 3*, 7–74.

UMO. (2004a). Retrieved May 21, 2006, from http://mpgu.edu/umo/02/zadachi.html.

UMO. (2004b). Retrieved May 21, 2006, from http://mpgu.edu/umo/.

Vocational education: 2003 report. Retrieved December 4, 2004, from http://www2.ed.gov.ru/prof-edu/nach/rub/zp/246,print/.

Working Group on the Priority National Project Education. (2007). *Итоги двух лет реализации приоритетного национального проекта "Образование"*. [Results of two years of realisation of the Priority National project Education.] Retrieved May 9, 2008, from http://www.rost.ru/news/2007/12/281759_12255.shtml.

# Chapter 8
# Sustainable Development, the Russian Way

In Chapter 3, it was argued that there is no single model of a sustainable society because of the differences across contexts. It was also argued that the specificity of the context should be accounted for when education for sustainable development (ESD) models are developed and strategies for empowering people through technology and vocational education are identified. Russian initiatives in conceptualising and developing sustainable development (SD) are considered in this chapter. Theories, political agendas and practices are presented here to demonstrate the mixture of approaches and interpretations of SD. A number of specific characteristics of the "Russian approach" highlight the importance of accounting for the specific context.

## Theories and Politics

The term sustainable development translated in Russian means steady/stable development. Although it is not an exact translation, it has widespread use in the Russian language; currently it is more important to "fill" the concept with scientifically grounded content, related to the modern scientific outlook, than to discuss the precision of the terminology (Moiseyev, 1995).

Recent debate on SD in Russia has been multidimensional, involving social, environmental, cultural, political and economic aspects. The development of political acknowledgement of the need for SD in Russia started in 1994 with the presidential decree: *The state strategy of the Russian Federation for the protection of the environment and ensuring of sustainable development* (Ukaz, 1994). The decree demonstrated an official commitment by the Russian government to SD. Further progress of the issue was presented in another presidential decree (Ukaz, 1996) that approved the *Concept of Russia's transition to sustainable development*. The concept states that in accordance with recommendations of the Rio conference, it is important for Russia to move towards SD that would help to solve, in a balanced way, the socio-economic problems and issues of nature protection. In this decree the president formulated two tasks for the government: (a) to consider this concept when any modelling or development

M. Pavlova, *Technology and Vocational Education for Sustainable Development*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 10, DOI 10.1007/978-1-4020-5279-8_9, © Springer Science+Business Media B.V. 2009

of socio-economic programmes takes place and (b) to develop and bring to the president's consideration a draft of the state strategy for the SD of Russia. The work on development of the state SD strategy began in the summer of 1996 and the first draft of the document was presented to the government in 1997. It was not accepted and was returned for revision. After the August 1998 crisis it became impossible for a number of years to talk about the transition to SD and the tasks of SD in their ecological interpretation were neglected. However, positions advocated in the *Concept* (Ukaz, 1996) are still valid and used for further development of the SD agenda.

The next official document, titled *Main positions of the strategy of sustainable development of Russia* (Shelehov, 2002), analysed the scientific principles behind the concept of SD. This *Strategy* was a result of the work of a special committee of the Duma and represents a new paradigm for Russia's development.

> The strategic aim of SD in Russia is to increase the level and quality of life of its population on the basis of scientific-technological progress, dynamic development of the economy and society, together with conservation of the renewable potential of the natural resources of the country as a part of the Earth's biosphere; and development of technological potential in the interest of current and future generations. (Shelehov, 2002, p. 11)

In some respect this is reminiscent of the ideal future from the former Soviet Union, albeit with more emphasis on global issues and protection of the environment. SD in the *Strategy* has been developed as a national idea, as a part of the ideology of the state. The state is considered as playing an increased role in the transition to SD. In the *Strategy* the central problems that relate to the transition to SD are identified as problems of management (pp. 122–123) that should be based on scientifically sound long-term programmes. One of the issues that relates to management is the establishment of sustainable regions that would lead to sustainable Russia as a balanced socio-ecologo-economic organism developing in space and time. The logic of development and implementation of the strategy is viewed by many scientists as follows:

- Science develops models for Russian SD (including regions);
- Executive power develops implementation plans for SD on the basis of proposed parameters;
- Legislative power develops required laws for realisation of SD strategy. (Platonov, 2001, p. 9)

Romanovich and Ursul (2006) also believe that a model of SD should be developed by science first and then be realised through management and administration at local, regional, state and global levels. Science has a particularly important role to play and Russia has a rich scientific heritage and tradition to draw from. The *Strategy* (Shelehov, 2002) together with the *Concept* (Ukaz, 1996) identified two main sets of theoretical bases for conceptualising SD: the theories of *biological stabilisation and regulation of the environment* and a theory of *nöosphere* (some discussion of this concept appears in Chapter 3).

## *Biological Stabilisation and Regulation of the Environment*

The first set of theories develops scientific foundations for natural ecological security and conservation of biosphere that is accepted as the environmental basis for SD of the whole civilisation. These theories have been scientifically explored and widely discussed in Russia. A rich tradition in the natural sciences extends back to the XIX century. Among more recent debates is the concept of *nature management*. It was formed in the period of the mid-1960s to the early-1970s (Kasimov, Malkhazova, & Romanova, 2008). Armand, a physical geographer and landscape scientist, was among the founders of the concept of nature management in Russia. He was also engaged in the practical implementation of his nature management principles. Armand's book *For Us and for Our Grandchildren* (published in 1964) was the first publication in Russian to put forward a scientific approach to the use and maintenance of natural resources as an issue central to the whole of humanity. Kasimov, Malkhazova and Romanova argued that Armand's book is conceptually very close and in many respects even identical to the Brundtland Report "Our Common Future" (World Commission on Environment and Development, 1987). They noted that the very name of the book, "For Us and For Our Grandchildren", identified the proposition formulated by the author, and is similar to the current interpretation of the concept of sustainable development – "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (Chapter 2.1).

In his book Armand wrote: "The moral duty of each generation is to leave more and better natural wealth to the next one than it has received from the previous one" (cited in Kasimov *et al*., 2008, p. 10). This idea of a fair distribution of natural resources in relation to our descendants precedes the wording of the Brundtland Report, where in the section "Preservation and strengthening of resource base", it argues that protection of the environment "should be regarded as a part of our moral debt in relation to other people and future generations". The similarity, both in sense and in words, is quite evident; however, Armand's book was published 23 years before the "Our Common Future" report. Moral values played a major role in his views.

Further development of Russian environmental scientific thought can be illustrated by the work of Timofeeff-Ressovsky (1968), who argued that:

> The Earth's biosphere is a giant living factory transforming energy and matter on the surface of our planet; it forms both the equilibrium composition of the atmosphere, the composition of solutions in natural waters, and via the atmosphere, the energetics of the planet. It also affects climate. Remember the decisive role of water evaporated by vegetation, the plant cover of the Earth, in the global water cycle. Therefore, Earth's biosphere forms the entire environment of humankind. A negligent attitude to it and undermining of its regular activity would mean undermining not only the supply of food and various industrial raw materials necessary for us, but also the gas and water environment of humans. Ultimately, humans would be unable to exist on Earth at all without the biosphere or with a biosphere that does not operate well. (pp. 59–60)

The need to study the laws of biosphere development has become an important area of study. Such concepts as "volume of the ecosystems", "economic volume of the ecosystems" and "sustainability limits of the ecosystems" have been used more and more often in modern Russia (Ursul, 2005). They emphasise the limits to which the global ecosystem (biosphere) can be disturbed by human economic activity. The sustainability limits of the ecosystems relate to ecological and natural resources types of security. The first one is characterised by the *level of conservation of biota*, the second one by the *level of withdrawal of natural resources* from the biosphere. The relative importance of the first component has been argued by Russian scientists with increasing urgency. The theoretical framework for this argument is the biotic regulation of the environment theory (BRET). Biota (from Greek *biotē*, way of life, from *bios*, life) refers to all living organisms of a particular area; it is the combined flora and fauna of a region. BRET has been developed by Gorshkov (1995), a biologist from St. Petersburg. The concept of *biotic regulation* forms a main feature of contemporary Russian understanding of the biosphere (e.g., see Gorshkov, 1995; Kondrat'ev & Losev, 2002; Losev, 2003). The concept is grounded on the premise that the natural biota is active in both the formation and maintenance of its environment, in contrast to the widely accepted notion that natural biota is merely adapting and responding to random changes in the external environment (see Gorshkov, 1995; Gorshkov *et al*., 1999; Gorshkov, Gorshkov, & Makarieva, 2000). Gorshkov, Makarieva and Gorshkov (2004) stated:

> It is commonly believed that the major ecological problem of humanity is to cope with the large-scale environmental pollution. It continues to be implicitly assumed that, as soon as this problem is solved (shift to no-waste technologies and clean energy sources suggests itself as an obvious logical solution), there will be no more grounds to expect any environmental cataclysms.… [We argue] that the persistence of an environment suitable for humans for any appreciative period of time is only possible as long as natural ecosystems undisturbed by anthropogenic activities occupy a globally significant area. Maintenance of a suitable for humans environment [sic] is the unique product of functioning of the natural biota. Once the natural biotic mechanism of environmental control is destroyed, both local and global environment rapidly (over a time scale of hundreds of years) degrade to a state unfit for life. (pp. 20–21)

The biota would react to any environmental change "as soon as its relative magnitude exceeds some critical value, which can be … called biotic sensitivity" (Gorshkov *et al*., 2004, p. 24). When environmental change remains below the biotic sensitivity level, then synthesis and decomposition of organic matter by the biota continues. However, as soon as some environmental parameter changes above the biotic sensitivity level, then the biota initiates compensation processes and keeps them going until the disturbance is diminished to a point that is below the biotic sensitivity level.

According to the theory of Gorshkov *et al*., life is based on biochemical reactions that convert inorganic substances stored in the environment into organic ones and back. Since the emergence of biota it has had a powerful formational impact on the environment. Under biota's influence, the regulated environment was formed and at the same time the corresponding regulating mechanisms of biota itself evolved.

This formed a highly organised system, the biosphere, which regulates all parameters essential for the biota (physical and chemical characteristics of the climate, atmosphere, soil, inland water and oceans) through the proper regulation of flows of biogenes (substances, participating in biota's functioning).

The following major propositions of the BRET were formulated by Gorshkov *et al*. (2000):

- Natural ecosystems that are undisturbed by humans create and control their own environment. They maintain it in a state optimal for the whole environmental community and, up to a certain threshold, compensate for all deviations from that optimum. Such biotic regulation occurs at both local and global scales.
- Biotic regulation is performed by the complex coordinated functioning of all species in the natural ecological community. The information needed to ensure such functioning is contained in the genomes of species. Stabilising natural selection protects this information from spontaneous decay. Evolution proceeds in the direction of enhancing the regulatory potential of the community.
- Information fluxes that are processed by natural biota while performing environmental control exceed the information fluxes that modern civilisation would ever be able to process by orders of magnitude. This means that the biotic mechanism of environmental stabilisation is unique and cannot be replaced by a technological one.
- Anthropogenic transformation of natural ecosystems completely destroys the regulatory potential of the ecological communities on a local scale and continually weakens the global power of biotic regulation. Anthropogenically disturbed and artificially created biological systems are not only merely deprived of regulatory abilities but themselves act as powerful destabilisers of the environment.
- Environmental parameters that are favourable for life on Earth are physically unstable. Without the stabilising impact of natural biota the environment and climate of Earth would rapidly degrade to a state prohibiting human existence. (Gorshkov *et al*., 2000, p. 32)

The acceptance of the BRET theory leads to a very different paradigm for dealing with the global environmental crisis. The main approach should be *preservation and restoration of a substantial part of the Earth's biosphere to its natural form in order to enable the stabilising potential of the natural biota to continue to function*. This strategy sets a ceiling on the level of exploitation of biospheric resources and economic development.

As argued by Efremenko (2006), a different paradigm is currently prevailing in the international discourse. It states that

> the global biota will adapt to anthropogenic transformation as it has been adapting to spontaneous environmental changes during the four billion years of life existence. Given this, a solution to the problem of long-term environmental stability is sought in the creation of environmentally friendly technologies that reduce the impact of modern industrial production and consumption. This solution provides incentives for the further cultivation of the remaining natural biota and other biospheric resources, and does not recognise or value their environmental stability functions. (p. 7)

Efremenko (2006) argued that technological solutions are necessary but not sufficient: "The idea that a technological solution to the problem of global environmental security is even in principle possible is not self-evident and demands rigorous scientific investigation" (p. 7). This position is closely related to the argument developed in Chapter 3 that positions value change (preservation of nature) ahead of technical fix, based on environmentally friendly technologies.

BRET supporters in Russia have developed an argument that this theory should be used as a framework for an integrated environmental policy at both national and international levels. For example, such huge areas in terms of the stabilisation of global environment as the Amazonian drainage basin or the Siberian Taiga need to be considered as a common good. This opens new directions for resolving the tensions between national and international interests discussed in Chapter 3.

Losev (2001) argued that the biotic theory helps to identify the most appropriate definition of SD. From his perspective, the definition provided in the report *Caring for the Earth. A Strategy for Sustainable Living* (IUCN, UNEP, WWF, 1991) fully corresponds with the biotic theory: SD is improving the quality of human life while living within the carrying capacity of supporting ecosystems. Although humankind cannot "create its history freely – it should coordinate itself with the laws of nature and primarily with the ecological laws" (Losev, 2001, p. 5). He argues that life sciences, particularly ecology, are priority directions for scientific development in the modern world.

Losev (2001) also argues that the main ecological problem is "the consequences of destruction of the ecosystems. That is, the system of regulation and stabilization of the environment" (p. 4). Furthermore, there is the underlying assumption that humankind is incapable of substituting for the complexity of the biota's regulatory mechanisms and thus must endeavour to ensure that the integrity of the biotic system is not compromised. This obviously demands detailed and precise knowledge about the functional aspects of the biota.

The second aspect of the biosphere-centric approach is the development of theories of a biosphere-compatible economy. Such an economy would not destroy the biosphere but preserve it and not go beyond the limits of the carrying ecological capacity of ecosystems. Although there is no fully scientifically grounded vision of how to organise it, this is one of the central tasks of any future "sustainable" society (Mantatov, 2006).

One of the main ideas of the concept of SD is "the limitation of anthropogenic influence on the biosphere and limiting transformative activity of civilization by the biosphere processes and cycles that correlates with an anthropogenic volume of the ecosystem" (Romanovich & Ursul, 2006, p. 503). Ursul (2005) proposes a formula that, in a simplified way, helps to model SD: $SD = E \times B \times S$ where E is economic effectiveness; B is carrying capacity of the biosphere (so biosphere can survive and revive); and S is social limitations (justice and equity in sharing basic welfare). Thus on the way to SD, humanity needs to develop a different form of rationality, one that could be described as socio-natural rationality within the system "humanity – biosphere". The end result of an increase in this type of rationality would bring humanity to the establishment of the nöosphere, the sphere of wisdom (Ursul, 2005).

## *Nöosphere*

The second set of theories comes from Vernadsky's (1945) work on the nöosphere. It is the scientific basis for socio-humanistic and socio-natural transformations on the way to the new paradigm of civilisation (Romanovich & Ursul, 2006, pp. 74–75). The official documents accepted nöosphere as the aim for and result of a transition to SD. The *Concept* (Ukaz, 1996) states that the development of humanity on the way to sustainable development would lead to the emergence of the sphere of wisdom (the nöosphere) foreseen by Vernadsky. The concept argues that harmonious co-existence of humanity and nature will become the criterion of national and individual wealth. The spiritual values and knowledge of humankind are the bases for these relationships. In developing his concept of nöosphere, Vernadsky established a philosophically rethought image of our desirable future, the one that in current terminology is called a sustainable future.

Co-evolution of humanity and biosphere on the basis of biosphere's laws could be strengthened by the development of the sphere of wisdom. Consolidation of ideas of SD and growing of the sphere of wisdom provide an opportunity to use a number of nöosphere ideas explored by Russian scientists to study and model the process of transformation to a sustainable society. Only a society that unites people with new values would be capable of SD. The *Strategy* (Shelehov, 2002) states that without a rebirth of its spiritual potential Russia would not be able to develop along the pathway to SD. Ideas of SD are very close to the Russian tradition and psyche.

> Sphere of wisdom in the Russian literature conceptualises a different qualitative existence of society where the real values are the moral-spiritual values and knowledge of the person who lives in harmony with the social and natural environment. Nöosphere is a concluding stage in SD, the desirable future of society where the ecologically permitted influence on nature by humans exist and needs of the people are rationalised. (Shelehov, 2002, p. 9)

The transition to SD requires significant change in the development paradigm, with the central aim being the establishing of all human activities within an ecological domain. This involves, among other aspects, a change in peoples' perspectives (frame of mind paradigm) and the development of a society based around the idea captured in the phrase "sphere of wisdom". "These changes should occur in a systematic way and one of the main mechanisms to administer this process is the moral, humanistic mind of united humanity that uses all possible socio-economic, political and technical means" (Shelehov, 2002, p. 10).

It is necessary to link the concept of SD with the development of spiritual and moral values that are oriented towards the survival of the whole of humanity but balanced with the national interests of Russia. To realise the ideas of SD it is important to change the world outlook to one that incorporates a global understanding of nöosphere as belonging to all humanity. Interpretations of SD as a "frame of mind" are clearly stated in most political and theoretical discussions in Russia.

Both types of theories (biological stabilisation and nöosphere) started in a period prior to the emergence of a SD agenda. However recent analysis has established

clear links between these theories and the concept of sustainable development. Both types of theories are viewed as two integrated elements in conceptualising SD.

Moiseyev (1990) argued that the term sustainable development is interpreted as a strategy for a transition period that brings humanity to the state when nature and society will be characterised in terms of "co-evolution" or "the nöosphere epoch". He formulated the ecological and moral imperatives that should underpin the transition period. According to Moiseyev, "ecological imperative" means putting a limit on the summative activity of people. Violation of this limit can lead to the most catastrophic consequences for humanity in the nearest decades, in terms of damaging people's health and the condition of the biosphere. Moiseyev further argued that the SD ecological imperative should be complemented by a *moral imperative*: it is necessary to limit human activity by new moral principles that emphasise a co-evolution of society and nature. To achieve this, Moiseyev argues that the nature of values should be changed. By this he means a change to the values that provide the basis for transition from a society of consumption to a society of creative activity, which he calls "ecological socialism". Moiseyev's proposal goes beyond the concept of sustainable consumption discussed in Chapter 5; it is a more radical approach to change.

The ideas of Moiseyev have been developed further by Vashchekin, Muntyan and Ursul (2000); Muntyan and Ursul (2003); and by Ursul, Los and Demidov (2003). Sustainable development is considered by them as a strategy of survival and continuous development of civilisation within the limits of the biosphere. Preservation of the biosphere is regarded as the first priority. Mantatova (2006) quotes Ursul, who maintains that "the final result of the transition to sustainable development should be forming the nöosphere as a social-natural system" which will provide the priorities of moral intellect, intellectual-information values and ecological humanism, and thus the harmony of mankind, society and nature will be realised in this "safe and indefinitely long co-development (co-evolution)" (p. 5).

In the nöospheric society each person is able to reveal his/her creative potential and abilities, their substantial talents, and will achieve real freedom. The nöospheric concept of SD is supported by many researchers (e.g., Girusov, Platonov, & Yanshina, cited in Mantatova, 2006). Mantatov (2006) argues that the sustainable development of society is only possible when the relationships both inside society and between society and the environment are in harmony. This involves a dynamic balance between the material and spiritual in the life of society. It also requires rational-scientific and moral-ethical methods for regulating human activity.

### Stages of Transformation to SD for Russia

Theoretical debate underpins the political documents, namely, the *Concept* (Ukaz, 1996) and the *Strategy* (Shelehov, 2002). However, different aspects of the debate are presented with different priorities in the documents, for example, the stages of transformation to SD for Russia. In the *Concept* (Ukaz, 1996), three stages of transformation to SD for Russia are stated: (a) to overcome the crisis and stabilise the situation; (b) ecologisation of economy (that is, the development of ecological

management; ecological certification of production processes and products; the incorporation of environmentally friendly technology and techniques); and (c) introduction of new technologies that would save natural resources. This concept emphasised economic growth and "technical fixes" such as effective use of energy, alternative ways of energy production, development of new waste management systems and so on. Aspects of nature preservation, for example, are not presented. This could be explained by considering the specific time that the concept was developed. In a situation of economic crisis the economy and technology were considered as solutions for SD, with an emphasis on clean and eco-friendly technology in particular.

In the *Strategy* (Shelehov, 2002), the transformation stages to SD for Russia are further clarified in terms of the following objectives:

- To overcome the long lasting socio-economic, ecological and structural crisis that occurred during the transition of Russia to a market economy and democratic civil society. At this stage the basis for a new Russian economy should be established. Development of the economy needs to be based on structural changes, increasing effectiveness through the use of ecologically safe technologies. This would help to start the process of stabilisation of the ecological situation in Russia.
- To guarantee the dynamic socio-economic development of Russia on the basis of effective use of its economic resources and development of high technologies together with the advantages of international economic cooperation and conservation of the renewable potential of nature and establishment of fairer global economic relations. (Shelehov, 2002, p. 12)
- To humanise the relationships between society and nature in the global scale and within the country by:

    - Development of the economy within the renewable capacity of the biosphere;
    - Transition from an emphasis in the system of human values on wealth (material values) to spiritual-moral values that are in line with the future nöosphere's orientation and development of society;
    - The realisation by everyone of the need for rational consumption. (Shelehov, 2002, p. 14)

This *Strategy* proposes starting with eco-friendly technologies and then incorporating value change thereafter. The idea of the limited capacity of the biosphere and the need for preservation of natural eco-systems is also included. The strategy argues that transition to SD should be evolutionary. Russia would not survive a new "shock of eco-therapy". Ecological radicalism that leads to the immediate shutdown of some industries is not appropriate (p. 14).

## *Ecological Doctrine*

Theoretical ideas on stabilising biotic regulation are more fully reflected in other political documents including the *Ecological Doctrine of the Russian Federation*.

The current position of the Russian state on SD is presented in the *Ecological Doctrine of the Russian Federation* accepted by the Russian Government (#1225-p, 31.08.2002) that incorporates the Concept of Russia's transition to sustainable development and the Concept of National Security of the Russian Federation (President decrees #1300, 10.12.1997 and #24, 10.01.2000). It notes that many countries have not achieved the tasks formulated at the UN conference in Rio de Janeiro. It highlights that the strategic purpose of the state ecological policy is to support the integrity of natural systems and their life support functions for the sustainable development of society; to improve the population's health; and to guarantee the ecological security of the country (Government of the Russian Federation, 2002, p. 3). The following tasks are identified to achieve the above purpose:

- To conserve and recover natural systems, their biological diversity and ability for self-regulation as a required condition for existence of the human society;
- Provide rational use of nature and assure equal rights in accessing natural resources by the current and future generations;
- Provide favourable environment as a required condition for improving the quality of life and health of people (p. 3).

The state ecological policy is based on the following main principles formulated in the Doctrine:

- Sustainable development, taking into account equal attention to economic, social and environmental components; and the acceptance of the proposition that it is impossible for human society to develop if nature is degrading;
- A priority for a society of life supporting functions of the biosphere compared to a direct use of its resources;
- A fair distribution of income accumulated from the use of natural resources and ability to have access to them;
- Prevention of negative ecological consequences that could appear as a result of human economic activity, taking into account the possible consequences far into the future;
- Cancellation of economic and other projects that would influence natural systems if the results of these influences on the environment are unpredicted;
- Use of nature on the fee-based approach and compensation to people and nature for damage which occurs as the result of breaking laws concerning the protection of the environment;
- Freedom of ecological information;
- Involvement of civil society, local authorities and the business sector in preparation, discussion, approval and implementation of decisions regarding environmental protection and rational use of nature. (Government of the Russian Federation, 2002, p. 4)

The ecological doctrine also identified three main directions in the state ecological policy: sustainable use of nature (inexhaustible use of renewable natural resources and rational use of non-renewable resources); reducing environmental pollution and conservation of resources (reducing air, water and waste pollution and

reducing use of energy- and resource-consuming products and services); preservation and recovery of the natural environment (preservation and recovery of landscape and biological diversity that is sufficient to support the natural system's ability for self-regulation and compensation for the results of human activity) (Government of the Russian Federation, 2002, pp. 4–6).

The focus of this policy is the nature and environment. It fully corresponds with the theoretical developments of the laws and principles of biosphere functioning. For example, the third direction of the policy is based on a biota conservation strategy. This *Ecological Doctrine* specifically stated that scientific knowledge and understanding of the ecological basis of SD are critical, so a number of directions for research are identified.

The role of ecological education stated in the doctrine is to increase the level of the ecological culture of the population. The general level of education in this area and in-depth professional knowledge in ecology are part of the policy (Government of the Russian Federation, 2002, pp. 15–16). The policy also stated principles for regional policy development and for international cooperation. The main aim for international cooperation is "realisation of interests of the Russian Federation through participation in the process of solving global and regional ecological problems and regulation of globalisation in the interest of sustainable development of the world community" (p. 18).

## *Specificity of Condition for Transition of Russia Towards SD*

Many SD authors highlight the specificity of the Russian context. Romanovich and Ursul (2006), for example, identified a number of specific features that characterise Russia on its way to SD. Together with global tendencies, these features influence the development of necessary measures. Among these features Romanovich and Ursul named the specificity of Russian psyche and spirituality,history and national traditions, Eurasian cultural, ethnical and territorial realities and ecological situations in regions that could facilitate or impede the process of transition. There are a number of negative tendencies, such as the decline of industrial and agricultural production, deterioration of ecological situation in a number of regions that are the results of technological catastrophes, uncontrolled use of natural resources and a decrease in the quality of soils. An increase in social inequality between rich and poor, decrease in life expectation, poor health and unemployment also feature as negative factors.

Among the positive starting points for Russia's transition to sustainability is the country's sizeable territory. With 11.5 hectares per person (compared with 3.35 in the USA, 0.29 in Japan and 0.76 in China), Russia has huge potential in terms of natural resources (natural gas – 33% of the world's supply; oil –second in the world after Saudi Arabia; coal – the third place after the USA and China; approximately one quarter of the wood supply, etc.). Accumulative value of all natural resources is 28 trillion in US dollars (currently only $1.5 trillion has been developed and is paying off) (Shelehov, 2002, p. 21).

The major demographical issue of overpopulation which is critical for many developing countries (and for the stability of the biosphere) does not affect Russia. Rather, it is the current depopulation phenomenon that is on the political agenda in Russia. Another point that differentiates Russia from many developed countries is that in Russia the consumer society is not yet established on a wide scale. It is therefore argued that there is no urgent need to limit consumption of natural resources or goods/services. The task is to use resources effectively. Danilov-Danil'jan (1996) believed that for Russia the transition to SD could be even easier than for other countries. Danilov-Danil'jan argues that to change the stereotype of over-consumption in developed countries and an orientation towards bigger families in developing countries will be more difficult than reconstruction of the economy and development of business and rational use of resources: "Transition to SD could be considered as a national idea that would unite all groups of society for the purpose of the rebirth of Russia" (pp. 6–7).

Evaluation of the ecological situation in Russia has been undertaken at the level of political documents (e.g., the Concept, the *Strategy*, the Ecological Doctrine) and supported by many researchers. The speed and the level of natural degradation in Russia sit between developed and developing countries. In terms of forest and soil degradation Russia is closer to developing countries, but in terms of air and water pollution it is closer to developed countries. Russian radiation pollution is among the highest in the world; pollution by toxic substances is higher than in developed countries (Shelehov, 2002). The state report "*About the conditions and protection of the environment in the Russian Federation in 2005*" identified 41 cities with populations of over 17 million as the cities with the high level of pollution. In 22 cities the maximum levels of concentration of the toxic substances in the air are 10 times higher than the accepted norm (cited in Grachev, 2006). Old technical and technological bases of the economy and production industry increase the impact on nature. Illegal hunting and fishing has dramatically increased over recent years, and this has reduced the population of animals and fish and is a threat to biodiversity.

On the one hand, 16% of the country's territory, which is bigger than Western and Central Europe combined and where more than 50% of the population live, is defined as ecologically unsatisfactory. On the other hand, Russia contains the world's largest natural eco-systems (65% of the Russian territory) that serve as a reserve for the sustainability of the biosphere (Shelehov, 2002, p. 8).

As summed up in the *Strategy*, the main premises (pre-conditions) for SD of Russia are significant land mass with non-renewable natural resources, undisturbed natural eco-systems, human capital and economic resources. For achieving SD it is essential to preserve territories with natural eco-systems, use non-renewable resources and human capital rationally and consider the specificity of the demographic situation – use economic resources for developing a human potential (Shelehov, 2002, p. 11).

## Russia's Role in the Global Processes for SD

The transition to SD is a global process. Each country should coordinate its effort within the global community to realise the principles of this new civilisation. According to Flavin (1998), Russia is among eight countries (USA, Japan, Germany, China, India, Indonesia, Brazil) which are influencing the transition of the whole planet to a sustainable future: 56% of the world's population live there, it accounts for 59% of the world production, 58% of carbon emissions and 53% of the world's forest. These eight "ecologically influential" countries include China with highest population, USA with the biggest economy and carbon dioxide emission and Brazil with the most variety of biological species. The combined impact of these countries on the sustainability of the planet should be acknowledged and accounted for by the global community. In Table 8.1 some figures are presented (Flavin, 1998, p. 72).

Russia is playing a significant role, particularly due to its large areas of natural forests. Losev (2001) in his analysis stated that Russia owns the world's biggest unbroken or just slightly damaged natural ecosystems, particularly forests. The total area of these ecosystems is 11 million square kilometres (forests consist of 8 million).

Of the natural ecosystems preserved on the 37% of the land of the planet (without taking into account glaciers and bare territories – Hannah *et al.*, 1994, cited in Losev, 2001), more than one fifth are located in Russia. "This means that preserved ecosystems of Russia are of a great importance for the global ecodynamics in the northern hemisphere and they play the main role in the ecodynamics of Eurasia. So these territories are not only Russian but the world's heritage" (Losev, 2001, p. 5).

**Table 8.1** Eight ecological 'Draught Horses'

| Country | Population (% of the world's population) | GNP (% of the world's GNP) | CO2 emission (% of the world's emission) | Forests (% of the world's forests) | Flowering Plants (% of the world's flowering plants) |
|---|---|---|---|---|---|
| | 1996 | 1994 | 1995 | 1990 | 1990 |
| USA | 5 | 26 | 23 | 6 | 8 |
| Russia | 3 | 2 | 7 | 21 | 9 |
| Japan | 2 | 17 | 5 | 0.7 | 2 |
| Germany | 1 | 8 | 4 | 0.3 | 1 |
| China | 21 | 2 | 13 | 4 | 12 |
| India | 17 | 1 | 4 | 2 | 6 |
| Indonesia | 4 | 0.7 | 1 | 3 | 8 |
| Brazil | 3 | 2 | 1 | 16 | 22 |
| Total | 56 | 59 | 58 | 53 | 68 |

Russia contains more than 20% of the world's fresh water (in its liquid form). Over the last 10 years carbon dioxide gas emission decreased in Russia by one third, which is around 60% of the world's decrease (Romanovich & Ursul, 2006, p. 24). CO2 emissions in Russia, when calculated in carbon in 2000, was 6% of the global emission and it was fully absorbed by the Russian eco-systems, thus Russia does not contribute towards destabilisation of the world's climate (Shelehov, 2002, p. 34).

Russia's contribution to the destruction of the global natural ecosystems is 7%; but if measured in more localised areas, the contribution to destruction is 10% in Eurasia and 30% in Europe (Losev, 2001, p. 6).

> Natural wealth of Russia is the basis for solving its economic and social problems. In the current situation, probably, the only way to step on the path of SD is the gradual denial (rejection) of intensive sale of resources, their rational saving and justice in receiving 'natural rent'. Natural resources of Russia serve the whole humanity: having on its territory … [a big percentage of] the natural forests of the planet, we clean the air for the whole humanity. Because of that Russia has the right to pose an issue in front of the world community about the global ecological rent levy. (Shelehov, 2002, p. 12)

Romanovich and Ursul (2006) argued that the main direction for evolution of the Russian society and state is the one that relates to nöosphere transformations in terms of socio-economic and state-legislative processes. Russia should not use all resources to achieve the ideals of the industrial-consumer societies of the West; it should choose a different way of nöosphere transformation for its successful move towards SD. A strong anti-consumer sense in SD discourse in Russia also positions it globally as exploring these alternative pathways.

A unique position of Russia as an "Orient-West" country provides special conditions for development of a dialogue between the Orient and the West through the experience of different cultures' cooperation. As argued by Mantatov and Mantatova (2006a) this could lead to the development of a new civilisation based on harmonious combinations of "the material and the spiritual, technogenic and cosmogenic factors, liberal and socialist values" (p. 7). They believe that Russia's conceptualisation of SD could lead to Russia's leading global initiatives to establish a "new global civilization on the principles of sustainable development' (p. 7).

> Russia has all the necessary prerequisites for that: rich natural and intellectual potential, favourable geographic position, spiritual tradition which allow [sic] to combine the West and the Orient values, adherence to the ideals of solidarity and justice, non-standard outlook and others. New spiritual (ecological and humanistic) civilization is imagined by us as an alternative to the present-day consumption society and to the material civilization on the whole. This is an ecological society which is intended to reach harmony between man [sic] and nature; it is a spiritual society where conditions are formed to reveal the creative potential of each person. The example of practical realization of the new spiritual civilization is post-information society [sic]with sustainable development. (Mantatov & Mantatova, 2006a, p. 7)

Mantatov and Mantatova (2006a) argue forcefully that civilisations of the Orient and the West could be synthesised in Russia; they illustrate their argument by using China as an example. China's strategy of SD illustrated how the civilisation of the West

and the socialist, spiritual civilisation of China can be combined. "The objective of that strategy is the launch of adjusted, sustainable and powerful organism of the Middle Prosperous Country tuned in a rhythm identical to nature. A synthesis of moral perfection and social activity, traditionalism and modernization is chosen as a mechanism of achieving this objective" (Mantanov & Mantanova, 2006a, p. 7).

## Regional Strategies

The important role of regional initiatives and SD strategies have been argued strongly in the Concept (Ukaz, 1996), the *Strategy* (Shelehov, 2002) and other political documents. The documents propose to resolve a number of issues at the regional level as it was argued that each region has a unique combination of natural, economic and social systems which require specific SD approaches. These issues include: establishment of economic systems that regulate socio-economic development of the region, taking into account anthropogenic influence on the environment and rational use of the natural environment; development of nature protective activities within the cities and areas around them, including waste management, water purification, tree planting; establishment of measures relevant to health improvement, development of the social infrastructure; development of agriculture using ecologically based technologies appropriate for the region, soil protection and improvement.

Lukina and Lukin (2006) argue that it is not an easy task to identify the specific factors necessary for SD within each of the regions of Russia. The *Law on Principles for Local Self-Government* lacks precision in terms of defining the economic status of the regions and lack of clear-cut inter-budgetary relations between the federal and regional levels. Another issue is the availability of data for managing the process of regional development. Some indicators vary greatly from one region to another and from urban to rural areas, including life expectancy and income per capita. Therefore, on the one hand, it is very difficult to estimate the income per capita in Russia's regions due to a large hidden economy and an inefficient tax system, and, on the other hand, the level of literacy and general education is nearly uniform in all regions of the county as a result of the long-established national education system. Therefore, as Lukina and Lukin argue, in order to overcome these difficulties, mathematical modelling has to be employed when planning strategies for SD. This would help to reveal potential errors and mistakes in making management decisions and smooth away any negative consequences of the decisions previously taken (Lukina & Lukin, 2006). Three regional strategies are considered below as examples of different approaches towards development of the regions.

### *St. Petersburg*

St. Petersburg is one of two major Russian cities on the Baltic Sea (the other one is Kaliningrad). Local Agenda 21 for the Baltic region (BA21) is a regional

multi-stakeholder process for SD initiated in 1996 by the prime ministers from the 11 member states of the Council of the Baltic Sea States. It was adopted in 1998 (Baltic 21, 1998).

> The Mission of Baltic 21 is to pursue sustainable development in the Baltic Sea Region by regional multi-stakeholder co-operation. Accordingly, Baltic 21 provides a regional network to implement the globally agreed Agenda 21 and World Summit on Sustainable Development activities, while focusing on the regional context of sustainable development. (Baltic 21, 2008a)

Baltic 21 members are the Council of the Baltic Sea member states, the European Commission, intergovernmental organisations, international financial institutions, international, sub-regional, city and business community networks and other international non-governmental networks. One principal outcome of the Baltic 21 Agenda is the programme, which consists of 30 different actions addressing the transition to sustainable development in the Baltic Sea Region. The programme is in three parts: *Joint Actions* addressing issues concerning several sectors (e.g., increased production and use of bio-energy and other renewable energy; use of regional networks for sustainable development; establishment of pilot projects for demonstrating sustainable development in practice; city co-operation and sustainable development issues in cities and communities); selected *Sector Actions* addressing sector specific issues (e.g., agriculture, energy, fisheries, forests, industry); and *Spatial Planning Actions* addressing spatial planning issues such as implementation of the Stockholm Declaration on Sustainable Spatial Development Policy; further development of Integrated Coastal Zone Management; and integration of the Baltic 21 Agenda into European spatial planning documents. St. Petersburg was not involved in the preparation of the document and did not sign it at the time, however, it was included in the Baltic 21 Agenda.

Achievements of the regions have been presented in the Baltic 21 report entitled *Reaching a Landmark – Ten Years of Cooperation on Sustainable Development in the Baltic Sea Region*, which was presented at the 7th Baltic Sea States Summit (Riga, Latvia, 4 June 2008) and recognised the valuable contribution of Baltic 21 in terms of the practical implementation of the SD agenda, in supporting capacity building and in the development, promotion, assessment and fostering of strategic projects in the field of SD in the Baltic Sea Region (Baltic 21, 2008b).

A number of initiatives in St. Petersburg contribute to the local Agenda 21. The first one is a Strategic Plan for development for St. Petersburg (General Council for Strategic Plan for St. Petersburg, 1997). The Strategic Plan was published in 1997 following consultations with citizens, the business and administrative sectors at different levels. St. Petersburg became the first city in Russia to develop such a plan. Eight main factors that influence city development were identified and issues related to them were included in the plan. These include geopolitical position; population; organisation of the city in terms of construction planning and construction regulation; natural environment; housing; engineering infrastructure, communication, transport; social sphere; and economic potential. The main aim was formulated in the plan as the development of St. Petersburg as a city integrated in the Russian

and international economy and as a multifunctional city, that provides a high quality living environment and appropriate industrial development (cited in Golubev & Sorokin, 2003, p. 38). Therefore there are two objectives of the Strategic Plan: (a) to increase income and employment through development of the economy and (b) improvement of general living conditions as a result of increased effectiveness of the utilisation of the city budget.

Another important document is the Local Agenda 21 (LA21) for St. Petersburg. In 1998 the St. Petersburg's administration invited scientists involved in developing LA21 to the city. In 2003, the concept of SD for St. Petersburg and the LA21 were published by the local administration (government of the city) (Golubev & Sorokin, 2003). The document identified SD indicators for the city for the period 2005–2008, taking into account the strategy of the city concerned with social and economic development. One of the main tasks to be addressed was the achievement of European standards for quality of life for all St. Petersburg residents. The definition of SD implies such "development of human civilization that is not destroying its natural basis and create life conditions that do not cause human degradation, and where social-destructive processes do not reach a scale that threatens the safety of society" (Government of St. Petersburg, 2006, p. 2). SD indicators developed for the city indicate the areas for forecasting and management of St. Petersburg's development. They are also considered as assessment instruments for the social and economic development of the city. The indicators include birth rate, life expectancy, population natality index, gross national product per head, provision of population with accommodation and cars, general health rate, infant mortality, satisfaction with place availability in preschool institutions, percentage of school age children attending school, proportion of the population with higher degrees, ratio between marriages and divorces, crime rate, public transport availability, area of public access to parks, level of air pollution by nitric oxide and human potential development index. These indicators demonstrate an emphasis on the socio-economic development of the region and they are balanced by the ecological degrees and activities in the area of ecological education (discussed in Chapter 9). For example, in 2002 the *Main directions of the St. Petersburg's policy in the area of environmental protection and provision of ecological security for the period 2003–2007* were adopted by the government of St. Petersburg. This document identified the main direction for the improvement that included the following: improvement of the legal basis for environmental protection; increase in eco-housing construction; development of industry on the basis of high technology; ecological monitoring; development of the ecological culture; improvement of the system of management of the environment; and provision of ecological security. LA21 for the city's regions have also been developed by local administrations.

City non-government organisations (NGOs) have taken an active part in pushing LA21 and BA21. NGOs such as Green World, Children of the Baltic and Eco-information Centre, are among the most active. Many international links have been established by NGOs and a number of successful projects have been realised. An example of one project started in 1998 in St. Petersburg is an *Eco-house*. About

470 people are living in this house and they throw away 300 kg of food waste every day in summer and 200 kg in winter. Residents of the house decided to establish a vegetable garden on the roof of the house. For that purpose, in the basement they transform the food waste into compost using Californian worms. Vegetable production has been very successful and sustainable over a number of years. The production of compost exceeds the garden's needs, so it is sold at the local market. This is an example of a closed production cycle that also brings money to the residents, so they use it for establishing a more effective heating system, building maintenance and other purposes.

## *Arctic*

Another example of a regional strategy is the strategy for the Arctic zone of the Russian Federation. Again, it is related to international collaboration that dates back to 1989. Eight Arctic countries – Denmark, Iceland, Canada, Norway, Russia, USA, Finland and Sweden – agreed on coordinated activities in the region. To reinforce the initiative, in 1996 an international declaration was signed for the establishment of an Arctic Council. Since then, the Arctic Council has played an important role in this process.

In 2006 a draft of the concept of the Federal Law *About the Arctic Zone of the Russian Federation* (Collegia of the Ministry of Regions, 2006) was developed. It established a number of measures related to the socio-economic development of the region and nature protection. The main idea of the law is to improve legal regulations of regional development with the aim of achieving SD of the Arctic zone of Russia. This law is aimed at increasing the quality of life in the Arctic zone, including the life of indigenous people; forecasting and overcoming possible social and economic crises related to the resource-based orientation of the economy; effective use of the natural resources of the Arctic zone; guarantee of ecologically balanced use of nature (resources and nature protection); and maintenance and development of the North Sea route as a national transport corridor in the Arctic.

The Russian Arctic zone includes the territory of eight regions of the Russian Federation, with each of them having their own constitution. Currently the relationships between the federal level and these eight regional levels in terms of legislation are not clear. The Arctic zone has not been viewed as an holistic unit for planning and development purposes. This law provides the basis for the long-term development of the zone. As a result of this law a strategy for SD of the Arctic zone should be developed together with specific regional programmes developed on the basis of this strategy. For example, the Ministry of International Affairs of the Russian Federation (2006) reported that in 2006 a large scale programme "Russian Federation – support of the national programme of activities for the sea environment protection in Arctic" started with a budget of 28.6 million US dollars. The programme is the basis for cooperation with United Nations Environmental Programme (UNEP) in the area of the Arctic.

## *Republic of Buryatia*

The strategy of development for the Republic of Buryatia illustrates a different approach towards regional planning compared with St. Petersburg. Although the main goal is to improve the quality of life, the main approach proposed to achieve this is the preservation of nature. When analysing the strategic objectives for the development of the republic of Buryatia, Mantatov and Mantatova (2006b) noted that the republic is aiming to develop society characterised by:

> scientific knowledge and high technologies able to provide the conditions to form educated and cultured citizens who can carry out a complex of social functions of their time; it is the society understanding the necessity of rational self-restriction of energetic and material expenses for the sake of future generations; it is the society providing man's security and recognizing the necessity to take care of human dignity of all its members; it is a nöospheric society where the measure of the national and individual wealth will be the spiritual values and knowledge of humans living in harmony with the environment. Achieving this large-scale long-term objective presupposes systematic solution of social, ecological and economic problems of sustainable development. The highest priority of the republic *Strategy* of development is humanity and first of all a rise of living standards and the quality of life. (p.19)

This statement is an example of how theoretical debates and policies on SD are interpreted in practice. The *Strategy* identified deep structural reorganisation of the regional economies based on resource saving and ecologically clean and high technologies. The *Strategy*'s ecological objective is to preserve the Lake Baikal ecosystem for present and future generations. The resolution of the 37th Plenary Assembly of the UN Associations World Federation (Barcelona, May 11, 2003) concluded:

> to recognize Lake Baikal and the Baikal natural territory as a target territory of sustainable development of world significance within the UN programmes on sustainable development. Taking into consideration the fact that Lake Baikal contains 20% of the fresh water world stock, [it is important to] take under protection Lake Baikal and the adjacent territory. (cited in Mantatov & Mantatova, 2006b, p. 20)

The Baikal natural territory is of great importance, not only in terms of its reserves of fresh water, but also due to the large territories around the lake that are practically untouched by economic activities. The ethno-cultural traditions of the indigenous people are preserved and these are relevant to SD ethics. There are no signs of over-consumption and no signs of over-population. The current tension that is caused by the lack of financial support for the region represents a dilemma for the local government. On the one hand, there is the need to protect and preserve the unique natural environment that is an important part of stabilising the whole planet. On the other hand, there is an urgent need to increase the well-being of the people. In fact, nowadays more than half of the republic's population live in poverty.

The social development of the Republic of Buryatia depends directly on finding a solution to "the Baikal's problem" (80% of the republic is occupied by the Lake Baikal watershed). As noted by Mantanov and Mantanova (2006b) there is a reduced emphasis on nature protection in Buryatia due to the budget deficit. The financial

situation has determined that there have been almost no ecologically safe technologies introduced in Ulan Ude, the capital. As a result, Ulan Ude continues to be among the most polluted cities in Russia. The *Strategy* argues that financial support for Lake Baikal needs to be sourced from the world community, as development of the Baikal region has world significance. Currently, transfers from the federal budget do not reimburse the annually accumulating losses for Buryatia. The close relationship between poverty, environment and economy are well understood in the strategy.

Mantanov and Mantanova (2006b) propose the organisation of a World Fund for the sustainable development of the Baikal natural territory. This would entail establishing a geopolitical foundation for SD of the whole Baikal region as a territory of world significance. This idea is based on the declarations of world summits on environment and sustainable development (Rio de Janeiro, Johannesburg) that envisage compensation for the regions with rich ecological potential for their removal from economic use of their natural capital.

## Federal Target Programmes

A number of the federal target programmes have had financial support over recent years to help realise the environmental policy of Russia. Programmes such as "Ecology and natural resources", "Nuclear and radiation safety of Russia" for 2000–2006 are examples. By way of illustration, the Ministry of International Affairs of the Russian Federation (2006) reported that in 2005 within the framework of SD, the national programme *Development of the water complex of Russia (Water of Russia – XXI century*) was successful in meeting projected targets. The main components are provision of required quantities of water to the population and for economic activities; prevention and rectification of the consequences of floods; prevention of water pollution; development and implementation of new, effective technologies for water purification and sanitation; improvement of state management of water resources; and legal, scientific and IT support for the water industry. The federally targeted programmes have proved to be an effective approach towards resolution of the most urgent environmental problems.

## Environmental Movement

The environmental movement in Russia is represented by many NGOs. These organisations are actively involved in a range of activities including the dissemination of information and knowledge among different stakeholder groups, including local authorities, members of the general public and local communities on environmental issues; organisation of seminars and training on problems related to ecological issues and their impact on human health and nature; undertaking activities to raise the awareness of consumers on sustainable consumption; encouraging NGO participation in ecological monitoring and monitoring of the governmental activities on management of natural resources, pollution; initiating projects for the

identification of ecologically critical areas, pollution and waste management. Many of them have been active in pushing Agenda 21 in the country, for example, Eco-Accord (Moscow), Centre of Ecological Policy (Moscow), Baltic Environmental Forum (St. Petersburg) and being efficient in promoting cohesion of civil society in pursuance of environmentally significant objectives. Inadequate financial resources and a limited range of funding sources that provide grants to NGOs for environmental purposes and unwillingness of local governments and businesses to support the projects of NGOs, are all factors that could negatively affect their activities. Nevertheless, there are many successful examples of NGO initiatives.

Russia's environmental movement has taken an active part in developing their interpretation of SD. For example, during 2001, several leading environmental organisations worked together to produce a draft of an ecological doctrine for Russia (http://www.seu.ru/documents/eng/doctrine/2.htm). The strategic goals of the state ecological policy formulated by them are:

- exercise of the present and future people generations for the favourable and 'health-friendly' environment;
- providing for non-exhaustive, rational use and protection of all nature resources;
- providing for sustainable development and ecological safety of the Russian Federation.

The main principles of the Russian Federation ecological policy stated in this document focus on the ecologisation of production processes, the efficient use of natural resources and the development of an effective civil society. It also focuses on the need for developing more effective management, legislative and economic systems in order to ensure the SD of society. This doctrine would appear to represent an attempt to adopt the internationally recognised approaches to the Russian context and it partly informed the development of the *Ecological Doctrine of the Russian Federation* (2002).

Another example is a global network of public interest NGOs that became united in support of a common goal for the elimination of Persistent Organic Pollutants (POP). The *International POPs Elimination Networks* (IPEN) mission is defined by both the IPEN Stockholm Declaration, which was adopted in 2001 after the Stockholm Convention was signed and the IPEN Dubai Declaration for a Toxic Free Future, which was adopted in 2006 after the global community endorsed the Strategic Approach to International Chemicals Management. Founded in early 1998 by a small number of NGOs, IPEN was formally launched in June 1998. Throughout the course of the five negotiating sessions, the network grew to include more than 400 public health, environmental, consumer and other NGOs in 65 countries. It also leveraged the resources and created a forum for NGOs and activists from around the world to participate in the negotiations (IPEN, 2008).

Russia, as a part of the Eastern Europe, Caucasus and Central Asia (EECCA) region, is an active member of IPEN. The recent IPEN NGO Regional Assessment report conducted by Russia, *Promoting Regional NGO awareness, communication, planning and collaboration*, presents the results of 50 NGOs surveyed. The report highlights the following activities that are the most typical for the EECCA region:

- *Raised public and stakeholder attention* to the issues by disseminating information materials such as reports, booklets, brochures and posters;
- *Organised multi-stakeholder meetings*/events with government officials, NGOs, local community members and/or private sector members to address chemical problems;
- *Organised media events* for press (radio, newspaper, television, internet); and
- Organised information and *awareness workshops and trainings*. (IPEN, 2007).

Cross-country links for the NGO provide a real basis for their activities and coordination of such activities that could lead to better results.

## Conclusion

This chapter outlined the ways SD is interpreted in Russia. Through the documents examined and discussed, clear priorities for the SD of Russia were identified. They include an emphasis on improving living conditions for people in Russia, developing an eco-sensitive economy, preserving nature and developing a new civilisation and a nöospheric society that establishes a harmonious relationship between humans and nature. Russia's theories of biotic regulation and nöospheric vision are brought together by Russian scientists who developed the concept of SD and strategies for its implementation. An emphasis on moral values and responsibility that underpin nature preservation and development of a nöosphere vision is an example of how the value-based approach to SD, argued in Chapter 3, is interpreted in a specific context. Criteria proposed to achieve this ethical principle proposed in Chapter 3 correlate with approaches suggested in Russia. An ethical basis for SD that promotes the mutual flourishing of human and non-human nature and formulated in the principle "duty to care for other people and other forms of life now and in the future" as argued in Chapter 3, is also supported by a number of Russian thinkers (e.g., Losev, 2001).

The specificity of Russia's transition to SD was also examined in this chapter. On the one hand, Russia has one fifth of the world's untouched nature; its forests are a stabilising factor for the whole biosphere. On the other hand, there are many highly polluted areas, where natural ecosystems are seriously damaged. The quality of life for the majority of people is very low. Processes at the government level are complemented by activities of the NGOs. LA21 has been developed by many regions in Russia.

The clear theoretical basis of SD provides an opportunity for the development of systematic approaches towards ESD. Concepts and practices of ESD in Russia are examined in the next chapter.

## References

Baltic 21. (1998). *An Agenda 21 for the Baltic Sea Region – Baltic 21*. Adopted at the 7th Ministerial Session of the Council of the Baltic Sea States, Nyborg, June 22–23, 1998. Retrieved March 7, 2008, from http://www.baltic21.org/?a,165.

Baltic 21. (2008a). *About Baltic 21: Background, objectives, goals, strategy and actors*. Retrieved June 21, 2008, from http://www.baltic21.org/?about.

Baltic 21. (2008b). *News*. Retrieved June 21, 2008, from http://www.baltic21.org/.

Collegia of the Ministry of Regions. (2006). *Конуепция проекта федерального закона «Об Арктической зоне Российской Федерации»* [Draft of the Concept of the Federal Law "About the Arctic Zone of the Russian Federation"]. Retrieved May 9, 2008, from http://www.minregion.ru/OpenFile.ashx/2006–12–22_concept_fz_arctic.doc?AttachID=745).

Danilov-Danil'jan, V. I. (1996). Устойчивое развитие – будущее Российской Федерации [Sustainable development – the future of Russia]. *Россия на пути к устойчивому развитию* [Russia on the path to sustainable development]. Moscow: РЭФИА.

Efremenko, D. (2006). The Theory of Biotic Regulation of the Environment as a Framework Concept for Integrated Environmental Policy: An Analysis of Russian Scientific-Political Discourse on Biodiversity, Climate Change and Environmental Services. Presented at *Survival of the Commons: Mounting Challenges and New Realities*, the Eleventh Conference of the International Association for the Study of Common Property, Bali, Indonesia, June 19–23, 2006. Retrieved May 9, 2008, from http://dlc.dlib.indiana.edu/archive/00001885/.

Flavin, K. (1998). Heritage of Rio. [Наследие Рио]. *Россия в окружающем мире. 1998. Аналитический ежегодник, 1998.*, pp. 13–17.

General Council for Strategic Plan for St. Petersburg. (1997). Strategic plan of St. Petersburg. Reprinted in D. A. Golubev & N. D. Sorokin (Eds.), (2003), *Concept of Sustainable Development and Local Agenda 21* (pp. 230–361). St. Petersburg: Souz Hudozhnikov.

Golubev, D. A., & Sorokin, N. D. (Eds). (2003). Концепция устойчивого развития и Местная повестка дня на XXI век [*The concept of sustainable development and the Local Agenda XXI*]. St. Petersburg: Administration of St. Petersburg, Union of Artists Publisher.

Gorshkov, V. G. (1995). *Physical and biological bases of life stability: Man, biota, environment*. Berlin: Springer-Verlag.

Gorshkov, V. G., Gorshkov, V. V., & Makarieva, A. M. (2000). *Biotic regulation of the environment: Key issue of global change*. London: Springer-Verlag.

Gorshkov, V. G., Makarieva, A. M., & Gorshkov, V. V. (2004). Revising the fundamentals of ecological knowledge: The biota-environment interaction. *Ecological Complexity, 1*, 17–36.

Gorshkov, V. V., Gorshkov, V. G., Danilov-Danil'yan, V. I., *et al*. (1999) Biotic control of the environment. *Russian Journal of Ecology, 30*(2), 87–96.

Government of St. Petersburg. (2006). Together with Committee for Nature Use, Environmental Protection and Ecological Safety, Russian Academy of Sciences and St. Petersburg Research Centre. *Indicators of Sustainable Development for St. Petersburg: Instruments for assessment of social and economic development of the city for the period from 2005 to 2008*. St. Petersburg: Author.

Government of the Russian Federation. (2002). *The ecological doctrine of the Russian Federation*. [Экологическая Доктрина Российской Федерации] Retrieved March 25, 2004, from http://www.ln.mid.ru/ns-osndoc.nsf/0e9272befa34209743256c630042d1aa/432569fa003a249c43256c9a002f10ca?OpenDocument.

Grachev, V. A. (2006). Report of the Head of the National Ecological audit Chamber. Retrieved May 9, 2006, from http://www.ecopalata.ru/php/content.php?id=709.

IPEN (International POPs Elimination Network). (2007). *Regional assessment report: Report form: Promoting regional NGO awareness, communication, planning and collaboration*. Retrieved April 23, 2008, from http://accord.cis.lead.org/pop/doc/EECCA%20Reg%20Report.doc.

IPEN (International POPs Elimination Network). (2008). *About IPEN*. Retrieved April 23, 2008, from http://www.ipen.org/ipenweb/aboutipen.html.

IUCN, WWF, UNEP. (International Union for the Conservation of Nature, World Wildlife Fund, and United Nations Environment Program). (1991). *Caring for the Earth: A strategy for sustainable living*. Switzerland: IUCN.

Kasimov, N. S., Malkhazova, S.M., & Romanova, E. P. (2008). *Environmental education for sustainable development in Russia*. Retrieved May 15, 2008, from http://www.geogr.msu.ru/ESD/pages/page3_6e.htm.

Kondrat'ev, K. Ya., & Losev, K. S. (2002) 'Illyuzii i real'nost' strategii ustoichivogo razvitiya'. [The illusions and realities of the strategy of sustainable development] *Vestnik Rossiiskoi Akademii nauk, 72*(7), 592–601.

Losev, K. (2001). Ecological issues and sustainable development perspectives of Russia at the beginning of the 21st Century. Report presented at the World Summit for Sustainable Development; International Eminent Persons Meeting on *Inter-linkages: strategies for bridging problems and solutions to work towards sustainable development*, 3–4 September, 2001, United Nations University Centre. Retrieved February 2, 2008, from http://www.unu.edu/interlink/papers/WG3/Losev.doc.

Losev, K. S. (2003). 'Estestvenno-nauchnaya baza ustoichivoi zhizni'. [The scientific basis of sustainable development] *Vestnik Rossiiskoi Akademii nauk, 73*(2), 110–116.

Lukina, O. G., & Lukin, S. I. (2006). *Provision for sustainable development of Russia within the framework of the Presidential program using Intelligent Systems*. The Regional Resource Centre: Tver. Retrieved May 15, 2008, from http://www.rrc-tver.ru/articles/356.

Mantatov, V. V. (2006). *Sustainable development: The problems of synsesing the problem of nature and morality*. Retrieved April 23, 2008 from the web http://www.baikal-center.ru/en/books/element.php?ID=1827.

Mantatov, V. V., & Mantatova, L. V. (2006a). *Sustainable development as civilization imperative*. Retrieved April 23, 2008, from http://www.baikal-center.ru/en/books/element.php?ID=1827.

Mantatov, V. V., & Mantatova, L. V. (2006b). *The Republic of Buryatia sustainable development strategy*. Retrieved April 23, 2008, from http://www.baikal-center.ru/en/books/element.php?ID=1827.

Mantatova, L.V. (2006). *Russian scientists on sustainable development*. The sustainable development institute of the Eastern-Siberian State Technological University. Retrieved April 23, 2008 from the web http://www.baikal-center.ru/en/books/element.php?ID=1827.

Ministry of International Affairs of the Russian Federation. (2006). *Деятельность России на природоохранном направлении в* 2005 гоДу. Retrieved March 19, 2008 from the web http://www.ln.mid.ru/ns-dmo.nsf/a1c87897b58a9d2743256a550029f995/432569f10031eb93c32570430031542c?OpenDocument.

Moiseyev, N. N. (1995). "Устойчивое развитие" или "стратегия переходного периода" ['Sustainable development' or 'the Strategy of the Transition Period']. *План действий 'Устойчивые Нидерланды'*. In [The Activities Plan – 'The Sustainable Netherlands'] (pp. 3–18). Moscow: ЭКСПРЕССАМ.

Moiseyev, N. N. (1990). *Человек и ноосфера*. [Person and the nöosphere]. Moscow: Молодая гвардия.

Muntyan, M. A., & Ursul, A. D. (2003). *Глобализация и устойчивое развитие*. [Globalisation and sustainable development]. Moscow: СТУПЕНИ.

Platonov, V. (2001). Actual problems of sustainable development of Russia. *Publication series of the Russian Nationals friendship University: Politologija, 3*, 5–9.

Romanovich, A., & Ursul, A. (2006). *Устойчивое будущее (глобализация, безопасность, ноосферогенез* [Sustainable future (globalisation, security, nöospheregenes)]. Moscow: Publishing house Life.

Shelehov, A.M. (Ed.). (2002). *Osnovnue polozhenija startegii ustoichivogo razvitija Rossii* [Main ideas of the strategy of the sustainable development of Russia] Retrieved June 21, 2004, from http://www.duma.gov.ru/sustainable/strategy.htm.

Timofeeff-Ressovsky, N. V. (1968). *Biosfera i chelovechestvo* [Biosphere and mankind].Obninsk.

Ukaz. (1994). *Ukaz prezidenta RF ot 4 fevralja 1994g. #236 "O gosudarstvennoj strategii Rossijskoj Federatsii po ohrane okruzhaustchej sredu I obespecheniu ustoichivogo razvitija"* [The decree of the President of the Russian Federation from the 4th of February 1994 #236 "About the state strategy of the Russian Federation on the protection of the environment and ensuring of sustainable development"]. Retrieved June 21, 2004, from http://www.ecolife.ru/info/docum/cel-prog4.shtml.

Ukaz. (1996). *Ukaz prezidenta RF "O kontseptsii perehoda Rossiskoi Federatsii k ustoichivomu razvitiyu"* [The decree of the President of the Russian Federation from the 1st of April 1996, #440 "About the concept of moving of the Russian Federation towards sustainable development"]. *Rossiiskaya Gazeta, 9*, 5.

Ursul, A. D. (2005). Sustainable development: The conceptual model. [Устойчивое развитие: концептуальная модель] *National Interests*, 1 [Национальные интересы]. http://ni-journal.ru/archive/2005/n1_05/5324690e/d93f12df.

Ursul, A. D., Los, V.A., & Demidov, F. D. (2003). *Концептуальные основы устойчивого развития*. [Conceptual basis of sustainable development]. Moscow: РАГС.

Vashchekin, N. P., Muntyan, M. A., & Ursul, A. D. (2000). *Постиндустриальное общество и устойчивое развитие*. [Post-industrial society and sustainable development]. Moscow: Not stated.

Vernadsky, V. I. (1945). The biosphere and the nöosphere. *American Scientist, 33*, 1–12. Reprinted by Executive Intelligence Review, February 2005. Retrieved March 7, 2008, from http://larouchepub.com/other/2005/site_packages/vernadsky/3207bios_and_noos.html.

World Commission on Environment and Development (the Brundtland Commission). (1987). *Our common future*. Oxford: Oxford University Press.

# Chapter 9
# Education for Sustainable Development in Russia

An international implementation scheme for the Decade of Education for Sustainable Development (DESD, 2005–2014) proposed the development of scenarios as a particular means of fostering the innovation necessary for widespread introduction of ESD. Each scenario should include, for the situation it addresses:

- Ways to discover what the key local issues of sustainable development are;
- Possible learning strategies;
- Ways of fostering links between the learning situation (school, adult programme, etc.) and the community, for example, involving schoolchildren in research projects monitoring environmental change;
- Ways of integrating local knowledge and culture; and
- Curriculum development processes enabling content to be decided locally, based on sustainable development principles. (UNESCO, 2005, p. 32)

Russia as a whole and its regions are on the way to developing ESD scenarios. In the previous chapter, key issues for SD in Russia were identified and examined through political documents and theoretical discourses. An emphasis on the development of a values perspective/dimension and the aim to establish a nöosphere society positioned education in Russia as one of the principal means for achieving the goals of SD. Opportunities for ESD identified in Chapter 7, together with debates on ESD in terms of possible learning strategies, ways of integrating local knowledge and culture, curriculum development and links between education and communities are explored in this chapter. The ways in which ESD is conceptualised, interpreted and realised in practice in Russia are the main focuses of the analysis below.

## The Role of Education in SD

All major political documents analysed in Chapter 8 (the *Concept of Russia's transition to SD*, the *Strategy of SD* and the *Ecological Doctrine*) highlight the role education should play in the transition to SD. The *Concept* (Ukaz, 1996) states that within the transition to SD, the role of education is the development of a new personality that helps the sphere of wisdom (the nöosphere) foreseen by Vernadsky (1945) to emerge, a personality that is oriented towards the system of ecological wealth, but not the wealth of the consumer society.

M. Pavlova, *Technology and Vocational Education for Sustainable Development*, Technical and Vocational Education and Training: Issues, Concerns and Prospects 10,
DOI 10.1007/978-1-4020-5279-8_10, © Springer Science+Business Media B.V. 2009

The *Strategy of SD* (Shelehov, 2002) also emphasises the importance of education. It states the need for a rebirth of the spiritual potential of Russia to be able to develop along the pathway to SD. The spiritual and moral values that are oriented towards the survival of the whole of humanity and balanced with the national interests of Russia should be developed through education. As a result, education provides both an instrument for, and a method of transition to, sustainable development. Through education it is important to change the world outlook to one that promotes a global understanding of nöosphere as belonging to all humanity. The transition to nöosphere requires profound changes in the values and actions of humanity and in that sense, it is closely related to two bases on which SD has been conceptualised in Chapter 3: the ethics of weak anthropocentrism and a value change response. ESD in Russia should develop the capability in students to view nature in a way that is called by Huckle (2005) "essentially poetic and non-manipulative" (p. 15).

The role of education as interpreted in this *Strategy* (Shelehov, 2002) is aimed at the development of an ecologically oriented world outlook and responsibility for SD and incorporating lifelong ecological education for all. Education at all levels needs to provide access to information about ways to resolve issues of SD. The development of new ethics, based on a caring attitude towards the biosphere, is a priority. It involves considering such factors as the capacity of the biosphere, the logic of its development, maintenance of a viable economy, limits to consumption and development of healthy lifestyles, as well as tolerance towards international and inter-religious relationships. It is also developed from the specificity of interpretations of SD within the nöosphere vision and a long lasting tradition of linking education and upbringing (values development). Therefore, ESD in Russia could be considered as a new framework for values education in schooling.

If the *Concept* and the *Strategy* emphasise value change in students that relates to a broad spectrum of SD issues, the *Ecological Doctrine* (Government of the Russian Federation, 2002) highlights the role of ecological education (EE) that is included amongst the other ways of implementing the national ecological policy. The main aim is to increase the level of the ecological culture of the nation, including educational level, vocational capabilities and public knowledge of ecology. To achieve this, it is important to:

- Develop state and non-state systems of lifelong ecological education;
- Include aspects of ecology, rational use of nature, environmental protection and SD of Russia in curriculum, at all levels of education;
- Increase the emphasis on social aspects of ecological education;
- Provide training and in-service training of ecology teachers for all levels of formal and informal education including issues of the SD of Russia;
- Include the development of ecological culture and ecology education in federal, regional and local programmes of development;
- Provide state support for education systems that implement ecology education;
- Develop educational standards aimed at explaining issues of the SD of Russia;
- Develop training programmes for managers in business, industry and the economy, to increase their information level regarding legislation in environment protection; and

- Provide support for and publication of materials on ecology in the mass media (p. 16).

Although the *Concept*, *Strategy* and *Ecological Doctrine* have slightly different focuses in identifying the role of education, they share an holistic understanding could be formulated. Education is deemed to be the vehicle for promoting an ecologically oriented outlook and behaviour, as well as a noosphere vision. This relates to two bases for SD conceptualisation in Russia: ecological theories and nöosphere theory examined in Chapter 8.

## Conceptual Bases of ESD

To develop the above ideas into a coherent document, a working group on Ecological Education of the Committee on Ecology of the State Duma of the Russian Federation, co-chaired by Kalinin, presented the *Conceptual bases for ESD* (Kalinin, 2002b). As stated by Kalinin, these bases were developed in accord with the Law of the Russian Federation *About education* (1996), *Concept of transition of the Russian Federation to sustainable development* (1996), *National doctrine on education in the Russian Federation* (Government of the Russian Federation, 2000) and *Ecological doctrine of the Russian Federation* (2002). In a broad context *the main aim of ESD* stated in the *Conceptual bases* is the assistance in the development of an all-rounded, educated, socially active person who understands new trends and processes in social life, acquires systemic views and moral, cultural and ethical principles and norms of behaviour, that provide readiness for socially responsible activity and lifelong learning in a rapidly changing world.

ESD should:

- Assist in the *spread of knowledge* about the environment and its conditions;
- Present *criteria, standards, recommendations for making decisions* in the areas of nature protection and complex/holistic solutions of social, economic and ecological problems;
- Demonstrate possibilities for *economy development while natural environment is protected and preserved*;
- Increase the *importance of ecological traditions and ecologically justified methods of economic development* applied by different nationalities for developing attitude of care for the natural-cultural heritage;
- Facilitate *personal growth, self-development, self-realisation, self-actualisation* of students;
- Provide opportunities for development of:
  - *Attitude of care* towards people, natural and cultural valuables;
  - Active *civic position*;
  - *Value orientation* and ecological-humanistic world view, based on the *ethics of responsibility* for environmental conditions, rational use of natural resources, for the current and future generations. (Kalinin, 2002b, p. 2)

The *Conceptual bases* argues further that more specifically, the aim of ESD is to facilitate knowledge and skills development, acquiring of experience, development of creativity, self-realisation, establishment of personality in students in the process of holistic solution and prevention of social, economic and ecological problems for increasing the quality of life for current and future generations on the basis of sustainable development. These aims of ESD are a mixture of the traditional ideals of developing an all-rounded person and the new demands for the prevention and solving of problems, having in mind the objectives of SD.

This document also identifies *theoretical world-view-based objectives* of ESD that help to develop understanding and *applied objectives* that relate to the conditions for developing skills. The first type, knowledge-based objectives, includes:

- The bases for *relationships between nature and society*; the importance of nature protection; value of natural resources; the need for effective use of resources, approaches to the problem of SD in global, regional and local contexts;
- *Particularities and dynamics* of the main processes in the world, Russia, regions and local communities, in terms of relationships between economic, social and ecological aspects of these processes;
- *Multifaceted character (including social, economic and ecological aspects) and the reasons for current problems* posed in front of the world community, states, regions and local communities. (Kalinin, 2002b, p. 3)

The second type, which is called applied objectives, is skill-based. These objectives include the ability to analyse, synthesise, identify and systematically collect social, economic and ecological information; cooperate with others to realise the concept of SD; predict and model processes related to sustainability of socio-ecological-economic systems; effective decision making; apply SD knowledge; critically assess information; and inspire people to act in the directions of sustainable development of the socio-ecology-economic systems.

Through the aims and objectives of ESD in Russia all three theoretical perspectives on conceptualising SD (as argued in Chapter 3), including value position (attitude of care for people, nature and culture, ethics of responsibility); the nature of proposed responses (value re-orientation that is followed by ecologically viable economic development and nature preservation); and the structure of proposed responses (social, economic and environmental), are presented in the *Conceptual Bases*. This multidimensional approach provides an opportunity to develop learning strategies and curriculum standards relevant for the ESD scenario specific for Russia.

The *Conceptual Bases* document also identifies a number of outcomes for ESD. They reflect the gradual achievement of ESD aims and recognise several stages in ESD realisation.

***The main outcome*** of ESD is students' behaviour reflected in a socially significant set of activities aimed at harmonising their relationships with the environment.

***The more immediate outcome*** of ESD is an understanding of the need not only for ecological, but also socio-economic changes in the management of the economy (incorporating global, state, region, city, organisation and learning institution levels) that are directly correlated with ecological demands.

***The long-term outcome*** (realisation of axiological basis of ESD) is the development of post-materialist values that characterise a society that could be established instead of the consumer society. Such values include humanism, freedom, creativity, morality, orientation towards a dialogue and cooperation (not power, status and hierarchy); professionalism, self-realisation, quality of life, understanding of yourself as a part of nature and responsibility for its protection, rehabilitation and preservation for future generations. (Kalinin, 2002b, pp. 3–4)

It is possible to suggest that through this staging process the emphasis will change from ecological education to the nöospheric component of ESD. This proposal is in accord with the stages of transition of Russia to SD examined in the previous chapter. Therefore, ESD should be developed with an orientation to the post-material civilisation that would have the following features:

- Limiting the role of material production;
- Development of the service and information sectors of the economy;
- Increasing the role of knowledge and flexibility of the educational system relevant to the new type of society. (Kalinin, 2002b, p. 4)

Orientation towards a post-materialist, post-consumer civilisation formulates a vision of a sustainable future for Russia. Pedagogical approaches and methods of the Russian ESD scenario are also proposed in the document. They include:

- Priority of moral values (prepare students for morally based judgements from ecological and socially grounded positions as a starting point for social transformation);
- Learning through experience and cooperation;
- Problem-based learning;
- Consideration of different learning styles;
- Development of capability of strategic and indicative planning, including strategic marketing (as the method of considering different needs of social groups);
- Gaining experience in managing projects which are socially important, practically oriented, aimed at achieving measurable outcomes in improving social, economic and environmental systems. (Kalinin, 2002b, p. 6)

Curriculum that is developed based on these principles would be closely related to the models proposed by the "global studies" by Parker *et al*. (1999) and Campbell *et al*. (1992) and discussed in Chapter 2 and the argument developed in Chapter 2 about the priority of moral values and active methods of learning. Problem-based experiential learning is also among the important aims of the modernisation of education in Russia. ESD could be realised through courses/subjects or as components of courses; however, it is argued in the *Conceptual Bases* document that the most valuable approach would be the reorientation of the whole system of education. ESD could be used as an *umbrella for different branches of knowledge*. That is, ESD could be used as the organising principle for an educational system oriented towards achieving solutions for existing social, economic and ecological problems and prevention of future problems.

## Political Developments Concerning ESD

### *Parliamentary Recommendation*

The *Conceptual Bases* document was produced in 2002. However, it has had limited impact on policy and practice in ESD in Russia. It took four years to achieve the next step in promoting ESD. On 25th May, 2006 the Committee on Ecology of the State Duma led a parliamentary discussion – *About participation of the RF in realisation of the UN Economic Commission for Europe strategy for education in the interest of sustainable development*. It was concluded that Russia's participation in the realisation of the UN Economic Commission for Europe (UNECE) *Strategy* for education for sustainable development (UNECE, 2005) was in the national interests of Russia. As a result of these discussions, the parliament recommended the development of the *National Strategy of Education, Enlightenment and Upbringing in the interest of SD* and the *National Action Plan for realisation of ESD in the RF* (Committee on Ecology, State Duma, 2006) as the appropriate measures for establishing a new educational paradigm. Members of the discussion recommended the Federal Government of the Russian Federation to speed up the consideration and adoption of the federal law *About the ecological culture* and include in the federal component of the school standards a subject *Ecology and SD* that would integrate all components of education relevant to the realisation of the concept of SD. It was also requested that the Russian Academy of Education develop a multi-component research programme entitled *Development of ESD for 2007–2010*. Non-government organisations (NGOs) were asked to support government initiatives and to be actively involved in the development of the *National Strategy* and *Action Plan* for ESD in Russia.

The government was requested to establish the National Council for work coordination related to the development of the system of education and upbringing (value-development) in the interests of SD. It was also recommended to include in the federal programme of education development the specific direction *Development of the system of ecological education, enlightenment and up-bringing in the interest of SD* (Committee on Ecology, State Duma, 2006). In the recommendations of this parliamentary session it was also noted that historically in Russia, favourable conditions for the development of ESD have been established. They are based on the previous achievements of the state education system and on the work of the outstanding academics. It was suggested that the development of ESD in Russia would be based on:

- A system of classical and engineering ecology education and related systems of geographical, biological and economic education [at the higher school level];
- Latest generation of educational standards for secondary and higher school, that includes imperatives of sustainable development;
- Appearance of the first elements of new institutional support for ESD (Committee on SD at the State Duma of the Federal Sittings of the Russian Federation; the

Scientific-Methodological Council on Ecology and Sustainable Development as a part of Educational Methodological Unit on classical education);
- Experience of the first research centres on SD at the universities;
- Practice of annual ecology and other olympiads at the regional and federal levels;
- Active involvement of Russian representatives in development of the UNECE *Strategy* for SD (2005);
- Developed interactive methods of learning for decision making in the interests of SD;
- A broad variety of successful programmes and projects on ESD conducted by NGOs;
- Cooperation with NGOs (State Duma of the Russian Federation, 2006).

The parliament's recommendations also proposed that activities in the development and implementation of ESD should be based not only on Russia's experience within the country but also on Russia's involvement in the regional ESD actions and in particular, on Russia's leadership in the development of the UN Economic Commission for Europe (UNECE) ESD strategy. The UNECE ESD strategy was initiated by the ministerial conference on *Environment for Europe*, held in May 2003 in Kiev. The conference emphasised the importance of environmental education and ESD in shaping educational systems at all levels – from elementary education through to the re-training of experts and decision makers. The Kiev Conference also called for the development and implementation of an ESD strategy. Russia and Sweden led the process of development of this strategy. In this process Russia represented the interests of countries with transition economies and advocated the need to account for the economic situations and educational traditions of Eastern Europe, the Caucasus and Central Asia (EECCA). The representative of Russia (Prof. Kasimov) was a vice-chairman of the task force and the working group for strategy development.

## *The UNECE Strategy for Education for Sustainable Development*

The UNECE *Strategy* for education for sustainable development (UNECE, 2005) was adopted in Vilnius in March 2005 by environment and education ministers. It aims to reinforce the need to include SD in regulations concerning education and to integrate a sustainable development agenda in education at all levels and in the operational culture of schools. The *Strategy* (UNECE, 2005) emphasises the important role education is playing in the life of society. Particularly, the document advocates ESD as a tool that can help translate our visions into future realities:

> Education for sustainable development develops and strengthens the capacity of individuals, groups, communities, organizations and countries to make judgements and choices in favour of sustainable development. It can promote a shift in people's mindsets and in so doing enable them to make our world safer, healthier and more prosperous, thereby improving the quality of life. (p. 1)

This powerful statement on ESD highlights the need and opportunity to re-orient people's values and to empower people with new visions and the means to achieve them. To acknowledge the complex nature of ESD, it is defined through a number of principles. For example, one principle specifically relates to vocational education:

> 19. ESD is a lifelong process from early childhood to higher and adult education and goes beyond formal education. As values, lifestyles and attitudes are established from an early age, the role of education is of particular importance for children. Since learning takes place as we take on different roles in our lives, ESD has to be considered as a 'life-wide' process. It should permeate learning programmes at all levels, including vocational education, training for educators, and continuing education for professionals and decision makers. (p. 5)

In the section *Implications for Education*, further issues are related to vocational education and workplace learning:

> 38. All sectors of the workforce can contribute to national, regional and global sustainability. The development of specialized training programmes to provide professionals and decision makers with the knowledge and skills to contribute to SD have been identified as a critical component of education for sustainable development.
>
> 39. Thus, vocational and continuing education have a very important role to play and should therefore be offered to decision makers and all professionals, especially those with a role in planning and management. It should be aimed at building knowledge and awareness of SD. Continuing education has two main activity areas: (a) upgrading knowledge and skills; and (b) providing new competencies needed in different professions and in different situations. Continuing education is one of the areas that would benefit from cooperation among the education sectors, stakeholders and the community at large.
>
> 40. Training programmes should address the key themes of SD, but at the same time take into consideration the needs of different professions and the relevance of these themes to their areas of work. Special attention should be given to subjects linked to the primary responsibility of a profession and its economic, social and environmental impacts. (UNECE, 2005, p. 8)

This *Strategy* is the only document on ESD relevant to Russia that highlights the contribution of vocational education to SD and states the ways vocational education and training (VET) should be involved in ESD. Hopefully these positions of the UNECE *Strategy* would influence the development of the *Russian Strategy* and the *Action Plan*. The UNECE *Strategy* recognises that education itself must be subject to change to be able to become a part of the SD agenda and that research should inform this change: "There is a need for increased cooperation and partnerships between stakeholders in research and development activities, ranging from identifying issues to working with new knowledge and making it known and used" (UNECE, 2005, p. 8). This document also sets up a framework for implementation that includes areas for action, international cooperation, financial support and responsibilities as well as a time frame. It is stated that by 2010 implementation of the strategy "should be well under way" and by 2015 "countries should have made considerable progress in implementing ESD" (p. 14). By definition, this UNECE *Strategy* should have influenced the political agenda on ESD in Russia.

## Ecological (Environmental) Education

The current status of ESD in Russia cannot be understood without an analysis of current ecological education (EE). Through examination of the documents (the Concept, the *Strategy*, the Ecological Doctrine) and through academic discussions, the issue of the relationships between ESD and EE has been posed again and again. As argued by Kalinin (2002b), a co-chair of the working group on Ecological Education of the Committee on Ecology of the State Duma of the Russian Federation, very often people see the difference between EE and ESD in terms of the number of areas addressed: ecological, social and economic for ESD and only the ecological aspect for EE. However, as argued by Kalinin (2002a), since 1977 (the Tbilisi declaration) the aim of EE has been formulated broadly as "stimulation of development in understanding relationships between economic, social, political and ecological aspects of the environment" (in Kalinin, 2002a, p. 1). Therefore, at the theoretical level, ecological education has been interpreted in broad terms. However, in practice it mainly means education about the natural environment.

For Kalinin (2002a) the main difference between EE and ESD could be established through an understanding that the current global crisis is not an ecological one, but a *crisis of management*. The concept of SD is the reaction to a crisis that is the result of the inability of society to adapt to the rapidly changing environment and the loss of ability for self-regulation and effective management. The way out of the crisis is in changing the type of relationships between humanity and nature through a reformation of social systems (the result of their poor functioning led to the current crisis), that is, the reform of management, development of theory and practice of sustainable management. Kalinin argued that EE and ESD could and should develop together. ESD could be considered as a systemic factor in the development of an educational system in establishing a new educational paradigm and EE could be realised through a specific subject, Ecology, that is gradually becoming compulsory in secondary schools.

The UNECE *Strategy* for ESD (UNECE, 2005) also highlights the difference between ESD and EE:

> [ESD] broadens the concept of environmental education (EE).... Therefore, environmental education should be elaborated and complemented with other fields of education in an integrative approach towards education for sustainable development. (p. 4)

In establishing ESD there is a need to widen perspectives away from the traditional "green" issues and shift the balance towards the economic and social sphere.

Russia, as a part of the Eastern Europe, Caucasus and Central Asia (EECCA) region, was involved in a review focused on implementation of environmental education. The research was conducted by NGOs in the region. The report (European Eco-Forum, 2006) concluded that EE has been a priority in the national environmental policies of all EECCA countries compared to ESD; EE and ESD are often insufficiently clearly defined and sometimes the term EE is substituted by ESD, although its meaning remains unchanged. It was also recognised in the

report that there are emerging positive tendencies in Russia where a number of resolutions and documents (discussed above) have been adopted to support ESD at the national level (European Eco-Forum, 2006). This report also analyses the differences in the EE and ESD provisions. For both areas it depends on the level of education. For higher education the elements and programmes on EE are widely represented due to Russia's experience and traditions in this field. A good start also was given to the development of ESD: "the Scientific and Methodological Council on Ecology and Sustainable Development for classical universities was established, State *Standard* in the field of ESD was developed [for higher education]" (p. 10).

ESD at the school level is mainly conducted through experimental projects. In 2006, 30 schools in Moscow were involved in the AsEcO (NGO) project *Local Agenda 21 for Schools*. In informal education, NGOs are organising different programmes and activities for school students. No data were presented about ESD and VET.

Among the recommendations of this research, two were: (a) to rename the objective relevant to education in the EECCA *Environmental Strategy* from Environmental Education to *Environmental Education and Education for Sustainable development* to focus on ESD as education that goes beyond EE; and (b) to incorporate EE and ESD into laws on education instead of drafting separate laws on ESD or EE in order to increase their status and legal power. These recommendations have been addressed to some degree in Russia through the parliament's recommendations (Committee on Ecology, State Duma, 2006). The EECCA report warned that in promoting ESD, "we should be careful not to diminish the importance of good quality environmental education" (European Eco-Forum, 2004, Section 3.2). Effective practices in EE could provide a valuable contribution to the establishment of ESD. The analysis of EE in Russia conducted by Kasimov, Malkhazova and Romanova (2008) supported the report's statements on the well-developed EE systems in EECCA countries. Currently there are five levels of environmental education and training in Russia:

- The *Preparatory* level includes elements of pre-school environmental education.
- The *General* level is environmental education in primary and secondary schools and in non-specialised colleges, technical and higher schools. Chapter 7 highlighted some examples of the inclusion of ecology courses within the non-specialised VET and higher education sectors.
- The *Specialised* (undergraduate) level is environmentally oriented training in biological, geographical, agricultural, chemical and other faculties of universities.
- The *Special* level is the training of masters and postgraduate students in environmental specialities at classical and technical universities.
- The fifth level is the re-training of experts in the different branches of the environmental sciences (continuing professional development).

A number of achievements in EE could be recognised at each level; however, according to Kasimov *et al*. (2008) environmental education remains a "significant problem" in Russian secondary schools. The main achievements are at the level of

higher education. In 1994 the Russian Ministry of Education approved two strands of specialised environmental education, namely fundamental environmental education within the framework of both the natural and social sciences and applied engineering environmental education delivered by universities of technology.

*Fundamental environmental education* is delivered by geographical, biological, economic, ecological and other faculties of state and private universities that prepare Bachelors and Masters students in areas of *ecology, nature management, geo-ecology* and *bio-ecology*. In addition to these four main areas of environmental education, many fundamental disciplines such as chemistry, physics, mathematics, biology, geology, geography, soil science, as well as agriculture, medicine and others have environmental modules in their courses. Over a 10-year period the number of such departments and faculties including environmental modules in their courses has increased by 15 to 20 times and by the end of 2003 about 130 Russian universities were training students in the environmental sciences (Kasimov *et al*., 2008). According to the new State Educational Standards for higher education adopted by the Ministry of Education of Russia, the block of fundamental natural sciences disciplines includes "Ecology" as a compulsory course and for some specialities "Nature Conservation" is another compulsory course. Kasimov, Malkhazova and Romanova examined the leading role of geography in the development of EE in Russia due to its unique position across the natural and social sciences. They also believe that geography provides a favourable basis for the realisation of ESD. *Applied engineering environmental education* is focussed on the needs of various branches of the economy. In the universities of technology there are two groups of specialities, *Safety and Health* (in 65 universities) and *Environment Protection* (also in approximately 65 universities).

To be able to study EE in depth, universities combine environmental courses from the federal component of environmental education with regional components, defined and developed by the university to account for regional specificity of environmental problems. At the federal level, guidance on the curriculum and standards development for higher education is provided by Educational Methodological Units (EMUs) that are associated with the Ministry of Education of the Russian Federation. The EMU for classical university education, headed by Moscow State University, consists of 20 Scientific Methodological Councils which co-ordinate the content of education in particular sciences, such as mathematics, physics, chemistry and so on. One of the councils supervises education in the field of environmental sciences. Its membership is about 100 professors from universities throughout Russia. In 2002 the Scientific Methodological Council on Ecology was transformed into the Scientific-Methodological Council on Ecology and Sustainable Development.

Kasimov *et al*. (2008) concluded their analysis of the EE: "over the past decade an up-to-date system of higher environmental education has been created in Russia, which is implemented now at universities in all regions of the country" (p. 6). They noted that about 4000–5000 ecologists, geo-ecologists and experts in nature management are graduated annually in Russia.

Two major universities, Moscow State University and St. Petersburg State University, actively promote inclusion of ESD into their teaching (Kasimov *et al*., 2008;

Verbitskaya, Nosova, & Rodina, 2002). Out of 261 departments at St. Petersburg State University, 61 (over 23%) offer courses relevant to sustainable development. The total number of such courses exceeds 280. Both universities have developed in-service programmes for higher education academics. In St. Petersburg State University there are two specialised subdivisions: The Interdisciplinary Centre for Further Professional Education and the Faculty of Upgrading Qualifications for University Teachers. They offer a number of programmes relevant to SD, covering areas of global ecological problems, information technology use in ecology, biodiversity, nature preservation, methodology of ecological research, concept of SD, ecological risks and social ecology (Verbitskaya *et al*., 2002).

When considering EE at the school level regional initiatives are the ones to be examined.

> Many regions in Russia have developed their own programmes in environmental education. Ecological organisations are active in all 89 regions of Russia, and their activities are aimed both at providing solutions to environmental problems and the provision of environmental education. (Verbitskaya *et al*., 2002, p. 280).

In St. Petersburg, for example, *The concept of developing ecological culture of St. Petersburg residents* (Government of St. Petersburg, 2006) was adopted on 7th February, 2006 by the government of the city. It formulated aims and objectives for the development of an ecological culture, activities and the provision of a legislative basis. In the framework of the regional school Standards, subject standards for ecology have been developed together with textbooks and reference materials. Vernadsky's (1945) theory, focusing on the laws of biosphere development, ecosystems, relationships between humanity and nature, possible ways of achieving SD and many other concepts are contained in the *Standard*. At the federal level, on 6th June, 2008 Medvedev, the president of Russia, requested the government to consider inclusion of ecology into the federal educational standards for compulsory state education (www.rian.ru/elements/20080604/109246003.html).

Therefore, EE and ESD are closely related in the minds of many people. Even for those who see the difference, EE is mainly viewed as a contributor towards achieving the aims of ESD and therefore should be further developed and implemented. Currently EE is best developed through university education. There are some regional attempts to include ecology as a compulsory subject in schools. In VET, however, very little has been done.

## ESD – Current Practices in Russia

A research study conducted in the UNECE region in 2004 (European Eco-Forum, 2004) was a review of current practices in ESD and the identification of opportunities for ESD development and implementation. Semi-structured interviews with individuals directly concerned with ESD policy making in the three countries, including Russia, were employed. Interviews were held with a range of government

officials (covering education, the environment and trade/economy) and a number of academic and NGO respondents. The research concludes that there are a number of opportunities for introducing ESD in Russia. The best levels for this are a regional component of curriculum and elective courses at the school level. Currently, through the federal component of the school curriculum there are not many opportunities, although ESD issues could be included in ecological and social studies. At the level of higher education, Russian standards allow the inclusion of ESD at the national level. Elements of ESD have been introduced in the ecological disciplines and environmental sciences at universities and institutes.

Non-government and non-formal education has been implementing ESD at the school level. There are numerous initiatives by teachers, NGOs and local administrations. Many NGOs are also involved in activities aimed at increasing the level of information in society about SD. The conclusion made in the report is that in Russia there are a number of favourable conditions for the development of ESD, however, to achieve positive results given the scale of the country, better federal coordination and initiative are required. In the Russian Federation the policy follows a classic top-down model.

> Russia belongs to those countries where to ensure that something is done we need laws, regulations, etc. from the top. If there is no official document, almost nothing can be done. Even when a decision is made it may not be implemented. It is too risky to expect that something will be done without it. Moscow State University, Russia. (European Eco-Forum, 2004, Section 4.4)

The opportunities for ESD development in Russia revealed in Chapter 7 consider culturally based competencies in school education and a general educational component of VET as an appropriate place in the curriculum to introduce the ethics and vision for a sustainable future embodied in ESD. Profile education in schools and specialised studies in vocational education could be a relevant place for the introduction of SD aspects, particular for specific areas. In both cases educational institutions have a voice in curriculum development.

The UNECE study identified a number of issues and concerns for ESD and particularly for implementation of the UNECE ESD *Strategy* within the Russian Federation. These include:

- Lack of a legislative definition of sustainable development;
- No clear agreement on the meaning of ESD;
- The necessity to develop a *National Strategy* and *Action Plan* and adopt them at the highest possible level;
- Absence of tax benefits for the private sector supporting ESD;
- The need for national co-funding for ESD projects;
- Lack of grants for small-scale projects on ESD;
- More support to NGOs and other non-formal and informal activities from state; and
- Better involvement of the mass media. (Section 2.2)

All the above issues influence teachers' and administrators' levels of understanding of ESD. If the level is low nothing much will happen in practice. Some of these

concerns have been addressed by the State Duma (Committee on ecology, The State Duma 2006). The current reality on the inclusion of SD issues in the school curriculum in Russia has also been analysed by Zevlakova, an activist from a NGO that promotes SD and holistic approaches to ESD in St. Petersburg. Zevlakova (2006, summed up by Pavlova, 2006) identified five approaches:

*Traditional environmental education renamed "Education for sustainability"*: Historically, the first experts who displayed interest in ESD were environmental educators. In Russia those are generally biology and ecology teachers. They continue to provide knowledge about ecology on the basis of the assumption that deep knowledge of ecology is needed for sustainable development. Usually they use traditional methods of "transferring" knowledge.

*Education through practical action*: Another common approach to ESD relates to practical environmental actions at schools and at students' homes, such as waste reduction, tree planting, optimisation of water and energy consumption (turning the lights off), "clean the river" campaigns, collection of recyclable waste, environmental monitoring. The main idea is that students must be taught "how to act sustainably".

*Education about sustainable development*: The popularity of this approach is increasing. Education about Sustainable Development is implemented as a separate subject in the curriculum. The messages that the students are getting (save water and energy, refuse to buy things) ask students to limit and change their consumption patterns, but without creating the image of sustainable future as attractive and worth working for. This approach is based on the same assumption as traditional environmental education (knowledge equals behaviour) without an holistic approach towards SD, as there are no changes made to the other subjects and school management.

*Education for solving environmental problems*: This approach represents an attempt to create special programmes that are aimed at developing systemic thinking through strategies for solving environmental problems. This approach requires fundamental changes in teaching practices and school management and a redesigning of the content of the school curricula. It can be seen as a way of putting ESD forward. Currently, it is not widely used.

*Education for sustainable development – call for systemic change in educational institutions*: This approach is aimed at helping students to realise the *scale of un-sustainability* and the *real causes* of the problems, as well as to offer positive, attractive and realistic alternative for the future that can empower students' beliefs in possible positive changes. The ESD content includes some examples of solutions that are adequate for the scale of particular problems. Then students are able to understand that solutions are needed to eliminate the causes of problems, but not the symptoms and effects. This is an emerging approach.

Current ESD practices in technology and vocational education are even more limited. There are no curriculum documents that outline the place of technology education in ESD. As discussed in Chapter 6, technology teachers are not really familiar with ideas of SD and ESD, however, they are interested and ready to learn and implement. Through the research project analysed in Chapter 6, technology teachers were formulating their vision of the desirable outcomes of their ESD

teaching. Five small groups of teachers were involved in the project. The results presented by one group were discussed in Chapter 6. The other four groups of teachers came to similar conclusions: a student who had received a suitable ESD through technology education would be:

- Attentive, conscientious, have an active life position, responsible, well educated, adapted to modern life and to the problems of modern life, healthy.
- Ready to work under any social and economic conditions; able to develop him/herself and aim at self-perfection, be able to adapt to a constantly changing world, striving to improving life (their own and other people's), tolerant, able to work on their own, having mastered knowledge and skills, be able to make decisions and accumulate experience.
- Well brought up, have good manners (throws a cigarette into a bin, not near it); must play sport, have a well-balanced diet; be aware of SD and tell peers about it; surround himself/herself with the goods that meet the requirements of SD; have a good sense of humor – it makes life more sustainable.
- Clever, knowledgeable, decent, kind, morally sustainable, technologically educated, taking care of own health and the health of the surrounding people, hard working, creative, intellectual.

Although teachers were not familiar with any ESD developments in Russia, these outcomes relate well to the objectives and outcomes formulated in the *Conceptual bases for the ESD* (Kalinin, 2002b) to assist the development of an all-rounded, educated, socially active person who behaves morally.

The Russian tradition of values education (upbringing) helped the technology teachers to accept and take ownership of a value-based approach to ESD. The majority of the above characteristics are not specific to technology education. However, the teachers consider the above outcomes as a result of their work. Therefore, technology education is only a context to develop an all-rounded, moral person. It is also possible to suggest that ESD should be developed through cross-curricular approaches because all subjects are able to contribute. In other words, as suggested in *Conceptual Bases for the ESD* (Kalinin, 2002b), ESD is an umbrella for different branches of knowledge, including technology.

Discussions with teachers involved in vocational education (interviews conducted by the author in 2007 in St. Petersburg) revealed that ESD is not known by VET practitioners. However, they understood environmental education. Federal policies on ESD are in the process of development; therefore, there is no shared national vision on how ESD could be implemented in the vocational education sector. As stated above, the UNECE *Strategy* (UNECE, 2005) is the only document that emphasises the importance of the development and implementation of ESD through VET. Currently, there are no resources or trained personnel able to address ESD. However, when one compares the results of the (2007) Russian study with research conducted by Goldney, Murphy, Fien, and Kent (2007) in Australia, one significant difference emerged – there is no problem in Russia associated with the presence of "a particular VET culture, pedagogy that prevents ESD development in VET". In fact, the opposite is the case – there are opportunities to include ESD in both

components of vocational education curriculum: general subjects (e.g., ethics, literature, history, foreign language, biology) and specialised subjects relevant to future occupations (see Chapter 7). Therefore, all international and Russian practices of and discourses on ESD in general education are applicable here. Furthermore, traditionally workshop teachers have been involved in the process of students' upbringing (values development). Over the last half century patriotism related to victory in the Second World War was the basis for value development. Now when the modern world has changed these teachers are searching for a new vision that could serve as the basis for value development (a statement made by Natasha). Natasha (not her real name) is the deputy-director of the Methodological Centre for VET in St. Petersburg that develops teaching materials and resources for all VET institutions in the city, as well as delivering in-service training for VET workshop teachers. Natasha stated:

> When you are talking to workshop teachers you realise that they have a deficit in new orientation. Too much [of value education] is built upon our victory in the Second World War (that relates to the age of teachers) which symbolise a fight between world evil and a victory over it. With the current generation it does not work so well as with the previous ones.

Natasha discussed the possibilities of ESD as a framework for upbringing (value development) with workshop teachers, for example, with teachers from the power equipment construction vocational schools that prepare students for heavy industry. They said that they would be very thankful if they have new ideas to build their values development strategies on. Natasha stated that there are no documents that regulate ESD development and implementation for vocational education. Knowledge in the VET system is divided into disciplines, thus it is very important to pull this knowledge together, so SD can be understood by students. The ethical component of ESD is important and students should not only know and have skills, they should also *want* to make changes and achieve a different outcome. Ecological education in VET is not systematic or well advanced, however, some aspects of ecology are covered in the subject biology, or sometimes ecology is a separate subject in the curriculum. EE is a part of vocational education when students are trained for particular occupations. Natasha identified some measures that would help to relate their in-service training to ESD development. These include more projects with international partners, more information, resources, books and new management structures. Therefore, she considers the general component of VET and the upbringing (value development) system as important first steps in introducing SD issues. To include ESD in the context of specialised knowledge is more difficult and requires more research in preparing teaching materials.

NGOs are also working with VET students. As another interviewee stated, the Baltic Ecological Wave in St. Petersburg organised Ecology practicum for VET teachers of the general component of education on a number of occasions. VET students have been involved in projects investigating an eco-construction and the eco-characteristics of materials (although she stated that it is a very recent practice).

## Conclusion

The analysis of initiatives at the state and regional levels (UNECE, EECCA) revealed that the current period is crucial in establishing ESD in Russia. The conceptual bases for doing this are closely related to the conceptualisation of SD outlined in Chapter 3 and Chapter 8. All three theoretical perspectives on conceptualising SD, including value position (attitude of care for people, nature and culture, ethics of responsibility); the nature of proposed responses (value re-orientation that is followed by ecologically viable economic development and nature preservation); and the structure of proposed responses (social, economic and environmental) are presented in the *Conceptual Bases for the ESD*. In Russia ESD is considered as a systematic factor in the development of the educational system in establishing a new educational paradigm that is oriented towards a harmonisation of the relationships between nature and humanity. Nöosphere wisdom and post-materialist society are the desired outcomes of ESD.

Currently in Russia, ecology education is better understood and positioned than ESD. Ecology as a learning area/subject is presented at different levels of education and it is viewed as an important contributor towards ESD. Recent positive changes in the country are well illustrated by the parliamentary recommendations (2006) ordered to support the establishment, positioning and implementation of ESD at the national level.

In vocational education ESD is not widely known. Opportunities for the introduction of ESD into VET identified in Chapter 7 have been confirmed through this chapter with one addition, the use of the system of upbringing (value development). Therefore, three components through which education for sustainable development can be developed in VET are as follows:

- A general component of VET (responsibility of academic teachers, including technology education teachers);
- Specialised studies (responsibility of classroom and workshop specialist teachers); and
- The system of upbringing (responsibility of workshop teachers).

This three-dimensional approach has great potential for the development of a full-scale ESD in VET.

Due to the close relationships between technology education and VET in Russia (as explored in Chapter 7), all strategies developed for technology education will greatly contribute towards VET's ESD. An all-institution approach is required for effective ESD development and implementation in VET, including close collaboration between different teachers.

## References

Campbell, W. J., McMeniman, M. M., & Baikaloff, N. (1992). Visions of a desirable future Australian society. *New Horizons in Education, 87*, 17–39.

Committee on Ecology. State Duma. (2006). *News update*. Retrieved May 9, 2008, from http://www.akdi.ru/gd/pl_sl/K24/250506.htm.

European Eco-Forum. (2004). *Education for Sustainable Development: Practice and Priorities in the UNECE Region. A Report on a Preliminary Study European ECO Forum, January–May 2004*. Retrieved December 4, 2007, from http://www.ecoaccord.org/english/edu/Phase%201%20Final%20Report2.htm.

European Eco-Forum. (2006). *Review of implementation of objective 6.3 (Environmental education) of EECCA environmental strategy from the point of view of NGOs of the region*. Retrieved May 28, 2008, from http://www.unece.org/env/esd/Implementation/ReportsStakehold/ecoforum_2006_e.pdf.

Goldney, D., Murphy, T., Fien, J., & Kent, J. (2007). *Finding the common ground: Is there a place for sustainability education in VET*? Adelaide: NCVER.

Government of the Russian Federation. (2000). The Decree #751, 04.10.00. *O natsionalnoj doctrine obrazovanija v Rossiiskoj Federatsii* [About National Doctrine on Education in the Russian Federation]. Retrieved February 2, 2008, from http://elementy.ru/library9/doctrina.htm?page_design=print.

Government of the Russian Federation. (2002). *The ecological doctrine of the Russian Federation*. [Экологическая Доктрина Российской Федерации] Retrieved March 25, 2004, from http://www.ln.mid.ru/nsosndoc.nsf/0e9272befa34209743256c630042d1aa/432569fa003a249c43256c9a002f10ca?OpenDocument.

Government of St. Petersburg. (2006). *The concept of developing ecological culture of St. Petersburg residents*. St. Petersburg: Author.

Huckle, J. (2005). *Education for sustainable development: A briefing paper for the Teacher Training Agency*. Retrieved April 4, 2006, from http://john.huckle.org.uk/publications_downloads.jsp.

Kalinin, V. B. (2002a). *About the relationships between ecological education and education for sustainable development*. Retrieved March 7, 2007, from http://www.aseko.org.

Kalinin, V. B. (2002b). *Conceptual bases for education for sustainable development*. Retrieved January 30, 2008, from http://www.aseko.org/theory/concept1.htm.

Kasimov, N. S., Malkhazova, S.M., & Romanova, E. P. (2008). *Environmental education for sustainable development in Russia*. Retrieved May 15, 2008, from http://www.geogr.msu.ru/ESD/pages/page3_6e.htm.

Parker, W. C., Ninomiya, A., & Cogan, J. (1999). Educating world citizens: Toward multinational curriculum development. *American Educational Research Journal, 36(2), 117-145.*

Pavlova, M. (2006). Technology education for sustainable futures. *Design and Technology Education: An International Journal, 11*(2), 41–53.

Shelehov, A.M. (Ed.). (2002). *Osnovnue polozhenija startegii ustoichivogo razvitija Rossii* [Main ideas of the strategy of the sustainable development of Russia]. Retrieved March 25, 2004, from http://www.duma.gov.ru/sustainable/strategy.htm.

Ukaz. (1996). *Ukaz prezidenta RF "O kontseptsii perehoda Rossiskoi Federatsii k ustoichivomu razvitiyu"* [The decree of the President of the Russian Federations "About the concept of moving of the Russian Federation towards sustainable development"]. *Rossiiskaya Gazeta*, 9 April, p. 5.

UNECE (2005). *UNECE Strategy for education for sustainable development*. Adopted at the High-level meeting of Environment and Education Ministries, Vilnius, 17–18 March 2005. CEP/AC.13/2005/3/Rev.1, 23 March 2005.

UNESCO. (2005). *United Nations decade of education for sustainable development 2005–2014. International Implementation Scheme*. Draft, January 2005. Paris: UNESCO.

Verbitskaya, L. A., Nosova, N. B., & Rodina, L. L. (2002). Sustainable development in higher education in Russia: The case of St. Petersburg State University. *International Journal of Sustainability in Higher Education, 3*(3), 279–287.

Vernadsky, V. I. (1945). The biosphere and the nöosphere. *American Scientist, 33*, 1–12. Reprinted by Executive Intelligence Review, February 2005. Retrieved March 7, 2008, from http://larouchepub.com/other/2005/site_packages/vernadsky/3207bios_and_noos.html.

Zevlakova (2006) *Review of the main approaches to education for sustainable development in Russia*. Paper presented at the UNESCO-UNEVOC seminar, Hämeenlinna, Finland, 8–11 January, 2006.

# Epilogue

This book has presented a number of interrelated arguments that contribute to achieving the overall aim of establishing the way sustainable development (SD) could be conceptualised and used to develop empowering strategies achievable through vocational education. The context for this book is the process of vocationalisation of general education. It was argued that technology education is among the most effective ways to deliver vocational education at the secondary school level. Generic competencies such as team work, effective communication, use of technology, and others capabilities required by modern industries are well addressed in technology education rationale and curriculum documents. Although there are differences in approaches towards technology education internationally, it has been developed within the paradigm of an economic imperative and was aimed at developing capabilities/competencies relevant to the world of work by learning about, through, and with technology.

However, current critical approaches question the economic rationalist view of education and argue for the need to change the paradigm: to shift from a social reproduction mode to education that helps students to transform realities to achieve a desirable future. Such a critical education requires a move away from a simple focus on competencies/capabilities where skills and knowledge are emphasised to a focus on the development of values and attitudes. In both technology and vocational education there is an understanding of the importance of developing values. However, there is no clear approach to value conceptualisations and the ways they could be addressed. In this book it has been argued that moral values provide the basis for value development. This argument was unpacked through the analysis of psychological, sociological and educational literature. It has been argued that moral values relate to consideration of the welfare of others, a notion that is closely related to the idea of responsibility that is viewed as the major emphasis for teaching and learning. The professional morality of teachers, described within what Oser (1994) called the regulative model, advanced the underlying aim of teaching based on the consideration of how students become relational, caring and responsible. The discourse approach for learning that encourages collaborative engagement and that values particular outcomes has been presented in expectancy-value terminology as an effective teaching strategy.

The development of students' moral judgement to enable them to be involved in the creation of a better society could be effectively achieved through education for sustainable development (ESD). Prior to the development of empowering strategies within ESD, the need to conceptualise SD was identified. In the current literature SD is interpreted in a number of different ways. In this book three cornerstones for SD conceptualisation were proposed: value position, nature, and structure of proposed responses towards SD concerns. A combination of these three aspects provides a multi-dimensional view of SD and influences the way ESD is conceptualised. The ethics of weak anthropocentrism (frame of mind or nöosphere wisdom) together with the value-change approach that is addressed through social, environmental and economic aspects of SD represents the preferred approach towards ESD development. The importance of the technical fix approach to technology and vocational education is accepted as long as it is underpinned by the value-change perspective. The position of weak anthropocentrism is well expressed by the International Union for Conservation of Nature and Natural Resources and the World Wide Fund for Nature (IUCN, WWF, UNEP, 1991) as the founding principle for transition to SD: *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*. Weak anthropocentrism promotes mutual flourishing of human and non-human nature.

A number of possible learning strategies for technology and vocational education, together with a planning framework, have been proposed in the book. Learning activities such as design of low-cost products to increase the quality of life for the poor, design projects focused on appropriate technologies and green products, product analysis, case studies and ASIST (Advanced Systematic Inventive Thinking) problem solving strategies are proposed as examples of classroom activities. A planning framework that helps teachers to put these activities into a coherent programme has been developed, based on two sets of theories: the nature of modern society (cognitive, practical, and aesthetic spheres) and the structure of proposed responses towards SD concerns (social, environmental, and economic contexts). The discussion of this framework has uncovered a considerable tension between the required value-based approaches towards SD and ESD and the aesthetically spaced nature of the modern world. Such characteristics of modern westernised society as colonisation of the cognitive and moral spheres of human life by the aesthetic realm, consumerism and identity formation through the meaning of artefacts could create a significant challenge for teachers implementing a frame of mind approach in their classroom practice.

At this point in the argument the powerful role of aesthetics and the aesthetics for sustainability were examined. A number of examples of how to address these challenges were also presented. It was argued that aesthetics should play a double role in technology education. First, students need to create sustainable products and apply aesthetic styles currently employed by a consumer society. In this way students will "force" consumers who do not care about SD to buy sustainable products. Second, there is a need to develop an aesthetics of sustainability that is closely related to the ethics of SD. In this book it is demonstrated that aesthetics and values are closely related, for example, the products of alternative technologies would have an aesthetic appeal for people who care about SD.

The next argument developed in the book focused on the importance of teachers' capacity building, both through pre-service and in-service formats. For pre-service teacher training programmes a model based on the proposed conceptualisation of SD and the principles for sustainable universities formulated in The Talloires Declaration was proposed. It is an example of the application of conceptualisations presented in this book. Both examples for pre- and in-service teacher education demonstrate that the approaches adopted were effective in training teachers towards ESD development and implementation; however, it is also acknowledged that more prolonged engagement by in-service trainees and more emphasis on value position within pre-service programmes are required.

The second part of the book presented a case study of Russia. It discussed the process of educational modernisation that provides a background for the ESD understanding and development in this country. The modernisation of Russian education placed an emphasis on the development of elements of both modern and late-modern educational models. On the one hand, culturally based competencies are introduced as a basis for curriculum development. On the other hand, economy-related profile education of senior schooling has been established. Although these elements are from different educational models, they could both contribute to the process of establishing ESD by development of the global vision of a nöosphere civilisation (a value-change) and the development of specific capabilities and practices that lead to SD (a technical fix). Another important feature established in the analysis is the close links between technology and vocational education in Russia. For example, a traditional emphasis on general education components of vocational education curriculum provides an additional opportunity to address the general issue of SD via VET.

Conceptualisation of SD in the Russian context has been advanced through two types of theories: biological stabilisation and nöosphere theory. Although both emerged prior to the SD agenda, these theories are currently considered as an appropriate basis for theorising SD. Through these concepts the aims of SD are related to two distinct, although closely related, areas: environment preservation, and the development of moral, spiritual values so that the "sphere of wisdom" (Vernadsky) as a new developmental paradigm could be established. Conceptualisation of SD as a frame of mind, addressed in the first part of this book, and as a nöosphere wisdom in Russia, are both developed within the ethics of weak anthropocentrism. Re-orientation of people's values on the basis of appropriate relationships between nature and society are widely advocated in Russian SD concepts.

Empowering strategies proposed in Chapters 3, 4, 5 and 6 unpacked the ways SD could be interpreted and addressed through education, so students could develop their visions of the future and the ways it could be achieved. Vernadsy wrote, "human responsibility determines everything" (in Mantatov & Mantatova, 2008, p. 17). Mantanov and Mantanova also quoted the results of the World Bank analysis that found that human capital makes up 64% of a country's development potential, with the natural capital making up 24% and the physical capital 16%. Therefore, human potential becomes the main resource if we are to build a sustainable future. In Russia, ESD is viewed among the important means for achieving sustainable

development. Achieving the value change required for establishing a nöosphere society and for changing the paradigm of development of civilisation relates to human responsibility. ESD in Russia is conceptualised on the basis of political and theoretical discussions on SD. Recent political requests to implement ESD at different levels of education justify optimism that some outcomes will be achieved in the near future. Current practices are mostly focused on environmental education that is viewed as one component contributing towards ESD.

Empowering individuals with new visions and means to transform current societies through the strategies discussed in the first part of this book could be fully implemented within the Russian context. Three ways this could be achieved in VET are through:

- General education component;
- Specific to occupation component, and
- Up-bringing (values development) component.

This book contributes to both literatures on empowerment and on sustainable development/education for sustainable development. The educational potential of the proposed approaches and strategies lies in the empowerment of agents to create their own meaning of SD, organise their own life and attempt to shape society itself. Re-orientation of individual values empowers them with new visions of reality and the means to achieve them. It is argued that ESD is an effective way to address moral values in schooling through technology and vocational education. It is hoped that this volume supports debate and dialogue in technology and vocational education on empowerment, SD and ESD. Context-specific wise thinking and planning is required for implementation of the strategies and approaches proposed in this book. It is a complex process that engages many different people and organisations.

## References

IUCN, WWF, UNEP. (International Union for the Conservation of Nature, World Wildlife Fund, and United Nations Environment Programme). (1991). *Caring for the Earth: A strategy for sustainable living*. Switzerland: IUCN.

Mantatov, V. V., & Mantatova, L.V. (2008). *The concept of forming the sustainable economics of the Republic of Buryatia*. Retrieved April 21, 2008, from http://www.baikal-center.ru/en/books/element.php?ID=1827.

Oser, F. K. (1994). Moral perspectives on teaching. *Review of Research in Education, 20*, 57–127.

# Author Index

# Subject Index