Sustainable Development and Education for the 21st Century

What We Can Do Now for the Children of the Future

– An Educational Paradigm Shift –

March 26, 2005
Tokyo, Japan

National Institute for Educational Policy Research (NIER)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)
International Symposium on Education Reform 2005

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2005
Forword

The UN Decade of Education for Sustainable Development, which was proposed by the Japanese government at the World Summit on Sustainable Development (Johannesburg Summit), was adopted by the United Nations General Assembly in 2002. It is to be implemented over the 10-year period from 2005 to 2014.

Amid these international trends, Japan is also expected to make efforts toward sustainable development, particularly in the area of education. The National Institute for Educational Policy Research accordingly held an international symposium on education reform as part of the activities marking the UN Decade of Education for Sustainable Development.

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Organized jointly with the Ministry of Education, Culture, Sports, Science and Technology, the symposium took place on March 26, 2005. Its purpose was to consider possible visions of what education for sustainable education should be, together with possibilities for putting it into concrete practice.

The keynote speech at the symposium was given by Dr. Ervin Laszlo, the eminent contemporary philosopher and futurist, the originator of systems thinking in philosophy, and the founder and President of the Club of Budapest. We also invited specialists in education for sustainable development. These were, from the United States, Victor J. Mayer, Professor Emeritus from Ohio State University; from the United Kingdom, Dr. Douglas Bourn, Director of the Development Education Association-UK; and from Australia, Peter Glasby of the Mt. Barker Waldorf School. Speaking from a variety of fields, they reported on their own particular theories as well as on the practices that are presently valued in their various countries. The possibilities of education for sustainable development in Japan were also explored in a panel discussion chaired by Atsuhiko Yoshida, Associate Professor of Osaka Women’s University (now at Osaka Prefecture University).

The symposium was attended by nearly 400 participants who listened enthusiastically to the speakers’ messages. Many expressed the opinion that this symposium had turned out to be a highly appropriate event to mark the first year of the UN Decade of Education for Sustainable Development.

The present report was compiled using the texts that the keynote speakers and panelists provided in advance. These have been augmented by figures and other material handed out at presentations, together with the substance of the panel discussion. Attached is also a CD (in Japanese and English-language versions) that we hope will help to recreate events on the day of the symposium.

The first study here is the thoroughgoing conception of education related by Dr. Laszlo. The presentations by the panelists are also filled throughout with information that should be useful in the formulation of educational policy and in educational practice inside and outside the school. We are certain, therefore, that this report will serve as a valuable reference for future examination of the modalities of education and sustainable development.

We will consider ourselves fortunate if this report proves to be of use in the times ahead in promoting the UN Decade of Education for Sustainable Development, and in the work of creating a sustainable society.

Shigenori Yano
Director General
National Institute for Educational Policy Research (NIER)
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The Japanese Government’s ESD Policy

Masayuki Inoue
Masayuki Inoue,
Director-General for International Affairs
Ministry of Education, Culture, Sports, Science & Technology

The Japanese Government’s ESD Policy

My name is Inoue. I am the Director-General for International Affairs from the Ministry of Education, Culture, Sports, Science and Technology. I am very happy that many people spared the time to assemble here today, a precious Saturday.

You may be wondering what a Director-General for International Affairs does. In 2001, the Ministry of Education and the Science & Technology Agency were merged together. We now cover very diverse fields together. That was when my position was created. I am also Secretary-General of the Japanese National Commission for UN ESCO. Education for sustainable development (ESD) is expanding all over the world. Today we would therefore like to speak about what is now taking place in Japan from a government policy point of view.

As Director Yano has already mentioned, Prime Minister Koizumi proposed a UN Decade of Education for Sustainable Development at the Johannesburg Summit. Japan took the initiative at the UN General Assembly in 2002 and the resolution was adopted in consensus. The next ten years, starting from 2005 will therefore be the UN Decade of Education for Sustainable Development, and UNESCO was designated as the lead agency. UNESCO is playing a central role in creating an international implementation plan for developing the next decade. Next month, in April, a UNESCO Executive Committee will convene to determine plans for the future.

How can we promote this international plan in Japan? Based on the implementation plan, we believe that we will have our own local efforts. The Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Foreign Affairs, the Environment Ministry, the Ministry of Land and Transport, and the Ministry of Agriculture, Forestry and Fishery are all going to cooperate to promote related measures. There is also going to be a liaison committee linking relevant ministries so that we can establish a system of cooperation. This is what happened so far and the present state of affairs.

When we talk about education for sustainable development, the core challenge is to define the meaning of sustainable development. I believe many people will be discussing this today. The concept is still under development.

The International Union for the Conservation of Natural Resources proposed this issue in 1980. Later in 1987, the issue was taken up in the form of a report entitled “Our Common Future” by the Brundtland Committee headed by G.H.Brundtland, former prime minister of Norway and the former Secretary-General of the WHO.

Before this U.N. Decade of Education for Sustainable Development was going to be unfolding, Japan proposed its ideas of what it should be. The Japanese National Commission for UNESCO actually made the following proposal.

“There is more need to establish sustainable development and to address issues in bio-diversity, atmosphere, water, food, population problem, health, human rights, poverty eradication, gender equality, peace establishing, and so forth. Therefore, each country and the entire world has to consider sustainable development in the wide
range of fields as a concrete system. That was how sustainable development was viewed and proposed by Japan.

Encompassing the environment and development, we are now considering the linkages with various fields of human rights, gender equality, eradication of poverty, cultural diversity, the prevention of disasters such as that recently experienced in the Tsunami in the Indian Ocean, and human security.

When we think about what kind of education is necessary for sustainable development, it goes without saying that it is important to actually educate and enlighten not just with facts and knowledge, but also with values and standards of behavior which support sustainable development. Returning to the proposals I mentioned earlier, it also mentions that the individual within society must form a concrete image of the society to be attained. According to the proposal, the individual has to have his/her own view with a global perspective in order to be nurtured as a global citizen for the creation of the new society.

This shows the trends in population in connection with sustainable development. There are also the issues of poverty and education to consider. If you look at the world right now, approximately 1.1 billion people live on less than a dollar a day. About 100 million children are not attending school and 57 percent of those children are girls. About 800 million adults are unable to read or write, and two-thirds of that illiterate population is made up of women. That is the present state of poverty and education in the world. Keeping that in mind, we need to think about educational for sustainable development.

In the Ministry of Education, Culture, Sports, Science and Technology, we have to consider what kinds of measures to take in connection with ESD. When we think about education for ESD, international cooperation and domestic measures both have to be taken into consideration. When we think about international cooperation, we also have to cooperate with the Ministry of Foreign Affairs.

Many people in the world are poor and not receiving education. How can you achieve education for all? If we think about international cooperation, we not only need to support the developing nations, but also to learn from the people of the development nations. That will also be extremely important. From this point of view, international networks need to be structured to learn many things.

Turning to the domestic measures related to ESD, the Ministry of Education, Culture, Sports, Science and Technology has started courses of study for environmental education and human rights education in elementary schools and also junior high schools. We have indicated some sample measures contained there in the slides regarding the utilization of integrated study class. What is essential is to enhance the quality of education. I would say that this is our biggest challenge right now.

In the Central Education Council we have started discussions on reforms and improvements. Our efforts have been triggered by the results of the OECD-PISA worldwide study disclosed at the end of last year. Compared to the previous survey, the Japanese children’s performance in reading skills has largely gone down. If you also look at the IEA studies, it seems that academic skills have gone down overall. Recognizing the gravity of this issue, the Central Education Council has started discussions toward reform.

Yesterday, the Executive Director of OECD, Mr. Johnston visited our Minister of Education, Culture, Sports, Science and Technology. He said that Japan’s performance especially in problem solving in that Pisa survey was very good. So there are good aspects to the present Japanese education. Keeping in mind that performance did drop in some areas, we need to promote discussions in the education council as to how we should steer the educational reform.

We have foreign guests here today, so let me briefly introduce the course of study in our elementary and junior high schools. In the elementary schools, the fifth-graders in social studies learn about the importance of pro-
ecting the people from pollution and the methods used to protect the ground and water through forestry. Sixth grade science students learn about how to nurture respect for life and how the creature’s body functions together with the relationship between creatures and the nature. These are the courses of study for elementary school students.

The lessons for junior high school students have to do with the preservation of natural environment, nurturing attitude to respect for life to observe nature as a whole (in the second field of science) as well as with the dignity of individuals, respect for human rights, protection of the natural environment, attitudes respectful of life, a deeper understanding of democracy (social and public field), and also environmental resources and energy (social and public field). These are the topics of study in the elementary and junior high schools.

We also have been using the time allotted in Japan to integrated studies. Depending on the reality of the community, it is possible to have your own unique studies in fields such as environment education, information education, international understanding education, or developmental education. In this way we can promote cross-disciplinary and integrated studies. We also are implementing measures such as the so-called Eco-School Pilot Model Project and the Green Plan to Promote Environment Education.

That covers some of the domestic measures being adopted. Let me now give you an example of international cooperation on ESD. From next fiscal year, the fiscal year starting from April 2005, Japan will be managing an education trust fund for sustainable development. About 200 million will be contributed to UNESCO for the development, with the consultation by Japan, of ESD-related textbooks, teaching materials, and activities on the community and school level. There also will be a compilation of successful case studies. At any rate, we are only at the start line and the international cooperation for ESD is to be promoted by governments, NGOs, and educators together. The linkage and cooperation is important.

This is the first year of the decade. We would like to gather various ideas from Japan and abroad to compile these successful case studies and good practices, and with that to develop the Decade for Educational Development.

In looking at the materials for today I noticed that there will be a report on the British situation. We would like to gather hints from various sectors through meetings such as this. In that way, I pray for the success of this effort.

Thank you very much.
Inspiring Timely Wisdom

—— A Crucial Task of Contemporary Education ——

Ervin Laszlo
1. THE TASKS OF CONTEMPORARY EDUCATION

The classical concept of the task of education is the handing down of useful knowledge in society from one generation to the next. This concept remains valid, but the definition of what constitutes useful knowledge is subject to change. Until recently, useful knowledge was considered to be knowledge that enabled the young generation receiving the education to find remunerative employment upon leaving school and thus be in a position to maintain him-or herself and his or her family. In a market-based economy it was assumed that remunerated jobs fulfill a useful function in society, so that receiving useful knowledge in the educational system automatically ensures usefulness for the student as well as for his or her society.

The above conception is still true, but it no longer covers all the tasks of education. There is an additional element of useful knowledge that goes beyond the immediate concern regarding finding remunerative and hence assumedly socially useful employment. This additional element can be defined with the term “timely wisdom.” Let me analyze briefly the difference as well as the relation between these two elements in reference to the tasks of education.

There are items and systems of knowledge that are timeless in the sense that they conserve their validity over time. Such knowledge is historical knowledge, including the systems of exact knowledge, that is, the knowledge developed in the exact sciences (mathematics, geometry, logic, and their various forms and subdivisions). Historical knowledge concerns familiarity with, and understanding of, past events and persons, as well as the systems of knowledge developed by them. A large part of education is taken up with gathering and conveying historical knowledge; this is the task of education that ensures continuity in a culture; it performs the function of memory in society.

Some elements of historical knowledge are truly timeless in the sense of being independent of the time and place at which they are conveyed: such is knowledge in the exact sciences as well as certain elements of knowledge in the empirical natural sciences. Euclid’s geometrical formulas, for example, retain their validity whether they are taught in the 19th or in the 21st century, in America, Africa, or Asia. Also Newton’s laws of motion retain their validity regardless of where they are taught, although they are not entirely independent of time: since the advent of relativity theory, the classical laws are valid only under specific circumstances (for example, on the surface of the Earth at speeds not approaching the velocity of light). Receiving such knowledge enables the recipients to enter active life in society in possession of main elements of received knowledge.

*For powerpoint slides used in this keynote speech, see pp.19 - 20, as well as the attached CD-ROM.
tering certain elements of this knowledge is a precondition of achieving competitiveness in the social marketplace. It is necessary for the young people leaving the educational system, and it is also necessary for society since it maintains its competitiveness in the international marketplace.

Conveying historical knowledge with due regard for the difference between unconditionally and conditionally valid knowledge is a valid task of contemporary education, but it would be a mistake to believe that it is the only task. A further task is to convey knowledge that ensures the ongoing viability of society beyond the immediate requirements of the domestic and international marketplace. This is an adaptive-more exactly, pre-adaptive-rather than a memory function, and it becomes essential when society is exposed to rapid and fundamental change. Under conditions of rapid and fundamental change knowledge that was hitherto useful may prove to be obsolete; and knowledge that was hitherto abstract or irrelevant may turn out to be useful.

Anticipatory knowledge is knowledge that comes from the empirical sciences: from the social sciences in regard to trend extrapolations and system-development simulations, and from the frontiers of the natural sciences in regard to new discoveries. Anticipatory knowledge extends historical knowledge into the foreseen and perhaps already emerging future.

Ensuring the ongoing viability of society calls for conveying not only historical but also anticipatory knowledge through the educational system. Gathering and developing anticipatory knowledge is the task of social and natural scientific research. It is a vital task, in view of the rapid and fundamental change to which almost all societies are currently subjected.

In itself, conveying future-extended historical knowledge does not exhaust the tasks of contemporary education. The remaining task is crucial today, although it has been the subject of controversy in the span of the last one hundred years. It is the task of enabling the next generation to develop the judgment necessary to function creatively and responsibly under new, and perhaps historically unprecedented circumstances.

Ideologically motivated authorities have deemed it necessary to instill the judgment and conviction they held required in society by authoritarian means. This has taken the form of attempts at systematic indoctrination, whether religious, ideological, or political. Religious indoctrination has been practiced during the Middle Ages in Europe, and political indoctrination has been practiced in the 20th century by the communist as well as the fascist regimes. These forms of indoctrination attempted to instill preconceived values and beliefs in order to win adherents to preconceived doctrines. They were not conducive to generating independent judgment and catalyzing personal creativity; on the contrary they suppressed both judgment and creativity.

Rather than through indoctrination, the young generation must have access to programs of education conducive to developing sound and independent judgment and the creativity to act on the basis of such judgment. This requirement highlights the difference between indoctrinating with preconceived values and beliefs, and catalyzing timely wisdom. The latter calls for providing relevant state-of-the-world briefings and an impartial learning environment to allow the unbiased assessment of the information contained in the briefings.

2. THE STATE-OF-THE-WORLD BRIEFINGS

We live in an era of deep-seated transformation. Its signs and manifestations are all around us. While globalization is integrating production, trade, finance, and communication, it is producing a social and ecological backlash characterized by regional unemployment, widening income gaps, and environmental degradation.

The benefits of economic growth, for long the main indicator of progress, are becoming more and more con-
centrated. Hundreds of millions live at a higher material standard of living, but thousands of millions are pressed into abject poverty, living in shantytowns and urban ghettos in the shadows of ostentatious affluence. This is socially and politically explosive: it fuels resentment and revolt and provokes massive migration from the countryside to the cities, and from the poorer to the richer regions. In such conditions organized crime, already growing into a global enterprise, finds fertile ground with a gamut of activities ranging from information fraud to traffic in arms, drugs, and human organs.

Terrorism is not the cause of crisis in today’s world: it is one of its dramatic consequences. The current crisis is rooted in the stress, frustration and hate generated by the impoverishment of the life-sustaining environment and the imbalance generated by the workings of the world’s economic and social systems.

The application of new technologies, a widely quoted indicator of progress, is a two-edged sword. Nuclear power promises an unlimited supply of commercial energy, but disposal of nuclear wastes and decommissioning aging reactors pose unsolved puzzles. Moreover the specter of nuclear meltdown, whether due to technical accident or intentional terrorism, remains unchallenged. Genetic engineering has a fabulous potential for creating virus-resistant and protein-rich plants, improved breeds of animals, vast supplies of animal proteins, and microorganisms capable of producing proteins and hormones and improving photosynthesis. But genetic engineering can also produce lethal biological weapons and pathogenic microorganisms, destroy the diversity and the balance of nature, and create abnormal, and abnormally aggressive, bacteria, insects and animals.

The new information technologies could create a globally interacting yet locally diverse civilization, enabling all people to be linked whatever their culture and ethnic or national origin. But if these networks remain dominated by the power groups that brought them into being they serve only the narrowly focused interests of a small minority and marginalize the rest. An overcommercialized Internet, television, and the electronic and print media cater to the demands of those who have the means to enter the global marketplace instead of give voice to all the people.

But the Great Transition harbors not only danger; it is also the cradle of opportunity. It is a process of societal evolution in which encounter with the system’s limits of stability initiates an era of transformation. This is an era of unprecedented freedom to decide the system’s future. The outcome of society’s transformation is not fated, and it is not decided by a higher authority. It is decided by a selection from among the small, and seemingly insignificant “fluctuations” that occur within society.

The four phases of a Great Transition describe the dynamics of fundamental change in society. The first phase is the trigger phase. In this phase society enters on an unsustainable path of development. A set of technological innovations come on-line, and they produce short-term benefits. They amplify the power of muscles to move and transform matter, extend the power of the eye to see and the ear to hear, and enlarge the power of the brain to register and compute information. However, the “side-effects” (which are often the systemic consequences) of prima facie beneficial innovations are not necessarily beneficial; on the contrary, they can be seriously destabilizing. Yet the new technologies are implemented without much concern with their longer-term consequences; political and business leaders think only of greater efficiency and effectiveness in carrying out tasks and projects they want to see carried out.

In the second phase of a Great Transition society becomes seriously destabilized and enters a condition of
systemic unsustainability. The snowballing consequences of the new technologies go beyond the ability of society’s structures and institutions to manage and control. Nature suffers in unforeseen ways: forests fail to regenerate, soils are impoverished, water tables are lowered and become unsafe, and the air over industrial and densely inhabited areas becomes polluted. At the same time more and more natural resources are produced both by a more effective exploitation of the already exploited resources and by opening up new resources (for example, coal in addition to wood, then oil in addition to coal). The availability of a larger quantity and a wider variety of resources enables more people to produce and to consume. As a result, the population grows. But a larger population using more and more kinds of resources cannot make do with the kind of structures that served life based on simpler and more limited resources. There is a need for special skills and special purpose organizational structures. As these are developed, the complexity of society grows, together with its population and its resource base.

Society grows beyond its traditional bounds, into an international and intercultural dimension. A more complex society with more people using more resources puts previously separate people into contact with each other and makes them dependent on each other. As intercommunity trade develops, the scope of social interaction expands; there is more and more exchange between diverse peoples and cultures. There is a corresponding pressure on society’s traditional structures and relations of power. The established institutions are under stress, and new ways of living, administering communities, and doing business are required. Some people come up with the new ways and reap the benefits; others fail to come along. Social structures tend to polarize into rich and poor, powerful and marginalized segments.

In the third phase of the Great Transition society’s transformation builds toward a crucial threshold. Expansion and integration combined with environmental degeneration produce unexpected consequences that disorient people and overload the administrative and control capacity of institutions. Society enters a period of social and cultural transformation, with some people holding to established values and swearing by tried and tested methods while a growing number look for alternatives.

When the critical threshold of stability is breached, a fourth phase gets under way. It brings either breakdown or breakthrough. Society either restabilizes under the emerging conditions, or heads toward crises and breakdown.

Great Transitions are part of the evolutionary dynamics of society. This dynamics is shared by all thermodynamically open complex systems and can be mapped by the bifurcation diagrams developed in evolutionary systems theory.

<Figures 2,3,4>

Processes of fundamental, irreversible change exhibit the same basic dynamics, whether they take place in physical nature, in the realms of life, or in the realms of human history.

<Figure 5>

3. IMPLICATIONS OF THE STTE-OF-THE-WORLD INFORMATION FOR THE FUTURE

In the third phase of Great Transitions previously dominant trends breakdown; the evolutionary path of the
system bifurcates. Alternative futures become available. We are approaching this phase today, and conveying a recognition that the current mode of societal evolution is entering a bifurcation is an essential element of the briefing contemporary education needs to provide.

The alternative evolutionary paths that now open for society can be illustrated by two “scenarios”: a breakdown and a breakthrough scenario.

THE TRANSFORMATION-PROVOKING INITIAL CONDITIONS

*The unsustainable economic, social, and cultural conditions*
- Increasing population pressure: 77 million humans added to the world population every year, 97% of them in poor countries
- Spreading poverty: nearly two billion people living on less than two dollars a day, more than one billion of them in urban slums at the lowest levels of physical subsistence
- Widening gap between rich and poor people as well as rich and poor economies: 80% of the human population has but a 14% share of global consumption, while the richest 20% accounts for 86%
- Persistent religious/cultural intolerance in the Middle East, the Balkans, the Indian subcontinent, and other hot-spots
- Rising resentment of America’s apparent hegemonic aspirations in the pursuit of global economic and political goals backed by military force
- Growing threat of terrorism and consequent armed retaliation

*The unsustainable ecological conditions*
- Accelerating deforestation and reduction of biodiversity: disappearance of tropical rainforests, loss of an untold number of species, monocultures on cultivated lands
- Accelerating climate change, with extremes of cold and heat, violent storms and changed rainfall patterns; threat of a new ice-age in Europe because of the deflection of the Gulf Stream by melting polar ice
- Accelerating climate change, with extremes of cold and heat, violent storms and changed rainfall patterns; threat of a new ice-age in Europe because of the deflection of the Gulf Stream by melting polar ice
- Rising sea levels: loss of low-lying plains and river valleys in Southern Asia, flooding of island countries in the Pacific, and threat to coastal cities throughout the world.

THE BREAKDOWN SCENARIO

*2005-2015: Rising stress in the economic, social, and cultural spheres*
- Fundamentalism fed by resentment over perceived economic and social injustice generates holy wars in the Muslim world
- Terrorism spreads, together with attempts to eliminate terrorists by attacking the countries that harbor them
- The North Atlantic alliance linking Europe, the United States and Russia collapses
- France, Germany, Russia, and China form a coalition to balance what they perceive as growing US military-economic hegemony, joined by Brazil, India, South Korea, and other developing countries
- There is a sharp rise in global military spending, as on the one hand the U.S. and its allies, and on the
other the alternative bloc countries enter the spiral of arms competition

- Global economic stagnation combined with U.S. unilateralism weakens the International Monetary Fund and the World Trade Organization and, as regional economic agreements become more attractive than multilateral trade arrangements and bilateral trade with the U.S., trade wars become frequent and increasingly destabilizing.
- North-South trade agreements are cancelled and trade flows disrupted; the international economic/financial system is in shambles
- Corruption as well as maverick and organized crime spread on the six continents.

Growing degradation in the ecological sphere

- Water and food shortages in Sub-Saharan Africa, China, Southern Asia, and Meso-America generate water-and hunger-wars
- Starvation and unsanitary conditions accelerate the spread of HIV/AIDS, SARS, and other epidemics
- Millions of climate refugees from flooded coastal cities and low-lying areas and from destitute urban and rural regions move inland on all continents.

2015-2020: The approach of global breakdown

- Nearly a third of the human population is homeless and two-third lack adequate food and clean water
- Political and economic conflict between the U.S. and its allies, and the alternative military-economic bloc reaches a crisis point; hawks and armaments lobbies on both sides press for the use of weapons of mass destruction
- Strong-arm regimes come to power in the developing world, determined to use armed force to right perceived wrongs
- Regional wars erupt in the traditional hot-spots and spread to neighboring countries
- The major military-political-economic power-blocs use weapons of mass destruction to achieve their economic and political objectives
- Some of the newly arising strong-arm régimes insert nuclear, chemical, or biological weapons to resolve regional conflicts
- War fought with conventional and nonconventional weapons escalates to the global level; the international economic and financial system is in chaos; political relations among states break down; anarchy and destruction become generalized.

THE BREAKTHROUGH SCENARIO

2005-2010: The first steps toward a breakthrough

- Regional wars erupt in the traditional hot-spots and spread to neighboring countries
- The experience of terrorism and war, together with rising poverty and a variety of environmental threats and disasters trigger positive changes in the way people think. The idea that people themselves can be effective agents of transformation toward a more peaceful and sustainable world captures the imagination of individuals in more and more societies. People in different cultures and different walks of life pull together to confront the threats they face in common.
- The worldwide rise of popular movements for peace and international cooperation leads to the election of
similarly motivated political figures, lending fresh impetus to projects of economic cooperation and inter-cultural understanding and to local and global measures to ensure or enhance the sustainability of the environment

- Local, national and global business leaders adopt a strategy where the pursuit of profit and growth is informed by a search for corporate social and ecological responsibility
- An electronic E-Parliament comes on line, linking parliamentarians worldwide and providing a forum for debates on the best ways to serve the common good
- Non-governmental organizations link up through the Internet and develop shared strategies to restore peace and revitalize war-torn regions and environments. They promote socially and ecologically responsible policies in local and national governments and in business

2010-2015: The crystallizing contours of peace and cooperation

- More and more funds are re-assigned from military and defense budgets to fund practical attempts at conflict resolution and the implementation of internationally agreed and globally coordinated ecological sustainability projects
- Reforms are undertaken in the world’s monetary system: a world currency is put into circulation by the reformed World Bank Group on the basis of population size rather than financial power, creating a more equitable flow of money among the world’s disparate economies
- Business leaders the world over join forces in creating a voluntarily self-regulating ecosocial market economy that ensures a fair access to economic goods and activity to all strata of the population
- Agriculture is restored to a place of primary importance in the economy, both for producing staple foods and for growing energy crops and raw materials for communities and industry
- A worldwide renewable energy program is created, paving the way toward a third industrial revolution making use of solar and other renewable energy sources to transform the global economy and lift marginalized populations out of the vicious cycles of poverty.

2015-2020: The emerging foundations of a sustainable world

- National, continental and global governance structures are reformed or newly created, moving states toward participatory democracy and releasing a surge of creative energy among empowered and increasingly active populations
- The consensually created and globally coordinated ecosocial market system begins to function
- As a consequence international and intercultural mistrust, ethnic conflict, racial oppression, economic injustice, and gender inequality give way to a higher level of trust, and a shared will by the world’s peoples to achieve peaceful relations among states and sustainability in the economy and the environment.

These scenarios illustrate the futures that can come about in today’s world. It is not the initial conditions that decide among them—the world from which they take off is the same; it is today’s critically destabilized and hence unsustainable world. The difference is in the way people respond to this condition. The decisive factor is not the problem, but the response to it. This highlights the need for timely wisdom based on informed judgment, and the creativity to act on the basis of such judgment.
4. THE FACTOR OF WISDOM

Perhaps the first requirement for inspiring timely wisdom is to recognize that many of the principles that govern today’s world are obsolete. Let me cite a paragraph from the Declaration adopted by the Club of Budapest’s World Wisdom Council on the 18th of December 2004:

“Where is the wisdom in a system that ———

- Produces weapons that are more dangerous than the conflicts they are meant to solve?
- Continues to undervalue women and abandons half of its children in poverty and hunger?
- Creates an overproduction of food, but fails to make it available to the hungry?
- Expects individuals to abide by the golden rule of treating others as they would be treated themselves, yet ignores this elementary rule of fairness in relations among states and among businesses?
- Faces a gamut of tasks and challenges, yet puts more and more people out of work?
- Requires unrelenting economic and financial growth for it to function and not to crash?
- Faces long-term structural and operational problems, yet bases its criteria of success on short-term accounting periods and the day-to-day behavior of stock exchanges?
- Assesses social and economic progress in terms of the gross national product and leaves out of account the quality of life of the people and the level of fulfillment of their basic human needs?
- Gives full priority to maximizing the productivity of labor (even though millions are unemployed or underemployed) rather than improving the productivity of resources (notwithstanding that most natural resources are finite and many are scarce and nonrenewable)?”

The World Wisdom Council suggests that if we are to move beyond the obsolete wisdom that underlies these and similar paradoxes, we must address some fundamental questions. They include the following:

- “Can we have peace within and among ourselves without living in peace with nature?
- Can we have a peaceful and sustainable world without understanding how others view the world?
- Can we afford to ignore the intrinsic wisdom present in traditional cultures and present also in young children when it comes to conducting our life in modern societies?
- Can we transform in time the prevalent glorification of greed, lust and power into a mindset hallmarked by dedication to justice for everyone, and respect for all people whether they live in our culture and society or in others?”

Young people need to recognize that some of the beliefs that are as yet prevalent in modern society are no longer functional. These include the belief that ———

- “Can we have peace within and among ourselves without living in peace with nature?
- We are all separate individuals enclosed by our skin; if we cooperate it is only to promote our own interests
- The value of everything, including human beings, can be calculated in money. What every economy needs is growth, and what every person wants is to get rich
- Women’s place is in the home; in the workplace women are best at assisting men, keeping order or cleaning up
- Newer is always better. It is desirable, and for the economy necessary, that we buy and use the latest prod-
ucts and technologies.

- The future is none of our business. Every generation, like every person, has to look after itself
- Crisis in the world is reversible. The problems we are experiencing are temporary interludes, after which everything will get back to normal.
- Business as unusual has evolved out of business as usual, and will sooner or later reverse back into it.

There are some beliefs that are not just obsolete but actually dangerous:

The Neolithic Illusion: Nature Is Inexhaustible—The belief that nature is a limitless resource, and provides an infinite sink for waste can lead to the overuse of vital resources and the overload of nature’s self-regenerative cycles. There are 3 billion malnourished people today, and when population peaks at around 12 billion, which could be already by 2054, this figure would double. Since more than 99.8% of food for human consumption comes from the land, maintaining the current, slight increase in the harvest of cereal grains, which make up 80% of human diets, will not be sufficient. Even on an optimistic ecological scenario, where the erosion of cropland and the loss of topsoil are halted, nature’s capacity to feed the human population would be definitively exceeded.

Social Darwinism: the Ideology of Competitive Fitness—The idea that competition is the basis of all life was suggested by Darwin’s theory of evolution through natural selection. The social application of Darwin’s theory, “Social Darwinism,” holds that in society, as in nature, a competitive selection process eliminates the unfit: only the fit survive. In society fitness is not determined by genes: it is a personal and cultural trait, expressed as smartness, daring, ambition, and the ability to garner money and put it to work. In today’s world the struggle for survival emerges in the merciless struggle of competitors in the world of business and politics. The resulting gap between rich and poor, the holders of power and the marginalized populations, creates frustration and issues in violence.

Market Fundamentalism: The Ideology of the free market—The ideology of the market rests on the belief that the market distributes benefits, so if one company or individual does well, other companies and individuals also reap the fruits. Central tenets of this ideology are that all human needs and wants can be expressed in monetary terms and can enter on the market as a form of demand with a corresponding supply; that there are no insuperable human, financial, or natural limits to the conversion of needs and wants into saleable commodities; and that the freedom to compete on the market is the basis of liberty and the foundation of social and economic justice.

Militarism: Force of arms is the best way to resolve social and economic problems—Global military spending surged in recent years, reaching and then surpassing one thousand billion dollars annually. Yet war has not eliminated terrorists and weapons of mass destruction and has led neither to peace nor to stability. At the same time according to the United Nations starvation and the worst forms of malnutrition could be eliminated on all continents with an annual investment of about $19 billion; shelter could be provided for the world’s homeless for $21 billion; clean water could be provided for everyone for about $10 billion; deforestation could be halted for $7 billion; global warming could be prevented for $8 billion and soil erosion for $24 billion. Investing in
such programs for a period of ten years would be more effective in creating conditions conducive to stability and peace than funding military campaigns to kill terrorists, attack unfriendly states and uncooperative régimes, and attempt to export democracy through military occupation.

The following graphs summarize the principal obsolete as well as adapted values and beliefs.

<Figures 7,8>

5. THE QUESTION OF TIMELY WISDOM

I now return to the topic of timely wisdom. Timely wisdom is not the mere extension of historical knowledge into the foreseeable future, since the third phase of a Great Transition creates fundamentally new conditions; it is a “bifurcation phase” characterized by strong nonlinearity. To cope with these conditions the extrapolation of historical knowledge is not sufficient. Consequently at the present time in history “sustainable development” is not development as previously experienced with some form and level of adjustment and adaptation. It constitutes a step-function in the development of society and its life-supporting environment. It follows that to achieve sustainable development we need new insight and fresh creativity.

Timely wisdom cannot be taught, but it can be learned. The way to learn it is to reach considered conclusions of one’s own, exercising sound judgment and the creativity to translate one’s insights into action. The crucial task of the educational system is to provide the context for this process of learning. This means providing the relevant state-of-the-world briefings, giving an unbiased view of the contemporary situation and the positive and negative opportunities that it harbors. Systematic exposure to this information can catalyze new insights on the part of the learners, and this in turn can motivate the search for, and the adoption of, a more adapted and responsible ethics.

The basic insight to crystallize in this learning process is that the presently unsustainable condition of society cannot be remedied by patch-up solutions: it is a shift in civilization. This would not be the first civilizational shift in history, but the first to occur rapidly, in the span of a single generation, and to occur on the level of the planet as a whole.

<Figures 9,10>

The ethics suited to a new and sustainable civilization likewise cannot be taught, but it, too, can evolve on the part of the learners themselves when they recognize the reality of the civilizational shift and the challenges it poses. The indicated ethics may include many principles and provisions, but its central tenet must be the respect individuals and organizations need to accord the limits of stability in human socio-ecological systems. Consequently the indicated new ethics could be many things, but it must also be a “spaceship ethics.”

<Figure 11>
6. CONCLUSIONS

To catalyze adapted insight and ethics is a crucial task of contemporary education. Without the insight that we are in the midst of a Great Transition toward a globally interconnected and interdependent civilization individuals will not fundamentally change the way they are thinking, and without the appropriate ethics they will not feel compelled to act on their insights. Since a new civilization cannot be created by directives from a higher authority but must arise from the fertile soil of grass-roots concern and creativity, education’s task of catalyzing timely wisdom in the young generation is crucial. Without it competitiveness in the short term could spell obsolescence in the long term.

Sustainable development is nonlinear development and calls for innovative insights and ethics. Today’s educational system needs to create programs purposefully oriented to the evolution of timely wisdom in the ranks of the young generation.

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- **Issues of Ecological Sustainability**


**Approaches to Peace and Human Security**


**Paths to Global Transformation**


Presentations

Educating for Sustainable Development: Global Science Literacy

Victor J. Mayer

The Challenge of the Decade for Education for Sustainable Development
– Education for Sustainable Development and Global Citizenship –

The UK Perspective

Douglas Bourn

The Relationship between Spirituality and Education for Sustainable Development

Peter Glasby
Educati ng for Sustainable Development: Global Science Literacy*

1. INTRODUCTION

The theme of this conference, consistent with the UNESCO Commission for Sustainable Development Work Program, is Education for Sustainable Development (NIER, 2004). The UNESCO Commission identified four major thrusts for (1) promotion and improvement of basic education; (2) re-orienting existing education at all levels to address sustainable development; (3) development of public understanding; and (4) awareness of sustainability and training. I have spent my entire professional life in science education pursuits--teaching at middle school and high school and after completing my Doctorate, teaching at the university level in the earth sciences and in preparing middle school and high school teachers of science. During these latter activities, I worked with colleagues at The Ohio State University and nationally whose primary commitments were to Environmental Education. Thus I believe I have a thorough view of school curricula, especially in science, and in the objectives and content of Environmental Education. Much of what I have done in these fields is supportive of at least the first three of these goals stated in the UNESCO report.

In my work with environmental educators I have consistently taken the view that the basis of any effective school program that seeks to enhance students understanding of and care for the environment must be based in an effective science program. However, the vast majority of science programs taught today have at their core a basic distortion of science and science methodology. They are focused on the outdated concept of a mechanistic universe and adapted primarily to develop and enlist future workers in applied science programs dedicated to the development of commercially or militarily useful technology. As a result, they fail to adequately represent the broad methods, goals and contributions of science and are therefore ineffective for providing a basis for school programs having environmental education as a focus. In the talk I will present a framework for a science program that represents the current nature of science and its methodologies, one that would be an ideal core of any environmental education program. A framework using the Global Science Literacy (GSL) and Earth Systems Education (ESE) constructs would serve well in a framework for Education for Sustainable Development (ESD).

2. HISTORY OF GLOBAL SCIENCE LITERACY

The genesis and history of GSL is provided in some detail elsewhere (Mayer and Tokuyama, 2002). Briefly,

*For powerpoint slides used in this presentation, see pp.36 - 43, as well as the attached CD-ROM.
it was initiated in 1988 subsequent to a conference held in Washington, D.C. The weeklong conference, sponsored by the American Geological Institute and the National Science Teachers Association with support from the National Science Foundation, included as participants some 20 scientists and 20 science teachers and science educators. Its final report defined the content and approach to be used in future science courses (Mayer and Armstrong, 1990). Presented at the conference by one of the participants from a NASA contractor, was the report of the Earth System Science Committee (1987). It provided a basis for many of the decisions made there and subsequently in developing the Earth Systems Education Program at The Ohio State University. In 1990, the National Science Foundation provided support for a five year long Program for Leadership in Earth Systems Education at The Ohio State University and the University of Northern Colorado. The 200 teachers and administrators participating in this program helped to provide the details for the final format of Earth Systems Education (ESE) incorporated in the curriculum guide, Science is a Study of Earth (Mayer and Fortner, 1995). This program and its report were used in the development of a number of Earth Systems Education Programs at the middle school and high school level.

In 1996, I spent almost eight months as senior researcher in the Global Education Program at Hyogo University of Teacher Education, Japan. Working with colleagues at the university, we developed the concept of Global Science Literacy. GSL used the ESE construct as the science curricular basis for developing the philosophy and characteristics of an international version of science literacy. One of the basic ideas is that science is an ideal curricular medium for promoting global understandings of culture. Through combining objectives of the social studies curricular effort of global education (Merryfield, 1997) and integrating its philosophy with that of ESE, the GSL construct was achieved (Mayer and Tokuyama, 2002).

GSL was developed in the post-Cold War era. It looks to the future challenges of science and science curriculum in an era of social unrest and environmental change. It is not directed toward the use of technology in commercial or military developments but only the uses of technology for expanding our knowledge of the Earth system we all share and for ameliorating the destructive environmental consequences of unfettered technological development. It provides a strong basis for an education for sustainable development.

3. ESSENTIALS OF GLOBAL SCIENCE LITERACY

GSL differs from the standard science curriculum, as it exists in most parts of the world today, in several ways:
1. It is conceptually organized rather than organized by science discipline.
2. It accepts the idea that there are aesthetic incentives to the understanding and appreciation of the subject of all science, the Earth system.
3. It incorporates as a major objective an understanding of how human activities impact, often negatively, the earth system.
4. It incorporates the science methodology and thinking of the system sciences as well as that of the physical sciences.
5. It recognizes the role of science in society by incorporating objectives from the social studies curriculum construct of global education thus capitalizing on the unique advantages of science and the science curriculum in promoting cross cultural understanding.
6. GSL curricula are taught with learning strategies or environments that accurately represent the nature of
science and the nature of the learner. As a result, such curricula use student-oriented activities and rely heavily on student’s investigative abilities.

7. By incorporating the systems science concept and thinking, it accommodates Eastern thinking and worldviews thus providing a wider international basis and cultural acceptance for the science curriculum.

1) Conceptually Organized

GSL curricula contrast sharply with the traditional way of organizing science curricula based simply on the various disciplines—a reductionism approach that does not allow for an adequate rendition of the actual subject of all science-our earth system. We have taken a cue from Laszlo (1972) who describes the systems view of nature:

In sum, nature, in the systems view, is a sphere of complex and delicate organization. Systems communicate with systems and jointly form super systems. Strands of order traverse the emerging hierarchy and take increasingly definite shape. Common characteristics are manifest in different forms on each of the many levels, with properties ranged in a continuous but irreducible sequence from level to level. The systems view of nature is one of harmony and natural balance. Progress is triggered from below without determination from above, and is thus both definite and open-ended. To be ‘with it’ one must adapt, and that means moving along. There is freedom in choosing one’s paths of progress, yet this freedom is bounded by the limits of compatibility with the dynamic structure of the whole. (pp.74-75.)

We suggest then that future science curricula, following the GSL approach, are conceptually organized rather than being organized by science discipline. That is, content is organized around the concept of the Earth as a system, often with the various Earth system cycles as components of the organizing framework (Orion, 2002). Since the Earth system and its environment in space are the subjects of study of all disciplines of science, content from the various disciplines is woven into this framework as it helps to explain the functioning of Earth processes. This focus for the organization of content brings science to the immediate interest and experiences of the learner. Instead of having to learn abstractions of natural occurrences, often confined to a laboratory setting, students apply basic science understandings within a familiar context, their habitat, a context that is often of aesthetic as well as intellectual and practical interest to them. We have used an unique organization of the content standards developed by the National Research Council of the National Academy of Sciences (NRC, 1996) (See Appendix B) and combined them with seven Earth Systems Education Understandings (Mayer and Tokuyama, 2002) to illustrate and guide the nature of the science content development in GSL curricula (See Appendix A for the seven Understandings). Through such an approach students will see science as Laszlo (1996) suggests; not just for its technical applications but for “such ‘soft’ factors as our view of nature, man and world.”

2) Incorporates Aesthetics

The first Earth Systems Understanding is “Earth is unique, a planet of rare beauty and great value.” This understanding was included at the insistence of scientists participating in a weeklong conference to define those
basic understandings to be included in science curricula (Mayer and Armstrong, 1990). They argued that one of the reasons they pursued a career in science was that they found beauty in the Earth system. It could have been sunsets, the aurora, plants, and animals, any of a wide variety of natural features that they found aesthetically pleasing and stimulating. This was a major incentive for them to follow a career that would lead them to a deeper understanding and valuing of Earth. Since this is true for scientists, science educators should also see the value of earth aesthetics as a part of the science curriculum. By including it as a context for teaching about earth processes teachers can attract a broader variety of students to an interest in science. For this reason, we believe that it should be included in science teaching and have thus included it as an understanding of ESE, the science curricular basis for GSL.

3) **Focuses on the Human Uses of the Environment and their Impact on the Earth System.**

Through achieving an understanding of how the various earth processes and cycles are known to function within the earth system, students will achieve a better understanding of how a technological society and a world market affects that system. Through including objectives of global education, they will be better equipped intellectually to suggest and support governmental policies that ameliorate the negative effects of industrial and commercial developments. They will have the knowledge and skills to move their communities toward a sustainable development future.

4) **Incorporates System Science Methods**

The science curriculum as it exists in almost all secondary schools throughout the world, emphasizes the content and methodology of the physical sciences. This elevates the controlled experiment to the highest levels of science “quality” in the minds of the teachers and their students-and in fact the citizens that have benefited from quality education during their college and pre-college educational experiences. This emphasis upon “experiments” as being the hallmark of good science went so far during the days of the United States’ National Science Foundation curriculum projects in the 1960’s and 1970’s that the only widespread curriculum effort in the Earth sciences, the Earth Science Curriculum Project (ESCP), used controlled experiments in its textbook. Many Earth science teachers were treated to the experience of a class of 30 children shaking pieces of rock in metal coffee cans during an effort to determine erosion rates in a contrived “experiment” that controlled for time and rock type. Ignored, even in this curriculum, were the methods of scientific investigation typically used by the geologist and ecologist. Frodeman (1995) in his seminal paper has described these methods as used by geologists. Mayer and Kumano (2002) in reviewing the characteristics of the system sciences, such as geology, have called these methods “systems science methods.” It is these methods that Darwin used in developing his theories of evolution and natural selection, and they are the methods that are informing us about the reality of global warming. They are also the methods of science that will be most useful in future attempts at solving some of the environmental and social problems we have inherited from a century of war and economic conflict. GSL incorporates this type of science methodology as a cornerstone for modern science education programs.
5) **Integrates Objectives of Global Education**

The nature of science investigation is such that it promotes inter-cultural cooperation and understanding. Its subject, the Earth system and its relationships to the Solar System and the Universe in general, is one held in common by all scientists the world over. The methodology of science facilitates communication among its participants, despite differing cultures and languages. These conclusions about the international nature of science as it is practiced can be verified by examining the authorship of science research studies published in most scientific journals. Mayer and Tokuyama (2002) applied this understanding of the cross-cultural nature of science and combined topics of science curriculum from the American national science standards with objectives of the social studies curriculum area of global education to formulate the content structure of Global Science Literacy (See Appendix B). Global education is a curriculum construct that seeks to develop a global perspective among students. Hanvey (1975) identified five elements of a global perspective—perspective consciousness, state of the planet awareness, cross-cultural awareness, knowledge of global dynamics, and awareness of human choices. These are understandings appropriate for inclusion in science curricula—in fact, supported by the very nature of science, its methodology and its content. They also bring a cultural focus to concerns about environmental changes and their impacts upon all nations.

6) **Use Effective Learning Strategies**

A variety of learning strategies are available to the teacher for both classroom and field-oriented activities. A sequence of inquiry skills adapted from the National Research Council Publication (2000), Inquiry and the national science education standards: A guide for teaching and learning, are especially useful in investigations. The original skills, included in figure 1 below, were used by a geologist while studying the occurrence of a “fossil forest” along the Pacific coast.

<table>
<thead>
<tr>
<th>Makes observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exhibits curiosity, defines questions, from knowledge background</td>
</tr>
<tr>
<td>Gathers evidence using technology and mathematics</td>
</tr>
<tr>
<td>Uses previous research</td>
</tr>
<tr>
<td>Propose a possible explanation</td>
</tr>
<tr>
<td>Published explanation based on evidence</td>
</tr>
<tr>
<td>Considers new evidence</td>
</tr>
<tr>
<td>Adds to explanation</td>
</tr>
<tr>
<td>Explanation informs public policy</td>
</tr>
</tbody>
</table>

**Figure 1. Inquiry skills used by a Washington State geologist.**

Each of these inquiry skills can be applied in both classroom and outdoor settings. Two require some modification including those concerned with publication and public policy. For teaching purposes, these can be replaced by the preparation of individual and class reports.
Charles Darwin undoubtedly used these and other types of inquiry processes in his classic works dealing with evolution and the theory of natural selection. Thompson (2002) has devised a fascinating field experience following the footsteps of Darwin’s development as an earth system scientist in his home area of Shropshire, England. This can be a model for types of field trips conducted in other areas where famous scientists lived.

The “jigsaw” version of cooperative learning is especially useful in both classroom and field activities and has been used in a number of workshops at Ohio State including one held for Cleveland City teachers at Stone Lab in Lake Erie. In this version of Cooperative Learning students belong to two groups. One, the “base” group coordinates information on a topic from different sources. Each of the base group members is also a member of an “expert” group. These groups acquire information from different sources. Individuals then reassemble into their base groups and share their information with the other members of their group. See Fortner (2002) for a detailed explanation of the Jigsaw.

Japanese educators have found student independent investigations carried on outside of school hours and during school breaks and vacations to be especially useful for outdoor activities. Natsuko (Shimono and Goto, 2002) conducted such an independent study of temperature variations in her home community. She found several different patterns over the seven months of her investigation. These patterns of temperature were dependent upon factors such as; developed vs. lesser-developed areas, hill vs. valley, summer vs. winter and morning vs. evening. Her science teacher assisted in the design of her study. Her father transported her to the various collection sites.

Parent assisted investigations outside of school hours have also been successful in both Japanese and American contexts. These are aided by the development of inquiry guides by the teacher specific to the area or topic to be studied. Goto (2002) developed one on the geology of the Miura Peninsula. It was published and made available to all of the 9th grade earth science classes of the Prefecture. Students and their parents used the guide to locate sites of investigation and to learn information about each of those sites. Also included in the guide were laboratory investigations that could be done at home. School laboratory sessions provided introductory and summarizing experiences for the students.

Conducting outdoor experiences and indoor laboratory and cooperative learning activities will require the cooperation of all of the teachers in a school. Administrative support is especially important. It requires someone who is not afraid of potential liability occurrences, willing to provide the extra funds necessary for transportation, laboratory materials, computers and resource materials, and for rescheduling classes and teachers to permit extended periods of time in which to conduct these experiences. Finally it is important for the teacher to integrate carefully the out of school experiences into the on-going science curriculum (Goto, 2002).

7) Accommodates Aspects of Eastern Thinking

The concept of the Earth as a system with humans as a subsystem is one that contrasts with the Western idea of the distinctness of man from the natural world-the philosophy in which modern science was founded. This Western idea led to the ascendancy of the physical sciences as a tool used in protecting us from the natural world and in wresting natural resources for our use. Science was useful since it enhanced our ability to utilize the resources of the natural world in our daily activities. This contrasts with the Eastern concept of people as integral parts of nature, depending upon and existing in harmony with natural processes (Mayer and Tokuyama, 2002). The system science methodology also reflects this type of thinking. Its conceptual schemes include the
human being as an integral part of the life system and illustrate the interrelationships of the human with other Earth systems. Thus GSL, incorporating system science methodology and with content structured around the concept of the Earth as a system, presents a curriculum in science much more in harmony with Eastern thinking than one founded entirely upon the thinking and philosophy inherent in the physical sciences. Therefore, students from both Western and Eastern cultures can be culturally comfortable with science curricula that use GSL as their philosophical and developmental basis.

4. HIGHER ORDER THINKING SKILLS FOR SUSTAINABLE DEVELOPMENT

Developing strategies for sustainable development in a world already seriously damaged by human intervention will require a workforce and commercial and political leadership will equipped with higher order thinking skills. Wilson and Livingston (1996), in their chapter entitled “Process Skill Enhancement in the STS Classroom,” surveyed the science education literature starting with the 1932 National Study of Education Yearbook through the AAAS Benchmarks (1993) and the National Standards (1996) to arrive at their conclusion that:

Science education has always articulated a need to have students develop their thinking and reasoning skills. The processes that scientists use have been seen as important to impart as “learnings” in science courses. (p.59)

Most science educators have believed that science can uniquely serve the curricular objectives of developing critical thinking among pre-college students. Thus, there has been an ongoing effort over the years to structure science curricula to be “activity-oriented”, “investigative”, “process oriented”. In doing this, however, educators have relied on a single stereotype of the “nature of science” and its methodology. Thus the broad nature of science and its methodology has been poorly represented in current science curricula.

The late Stephen Gould (1986), Agassiz Professor of Zoology at Harvard University, described our science education and its methodological emphasis as follows:

Most children first meet science in their formal education by learning about a powerful mode of reasoning called “the scientific method.” Beyond a few platitudes about objectivity and willingness to change one’s mind, students learn a restricted stereotype about observation, simplification to tease apart controlling variables, crucial experiment, and prediction with repetition as a test.

He goes on to point out that science curricula fail to provide a background in an essential component of the system sciences, that of history. In fact, they condition students to feel that a science that focuses on description and one in which experiments cannot be conducted is not science at all.

This focus on “experimental science” extends across the Atlantic as well. In the report entitled Beyond 2000 (Millar and Osborne, 1998) British science educators recommend that the ideas about science in secondary school should include:

how to design a simple investigation of the relationship between two variables, keeping
other variables and factors constant.

Thus the impression given is that the only acceptable type of science methodology is the controlled experiment of the physical scientist. Left out of the American Science Education Standards, the Benchmarks of the American Association for the Advancement of Science, and indeed all science curricula worldwide, including Japan’s, is a treatment of the predominant methodology of the earth and ecological scientists—what we have termed, system science methodology (Mayer and Kumano, 2002).

If an important objective of science teaching is the development of thinking skills as suggested above, then why does the science curriculum focus on an investigative methodology that is useless to the average citizen? How often can you or I solve a problem in our daily lives by thinking through a controlled experiment? Certainly the attention paid to the variety of variables in our problem assists us in our endeavors. But, we can seldom run a controlled experiment to gather data to help us think through or solve our problem. It is our contention that the system science approaches, however, are useful to the average citizen. Thus they should be given status in any science program in which problem solving and thinking skill development are important objectives. They are especially important in a democratic society when the citizen is to judge developmental policies for their relevance to a sustainable future.

Resnick (1987) described the characteristics of higher order thinking as:

1. non-algorithmic (the path of action is not specified in advance);
2. often complex (the total path is not mentally visible from any single vantage point);
3. yielding multiple solutions (each results in certain costs and benefits rather than unique solutions).
4. involving nuanced judgment (and interpretation).
5. applying multiple criteria (which sometimes conflict with each other).
6. involving uncertainty (not everything needed will be known).
7. involving self-regulation of the thinking process (it is not guided at each step by someone else).
8. imposing meaning (develops order among apparently disorganized information).
9. requiring effort (considerable mental work is necessary).

Few of these characterize the thinking involved in the experimental sciences. System scientists such as geologists, however, can identify most of these characteristics, in the reasoning procedures they use.

In Mayer and Kumano (2002), we review Frodeman’s characterization of the system science methodology used by geologists:

Frodeman (1995) characterizes the reasoning methods of the geological sciences as hermeneutic or interpretive, and historical. The geologist applies this type of reasoning to the various characteristics of an outcrop, “judging which characteristics or patterns in the rock are significant and which are not”. It is apparent that in this process, preconceptions will be involved in making judgments. Thus, the data used by the geologist will be meaningless to the uninitiated until “the geologist introduces concepts for ‘seeing’ the rock”. In a sense, this type of reasoning may be a tool in the development of all human knowledge, even in the ‘objective’ physical sciences (Eger, 1992). However, it is basic to the system sciences. There are three characteristics of hermeneutics that play fundamental roles in geological reasoning. They include the
“hermeneutic circle—the fore structures of understanding, and the historical nature of knowledge”. The hermeneutic circle is a process of back and forth reasoning where earlier conceptions are used as new data are presented to continue to build a conceptual structure. Thus, “wholes at one level of analysis become parts at another”. This is the means by which all understanding progresses. The second point, fore structure, relies upon the scientist’s preconceptions and foresight. Preconceptions are the theoretical basis upon which the interpretation of data is approached and foresight the “presumed goal of our inquiry and our sense of what will count as an answer.” The final characteristic includes the tools and sets of procedures or practices that are brought to the collection and processing of data. The nature of these tools and procedures also shapes the types of data acquired and their interpretation. This will include the discussions and critiques of colleagues as interpretations are developed or discussed in the literature. As these interpretations are accumulated over time, “the body of scientific knowledge comes to have a strongly historical component.”

Frodeman, in his preface to a collection of essays entitled Earth Matters (2000), states that the Earth sciences provide a model of reasoning that is more attuned to the realities that we face in our daily lives than do the physical sciences. The Earth sciences have a distinctive method of reasoning:

...that is deliberative rather than simply calculative, interpretive rather than purely factual, and historical rather than experimental-again, like our own personal and public lives. (p.ix)

He further argues the appropriateness of the system science methodology as a model for reasoning since knowledge can no longer be treated as discrete packages of information. Now and in the future, disciplines will need to be able to indicate how their information relates to that of other disciplines in a political and logical manner that fit the concerns of society.

In our opinion, it is crucial that the systems science mode of thinking become an important component of all secondary school science curricula, and especially those that claim to develop higher order thinking skills. Not only will this serve our students and future citizens well in their life long endeavors, it will also help to correct the misconceptions about the nature of science that concern Frodeman. Perhaps most important however, is that such programs will help to equip future citizens with the thinking skills essential in solving our environmental problems while ensuring an improving life style for all the world’s citizens.

5. CONCLUSION

Our objective in Global Science Literacy is to continue to teach students science and enroll them in the practice of scientific thinking and problem solving methodology. We differ from the science that is practiced in most science classrooms around the world in that we argue for the inclusiveness of the ‘systems sciences’ approaches to investigative methodology in classrooms. We argue that science needs to focus on the grand ideas about how the Earth system and its environs in space function using them as the organizational framework for science courses rather than the traditional science disciplines. Science instruction should capitalize on the beauty inherent in our habitat by including the role of aesthetics in the teaching of science. Science instruction should emphasize the implications of science methodologies and practices in facilitating cross-cultural communication.
and understanding. Science based on GSL will emphasize those science understandings that shape our philosophical view that places us as a human species within the earth system, our home in space. Such a science program can provide the core for effective environmental education, preparing students to support and understand sustainable development policies.

Such a program would satisfy many of the objectives of ESD. The following topics included in the Broad Framework and Content Framework for ESD would be systematically treated in such a program; energy renewal, science and technology, nature studies, biodiversity, human development, intercultural understanding, sustainable consumption and production, global education, health education, and population education (NIER, 2004). It is a vision of inter-cultural cooperation and communication—a vision that offers to students and their teachers a fuller understanding and appreciation of their habitat, its history and future. With its inclusion of systems science methodology it offers an improved basis for developing critical thinking skills giving students the skills necessary to develop and support measures leading to sustainable development.

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Appendix A: Framework for Earth Systems Education

Understanding#1: Earth is unique, a planet of rare beauty and great value.

- The beauty and value of Earth are expressed by and for people through literature and the arts.
- Human’s appreciation of planet Earth is enhanced by a better understanding of its subsystems.
- Humans manifest their appreciation through their responsible behavior and stewardship of subsystems.

Understanding#2: Human activities, collective and individual, conscious and inadvertent, affect planet Earth.

- Earth is vulnerable, and its resources are limited and susceptible to overuse or misuse.
- Continued population growth accelerates the depletion of natural resources and destruction of the environment, including other species.
- When considering the use of natural resources, humans first need to rethink their lifestyles, then reduce consumption, then reuse and recycle.
- By-products of industrialization pollute the air, land, and water, and the effects may be global as well as near the source.
- The better we understand Earth, the better we can manage our resources and reduce our impact on the environment worldwide.

Understanding#3: The development of scientific thinking and technology increases our ability to understand and utilize Earth and space.

- Biologists, chemist, and physicists, as well as scientists from the Earth and space science disciplines, use a variety of methods in their study of Earth systems.
- Direct observation, simple tools, and modern technology are used to create, test and modify models and theories that represent, explain, and predict changes in the Earth system.
- Historical, descriptive, and empirical studies are important methods of learning about Earth and space.
- Scientific study may lead to technological advances. Regardless of sophistication, technology cannot be expected to solve all of our problems.
- The use of technology may have benefits as well as unintended side effects.

Understanding#4: The Earth system is composed of interacting subsystems of water, rock, ice, air, and life.

- The subsystems are continuously changing through natural processes and cycles.
- Forces, motions and energy transformations drive the interactions within and between the subsystems.
- The Sun is the major external source of energy that drives most system and subsystem interactions at or near the Earth’s surface.
- Each component of the Earth system has characteristic properties, structure, and composition that may
be changed by interactions of subsystems.

- Plate tectonics is a theory that explains how internal forces and energy cause continual changes within Earth and on its surface.
- Weathering, erosion, and deposition continuously reshape the surface of the Earth.
- The presence of life affects the characteristics of other systems.

Understanding#5: Planet Earth is more than 4 billion years old and its subsystems are continually evolving.

- Earth’s cycles and natural processes take place over time intervals ranging from fractions of seconds to billions of years.
- Materials making up planet Earth have been recycled many times.
- Fossils provide the evidence that life has evolved interactively with Earth through geologic time.
- Evolution is a theory that explains how life has changed through time.

Understanding#6: Earth is a small subsystem of a solar system within the vast and ancient universe.

- All material in the universe, including living organisms, appears to be composed of the same elements and to behave according to the same physical principles.
- All bodies in space, including Earth, are influenced by forces acting throughout the Solar System and the universe.
- Nine planets, including Earth, revolve around the sun in nearly circular orbits.
- Earth is a small planet, third from the Sun in the only system of planets definitely known to exist.
- The position and motions of Earth with respect to the Sun and Moon determine seasons, climates, and tidal changes.
- The rotation of Earth on its axis determines day and night.

Understanding#7: There are many people with careers that involve study of Earth’s origin, processes, and evolution.

- Teachers, scientists, and technicians who study Earth are employed by businesses, industries, government agencies, public and private institutions, and as independent contractors.
- Careers in the sciences that study Earth may include sample and data collection in the field and analyses and experiments in the laboratory.
- Scientists from many cultures throughout the world cooperate and collaborate using oral, written, and electronic means of communication.
- Some scientists and technicians who study Earth use their specialized understanding to locate resources or predict changes in Earth systems.
- Many people pursue avocations related to planet Earth processes and materials.
Appendix B: Global Science Literacy Curriculum Frameworks

**<Middle School>**

<table>
<thead>
<tr>
<th>E. Structure of the Earth system ESU 4</th>
<th>S. Natural Hazards ESU 4</th>
<th>S. Risks and Benefits ESU 2, 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>B. Structure and function of living systems ESU 4</td>
<td>P. Transfer of energy ESU 4</td>
<td>P. Properties and changes of properties in matter ESU 4, 5</td>
</tr>
<tr>
<td>P. Motions and forces ESU 4, 6</td>
<td>B. Populations, resources and environments ESU 2</td>
<td></td>
</tr>
<tr>
<td>B. Populations and ecosystems ESU 4</td>
<td>B. Populations and ecosystems ESU 4</td>
<td></td>
</tr>
<tr>
<td>B. Reproduction and heredity ESU 4</td>
<td>B. Diversity and adaptations of organisms ESU 4</td>
<td></td>
</tr>
<tr>
<td>H. History of science ESU 3</td>
<td>B. Regulation and behavior ESU 4</td>
<td>S. Personal health ESU 1, 2, 4</td>
</tr>
<tr>
<td>H. Nature of science ESU 3</td>
<td>S. Science and technology in society ESU 2, 3, 7</td>
<td></td>
</tr>
<tr>
<td>G. Humankind as an entity interconnected across space and time ESU 4, 5, 6</td>
<td>G. Earth, humankind’s ecological and cosmic home ESU 1, 4</td>
<td></td>
</tr>
</tbody>
</table>

Possible organization of science standards and global education objectives for use in developing middle school (years 6 to 9) science curricula. Letters at the beginning of each standard identify the standards group it belongs to except for “G”. It identifies global education objectives.

**<High School>**

<table>
<thead>
<tr>
<th>E. Origin and evolution of the Earth system ESU 6</th>
<th>E. Origin and evolution of the universe ESU 6</th>
<th>S. Natural Hazards ESU 4</th>
<th>S. Environmental Quality ESU 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. Geochemical Cycles ESU 4, 5</td>
<td>B. Matter, energy and the organization of living systems (including cells) ESU 4</td>
<td>P. Interactions of energy and matter ESU 4</td>
<td>P. Structure and properties of matter (includes atoms) ESU 4</td>
</tr>
<tr>
<td>P. Chemical Reactions ESU 4</td>
<td>P. Motions and forces ESU 4</td>
<td></td>
<td>ESU 4</td>
</tr>
<tr>
<td>B. Biological Evolution ESU 5</td>
<td>P. Conservation of energy and increase in disorder ESU 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B. Molecular basis of heredity ESU 5</td>
<td>B. Behavior of organisms ESU 4</td>
<td>B. Independence of organisms ESU 4</td>
<td>S. Natural and human induced hazards ESU 2, 4</td>
</tr>
<tr>
<td>S. Personal and community health ESU 1, 3</td>
<td></td>
<td></td>
<td>S. Population growth ESU 2</td>
</tr>
<tr>
<td>H. Historical (and cultural) perspectives ESU 1, 2, 3</td>
<td>H. Nature of scientific knowledge ESU 3</td>
<td>S. Science in local, national and global challenges ESU 1, 2, 3</td>
<td></td>
</tr>
</tbody>
</table>

G. Global social structures as a level of human social organization

A possible organization of science standards and global education objective for high school (years 10 through 12) science curricular development. Letters in front of the topic indicate the group of standards topic it is related to except for the letter ‘G’. It indicates a global education objective. The code ESU indicates the Earth Systems Education Understanding the topic is related to.
EDUCATING FOR SUSTAINABLE DEVELOPMENT: GLOBAL SCIENCE LITERACY

Victor J. Mayer
Professor Emeritus, The Ohio State University

The Concern

In the light of the globalization of human civilization taking place before our eyes, the evolution of a global consciousness is urgently needed if mankind is not to destroy itself and all life on this planet by its inability to responsibly manage its technological ingenuity.

(Karan Singh in Laszlo, The Whispering Pond, 1996)

The Challenges of Globalization

• Economic Development
• Resource Conservation
• Environmental Degradation
• Technological Adaptation
• Cultural Integration
• Social Changes and Conflict

Need an Effective Environmentally Oriented Science Curriculum

What is Education for Sustainable Development?

• Develop knowledge, skills, perspectives, and values
• Holistic approach
• Encompass many issues including the preservation of biodiversity and cultural diversity

Earth Systems Education

UNESCO Bangkok, 2004

Earth Systems Education

The basis for a new model of science curriculum development

• Conceptual organization not by science discipline
• The systems view of nature is central
• Emphasizes the broad conceptual and philosophical contributions of science

In sum, nature, in the systems view, is a sphere of complex and delicate organization. Systems communicate with systems and jointly form super systems.

Laszlo, The Systems View of the World
**Earth Systems Education**

**Conceptual Organization of Curricula**

- Studying our habitat
- Our Earth as a system and its environment in space

**Earth Systems Understandings**

Basic to Global Science Literacy, seven understandings can guide the development of environmental science experiences:

- Source in Conference of Scientists and Educators
- Sponsored by the National Science Teachers Association and American Geological Institute
- Supported by the National Science Foundation

Please refer to Appendix A for the seven complete understandings.

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**Earth Systems cause great beauty**

- Lake Erie, Ohio

**Temple, Japan**

---

**Rice Farming in Japan**

- Environmental and resource conservation

**Quarry, Japan**
**Systems Science Investigation**
Typical of Earth Science and Ecology

- Observation
- Careful description
- Judge significant patterns
- Back and forth reasoning and accumulation of information
- Historical aspect of knowledge

**Reduction vs. System Science Methods**

Reduction Science
- Isolate single variables
- Conduct controlled experiment
- Find fundamental particles
- Time not a variable

System Science
- Study of a whole
- Judge patterns of significance
- Accumulative nature of knowledge
- Historical aspect of knowledge

**Systems Thinking**

- This kind of thinking is crucial in making good everyday decisions.
- It is the type of thinking that will support sustainable development.
- Thus it is essential that school programs emphasize this type of thinking—giving students frequent and constant practice in it.
- It supports the development of critical and higher order thinking skills

**Critical Thinking**

Resnick (1987) described the characteristics of higher order thinking as:
1. non-algorithmic (the path of action is not specified in advance);
2. often complex (the total path is not mentally visible from any single vantage point);
3. yielding multiple solutions (each results in certain costs and benefits rather than unique solutions);
4. involving nuanced judgment (and interpretation).

**Critical Thinking**

5. applying multiple criteria (which sometimes conflict with each other).
6. involving uncertainty (not everything needed will be known).
7. involving self-regulation of the thinking process (it is not guided at each step by someone else).
8. imposing meaning (develops order among apparently disorganized information).
9. requiring effort (considerable mental work is necessary).

**Global Education**

- Humankind as an entity interconnected across space and time
- Earth, humankind’s ecological and cosmic home
- Global social structures as a level of human social organization

See Appendix B for Curriculum Framework
Independent Student Investigations

- Vacation Periods can be used by teachers for student investigations:
  1. Used by some Japanese teachers
  2. Teacher and often a parent will provide guidance and transportation if necessary
  3. Equipment, if necessary can be provided by the school
  4. Certain government agencies and private organizations can provide assistance and guidance.

Example: Natsuko's Research Project
- Conducted in her home area near Yokohama City
- Measured temperature variations between valley and hill, developed and lesser developed areas, morning and evening, summer and winter.
- Assisted by teacher in formulating study and father in providing transportation

Parent Assisted Investigations

- An investigation guide provided to parents and students
  - Includes necessary directions to parent and student
  - Investigation conducted after school and on weekends
  - Background information included in the guide

Example: Field Guide on the Geology in Minatogawa
- Developed by teachers
- Published by the Board of Education
- Provided to all high grade students
- Used by parents and students during vacation periods

Field Trips

- Secondary School Students in Geibikei, Iwate Prefecture

Earth Systems Education Programs

- Bexley Middle School, Ohio
- Biological and Earth Systems Science, Ohio
- Cache La Poudre Systems Project, Colorado
- Integrated Science I & II, Weld County Schools, Colorado
Characteristics of Global Science Literacy

GSL differs from the standard science curriculum existing in most parts of the world today:
- It is conceptually organized around the Earth system, thus brings a focus to environmental concerns;
- It accepts the idea that there are aesthetic incentives to the understanding and appreciation of the subject of all science, the Earth System—thus environmental experiences are central;

Characteristics of Global Science Literacy

- It incorporates the science methodology and thinking of the system sciences, essential for developing the critical thinking skills for sustainable development;
- It recognizes the role of science in society by incorporating objectives from the social studies curriculum construct of global education (refer to your paper appendixes);

Cultural Relevance to Eastern Thought

- Systems view is more compatible with Eastern Thought
- Humans are one with the Earth System rather than being apart from it
- Systems view is one of harmony with nature, not in conflict with it

Conclusion

Environmental science investigations must be central to any quality science education program.

Conclusion

By incorporating the systems science concept and thinking it accommodates Eastern Thinking and world views and gives a solid core for constructing an education for sustainable development.

Credits

- Earth Systems Education – OSU and Northern Colorado University
- Global Education – Hyogo University of Teacher Education – JAPAN
- Research and Development – Shizuoka University and Ministry of Education – JAPAN
- Implementation – Korea National University of Education and Pusan National University – KOREA
- Theory and Philosophy – Educators from Israel, Great Britain, Germany, Taiwan, Spain, South America
Products

- *Science Is ... A study of Earth*, 1995, published by the Ohio State University
- Articles in International Peer Reviewed Journals
- Earth Systems Education Curricula
- Book – *Implementing Global Science Literacy*, published by The Ohio State University, 2003
- Presentations at International Conferences

Dedicated to Phyllis Bachhuber Mayer – in Fond Memory
The Challenge of the Decade for Education for Sustainable Development
—Education for Sustainable Development and Global Citizenship—
The UK Perspective*

1. INTRODUCTION

In my presentation today, my aim is as follows:

- Summarise why I as head of the leading development education organisation in the UK see sustainable development as important;
- Remind ourselves of the aims of the UN Decade on Education for Sustainable Development, the role of UNESCO and what is currently happening internationally;
- Raise some of the issues arising from what has happened in England on Sustainable Development Education in England over the past year.
- Suggest that we still need to spend more time discussing and sharing ideas and practices about education for sustainable development means
- Pose some challenges for us all to consider.

I will divide my talk into three main sections:

- What we mean by Education or Sustainable Development
- What is a Sustainable School?
- Ensuring Education for Sustainable Development practice relates to agendas and needs of people and engages them in the debates and issues.

2. DEVELOPMENT EDUCATION AND ESD

I come to the agenda of education for sustainable development as a development educationalist, as one who sees sustainable development closely linked to understanding the world in which we live, the divisions between rich and poor and the need to engage people in working for a more just and equitable world.

I am Director of a large umbrella organisation in England that puts promoting the principles of development education and sustainable development education as its mission. We have over 250 organisations in our membership. We see development education as an integral component of sustainable development education as was outlined in Rio Summit in 1992 although this has not been easy to secure in England as will be outlined later.

*For powerpoint slides used in this presentation, see pp.56 - 59, as well as the attached CD-ROM.
For development educationalists today there is increasing recognition that our agenda is not about learning about development, but encouraging an understanding of how the global and the local are interconnected. Also to give people the skills and knowledge to engage in society to secure global as well as local and national change that can ensure a more just and equitable society (See www.dea.org.uk).

Development education practice in England is closely linked to debates and programmes around areas such as active citizenship, human rights, improving the quality of life and understanding cultural diversity (Bourn).

2005 is a year which it is not only the launch of the Decade on Education for Sustainable Development but is also the first review of progress with the Millennium Development Goals and increased international pressure from civil society organisations to ‘make global poverty history.’

Therefore discussions about education for sustainable development need to include discussions about development education and where the global and the environmental dimensions to education relate. The roots of education for sustainable development could be argued to be from both the thinking and practice around environment education and development education. Indeed education for sustainable development has been seen as a bringing together of these two educational movements (Belgeonne, 2003).

3. UNESCO AND UN DECADE ON EDUCATION FOR SUSTAINABLE DEVELOPMENT

At the World Summit on Sustainable Development in Johannesburg in 2002, it was agreed, following the leadership from Japan, to recommend the creation of a decade on Education for Sustainable Development.

Since then UNESCO have developed their strategy in taking this work forward which was recently reaffirmed at a meeting of key bodies in Paris. To UNESCO they see the decade as closely linked to the global campaign of Education for All. They also want to encourage initiatives at all levels, local, national, regional and global. They recommend that national strategies ensure engagement and partnership with the key stakeholders including voluntary bodies as well as education ministries and schools.

For UNESCO, the Decade of Education for Sustainable Development aims to promote education as a basis for a more sustainable human society and to integrate sustainable development into education systems at all levels. They see:

*Education for sustainable development as a dynamic concept that utilizes all aspects of public awareness, education and training to create or enhance an understanding of the linkages among the issues of sustainable development and to develop the knowledge, skills, perspectives and values which will empower people of all ages to assume responsibility for creating and enjoying a sustainable future. It is about the way we live our lives, the way we respect the lives of others-far and near, present and future-and our attitudes to the world around us.*

(www.unesco.org)

UNESCO’s ‘Draft Implementation Scheme for the Decade encourages national strategies to consider the following:

- Identify and work in partnership with key stakeholders
- Identify and set up appropriate financial mechanisms to cover support to implementing the decade.
- Ensure ESD is reflected in existing educational plans
• Develop a framework for co-operation across government and with civil society bodies.

4. EDUCATION FOR SUSTAINABLE DEVELOPMENT IN ENGLAND

The UK could from an initial reading of what is happening on Education for Sustainable Development be seen as one of the few countries that had already begun to implement many of the aims and goals of UNESCO’s strategy. But as will be argued later what has happened in England over the past three years has presented as many problems as well as openings for engaging broader support and understanding of sustainable development.

The UK government’s strategy on sustainable development has been based around phrases like ‘Making a Better Quality of Life’ (See www.defra.gov.uk). This has been the title of the government’s strategy. It has aims, priorities, and guiding principles as follows:

<table>
<thead>
<tr>
<th>Aims</th>
<th>Priorities for the future</th>
<th>Guiding principles</th>
</tr>
</thead>
<tbody>
<tr>
<td>• social progress that recognises the needs of everyone; • effective protection of the environment; • prudent use of natural resources; • maintenance of high and stable levels of economic growth and employment.</td>
<td>• more investment in people and equipment for a competitive economy; • reducing the level of social exclusion; • promoting a transport system that provides choice, and also minimises environmental harm and reduces congestion; • improving the larger towns and cities to make them better places to live and work; • directing development and promoting agricultural practices to protect and enhance the countryside and wildlife; • improving energy efficiency and tackling waste; • working with others to achieve sustainable development internationally.</td>
<td>• putting people at the centre; • taking a long term perspective; • taking account of costs and benefits; • creating an open and supportive economic system; • combating poverty and social exclusion; • respecting environmental limits; • the precautionary principle; • using scientific knowledge; • transparency, information, participation and access to justice; • making the polluter pay.</td>
</tr>
</tbody>
</table>

These aims, priorities and guiding principles highlight many of the challenges in understanding sustainable development:
• The tensions between social and economic progress and environmental impact;
• Improving everyone’s quality of life but recognising the impact if we are serious about sustainable development;
• Urban versus rural needs;
• Ensuring sustainable development tackles social exclusion, injustice and poverty; and
• Impact at all levels: local, national and global.

I was a member of the UK Government’s Sustainable Development Education Panel from 1998 to its conclusion last year. Its role was to advise government on the development of strategies to promote and support ESD, to highlight best practice and to make recommendations for action. This Panel included representatives from a
number of NGOs, professional associations, government advisory bodies, business and trade unions. This Panel defined ESD as:

Education for sustainable development is about developing the knowledge, skills, understanding and values to participate in decisions about the way we do things individually and collectively, both locally and globally, that will improve the quality of life now without damaging the planet for the future. (DETR, 1998)

In developing this definition within the context of the school curriculum, the following concepts were suggested as incorporating its main principles:

**Interdependence**
understanding the connections and links between all aspects of our lives and those of other people and places at a local and global level, and that decisions taken in one place will affect what happens elsewhere

**Citizenship and stewardship**
recognising that we have rights and responsibilities to participate in decision-making and that everyone should have a say in what happens in the future

**Needs and rights of future generations**
learning how we can lead lives that consider the rights and needs of others, and that what we do now has implications for what life will be like in the future

**Diversity**
understanding the importance and value of diversity in our lives—culturally, socially, economically and biologically—and that all our lives are impoverished without it

**Quality of life**
recognising that for any development to be sustainable it must benefit people in an equitable way, it is about improving everybody’s lives

**Sustainable change**
understanding that there is a limit to the way in which the world, particularly the richer countries, can develop and that the consequences of unmanaged and unsustainable growth are increased poverty and hardship, and the degradation of the environment, to the disadvantage of us all

**Uncertainty and precaution**
realising that as we are learning all the time, and our actions may have unforeseen consequences and that we should therefore adopt a cautious approach to the welfare of the the planet

(DETR, 1998)
In reporting on progress on education for sustainable development in 2003, a Parliamentary Committee in England commented:

There is little dissent that these concepts encompass the range of thinking required to engage with the multi-faceted issues, such as climate change, which sustainable development embraces. An understanding of some or all of the concepts is not uncommon; they provide the basis for many other life skills and are consistent with what many would consider a good all-round education, providing the foundation for personal and professional development.

(Environment Audit Committee Report)

Throughout the life of the Panel the following key issues continued to emerge as major challenges:

- the tensions between social and economic progress and environmental impact;
- Lack of clarity as to what is meant by education for sustainable development which is linked to how do we communicate its key messages and principles;
- Over-emphasis within education policy-makers and practitioners to see ESD as about the environment and green issues.
- Learning agenda not seen as central. All too often interpreted as environmental management indicators
- Recognition that need to make closer connections to debates in society about citizenship, social inclusion, health and quality of life matters.

In essence whilst the aims of the government’s strategy for sustainable development were visionary and the underlying principles agreed by the Panel provided a framework to implement this vision, educational policy-makers have unfortunately tended to reduce ESD to technocratic and management focused indicators rather than learning outcomes.

This is despite the opportunities created from the revisions to the national curriculum for schools in 2000 which made explicit references to sustainable development and the development of an excellent website co-ordinated by the curriculum authority to support schools and teachers (www.nc.uk.net/esd).

In September 2003 our Ministry of Education in England launched its Sustainable Development Action Plan. Those of us who were directly engaged in education for sustainable development were initially enthusiastic about the Plan. Its main objectives are as follows:

“All learners will develop the skills, knowledge and value base to be active citizens in creating a more sustainable society.”

“We will pursue the highest standards of environmental management across all properties owned and managed by The Department and its associated bodies.”

“We will encourage and support all publicly-funded educational establishments to help them operate to the highest environmental standards.”

“We will make effective links between education and sustainable development to build capacity within local communities.”

(DfES, 2003)

Since then there has been some progress in taking forward the Action Plan, but in the main where there has
been movement it has been in terms of short-term initiatives be it around school transport, ‘greening the school buildings’ energy or waste.

My organisation, alongside other voluntary bodies have been involved in working groups around the strategy where there has been a recognition that there is a need to clarify role, purpose and key aims of the strategy.

Where there has been progress, it has been based on work already undertaken by educationalists and bodies who have some expertise in the area.

5. SUSTAINABLE SCHOOLS

One interesting example has been from a national agency that monitors the quality of teaching within schools, called OFSTED.

In September 2003 they published findings from an initial survey on how ESD is reflected within about 20 schools. The outcomes were:

ESD has clear links with a number of subjects where opportunities for its development are presented in National Curriculum programmes of study, notably in geography, science, design and technology, citizenship and personal, social and health education (PSHE).

While each school in this survey is unique in its approach to ESD, the factors which most strongly characterise the work of the most successful schools included the following:

- A whole-school commitment, led by senior management, to integrate ESD into the work of the school, ensuring that it is able to maintain the momentum and sustainability of initiatives.
- A well-developed local support network including community groups and non-governmental
- Giving pupils both individual and collective responsibility in looking after and improving their learning environment.
- An emphasis on inclusion in promoting positive attitudes and values which are intended to equip pupils to develop as individuals and enable them to contribute to a sustainable common future.
- Clear objectives on the part of the teachers that include physical outcomes (for example, a pond or a recycling scheme) or aim to affect pupils’ attitudes and behaviour (for example, looking at attitudes to asylum seekers or developing as active citizens).
- The active involvement of pupils in initiatives that promote sustainability-for example, to conserve energy, recycle materials and improve the whole school environment, including the school grounds.

The report then proposes the following as a check list:

- Could the school promote a culture and ethos which values the development, knowledge, attitudes and skills in pupils to enable them to participate individually and collectively to improve the quality of life in a sustainable way?
- Has the school produced a policy statement for ESD which sets out the aims, priorities and targets for promoting ESD as a whole-school initiative, and identified strategies to promote and raise the profile
of ESD within the school and the wider school community? Has it co-ordinated and monitored ESD initiatives and activities throughout the school to ensure a consistency of approach?

- Is there a programme of staff development in place to raise awareness of ESD and develop teachers' competency and skills?
- Have subject leaders identified opportunities within their schemes of work to enable ESD to be delivered and reinforced through the curriculum? Does the teaching approach promote active learning to develop pupils' understanding of sustainable development?
- Does the school develop active and responsible citizenship and stewardship through pupils' involvement in active decision-making through a school council or eco-committee?
- What links has the school established to support and develop a global and international dimension within the curriculum?
- How does the school involve, and make use of, the wider school community to enrich learning and pupils' personal and social development including the effective use of business, local authorities, non-government organisations and community groups to support their work in developing the sustainable agenda?
- In what ways does the school respect and value diversity?
- In what active ways is the school involved in improving performance against sustainability indicators, including waste management, fair trade and a green purchasing policy?
- Has the school embarked on, or maintained, a programme of ground development and improvement to support learning, promote stewardship and improve the quality of life?

(www.ofsted.gov.uk)

An excellent example of a school addressing education for sustainable development is Crispin school which is a comprehensive school of 1,142 pupils aged 11 to 16 in the town of Street in Somerset. Pupils come from the town and the surrounding rural, predominantly agricultural area. A third of the intake travel to the school by bus.

The school has an ESD policy that is overseen by the deputy head of the schools. ESD is explicit in the aims of the school— 'pupils should be equipped to contribute to a sustainable common future.' This is spelt out in more detail and includes ‘being committed to social justice.’ The aims are seen as a vehicle for promoting the school values which are the basis of all school activity.

ESD has been addressed in the following subjects:

- the tensions between social and economic progress and environmental impact;
- In mathematics pupils look at angles of the sun for work on the Sundial project, which is being done in conjunction with the partner school in Kenya
- In modern foreign languages pupils use ecological footprints data from Francophone countries
- In art a wide range of activities has been undertaken, including involvement with a project run by a local development education centre
- Waste management and health promotion are part of the citizenship programme.

Such ESD is delivered through assemblies and theme days outside of the formal curriculum. Assembly themes include: Rights and responsibilities, World Food day, United Nations day and World Children’s day.
A day’s activity for senior pupils at the school considered the question: ‘What needs to happen for Crispin to be a sustainable school in 100 years’ time?’ Pupils made a series of visits, e.g. to landfill sites, straw bale built house, an organic farm, the redevelopment of an old industrial site, and then had workshops, e.g. on sustainable buildings, designing for the future, organic food.

ESD is retained through the school because it is incorporated in the structure of the school through:

- the school aims, values and ethos
- responsibility and commitment to ESD at senior management level
- encouragement of enthusiasms.

ESD is part of a coherent set of values to which everyone in the school can subscribe (www.nc.uk.net/esd).

6. INITIATIVES IN LIFELONG LEARNING AND HIGHER EDUCATION

The government has also recently published consultation documents on education for sustainable development related to higher education and one for skills and training for lifelong learning. Both documents whilst offering examples of practice linked to learning, predominantly focus on environmental management indicators for measuring progress and change. The vision of both documents refers to creating a culture of learning about sustainable development being part of normal practice. However the models to achieve this vision emphasise good practices in institutional practices. Changes in people’s value base in terms of social justice, human rights and interdependence are not emphasised, merely mentioned in passing. There is an over-emphasis in my view on working towards behavioural change as though there were so form of idealistic and more sustainable way of living (HECFE, 2005; Learning and Skills Council, 2004).

7. DEBATING ESD DURING THE DECADE

The implementation strategy from UNESCO states that ‘ESD is ‘fundamentally about values with respect at the centre: respect for others, including those of present and future generations, for difference and diversity, for the environment, for the resources of the planet we inhabit.’

What has been missing from the implementation programme in England has been values and what are the learning outcomes we are all trying to achieve. If ESD is not seen as connected to developing greater understanding and skills of what is happening the world today, then what is its purpose.

There are two main reasons for this:

- Desire by politicians to see progress and putting pressure on policy-makers to deliver;
- Lack of clarity about what is Education for Sustainable Development.

The government has been wanting to develop action plans and strategies but it has been too top down and based on short-term targets and goals as though they would somehow secure some magical behavioural change.

It is the latter than that I finally want concentrate on. Policy development and implementation on education for sustainable development has in the UK and I would suspect in other countries, gone ahead of debating what we are trying to achieve, taking risks and encouraging innovation and reflecting on what is good practice.

By rushing into producing policies and plans there has been a lack of debate and dialogue as to what is
meant by the terms being promoted. The example highlighted from a school is an excellent example but it is a very rare one.

Therefore until there is a clarity about what is meant by ESD and there is a recognition that it is about a long-term learning process, then there is a danger it will be reduced to environmental management indicators that rather than empowering people to be responsible and active global citizens.

As Juergen Rost from Germany has stated in the DEA’s Development Education Journal:

Education for sustainability is to a greater extent a concept that stems from an expression of (international) political will. It could be understood as a kind of mission from the political arena, given to education professionals and academics, to design an educational concept that correctly deals with the necessary requirements for sustainable development in our world.

Rost goes onto suggest that this educational could be described in the following way:

Education for sustainable development should make people competent and give them the motivation to appreciate environmental change in order to take part in a societal development that guarantees the quality of life for all people today, but does not prevent future generations from fulfilling their needs.

This realisation of the basic principles of Agenda 21 into a theoretical set of educational goals could be regarded as a functionalist educational notion. Education should equip the next generation to fulfill a particular task. In this way, education for sustainability fits well with other functionalist educational notions, such as education as the basis for undertaking further vocational qualification or for being able to estimate the effects of the use of STS Science and Technology in Society.

(Rost, 2004)

Professor William Scott and Stephen Gough from Bath University in England have stated that learning has to be at the heart of what we understand by sustainable development education. Understanding sustainable development is complex and too many people it will seem impossible to achieve. They suggest that “sustainable development cannot possibly mean an ‘end state’ to be achieved because there are no end states. If sustainable development means anything it can only be a way of describing an adaptive approach to managing human-environment co-evolution.” (W. Scott and S. Gough, 2003)

8. PROBLEMS AND CHALLENGES

In England and in other countries, some of the problems I have seen about how ESD is perceived are the following:

- Desire by politicians to see progress and putting pressure on policy-makers to deliver;
- Over-emphasis on ESD being linked to environmental agendas and that somehow by learning about sustainable development, magically people’s behaviour will change with regard to transport use, consumption patterns and energy use.
• Little recognition of the development context, particularly the Millennium Development Goals. I would see environmental NGOs as guilty and in some cases more guilty of these perspectives than governments.

• Reduction of ESD to a series or collection of issues be it food, transport, energy use etc. No recognition of the holistic and inter-connected nature of ESD.

John Huckle, one of the leading thinkers on ESD in the UK suggests that Education for sustainable development (ESD) is about understanding the social practices that shape and are shaped by different discourses. It is also about cultivating critical choice amongst discourses. Classroom talk plays a key role for it is through dialogue that pupils (with guidance) can decide what is technically possible, culturally appropriate, and morally and politically right. Language enables them to critically evaluate discourse, judge knowledge claims, and arrive at consensus about those forms of technology and governance that may enable people to realise their common interests in sustainability. ESD requires that the ground rules for classroom talk are made visible (Huckle, 2003).

9. EDUCATION FOR SUSTAINABLE DEVELOPMENT AND GLOBAL CITIZENSHIP

To me central to any strategies for promoting ESD has to be how connections can be made between the agendas of ESD and people’s active engagement in society. What makes education for sustainable development potentially so exciting and to governments and decision-makers so challenging, is the emphasis in much of the writing on the subject on a sense of social responsibility, of involving people in decision making in new ways. Understanding Sustainable development needs to be much more than environmental economic indicators or gathering data. It is about challenging values, attitudes, and ways of living. Above all ESD if it is to be how to understand the importance of why we need to live in a sustainable society and on a sustainable planet, then the concepts of equity, interdependence, co-operation and citizenship need to be central. Securing changes involves both the consumer and the decision making.

ESD therefore if it is really effective, has to be rooted in approaches towards learning and education that are participatory. It is about enabling people to have the skills, confidence and knowledge to improve the quality of life for themselves and for others at local, national and global levels.

Professor Tim O’Riordan, a member of the UK Sustainable Development Commission has said that he sees ‘education for sustainability as the creation of a sense of global citizenship in all humanity.’ Education for sustainability is linked to democratic development. ‘Democracy is both the necessary vehicle for the transition to sustainability and the greatest obstacle.’ Therefore he suggests we cannot divorce it from participation and empowerment.

Our vision is a world in which there are many opportunities to learn about sustainable realisation development. A world in which a skilled population make informed decisions in their home, community and working lives and in their leisure activities. A world where people understand and take responsibility for the impact they have on the quality of life of other people, locally and globally.

If sustainable development is about the interrelationship of environment-economy-society, it means including the agendas of citizenship and social inclusion, combating poverty at local, national and at a global level, and general public concerns about the quality of life. It is about learning about how we can move towards a more
sustainable society for all.

REFERENCES


Key Websites

www.nc.uk.net/esd (website of Qualifications and Curriculum Authority on Education for Sustainable Development)
www.unesco.org
www.dea.org.uk
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www.defra.gov.uk
Sustainable Development and Education for the 21st Century

Education for sustainable development and global citizenship - The UK perspective

Doug Bourn
Director
Development Education Association

Themes
- Why sustainable development education (ESD) is important
- Aims of UN Decade of sustainable development, role of UNESCO
- What is happening in the UK
- Sharing ideas and practices about ESD
- Challenges to consider

Development education and education for sustainable development
- Links with areas such as active citizenship, human rights, quality of life and cultural diversity
- 2005 is also a year of major development initiatives

Development education + Environmental education = Education for Sustainable Development

UNESCO and UN Decade on Education for Sustainable Development
- Promote education as a basis for a sustainable human society and integrate sustainable development into all education systems
- Utilises all aspects of public awareness, education and training to create or enhance an understanding of the linkages among the issues of sustainable development
- Develop the knowledge, skills, perspectives and values which will empower people of all ages to assume responsibility for creating and enjoying a sustainable future

National strategies need to consider:
- Identify key stakeholders.
- Identify and set up financial mechanisms
- Ensure ESD is reflected in existing educational plans
- Develop framework for cooperation across government and with civil society organisations

Education for sustainable development in England

‘Education for sustainable development is the knowledge, skills, understanding and values to participate in decisions about the way we do things individually and collectively, both locally and globally, that will improve the quality of life now without damaging the planet for the future.’

Concepts
- Interdependence
- Citizenship and stewardship
- Needs and rights of future generations
- Diversity
- Quality of life, equity and justice
- Sustainable change
- Uncertainty and precaution in action

Reflection on Progress
- Lack of clarity as to what is meant ESD
- Over-emphasis on environmental and green issues
- Learning agenda not central
- Closer connection to debates about citizenship, social inclusion, health, quality of life.

Ministry of Education’s Action Plan
All learners will develop the skills, understanding, knowledge and value base to be active citizens in creating a more sustainable society...
We pursue the highest standard of environmental management across all properties owned and managed by The Department and its associated bodies...
We will encourage and support all publicly-funded educational establishments to help them operate to the highest environmental standards...
We will make effective links between education and sustainable development to build capacity within local communities.

(DfES 2003)

Sustainable Schools
- Whole school commitment led by senior management
- Well developed local support network
- Pupils having responsibility
- Promotion of positive attitudes and values
- Clear objectives
- Active involvement

Good Practice: Crispin School
- ESD Policy
- Within range of subjects
- All school activities
- Values and ethos
- Management support
- Enthusiasm of teachers

Debating ESD
- Desire by politicians to see progress and putting pressure on policy-makers to deliver
- Lack of clarity about what is ESD
Education for sustainability is to a greater extent a concept that stems from an expression of (international/political will. It could be understood as a kind of mission from the political arena, given to education professionals and academics, to design an educational concept that correctly deals with the necessary requirements for sustainable development in our world.

(Juergen Rost)

‘Sustainable development cannot possibly mean an ‘end state’ to be achieved because there are no end states. If sustainable development means anything it can only be a way of describing an adaptive approach to managing human-environment co-evolution.’

(W Scott and S Gough 2003)

Problems and challenges

• Over emphasis on environmental agendas
• Magically that by learning about sustainable development people’s behaviour will change
• Little recognition of the development context, particularly the Millennium Development Goals
• No recognition of the holistic and interconnected nature of ESD

Ways forward

• Emphasis on a sense of responsibility
• Challenging values, attitudes and ways of living
• Rooted in approaches towards learning and education that are:
  – participatory
  – about economic and social change
  – able to give people skills, confidence and knowledge

ESD and Global Citizenship

• Education for sustainability as the creation of a sense of global citizenship in all humanity.
• Democracy is both the necessary vehicle for the transition to sustainability an the greatest obstacle

Our vision is a world in which there are many opportunities to learn about sustainable development. A world in which a skilled population make informed decisions in their home, community and working lives and in their leisure activities. A world where people understand and take responsibility for the impact they have on the quality of life of other people, locally and globally.’

(Tim O’Riordan)
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1. INTRODUCTION

It is eminently clear that we live in a time of world crisis and critical change (Laszlo, 2003). Apart from the two questions Laszlo asks in the preface to his book, *You Can Change the World*. I would like to add a third: “What role can the education of children play in making the changes necessary to make the World a better place, not one that is engulfed by strife?”

If we take these questions really seriously, with the full depth and gravity of their content then we will realise that as educators we have an important and extremely challenging task before us, one which does not have easy answers, one which requires a magnitude of change that may leave us feeling inadequate, but one which can also fill us with a content for our lives that touches the existential core of existence and can fill us with a holy reverence for our task.

It is a task which requires courage for the truth, it requires knowing in new ways, it requires creativity and initiative and the strength to swim against the current of popular belief and the habits of thought and action that come down to us from the past. At the same time it asks of us to explore the wisdom that has come to us from the past and, with respect, re-contextualise (reinterpret) it for our modern times. In other words we have before us a task, which asks us to plumb the depths of the human being and to find there the highest and the best for the world.

Plumbing the depths of the human being means confronting qualities such as care, devotion to a task, courage, initiative, love, and others qualities of the human soul. These qualities though powerful and real in their effect are not material. They can give the human being an infinite resource unbounded by material constraints. We are dealing with the spirituality of the human being.

Traditionally, spirituality has always played a major role in the education process-from the initiation rites of adulthood in indigenous tribes to the temple schools of great civilisations. In the modern world, with the secularisation of education and the influence of materialism on world cultural values, there is a need to redefine spirituality in a way that frees it from its traditional links with religion and allows a young person of the modern world to orientate to those non-material values that have inspired great individuals of the past and present to bring about change and innovation to the inevitable challenges of being human beings in the world.

*For powerpoint slides used in this presentation, see pp.75 - 83, as well as the attached CD-ROM.*
2. WHAT IS SPIRITUALITY AND WHY IS IT IMPORTANT FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD)?

To begin with, I would like to suggest that spirituality is part of our experience that is not based in the outer world of causative necessity. It is an experience of newness, revitalisation... an experience of creation ... an experience of becoming. It is a part of our experience where absolute newness may arise, something that has not yet emerged in the universe. This is an experience that belongs to the inventor, the philosopher, the mystic, the scientist and artists of all kinds. It is also can be the experience of the everyday human being. I don’t think this has been the way that it has been thought about traditionally.

It is a view of the world that connects the creativity of the human being with the creativity of the world. In Thich Nhât Hanh’s wonderful little book, *The Heart of Understanding — Commentaries on the Prajnaparamita Heart Sutra*, he develops the idea of interbeing and explores the Buddhist notion of emptiness. He asks if there is emptiness then we must ask ‘Empty of what?’ The answer resounds meaningfully: ‘Empty of separate self.’ All things are in interbeing, codependant on each other not only materially but also ideally or spiritually. The human being is the agency for the reconnection and the recreation. In our world today the idea of separate self is pervasive. It is part of the materialistic paradigm of much of western society which regards the self as the consumer of goods to establish its sense of separateness and power.

This pervasive egotism cannot be overcome by preaching or moralising but it can be overcome by interest ... interest in the other, be it another person, another being, another place, another idea. This interest takes us out into the area of interbeing, which can lead to care, and real love. Interbeing is the equivalent of spirituality. It is the non-material, ideal stuff of connection, be it connection between organisms in an ecosystem, between people or between the parts of a machine. It is what binds the parts together into a meaningful whole.

That is why this spirituality is of immense importance in education for sustainable development because it can create in the learner the sense of connection to the world with which we can interact in a caring and beneficial way.

3. WHAT ARE EXAMPLES OF SPIRITUALITY?

In attempting to answer the question I would like to give two examples, one will be from the rich store of great human biographies and the other from the breadth of wisdom in the world of nature.

Mahatma Ghandi was a man who could have gone on living his life according to the norms of his day. He could have accepted the brutality of the colonisation of his country and the way the Indian people were being treated. He chose not to. He chose the harder path, the path of sacrifice, of conscience and hardship to reach a higher more universal goal. His act of “walking to the salt mine” in the face of brutality changed the freedom movement in India. It touched the conscience of the World.

In considering a great human life we become aware that the person has listened to their inner conscience rather than to the pressures of outside processes. There they have found the source of inspiration, which have led to deeds that have been transformative for society, in a remarkable way.

Their lives have in turn inspired others to greatness leading to a cascading effect. From one person’s inspiration something new and innovative is brought into general effect. It is like a new “non-material” cause that has been brought into life. The spirit of the human being becomes an effect in the world.
We also find spirituality in the wisdom of nature around us. In Australia we have a visiting bird, the shearwater—what we call them the mutton-birds. It arrives on the islands south of Australia in November, when the Winter storms are over. It returns with its mate every year to the same island—even to the same burrow where its nest is made. Eggs are laid by all shearwaters within the same week and they have this habit of gathering at dusk in great numbers, sitting on the ocean in front of the islands where they nest and then together rising up and descending onto the islands and their burrows.

The young are fed and raised all through the summer so that by the end of summer they are ready for the great flight to the northern hemisphere. The adults leave earlier, en masse and are followed by the chicks at a later stage. By what means do the young birds that have never been beyond their limited range, find their way to the northern feeding grounds with no prior experience?

We could also wonder at the process by which the embryo develops. The single cell with which each of our bodies began, started to divide, became 2 then 4, then 8, then 16 and so on. Towards the end of the first week it then becomes a small cosmos, like something out of one of the many creation stories, a heaven and an earth. The mass of cells, the morula differentiates into the trophoblasts and the embryo blasts. What is the conductor of this “little symphony” of cells?

This and many other phenomena lead one to the conviction that nature is not just one great heaving machine subject to the world of chance, but instead a finely tuned, balanced and wisdom filled world of “interbeing” (Nhät Hanh, 1988).

This wisdom in the world is accessible to human beings inwardly, as something, which guides their actions and creations. In addition human beings are not confined to what is found as wisdom in the world. We can add to it, we can create within this world. In this we become co-creators in the world’s becoming. If we identify this wisdom as spirit we can say: “The animal lives in spirituality whereas spirituality lives in the human being.”

This places human beings in a unique role. We cannot say to a lion: “Be a better lion!” But we can ask a human being to be a better human being.

This is of course what is being asked in ESD. We are asking for human beings, to be better human beings! Take hold of the wisdom that you can find within you (new wisdom) and around you and be better human beings so that this wonderful world we live in can be a better place. The world becoming a better place is dependent upon us being better human beings.

Of course there is a danger in the present generation projecting their ideas too much about what is better for the future based on the past or the present. This could lead to abuses of education seen in totalitarian states.

The element of freedom is important in this process. Investing in this becoming of the human being’s like investing in something not completely known. That is the human spirit. The great Austrian philosopher and educationalist, Rudolf Steiner once said:

We shouldn’t ask: what does a person need to know or be able to do in order to fit into the existing social order? Instead we should ask: what lives in each human being and what can be developed in him or her? Only then will it be possible to direct the new qualities of each emerging generation into society. Then society will become, what young people as whole human beings, make out of the existing social conditions. The new generation should not just be made to be what the
present society wants it to become!

Steiner (Quoted in UNESCO exhibition “Waldorf Education Worldwide” 1994)

This becoming of the human being is quintessentially connected to the spirituality of the human being and education is all about the becoming of the human being. This has important consequences for the way we think about education, because it places emphasis on the spirituality (the becoming) of the person and awakening the awareness for interbeing between our wisdom and the wisdom in the world. All other topics of education for ESD are dependant on this happening in some way because teaching people the intellectual content of human rights has no value unless there is a corresponding change in the human being which inspires care of others and values the principle of human rights deep in the psyche. The same can be said for environmental education. Writing an intellectual content document about is only of value if it addresses a fundamental change in the way children care for and value the natural world around them and the human societal world around them.

<Slide 1: Summary of the relationship between ESD and Spirituality>

Spirituality characterised in this way is not a religion. Most religions support the mood behind this spirituality but then have items of dogma, which one has to believe. Here is presented a view of spirituality that is placed right within the human, one world context. So though we are advocating spirituality in education we are not advocating sectarian religious education. It is important to make the distinction, not because there is anything implicitly wrong with religion but because in a global world there is a need for families to be able to choose their own religious path freely, not to have it imposed upon them by an education system. The spirituality here is developed from an experiential base and is not a doctrine of belief.

Bringing this ideal to practice in education involves much more than instruction. Ultimately it involves an integration of our lives and our teaching. If we succeed as individual teachers, as teaching institutions as administrators of education to role model sustainability in everyday life in the classroom. If the organisation of the school and even the design of the buildings, reflect an ideology of sustainability, if there is an ethos of sustainability, role modelled by the adults in the school and if the content we bring to our lessons is of a kind, which engenders wonder, reverence and love for the world then there will be little need to formally teach about it. The values of sustainability will be inculcated through the ethos of the school from the first day the child arrives. In the school I work in this has been taken on as a whole school approach.

It affects:

- the design of the buildings, materials, aspect, landscaping ..., 
- the management (non-hierarchical, consensus based, sharing of responsibility, support of initiative, social responsibility),
- the curriculum (Integration of art into all subjects to encourage creativity, making use of world culture in the curriculum, balancing of ‘head’, ‘heart’ and ‘hands’), and the methodology (balance between teacher centred and student centred education, balance between reflection and doing, age dependant approach which addresses individuals, concentration on helping the human being develop rather than on competitive outcomes.)

If we are working holistically in applying these ideas it is essential to understand child development.
Whereas in the first two ages of childhood the way to prepare children for the role of caretakers of the world is not by instruction about it but more to do with exemplifying beauty and goodness in the physical and cultural environment of the child in a way that inspires care and responsibility, the high school years can be characterised as a schooling of levels of judgement. This judgement can flourish in the soil of a rich and versatile feeling life.

4. HOW IS THIS PUT INTO PRACTICE IN THE LEARNING ENVIRONMENT OF A SCHOOL?

As the learning process begins with imitation and then slowly becomes more conscious and self-directed in the later stages of childhood and adolescence, the best way to learn is to be surrounded by living examples of sustainability and the values that allow the growing person to find in themselves the source for the care and development of the environment. This requires an integrated, holistic approach, which begins with teachers incorporating these values into their own lives, the educational institutions giving attention to architecture, landscaping, administrative structures and the development of the curriculum through the three ages of childhood. If a school embodies the principles of sustainable development then teaching about it takes a different form that has more to with bringing what has been engendered unconsciously to consciousness when the child is of an age to do something about problems.

The way of doing things is as important as the what of doing things. The following table is a brief summary of the process by which education can work in the three ages of childhood, moving from a body experience of the surroundings and then being brought to consciousness as a last step in the process.

- **Age 1 0-7 years**: Goodness, beauty and truth are in the physical environment of the child.
- **Age 2 7-14 years**: Goodness, beauty and truth are in the environment but become abilities in the feeling life through art.
- **Age 3 14-21 years**: Goodness, beauty and truth are a part of the educational environment but now become something to be brought to consciousness out of the students own judgement for truth.

In the high school years the subjects slowly take on a more formal style and are taught by specialist teachers. The play of childhood and learning of the early school child is brought more to consciousness in the appreciation of the laws of nature, not taught by abstract concepts in text books but out of the experience of phenomena which allow the growing person to develop their own understanding based on experience. The students learn how to learn.

This kind of understanding may lead parents and teachers to reconsider seriously how much exposure they give little children to the catastrophes of the world at an age where they are not able to do anything about it. Where exposure to immense problems is advocated as a way of educating students about environmental problems, one really has to ask is this not breeding a kind of apathy where one is hardened to events for which one is not in a position to engage wilfully to remedy the situation. It is quite different if projects are being done to help a problem situation.

A discussion of all of these topics would require a bigger time and space than we have here. Two examples...
from the high school curriculum at Mt. Barker, South Australia will therefore be described to exemplify how subjects can be integrated in such a way that the students can have experiences that are both explicit and implicit.

By explicit is meant what is explained in the course of teaching. It includes skills, which are taught and then assessed.

By implicit, is meant that which is engendered by the experience of the students engaged in the activities. It includes feelings of wonder, reverence, and insight. It includes feelings of greater worth, self-knowledge and also inspiration. These are not taught explicitly and not assessed formally but in the long run are probably more important as actual agents of innovation and change in the world.

5. SURVEYING AN EXAMPLE OF AN INTEGRATED APPROACH TO TEACH BOTH THE EXPLICIT AND IMPLICIT AREAS OF A CURRICULUM TO HELP IN THE GROWTH OF THE INDIVIDUAL’S OWN INDEPENDENCE AND FEELING AT HOME IN THEIR ENVIRONMENT.

Each person is born at a particular location on the Earth. We could say that each human being comes from a state of Universality into the Particularity of a location, family, culture and time. The Education process needs to help the becoming person to find a relationship to all aspects of the particularity that they have been born into. Learning to know and love the landscape of which you are a part is an important, if not essential, ingredient of becoming yourself.

In Mt. Barker this individual relationship with the natural world is cultivated from an early age by integrating content of different subjects in the curriculum with engaging experiences of the great natural world e.g. Sailing expeditions are linked to the physics of air and water, a canoeing expedition is linked to the study of geomorphology, and a challenging 7 day walking expedition is linked to landscape painting and botany.

In Class 10, for some 16 years now we have been running two-week camps in the outback of South Australia surveying sites of historical, archaeological and geological significance. We wanted to go beyond a school exercise and make it into a task that benefited the wider community in some way while teaching the students about how the land is measured.

The Aboriginal people had maps of this land, maps recorded in their sacred song and oral ritual. Equipped with this knowledge the initiate knew at first the story and the song lines of his own tribal lands. Increasing degrees of initiation equipped the initiate to travel further and further afield. The most initiated Aboriginal men could wander the length and breadth of the continent because they knew the sacred songs of all the places they travelled to.

The first white explorers of Australia were also mapmakers extraordinaire-Cook, Flinders & co.

When the boundaries for the states and territories were laid down it was surveyors who had the job of locating and marking these boundaries and parts (Steele, 1978).

One soon discovers, surveying is a very fundamental human activity of locating oneself on the earth. To do this one uses a series of techniques that exploit the laws of mathematics, the movement of the sun and a sophisticated precision technology, the optical theodolite. This location of the objects and shapes of the landscape onto the two dimensional plane of a sheet of paper may seem a mundane exercise until one is confronted with doing it. Then the complexity and thought activity that fills the work becomes apparent. The practice of this activity can bring an experience of the power of thought and an inner surety in oneself. Such experiences, which
happen often at an unconscious level, can be of immense value to the adolescent who is seeking surety and inner order within the often-confusing feelings and experiences that accompany that stage of life.

If possible, it is important that the surveying task for the year has been given by the outside world i.e., it comes from a need. For more than 10 years we mapped and catalogued ancient petroglyph sites for the Department of State Aboriginal Affairs. This is important for the student’s experience because it gives them the sense that they are involved in the real world and contributing to it by their learning. More recently we have been working for the Geography Department of Adelaide University mapping geological outcrops, which are being researched for what they can tell us of climate change around the last glacial maximum, about 18,000 years ago.

This given task provides the location where we work for the next 9 days from morning to sunset to place the things of interest, rock carvings, fences, trees, cliffs, creek beds on a sheet of paper in the right relation to each other.

We show them the techniques for making a precise, topographic map of the location—with specific detail depending on the task given us by the community.

In the term 1 of Class 10 they learn trigonometry. They learn mechanics (statics, kinetics and dynamics). They do a course in senior first aid. They have learnt map reading, abseiling, use of compass and the use of magnetic declination. They have learnt how to walk and carry what they need to live in the wilderness.

Then we take them into the arid mountainous region of South Australia and we teach them surveying for 9 days.

This involves the methods of triangulation, with optical theodolites, the use of satellite technology and incorporating the measurements of the land into the digital format needed for computer mapping. Their own body experience is transformed in the evening into digital representations.

It is important to orient in the new environment. Students are taught how to do this in a simple way to begin with, using star constellations by night and the sun by day. They are also given an introduction to the geology of the site. Then they begin the process of building a mud map. This involves walking over the site in pairs, sketching the elements of the landscape from a bird’s eye perspective. The different bird’s eye views are then built into a composite view of the whole site, either as a drawing on the ground or on a large sheet of paper.

The next step is to lay out a grid of triangles with the students. This acts as a reference for the detailed mapping. Pegs are actually hammered into the ground. They become the triangulation points of the map. These are equivalent to the triangulation points that are found, all over the world as permanent reference points for the mapping of each country.

Angles between triangulation points are measured with extreme accuracy using optical theodolites.

One grid line length—the Base-Line—is measured accurately using a surveyor's steel band.
The Base-Line is oriented to true north (the sun’s zenith direction) by setting a theodolite up on one end of the Base-Line, zeroing it on the other end and then tracking the sun till it reaches its zenith. This gives the bearing of the Base-Line.

Using the trigonometric Sine Rule, the lengths of all the other sides are calculated, using the one accurate length measurement of the Base line and all the grid angle measurements. This is a long and tedious task, especially at night after a long days work. The students had met this in their recent Trigonometry lessons where they had practised finding the side lengths of simple triangulation grids. Now it is their own real grid!

All this work is just the preparation for the mapping-the temporary framework. Now we have across the site fixed points whose special relationship to each other is exactly known. The students are ready to learn and apply the skills of detailed mapping-tacheometry and off-set traversing. The most commonly used technique is tacheometry, which, as its name suggests means “speed measurement.” It is based on the principle that the measurement of a vertical staff in the field of view of the theodolite telescope is related to how far away the staff is. Each working group begins to build up an accurate map of the detail in their designated area-creeks, fences, large trees, rock walls etc.. The class map then grows out of the combined efforts of all the groups. They see immediately the need for a common standard of precision and care and an agreed legend to represent each feature of the landscape.

To give an idea of the topography of the site levelling profiles are taken between chosen triangulation points, using a Dumpy Level and the profiles are drawn, making repeated use of Pythagoras Law.

Finally all the results are drawn up into the map.

The education process for these students lies in the inner confidence and certainty gained from learning and applying these techniques. At the same time students are exposed to a working life style that demands hard co-operative work and an extended daily exposure to the elements of the landscape. The site is given to us each year by an outer need. This is where we work for 9 days from morning to sunset to place the things of interest, rock carvings, fences, trees, cliffs, creek beds on a sheet of paper in the right relation to each other.

On the afternoon of the 9th day, we pack up our surveying gear, drive further north into the night until we arrive at the place to begin a four-day walking expedition.

The singularity of our surveying task is replaced by the personal challenge each person feels when confronted by the physical and emotional task of walking and climbing across the landscape for four days. Water is rare but available in certain special locations. The mapmakers become map-readers. A new confidence is built in the precision of these symbolic, precise pictures of the landscape.
On the last night together around our single fire, one senses the growth that has occurred at a personal and
group level. The brilliant stars blaze above our circle of warmth and each one carries into sleep experiences
which have gone deep and touched each one’s humanity at many levels which will continue to resonate in their
further lives. The explicit instruction each has received fulfils a rich variety of formal and life skills but has
been taught in a novel setting and very close to the earth. This instruction is examinable.

The experiences that are in fact lived through are at least equally significant as they imply and engender val-
ues that prepare the student in a very rich way for the great examination that life offers. These experiences are
engendered by the necessary precision and teamwork needed to fulfil the surveying task, by the experience of
solidarity gained by a small group of students having to navigate as a self reliant team through a new landscape
where they carry all their shelter and food for survival. Such experiences have an enduring effect on the stu-
dent’s relationship both with his/her self and with the natural world in which they live.

The second example is Projective geometry from the mathematics curriculum as taught to class 11 students.
Here we have a subject, which integrates mathematics, geometry, art and biology.

Projective Geometry can be described as “the geometry of the eye.” We stand between the train tracks and
we see them meeting off in the far distance. This is the basis of Perspective Drawing, a special case of the
more general Projective Geometry. We know the train tracks never meet, they remain a fixed distance apart.
This is Euclidean Geometry, the geometry of measurement.

Although Euclidean Geometry was known long before the birth of Christ in the ancient civilisations of Egypt,
Greece and Rome, the regular, familiar shapes such as the triangle, circle and ellipse are actually special cases
among the infinite number of shapes that comprise Projective geometry. Hence the saying of Arthur Cayley
(1821-1895): “Projective geometry is all geometry.”

It is Euclidean space widened to embrace the infinite. In Projective geometry all figures and transformations
come about through the interweaving of point, line and plane. A line is composed of an infinite number of
points and a plane is composed of an infinite number of lines. But a plane contains an infinite number of points
as well as lines. A line is also the meeting point of an infinite number of planes, and an infinite number of
planes and lines pass through any given point. Thus each element is fundamentally related to the other two.

The polarity between point and plane touches a mystery of the infinity of space as well as the touch ability
of space. It is the same mystery alluded to by the medieval mystic Angelus Silesius when he said:

“I know not what I am,
I am not what I know.
A thing and not a thing,
A point and a circling.”

It is also, I think, the mystery of the organism and its environment, the self and the world.

If we take a line, and using a technique of geometry “transform it onto itself”, we find that the pattern gener-
ated by the movement of any point along that line is related to a geometric sequence, sometimes called “hyper-
bolic measure” or “growth measure.” The actual transformation is given the name collineation and it’s most simple one-dimensional movement is shown in this diagram.

<Slide 29: Transformation of a line (From Gabriel Bond’s Year 12 thesis)>

To begin to make the points of growth measure along m 1 we choose any initial point 1, on line m 1. The ray from this point to A crosses m 2. A ray from O through this crossing point locates the second point along 1, point 2. The ray from 2 to A again crosses the line m 2, and a ray from the second crossing point through O locates point 3 along m 1, and so on.

We end up with a series of points, which are quite widely spaced in the middle and more narrowly spaced at either end towards the two invariant points, X and Y. This proves to be an interesting measure and one, which the great English geometrician, George Adams called a ‘Growth Measure’. This form of measure can be found, for example along the stems of plants where we have the rhythmic appearance of growth nodes between two points of contraction, the seed at the base and the bud above. It turns out that the cross ratio of the distances between the points is a constant in such a measure. This is demonstrated approximately in these nodes along the stem of this bamboo.

<Slide 30: An example of a growth measure in a bamboo stem>

Now if we take one of those invariant points Y and take them to infinity, something interesting happens.

<Slide 31: The growth measure with one invariant at Infinity>

Another series of points emerges which are a perfect multiplicative sequence. The distance between each successive points increases by a constant multiplier. This series of points is called a geometric series.

This special case of a growth measure is found particularly commonly in that beautiful group of animals, which include the garden snail, the giant squid and the nautilus. I am referring to the Mollusca.

<Slide 32: The Nautilus shell — an example of growth series with a constant multiplication factor>

If the nautilus shell that has been sectioned and distances between the internal chamber walls, are measured along the outside coil then these distances have a common multiplier which is in this case 1.06.

These measures which are come to by interesting geometric constructions seem to be measures that are made use of in many ways in Nature. Here there is an important experience for the student. The creative and lawful activity they are accomplishing is discovered in the creatures of the world around them.

If we now project growth measures onto the sides of a triangle we get a new situation, which involves not just linear elements but planar elements.

<Slide 33: Growth measures projected onto the sides of a triangle>

<Slide 34: 2 dimensional path curves>
By joining the invariant points Y and Z to the points of the growth measure opposite it, we find that the pattern of lines produces a whole series of new growth measures. As we follow the line ZC as it moves to ZD, it crosses YD and YC. These movements in the plane can now be traced by joining the intersections of the straight lines by curves. A whole family of curves emerges. These are called ‘path curves’ and were discovered by Felix Klein in the 19th Century.

<Slide 35: From Madison Bycroft’s Main Projective geometry book>

It is like a two-dimensional growth measure. The shape of the families of curves is determined by the multipliers, which are working in the growth measures on the sides of the triangles. If the multipliers along the two sides happen to be equal then the curves become conic sections—ellipses, hyperbolas and an occasional parabola.

Quoting Lawrence Edwards: “We have a plane in which everything is moving. What can live and hold itself intact, within the flux? It is the whole set of path curves, and nothing else! Qualitatively we have a similar situation in any living organism; the substance of which it was made was not in it yesterday, and will not be in it tomorrow; as far as its matter is concerned it is in a state of continual flux ... The form can live within the flux. Something greater than the substance takes it up and moulds it, uses it and then casts it away.

<Slide 36: Adapted from Gabriel Bond’s thesis>

Just as we took one of the invariant points of the line growth measure and took it to infinity, so can we take one of the points of the triangle and take it to infinity, leaving the other two invariant. The sides of the invariant triangle are now parallel and meet Z at infinity. Here we get a family of egg like path curves, which remind us of many forms in Nature.

<Slide 37: From Madison Bycroft’s Projective Geometry Book>

The next step is to take the two-dimensional work into three dimensions. We can say that the three-dimensional form of the triangle is the tetrahedron (a triangular sided pyramid). It is made up of 4 points, 6 connecting lines and 4 planes. We wont be doing this here but imagine now that all the points of the these six lines which have growth measures on them are now brought into intersection. All the points of space will be moving in a set of beautiful path curves, which weave through all of space.

<Slide 38: Invariant tetrahedron from Edwards, 1993>

This is an attempt to portray a simplified version of this complex and beautiful configuration. Only one of the space curves is shown. Now we have to imagine the line WZ receding further and further into the distance until it merges with the horizontal line at infinity. Then the planes XZY and YZW will be sloping toward one another less and less steeply, until finally they become parallel horizontal planes through X and Y.

<Slide 39: Adapted from Thomas, 2004>
Z and W become imaginary and merge into “the absolute circling points at infinity” (Lawrence Edwards assures us that these are well known to mathematicians. These points create in the planes logarithmic spirals (Similar to those seen in the arrangement of florets of the Sunflower and other flowers). Only one spiral of each family is shown in the slide. Now these moving lines create a whole new family of spiralling forms, which intersect with the spiralling forms on the plane beneath. The intersections of these planes of movement create another family of forms.

Spatially the matter is very complex and extremely difficult to hold concretely in one’s imagination. However, the forms that can be made mathematically turn out to be very close to forms that appear in nature.

One of the most archetypal and primary forms of space is the egg, having its sharp and blunt ends on the invariant points of X and Y, and covered with an infinite family of path curves.

The shape of the egg forms depends on the growth measures used in the transformations. This leads to the descriptive number relationship which Edwards’s calls the lambda value for the path curve. Diminishing the lambda value causes the form to pass through an opening gesture so that vortex forms also belong to this field of forms.

Here we have a constructed form of a rose bud to demonstrate the relation between the geometric imagination and the life form.

There has been software now created to make easier the long hours of measurement and calculation needed to test the nature forms against the geometrical forms. Here are two examples.

It’s based on the measurements done on the screen.

Now Lawrence went on to show how the heart was also subject to these forming laws of projective geometry. One of the more wonderful parts of Lawrence’s work was his work with the heart. He became interested in the form of the heart and the way the cardiac muscle spiralled around the organ.

He was given angiograms of the heart by Edinburgh hospital. These are like a movie of the internal shape of the heart during its beating, taken for diagnosis and treatment of heart patients.

He found there in these moving images that the heart’s internal shape actually follows very accurately path curves in a dynamic way.

This led him to try and understand the anatomy of the heart.
He came across the work of the 19th century biologist Pettigrew who had painstakingly dissected the heart to discover seven layers of muscle.

Now the interesting thing with Pettigrew’s work was that he discovered that the seven layers are in a mirror relationship to each other. They start off on the outside the cardiac muscle fibres spiralling in one direction steeply spiralling in one direction on the outside and then the subsequent layers spiralled less steeply till it became the middle layer in which the fibres circled horizontally.

From there to the inner wall the layers changed their slant. They now spiral in the opposite direction. This gives a picture like this for the heart.

So you have this kind of picture for the heart and these forms are all path curve forms. Lawrence discovered through his angiograms and his analysis. That as the heart was beating the path curve from changed from one that was extended almost to infinity and to one that the lines that form it come right in close to the heart.

In systole, the moment of contraction of the heart, a moment of great intensity, when the heart becomes like a thorn, the lines (planes) stream in from the infinity of space and in diastole, the relaxation of the heart when it fills with blood, the planes go back out to infinity.

So we have this movement that can now be portrayed here.

We can now imagine within the pulsing heart we have something, which leads us from infinity to here and now. We have this connection of the human being to the infinity of space and the present place and location where he lives.

For students to learn about this, to learn about nature in this way, to learn about mathematics in this way, where they are not kept in separate compartments but where the subjects are continuously connecting them to themselves and to the world, means that the students grow both inwardly and outwardly into the world. They learn to know that within themselves they have access to the outer world. They grow in confidence and the world is not a place that is strange to them. It is a world from which they have sprung and a world into which they have a creative role to play.

This way of teaching is so crucial for students to be participants in the world we have today. Students are not going to grow into adults that are going to participate in the world if they learn of a world of grey chance movements of which they are a chance outcome. That’s not a story that engenders love. Our teaching has to bring out the creativity of people because they belong to a creative cosmos and it is ultimately our own creativ-
ity which will recognise the creativity of the world around us. The education process will help in a profound way if it can help students to come in contact with their own creativity and realise that their own creativity is a special instance of the creativity of the cosmos.

Then I think we can trust that we will have human beings in the future who will play a part in partnership with nature to make the world a better place.

REFERENCES


ACKNOWLEDGEMENTS

Slides 29 and 36 are from Gabriel Bonds’ Year 12 thesis, Form and Freedom, from the time she was a student at Mt Barker Waldorf School.

Slides 35 and 37 are from Madison Bycroft’s book while she was a student in year 11 at the Mt. Barker Waldorf School.

I am grateful to the advice from Dr. Yoshiyuki NAGATA in preparing this paper.

I would also like to thank my colleague, Dennis Millar for helpful conversations about Projective Geometry.
The PowerPoint slides featured in this report are the author’s original copies, not those actually used during his presentation.
Breathing (or hyperbolic) Measure. A point is shown moving along a line between two invariant points (with construction).

Bamboo— an example of a breathing growth measure between two invariant points.
A simple growth measure with one invariant point at infinity.

Growth measures projected onto the sides of a triangle.

2 dimensional path curves.

Path curves formed when one point is taken to infinity.
Two invariant planes become parallel

Typical path curve together with the invariant planes and axis.
Different Path Curve Forms

Yellow rose bud

Sea Urchin

Measurements on a pine cone

Pettigrew’s drawings of the layers of the heart

7 layers of the heart
Left ventricle of the heart behaving as a path curve from diastole to systole:

Secret of the heart
Panel Discussion

Victor J. Mayer
Douglas Bourn
Peter Glasby

Chair: Atsuhiro Yoshida
Discussant: Masakazu Goto
Panel Discussion

Moderator:
(Atsuhiko Yoshida, Associate Professor, Osaka Women’s University)

I had intended to summarize what Dr. Laszlo had said, but since we have such a limited time for the panel discussion, I would like to go to Mr. Goto’s presentation. Mr. Goto is actually from NIER, the organizer. He is a senior researcher at the National Institute for Educational Policy Research (NIER). Before that he was in the front lines of education for integrated studies in public schools. So he has that kind of experience.

We have had a rather broad-based talk up to now. Now we can hear about something closer to home: what is taking place actually at schools. One of the objectives of the Panel Discussion will be to bring the talk closer to heart. We will discuss what we can do within the limitation of reality in Japan. If we can find even seeds for future discussion today, I will be more than happy.

Mr. Goto, please.

Goto:

Thank you very much. I would like to take 10 minutes of your time. Excuse me putting a hat on. You’ll know why I have this hat on at the end of my talk.

When I was a student I didn’t like to study. Mr. Oku and Mr. Kasai were my English teachers. Now I think English is fun because they taught so well. But back then I liked science more and wanted to become a science teacher.

When you think about education that energizes children, what kind of education is that? In my case, class should be fun. When I taught the Mendel’s law of inheritance, I tried to play the role of Mendel. We ate green peas together, which made my students very happy.

Then I played Dr. Schweitzer, a European who became doubtful of his life in wealthy Europe and went to Africa to dedicate himself to the people over there. You could say that this kind of behavior can lead to moral education, education of the heart. When I acted out the role of Dr. Schweitzer at that time, one of my students wanted to become a doctor. I hope that what I did left some impression.

My friend Mr. Kuriki drew this cow. I am not good at painting or drawing pictures but fortunately, my colleague, Mr. Kuriki helped me and we had a good collaboration work. By indicating this, students will know about good communication between teachers; how I am friendly with other teachers.

As a former physics major, I originated many teaching materials. After the class of chemistry experiment, I made a notebook which got automatically opened by a shout, “Open Sesame”. You can see that this kind of experiment is very dynamic. That attracts students. You can reproduce the experiences that took place in the past. Students gathered around. One of them tried to make up a pop-up type notebook. The next morning, the child brought a pop-up notebook of his/her own, and I was very much impressed by his creativity.

I’m engaged in geology. There was an earthquake recently in Fukuoka. You can’t really see an earthquake, but there are propagating waves. So I used a Q-tip to indicate how the waves can propagate.

But I felt at that time that the teacher was playing the central role, not the students. Feeling that science has

*Parts of the discussion in this section are based on interpretators’ words in the symposium with some modification.*
to do not with the environment created by the teacher but with real nature, I wanted to use real nature in my class. You probably all like nature. I think 90 percent of students answer that they like nature. They are interested, and that encourages them to ask more questions and leads to a good relationship among the students. No barrier exists between boys and girls here because it is natural. You use these cheap tools that you can get at one-dollar coin shop and it can still lead to a good experiment. You don’t have to pay 1,000 yen to buy a beaker. You can even use a used pudding cup. When we went into nature, one of the students who didn’t like going to school before became very kind to other children. I think people become kinder in nature.

If you go into a dark cave, for example, you feel very small. I call that reverence. I would say this is reverence towards nature, or spirituality as described by Mr. Glasby. This shows that humans are part of nature. It’s also good not just for science education, but communication as well. I am a science teacher, but I understand that teaching something is to educate a human being. Students can become closer each other because it is natural. If you are a junior high school teacher I think you can very easily understand this intimacy.

Dr. Mayer talked about Earth Systems Education. From his idea, we can learn a lot. Teaching science should not be done separately. Physics, chemistry, and geology should be integrated when teaching. We understand this but we still have no name for this, no concrete idea for that either. Based on the system thinking of Dr. Laszlo, Dr. Mayer originated a theory named Earth Systems Education. I have studied this theory for more than ten years but he has been practicing this for 15 years already and this is a good reference for the integrated studies class in Japan.

Please think about what Mr. Glasby said. What happens to children if you take them for outdoor trip? In the botanical class, as a part of science education, students always ask, “Can we eat this plant?” “Shall we try it out?” I reply.

A very kind teacher in Home Economics, Ms. Mizuno helped us. After the field trip, when the school was over, we had a tempura feast. These are wild plants that we make into tempura. We realize that horsetails taste very good when cooked in kinpira flavor. We know how boiled horsetails taste but not the fried ones. I teach them that this plant is named horsetail. Then they remember that. It is a science class but they learn English at the same time.

In Japanese language class, students are to write essays often now. So, it may be a good idea to take them out for bird watching, for example, to find seeds of topics for essays. How about wild observation integrated with an art class? An art teacher, Mr. Igarashi, who is teaching Kamakura Carving, one of the traditional arts, helps us by joining my outdoor watching. It is a kind of team-teaching. We picked up plants which we learned last year and he teaches how to artistically express them. Students see this and think that Mr. Goto is doing something at the art room. They learn something good from seeing that teachers are helping each other.

Dr. Mayer visited our school and taught science in English. He asked simple questions. “What is this?” They answer, “It is quartz, it is white, it’s clean.” The conversation was simple but students got very excited and they could continue to speak English for an hour. Or they sketch flowers that they have seen on their outdoor trips. We teachers can tell them that the object they are sketching is “Beautiful” in English. That is art, but it can also be science and English. I think that this kind of fusion and expansiveness makes it more interesting for the students to learn.

The teacher whom I liked and respected was an English teacher, but I became a science teacher. At any rate, if you want to energize children you have to go outside the scope of science discipline. It should be an integrated type of study. This kind of study did not exist by name when I was a teacher. Now I am experimenting
that by asking helps of teachers in other fields as well as utilizing special time for extra curricula activity. Fortunately, we can have that kind classroom hour designated for integrated studies.

Why is field work so effective? I often caught beetles when I was small. I liked catching insects. Nature itself is the classroom for integrated education. Many of the children’s questions in nature are very difficult and often, you cannot answer. Curators cannot answer, Ph.D. holders cannot answer. When the children see that even the teacher cannot answer the question they feel more curious and energized. That means that students and the teacher are put in an equal position when learning, on an equal footing. I think that motivates their learning.

One of the main reasons I shifted to geology was this field work. This was a 10 centimeter shark tooth discovered by a student. The shark was a large one, about 20 meters long named Calcarodon Megalodon. Now it is part of a museum exhibit. The student who found it had no knowledge about the tooth. University professor wanted to have it but it was not to be. Now we know that the museum and the schools will develop a relationship. Oftentimes many students go to museums because they want their questions answered. That leads to a network and the participatory type of education described by Dr. Bourn.

Dr. Bourn’s idea is to come out and participate, I guess. I have engaged in this type of activity over 12 or 13 of the last 16 years. Now we have a course of study which requests “period for integrated studies”. Now education must, not can, use regional resources such as nature and facilities outside of school. You may ask museum curators to come and help you or specialists of nearby colleges for cooperation. If you have outdoor trips you can ask bird watching experts and have exchanges with them. Human networks may be formed. That leads to changes in the values of the students: they are not studying just to get good grades on a test. You have to change values, as mentioned by Dr. Bourn. Otherwise, the world is not going to change.

Then, in a few years time, science classroom may become like a science museum and you will be able to exhibit students’ works, or participate in voluntary activities. I have had team teaching with my colleague, Mr. Masuda, and received awards from the prefecture governor and prime minister. As a result, now 10 years later, we have these various textbooks such as “Nature of Miura” to supplement the main textbooks in use. This is something that we cannot attain in a few years. These are about the region. What at first was just a sheet of student report became layers of papers in several years and teachers collected them and compiled them into a book entitled “Geology of Miura”. They are in full color and have been created by the students and published by the local Board of Education finally.

We wanted to expand these activities. NHK (Japan Broadcasting Corporation) actually wanted to make a program on education for nature-experiences which students need more today. Five years ago they created a program about observing nature with the cooperation of schools that have museums, teachers, people in the region, and students who work together in this way.

Lastly, I’d like to tell you why am I wearing this hat. I majored in physics but felt that physics itself was not going to make people happy. You could have conveniences, but that doesn’t necessarily lead to happiness. Once there was a physicist and essayist whose name was Torahiko Terada. This scientist Terada says that in a bowl of tea you see the Pacific and when the tea gets hot, if you hold the palm of your hand over the bowl, you see the droplets of steam. So he used a teacup with tea to talk about the Earth systems. It is a miniature of water circulation system. Or miso soup in a bowl. There is seaweed inside. He says that you cannot break down the earth to watch the Earth’s mantel convection, but you can use a bowl of miso soup to imagine this. I thought this was very effective. He knew how to interpret things with imagination. I was enchanted by his idea and that’s why I wear Torahiko hat which you see in his photo.
But it is actually very difficult to have this kind of education because there is not enough time. I always had to question which to take, conventional basic subjects or integrated style; whether you should focus education on taking tests, or whether you should focus education on interest. I wanted to become like this scholar Terada, so I have been doing my best. But there is a limit for me to reach. I feel I have been lucky because various communications and relationships could be established around me that made it possible to continue my style.

Thank you very much.

Moderator:

Thank you, Mr. Goto, for sharing your very true intentions.

We had been listening to the most advanced experiences and cases from overseas. We would now like to hear again from the three speakers from overseas. We would like to hear what they have thought of Mr. Goto’s stories. Let’s use this as a case study. What were so good about this organizers of the symposium were how they selected the speakers. We invited speakers from three different countries who represent three different areas: development education, environment education, and spiritual education at Mt. Barker Waldorf School. These areas can be, in other hand, interconnectedness with society, nature and inner self. If you recall, at the beginning Dr. Ervin Laszlo talked about the importance of such interconnectedness. We have specialists who have been practicing and putting these concepts into action.

I would like to invite each of you to comment on what we have heard from Mr. Goto. First, let me turn to someone who has known Mr. Goto for very many years. Dr. Mayer, whose specialized fields are environment education and science education, would you like to comment on what you have heard from Mr. Goto?

Mr. Goto started with science, but it went beyond the boundary of science to reach integrated education finally. Dr. Mayer, you talked about the integrated aspect of education which you eventually reached in the course of time through practice. But we suffer from lack of time, and we of course have to think about what the test examinations should be like. We wonder if that approach alone will give the fundamental skills and learning necessary for the student. I am sure you have had many problems and challenges in practicing this, and Mr. Goto is still struggling with this. If you could touch on that also, we will be very interested in hearing your reaction to what you have heard so far.

Mayer:

We talked about systems and the Earth System. As an example from his physics teaching, Mr. Goto used the example of the tea, miso soup idea integrated with the Pacific Ocean. Those of you who are not Earth scientists may not realize that that is part of the hydrologic cycle: water evaporated from the Pacific Ocean falls over Japan, and you tap that water for use in tea and miso soup. Well, I wish you’d used more of a geological example. The one I use also includes the example of dinosaur urine as the Earth system that brings in time as well.

When I was teaching at geology at Ohio State I also used beer as an example. When the men and the boys drink beer it comes out eventually, and then it enters back into the Earth system and once again gets into the waterways, evaporates, and comes back as beer. So this recycling is an example of what happens in an Earth system.

I think you just heard an example of why Mr. Goto was an exemplary teacher. I spent something like 30 years at Ohio State preparing science teachers. We had some good ones and we had some bad ones; some that were very effective in the classroom and others that were totally ineffective. Unfortunately, many of those inef-
effective teachers are still there in the classroom. No matter how hard I worked to convert the ineffective teachers into effective ones, it often didn’t happen. I came to the conclusion that, in one sense, the really good teachers are born and not made. In other words, they have a certain personality, inquisitiveness, enthusiasm, that makes them good teachers and concerned for students. You can help a little bit of that in teacher preparation, maybe in the enthusiasm for students and certainly in the content that they learn. But it’s very difficult to have a student teacher come in who doesn’t have the potential and then try to convert that teacher into an excellent teacher like Mr. Goto. You can see the kind of enthusiasm that I have observed in his classroom over the years and in his work now in NIER in terms of collecting information around the world that would be useful here in Japan for developing more effective teaching and instruction.

**Moderator:**

Thank you very much, Dr. Mayer. Now let me turn to Dr. Douglas Bourn. You talked from the standpoint of an NGO and you engaged in social activities, so you have a truly social perspective, a community perspective, in your work to develop education. This may not be too relevant a question for Dr. Bourn, but I nevertheless dare to ask because to develop a link between development education and environment education is an important issue in your country. This link is essential for ESD, yet we have not been particularly successful at this in Japan. Dr. Bourn, would you like to comment at this juncture?

**Bourn:**

Thank you. Let me point out one of the challenges we have in embarking on our journey in learning and understanding about sustainable development. On one level we need to look at it, as I have said, in a holistic way, but we also need to make sure of the relevance of the conceptual framework we are discussing, or which is being discussed in many places, to the study of particular subjects, themes, or issues.

If you take some of the areas that we have mentioned, particularly some of the areas of scientific inquiry, there are, as has been mentioned earlier today, dangers of actually taking the discussion into what I see as a rather narrow framework. If we are talking about some of the areas of study and learning that have just been outlined, what is different about those areas if one looks at it through a sustainable development lens or perspective? What makes that different? I think it’s not just about asking where the human development part can be found; it’s also about the interrelationship of economy, environment, and society. What are the things that are different in that area? And what is the learning process?

I have some concerns about some of the things I have heard this afternoon. It seems that some areas of existing learning and practice somehow neatly fit into some of this framework we’re talking about with ESD. I don’t think it’s as simple or as easy as that. I think we need to be clear about some of our big picture goals and then make that relevant to the study of science, geography, or whatever subject we are discussing. That is not an easy journey and it may require some fairly radical rethinking about how we teach particular subjects, firstly in terms of the social relevance, secondly in terms of discussing things that may seem to be controversial.

As outlined earlier by Victor, there’s not just one way of interpreting data and information; there are many ways of seeing things. That poses some wider questions about how we see and relate to sustainable development. And yet for me, for some of the issues that I am concerned about to do with combating global poverty and the inequality of the world, scientific inquiry and the study of science in their broader holistic sense have a huge amount to offer, both in terms of this area and in terms of areas of learning.
Yet, in many ways those alliances and debates do not happen. In too many areas of work that I’m engaging in with NGOs, people often see scientists and science education as bad people who have done bad things to the world. They do not appreciate that learning and understanding about some of the issues we have talked about today can help to change the world for the better and to make that connection to some of the big picture questions that we’re talking about. We shouldn’t ignore the fact that some of those questions are very difficult and not something that can just be resolved by putting policies and programs in place. They have to start in the classroom; they have to start with the actual training of teachers and educators to start looking at things in a different way.

Moderator:

Thank you very much. You have to look at the bigger picture, the holistic view. As was mentioned, we were pretty impressed by the keynote speech by Dr. Ervin Laszlo. I think we were once more reminded of the importance.

Now, once again, Mr. Peter Glasby. Mr. Glasby, you have listened to Mr. Goto on the subject of reverence. I think that leads to your proposition, as well. What was your impression of Mr. Goto’s view?

Glasby:

I’ve had the pleasure of having dinner with Mr. Goto last night. I became aware then, during dinner, what a good teacher he is. The qualities of enthusiasm for his subject, for the children, and for life are invaluable in the teaching process. So I’d first of all like to acknowledge them, because they are sometimes left out of the formula.

I’d like to add something. Perhaps Mr. Goto has already spoken about this, but if he has it has passed over me. The act of going out into the environment by itself is wonderful for children, but I don’t think it’s enough, and it doesn’t automatically lead to children with a greater reverence for life.

Ultimately, children and people gain a reverence for life from two directions. One is by finding within themselves a sense of their own worth. Without that, it’s hard to have a sense of the worth of anything else. This is a very important step and it involves practically helping children in the process of understanding and developing ideas.

When you do experiments or when you go out into nature, it’s not enough just to be there or just to do experiments and have fun. It’s important to do that. The next step is to treat the experience of the students as something to be valued, as something to enter the process of knowing. If students slowly learn that experiences are valuable in forming their ideas and that they are helped in that process, then they gain gradually an independence of judgment to form their own ideas that recognize the world for what it is, something of great value. That step, I think, is critical; not to be missed. And how that happens is critical because much of learning doesn’t value the experience of children. It gives them experiences, but then uses the experiences as signals to introduce some formal ideas of knowledge that come from somewhere else. They don’t build the knowledge out of the experience of the students. I think that step of taking the experience of the students and allowing that experience to grow into knowledge empowers the children ultimately.

Moderator:

Thank you very much. I was maybe expecting a different approach. But I think this “spirituality” from Mr.
Glasby has really touched upon the very gist of the problem raised by Mr. Goto. Indeed, he responded to Mr. Goto’s question very well.

Experience must translate into knowledge. Its process is important. His message is really crucial. In integrated education or learning you have to go beyond the school classroom boundaries. One must go through many experiences.

But people sometimes ask, “Does it really do you any good?” “Can students really learn something?” There is a controversial debate as to whether the experiences will indeed benefit children. I think Mr. Glasby responded to this very well.

Dr. Mayer also taught us many things. They are going through many experiences, a diversity of experiences, but they are translated into real knowledge, a system of science. And he emphasized the importance of critical thinking. In that context I think there was much to be learned from his practical method.

Mr. Goto, having heard from the three other speakers, what is your observation?

Goto:

Well, Dr. Mayer did basically mention systems. It’s not just individual phenomenon. Everything is related in nature. All things are connected. I was not good at teaching field work in the beginning, but once you are outdoors, once you’re out in the beautiful nature of the forest, the students should learn certain skills in more depth. If they don’t experience things, they just end up with superficial knowledge. There is a way to connect the knowledge with the outdoor experience. That is what we teachers have to provide, and it becomes possible once we are all outdoors.

The spirituality discussion took place earlier on. I don’t use this term “spirituality,” but I agree completely with what Mr. Glasby said. When I was young there were many forests around us. We were able to experience there a sense of wondering, movement and reverence, feelings which were within us. Dr. Mayer talked about some oriental ideas in teaching. I think these things were originally a part of our culture, but they are now lacking in our practices today. This could be a problem in many ways.

We have abundant nature in the Orient. Students learn something religious from the nature and it is like animism but not monotheism. Students seem to pick up these things unconsciously. I teach geology and when we are walking and happen to step on a stone which is 3 million years old, you may not be able to step on such an old stone if you know that it’s so old. This did not happen when I was teaching physics. If you know the area, the landscape around you, better, this is what you will have. We have been able to experience all these things in the past outside of the school system, but now that is not very possible. So now the schools should offer such opportunities, I believe.

I like Terada Torahiko but Miyazawa Kenji or Minakata Kumagusu even more. These were teachers who enjoyed learning. They did not stick to plants and rocks only but they also loved music, drawing, and painting. These attitudes can be obtained by going out into the nature of the area. They are very good examples.

Moderator:

Thank you very much. I think we are staying a bit from main theme for our discussion. Some of you may be finding it difficult to follow the discussion, so I wonder how I should direct the flow at this point.

Mr. Goto mentioned the cultural factors: we can see our spirituality, something spiritual in our culture, and the interconnectedness in nature and this was a part of Japanese culture for a long time. I wonder if there is
anyone else on the panel who would like to respond to this comment by Mr. Goto. Anybody?

**Glasby:**
I once read that Buddha said, “What you see is what you think.” I thought about this for a long time and I’m sure it’s very true. When you go into nature, you see a lot about the plant world if you’re a botanist and you see a lot about the animal world if you’re a zoologist. The way we form our ideas befits the way we perceive. Mr. Goto mentioned that you have had a culture in Japan which, as I understand it, had a huge cultural influence on society and brought about a love and respect for nature. The question one has to ask today is: What cultural impulse do we have in society today to cultivate that respect and love for nature? That’s the question.

**Moderator:**
That is a good point. Mr. Goto referred to culture, and Dr. Laszlo mentioned ‘timely wisdom’ in his keynote. I think we can relate the discussion to the term Dr. Laszlo chose. Shall we re-consider this point? Dr. Laszlo looked into the old civilization and cultures. They had something different from Logos: something more holistic; holistic knowledge or wisdom. People lived in better harmony with nature and the environment in those days. Their lifestyle was like a co-existence with the nature.

Dr. Mayer showed some pictures from Japan’s rural area in his presentation earlier on maybe to show people’s wisdom for harmonizing with nature. Now, in the 21st century, perhaps we should re-discover the wisdom. But it must be ‘timely wisdom’ in line with the time in which we live. I think that is the issue or suggestion Dr. Laszlo mentioned. And this could be our new focal point.

We only have time for one more round on the panel, just one last opportunity to speak. Could you wrap up what you have learned today, what you have observed today, in your closing remarks for this afternoon? Is there anything you could suggest as we try to do our part for sustainable development education in Japan? Let’s start from Dr. Mayer.

**Mayer:**
I don’t know if I can give you suggestions, but I can respond to a couple of items. I guess I’d rather do that. Dr. Laszlo and I both brought up a similar item to do with culture in our talks; specifically, how Oriental societies differ from Western societies in their respect of nature, their appearance in terms of integration of human beings with nature. There is a stark contrast. I think you still have it here in Japan under the surface. I’m impressed, for example, by moon-watching nights. People go out to watch the moon when the moon is full. And when the cherry blossoms bloom in spring and you go out to some of the castles and areas with a lot of cherry blossoms, there are all kinds of people there enjoying nature. And there is also firefly-watching in the spring when there are fireflies. I can also talk about other ways of enjoying nature such as mountain climbing.

In a sense, I think that relationship to nature is still here. But in the process of development, I think you have acquired a Western perspective which places importance on what I call a reductionist science in place of your basic cultural propensities. I expect you can return to that; it’s still there underneath.

I’d like to make one other comment with respect to Dr. Laszlo’s talk and his two scenarios, the positive scenario and the negative scenario. I guess I’m much more pessimistic about which of those scenarios we are now embarked upon because of climate change. There’s a lot of evidence that you don’t see in the papers. We have a couple of professors at Ohio State who are in the top ranks of investigators in global climate change. They’re
glaciologists who examine the records deposited over 100,000 years or more in glaciers. That is giving us a very remarkable story in terms of the rate at which climate has changed over the industrial age. Even more remarkable is how rapidly sudden changes in climate can occur in the geological record. I forget the exact date of what’s called the lower Dryas. This is a period of time, maybe 10,000 to 20,000 years ago-I forget the exact date-when the climate had a sudden fluctuation in a period of 10 years.

What happens with the system? Our atmosphere is a system which is now essentially stable in the amount of energy it has within it, but we’re pumping more and more energy into that system. We are beginning to see more extreme storm activities; tornadoes where there weren’t tornadoes before. That’s an expression of the increasing amount of energy in that system. When a system eventually has so much energy that it can no longer adjust, it descends into chaos. As Dr. Laszlo pointed out, we have no idea what chaos might occur, what the condition might be, if that situation comes to be. Our scientists can’t predict chaos; they can’t predict the next level that the atmosphere will go into. There is some real concern among the glaciologists that we’re getting very close to putting in an amount of energy system that might disrupt the system entirely.

When you put that into what we’re talking about in terms of the global situation, we have no idea what may result. So I’d like to leave you with real pessimism, if nothing else. I would at least like to have some influence on the use of energy in your country. I have given up in our country. We have two oil executives in charge of our country right now, and believe me, it’s the worst situation we’ve ever had.

Bourn:

I want to come up from the other end of the spectrum with two or three observations. One, if someone asks me what are the key skills that people need to learn and develop in the 21st century, I would say it has to do with ambiguity, complexity, and uncertainty. When we start to look at some of the questions outlined by Dr. Laszlo in his presentation, particularly the question of which scenario we are on, at one level, on a political level, you might almost get a sense that we’re on both at the same time. There is some political rhetoric about trying to address some of the concerns to do with working towards a more sustainable society, yet at the same time we know, because of what’s happened internationally in recent years, that the opposite is in fact happening.

Partly to echo Victor’s comment, I think there is a danger of a sense of pessimism. What I feel out in the societies of many countries is a sense of confusion, alienation, a sense of feeling disengaged. In our discussions today we have started to reflect on and think about how we can bring these discussions back to how people organize their daily lives.

One of the things I sometimes get concerned about when we talk about the respect and love for nature in a number of civilizations and cultures is the danger of reducing that love of nature to seeing nature as a theme park. We somehow put a circle around it and keep it there. Meanwhile, we get along with the rest of our lives, driving our cars, putting more pollution into the air, etc. One of the things we need to see is actually how we can ensure that those things do not become separated out. If there is within a culture or a civilization a respect for nature, it is not just seen as something out there in the mountains or out there in our gardens. It’s about actually how we live, our everyday lives.

Of the leading industrialized countries in the world, I think Japan has real challenges in that regard. You cannot divorce discussions on education for sustainable development from discussions on what sort of society and world the next generation will want to live in or should live in. If you start to bring those things together, if we
have some vision of society and the world in which we want to live in and we understand that what happens here has an impact on somewhere else in the world, then we have a responsibility to learn more about how we can ensure that happens. Because it’s not going to happen just by politicians or policies being made; it’s going to happen by our own endeavors and by our own actions.

**Moderator:**

Now looking at our society today, I think things are apart. They are not really connected. That’s the way we are today in Japan. Is nature out in the mountains?

Dr. Bourn says, “No, it’s how you live your everyday life.” Thank you for the comment.

Mr. Glasby, please.

**Glasby:**

Yes, I’d like to just pick up Dr. Laszlo’s third point. He talked about historical knowledge, anticipatory knowledge, and then he talked about the remaining task: “Enabling the next generation to have new values and independent judgment.”

Without disagreeing with Victor in any way-I share some of the pessimism-I’d like to leave on an optimistic note. It’s based on experience with students. In my daily life I experience new students coming into the school and growing. The wonderful thing about human beings-and this is implicit in the way I have talked about spirituality-is that human beings are the only beings who, as far as I know, are in touch with the newness of the universe. All new ideas will come from human beings.

The younger generation who are going to our schools are quite amazing. Any ideas we have with our old heads, as wise as they be, don’t always match up to what these young people are bringing in the way of new ideas. If our education can develop so that it does not impose outcomes in the education program, outcomes which are always in the context of what we know, then we can progress to outcomes that are in the unknown, in something that is new. The world desperately needs newness and that is going to come through people. I see this task of education as enabling that.

In the last four months I have experienced old students from our school. A group of them in their early twenties went to the Afar desert in Ethiopia and built a clinic. They financed the whole project and built it themselves in two months. Another group from the school went to Cambodia and built a hostel. There’s a student sitting in the auditorium right now learning about sustainable urban design in Japan. She has already made a significant contribution in that area. And I could go on. So the younger generation I think is where our hope lies in the face of pessimism.

**Moderator:**

Thank you very much. It’s already 15 minutes after 5:30. Mr. Goto, you are from the organizers, so if you could summarize...

**Goto:**

Thank you very much. Soon we will be closing.

Why is it that we asked Dr. Laszlo to be our keynote speaker? There is a reason. In talking of school education, we can anticipate that ESD will be taken up in integrated studies. Yet integrated studies are not necessar-
ily going so smoothly. There are certain fluctuations: Is it a base of all or is it an integration of all... I want children to be energized to learn. That means that we cannot avoid integrated studies. I hope the teachers will build up integrated studies from here on, and I am trying to think about that from my position in NIER as my mission.

One conclusion is that ESD is to be promoted within each region and locality in an endogenous fashion. The government wants to see good curricula and they have set up a course of study. But is that enough? Education is not like that. You have teachers and you have what people want in their community. That’s endogenous. And then you have the curriculum that the government considers. When you have an intersection or intertwining of the two, you get good education. We should not just choose either basic studies or integrated studies. Rather, we should look at the students, we should look at the teachers and community, and come up with a good balance. That balance is of course important.

Coming to a bigger issue, how do we live our lives? I read Dr. Laszlo’s book. It was written about 25 years ago. It was “systems view of the world”. It was very implicative and I was moved greatly. He goes from the world of matter to living things to spiritual aspects. He considers an integral theory encompassing everything. We tend to think about integration within a certain subject, but we are trying to rear the whole individual. That means that you have to cultivate the whole person. That kind of philosophy therefore is very important. When I started I didn’t think about that, I just wanted to make children come alive and I wanted to do it bottom up, endogenously. But there is always the national curriculum that I have to keep in consideration and struggle with, and I think that’s important.

As Dr. Bourn has said, ESD is participatory. It’s not just about knowledge or technology. You have to change values or the way you live. From Dr. Bourn we learned about the action plan in the UK. They are ahead of us. I hope that we can learn from them in that sense. I think Dr. Bourn gave us a very broad picture. I agree with his view that we really have to participate in changing values. To learn is to participate, not for the sake of the test performance, but for the sake of forming one’s value. I also agree with what was said on spirituality.

As a scientist, I don’t think Dr. Mayer emphasized the spiritual aspect too much. But since I was born in Japan, since I was not happy enough learning and teaching physics, since I have visited Zen temples including Engakuji for Zazen meditation-albeit just as a hobby-I think that should be integrated into our view of how we want the world to be. That’s why we invited Dr. Laszlo. We wanted to think about 21st century education from that vantage point.

Who were the Japanese who were thinking about what Dr. Laszlo was saying? There was such a person in Japan. I have kept this beard or mustache for this very end. I like this man, Minakata Kumagusu whom I cited a while ago. He researched various topics including myxomycete, botany and religion, and he changed his view of life. One hundred years ago he used the word “Ecology.” Quite surprising. Dr. Laszlo has actually worked for many years with UNESCO. There is the Kumano Shrine which was preserved by Kumagusu as part of the conservation of nature, and the shrine and forest have become its World Heritage. I think that kind of action was participatory, as Dr. Bourn said. It may start out only as a small effort. When I first started my outdoor trips it was on a very small scale and often, I could not answer questions imposed by students, which embarrassed me but then I got assistance from the arts teachers and other teachers, so naturally good things came into being.

We have to think about this endogenously developed culture of viewing things as systems. We have compe-
tent teachers in Japan. When thinking about ESD or the 21st century we can learn from our predecessors and the culture that they valued.

Thank you very much.

**Moderator:**

Since time is up, we have to close this session. Dr. Mayer, Dr. Bourn, Mr. Glasby, thank you for sharing your precious experiences. I believe that we will make the most of what we’ve learned today in our own situations. Thank you also for all the audience here.
The works by Dr. Ervin Laszlo that have been published in Japan include just one illustrated storybook. In it we find the scene excerpted below. The protagonist of the story, a youth named Bud, sees an old trumpet tree. It is the kind of tree that produces golden blossoms, but its branches are drooping now and it seems about to wither away. In this scene, Bud addresses the tree*:

Bud: How did you grow so withered and ash-colored?
Trumpet Tree: That is a very long story. A lot of things happened. My body is all worn out. It’s because you have been so recklessly going around and doing whatever you pleased. The way you’ve behaved, you must be a thoroughgoing fool.
Bud: What a thing to say! But now do I do anything right?
Trumpet Tree: When you stop where you are, and think.

Ervin Laszlo, *Chenjinga Warudo* (Japanese-language work with English title *Your Life in a Changing World*)

In this picture book, the youth named Bud is a symbol of human beings (the human race), while the Trumpet Tree represents nature (the earth). When the old tree says, “stop where you are, and think,” these words appear to be a message directed to each and every one of us, where we are situated in the midst of our unsustainable societies. Dr. Laszlo is asking us whether we have ever faced a time when we had to stop and think, and this is a question that can be found posed here and there throughout his writing, not just in this story.

In recent years, Dr. Laszlo has continued to broadcast messages of this kind, sounding a warning bell for human society, which has been “recklessly going around and doing whatever [it] pleased.” The fact that we were able to invite him here to this international symposium has provided the educational community in Japan with a precious opportunity to turn and look back at where we have been. Dr. Laszlo, who is known as a contemporary philosopher and thinker, and has even gained renown as a futurist, has shared his theory of education with us. This contains a message of penetrating insight into the educational community. As suggested in the keynote address, the state of conventional education is such that its function might very well have been on the side of withering the Trumpet Tree. That education has been entirely too preoccupied with immediate profit, and has placed greater value on competing rather than on coexisting with others. Just as we saw during Japan’s period of high economic growth, education also believed in the myth of growth, and it may have been “going around and doing whatever [it] pleased.” The result has been that everywhere we look, we find the sight of the exhausted trumpet tree, if we but notice, and we are acting bewildered. The youth named Bud can be taken as the image of ourselves as we live in our unsustainable contemporary society.

When we turn our thoughts to education, it is crucial that we temporarily cast off our various motives and expectations so that we can reexamine our vision of what education today should be in light of the reality of unsustainability that faces the entire global community. This is what Dr. Laszlo has explained to us in his

*The following excerpts have been translated from the Japanese edition of “Your Life in a Changing World”, and proofread by the author, Prof. Dr. Laszlo.
keynote address. The story of Bud and the Trumpet Tree explains how the coming decade, in other words the period from 2001 to 2010, will be a turning point. It tells us that now is the time to choose. As it happens, the UN Decade of Education for Sustainable Development has started at the middle of that turning point, so the developments during the first half of this decade are going to be crucially important. We are living in this period of choice between alternatives, and Dr. Laszlo has suggested to us that the keywords for overcoming the circumstances that face us are “timely wisdom.”

When discussing such things as children, schools, academic ability, or education for the heart and mind, we seem to be trapped by old paradigms. We should free ourselves from the kind of nearsighted views of children and views of academic ability we find in recent years, and stop where we are to take a deep new breath of fresh air and reorient ourselves. This is something so vital that Dr. Laszlo appears to have communicated it as an undertone in every topic that he touched on in his keynote address.

The three panelists spoke very intriguingly at this international symposium, as though to further clarify the new paradigms that Dr. Laszlo described. Dr. Mayer, Dr. Bourn, and Mr. Glasby spoke from the foundation of their respective specialties, but they also took a perspective on education for sustainable development (ESD) that transcended the boundaries of their various specialized fields. Working from that perspective, they spoke to us of matters that go to the very core of what we think education should be in the times ahead. The promotion of ESD frequently involves some inquiry into its differences from conventional education on the environment and on development. The presentations by these three speakers, however, offered us prospects on ESD as what we might term an unexplored area of comprehensive endeavor, and in doing so, what they had to say was very suggestive.

The old Trumpet Tree remarks, “In all things, you begin when you take notice.” The words we heard from every one of the presenters at this symposium afforded glimpses throughout of their desired vision of a sustainable future. These are the messages we hope to share with our readers, and nothing could make me happier, as one of the symposium organizers, than to know that doing so helps us to move farther forward toward a more sustainable society.

Now that the editorial task has ended, these comments may seem in some way apologetic. Nevertheless, I will state here, partly by way of self-admonition, what this international symposium did not accomplish. Looking back at the symposium, the most regrettable thing is that no female specialists or specialists from the developing world could be invited to participate as panelists. That this could happen in such an event on the topic of ESD is a matter that demands reflection on our part, regardless of what constraints there may have been on the process of organizing the symposium. It is widely recognized that ESD is a broad concept that does not just include environmental education and development education, but also extends to gender, human rights, international (intercultural) understanding, welfare, and other such areas. Needless to say, it is unconscionable for a program advocating ESD to be caught up in conventional paradigms, so that its organization is lacking in balance and imagination from the gender and regional points of view.

I would like to note, in closing, that the planning and organization of this international symposium involved consultation with many people who provided us with their valuable views and opinions. I want to take this occasion to express our gratitude to them. Our heartfelt thanks must go, first of all, to the keynote speaker and the panelists. We are also deeply grateful to Mr. Atsuhiko Yoshida, who took on the role of moderator for this symposium on the challenging, multi-disciplinary topic of ESD. Our thanks go as well to Ms. Yoko Tsurumi, who provided her conscientious editorial support in the compilation of this report.
Without the unstinting work performed by these many different individuals, neither the international symposium nor this report could ever have been realized. I am happy to have this opportunity, therefore, to extend my sincere thanks and appreciation to them all.

Yoshiyuki Nagata
On behalf of the Secretariat
International Symposium on Education Reform 2005
International Symposium on Education Reform 2005
— Sustainable Development and Education for the 21st Century —

PROGRAMME

* OPENING ADDRESSES by the ORGANIZERS
13:00-13:05 Opening Address by Shigenori Yano, Director-General of the National Institute for Educational Policy Research (NIER)
13:05-13:20 Masayuki Inoue, Director-General for International Affairs, Ministry of Education, Culture, Sports, Science and Technology (MEXT)

* KEYNOTE SPEECH
13:20-14:20 Keynote Speech by Ervin Laszlo, Founder and President of the Club of Budapest, Hungary

14:20-14:40 — Break —

* SPEECH by PANELISTS
14:40-15:10 Victor Mayer, Professor Emeritus, The Ohio State University, United States
15:10-15:40 Douglas Bourn, Director, Development Education Association, United Kingdom
15:40-16:10 Peter Glasby, Senior Science Teacher, Mt. Barker Waldorf School, Australia

16:10-16:30 — Break —

* PANEL DISCUSSION
16:30-17:30 Panel Discussion
Moderator: Atsuhiko Yoshida, Assistant Professor, Osaka Women’s University
Panelists: Victor Mayer, Douglas Bourn, Peter Glasby
Discussant: Masakazu Goto National Institute for Educational Policy Research (NIER)
Speaker
Masayuki Inoue  Director-General for International Affairs, Ministry of Education, Culture, Sports, Science and Technology (MEXT), Japan

Keynote Speaker
Ervin Laszlo  Philosopher, futurist, founder and president of the Club of Budapest

Panelists
Victor J. Mayer  Professor Emeritus, The Ohio State University, United States
Douglas Bourn  Director, Development Education Association, United Kingdom
Peter Glasby  Senior Science Teacher, Mt. Barker Waldorf School

Panel Discussion Chairperson
Atsuhiko Yoshida  Associate Professor, Osaka Women’s University, Japan

Discussant
Masakazu Goto  Senior Researcher, National Institute for Educational Policy Research (NIER), Japan

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