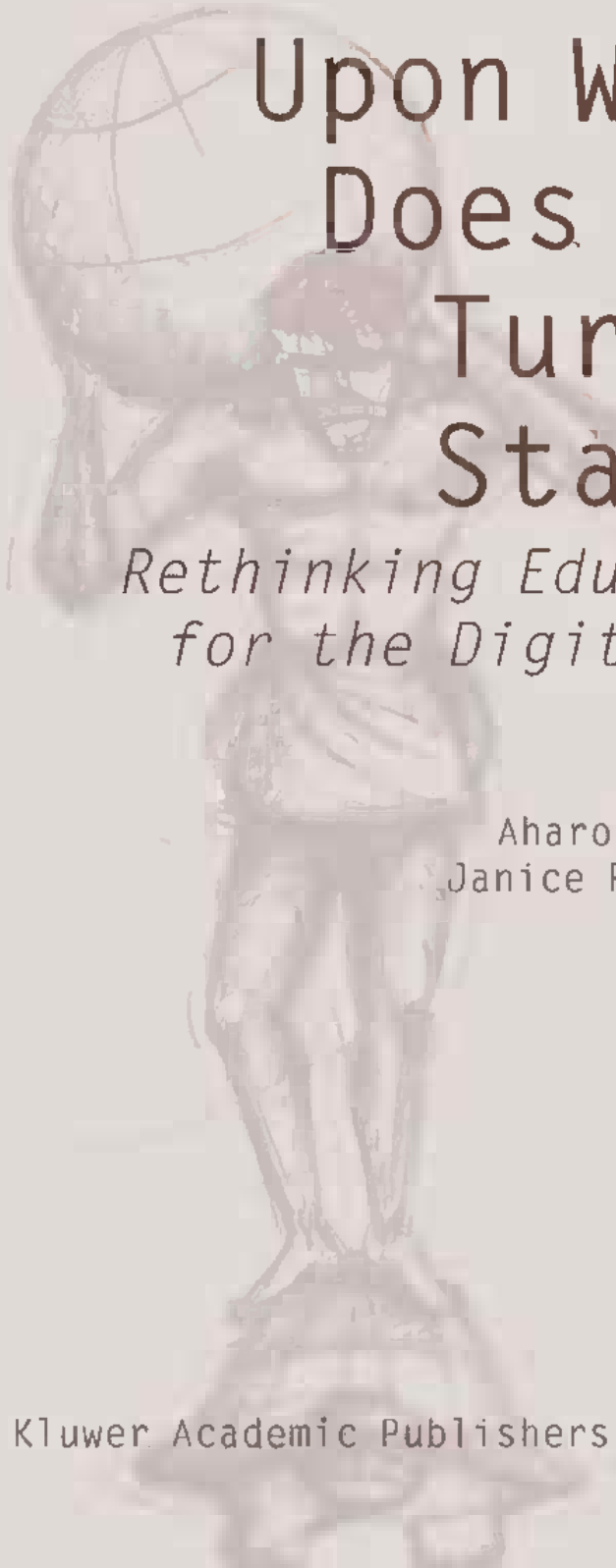

Upon What Does the Turtle Stand?

Rethinking Education for the Digital Age

Edited by
Aharon Aviram &
Janice Richardson

Kluwer Academic Publishers

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* Adapted from the French Version by Janice Richardson.

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FOREWORD

This book brings together the reflections of independent researchers from around the world. Sixteen authors from fourteen countries present their views on the use of information and communication technology (ICT) in education, offering valuable insights through the examination of current issues relevant to the future of education. What will education be in tomorrow's world? How can ICT be used without rendering education a purely technical process? How can we succeed the renovation of educational subjects without transforming them into technical objects?

The introductory chapter of this publication guides us into the essays through a classification organized by the editors to illustrate different attitudes to technologies:

- The 'Globalizers' see the integration of ICT and education as a means of enhancing the competitiveness of their society in a global economy;
- The 'Reformists' see it as a means of bringing about significant change in didactics in the various disciplines, and even in the 'basics' of education;
- The 'Humanists' consider technologies as possible catalysts for changing the aims and values of education from learning-oriented to humanistic;
- The 'Heretic' sees values and aims as being determined exclusively by technology, and economy and culture as sub-products of the technology-guided process. He therefore does not see any sense in interrogations as to which aims should guide us in integrating technology with education.

Obviously, some arguments stretch across all four categories without completely matching any so-called type. Nevertheless, this approach offers an interesting way of reflecting on current attitudes and on just where one positions oneself. It also raises a number of questions:

Will the future bring crises that could generate conflicts between the 'globalizers' and the 'others'? Can compromises be found, perhaps by listening more attentively to the 'reformists' and the 'humanists'? Do today's 'heretics' believe in technology as « The Guide », the road towards some kind of technological 'messianism'? And what about those who resist technological determinism, may they not finish up "burned" for their heterodoxy?

Among the many reflections united in this anthology, I would particularly like to underline the importance of thinking in terms of values. Values are at the core of our democracies. They are also at the core of our education systems. Given growing cultural diversity, we have to understand and integrate these values as well as the values from other countries and continents.

Can we influence the changes taking place in the way technology is used in education? If the answer is "yes", then which social values do we want to foster? Which educational goals do we want to pursue? What can we do to better serve what we see as desired values and educational goals?

We are entering an increasingly complex society where it may be far more important to ask the right questions than simply to provide answers. So, let us thank the authors for these questions, and just enjoy the book.

Ms Viviane Reding
European Commissioner of Education, Culture and Sport

PROLOGUE

Lens - education through the eyes of a teacher

LENS: a transparent substance used to form an image by focusing rays of light: a medium that focuses or clarifies. (definition from Websters' Dictionary)

As a teacher, I am that LENS... focus… images… clarify… light… I am a lens through which my students see the world… I am a lens that brings to my students a world of images, a lens that brings life into focus, a medium that clarifies what is, and projects what may be… a transparent substance that accumulates the rays of learning, and casts the beam of knowledge upon them.

As a teacher, I am a wide-angle lens. As such, I can widen students' perceptions of all that is around them, I can spread their thoughts and concepts throughout every corner of the globe, from the dusty villages of India to the frozen tundra of Antarctica. I can stretch their sense of time, and have them walk with pharaohs in ancient Egypt, or live through a time warp in some infinite future. I can send their minds toward boundless horizons of yet unthought-of domains – stretching, reaching, diverging, casting their shadows far beyond any I can conceive of...

I am a telephoto lens. As such, through knowledge, I can give to students images and tools that will provide the opportunity to reach farther than they thought possible. I can multiply the distance their mind will travel, I can magnify the power of their thoughts to reach for solutions that can be theirs. Through me, they can see the stars, faintly glimmering in my lifetime, but brilliantly bursting upon them in theirs. I can bring to them the world up close, and take their minds to heights and depths uncharted and unexplored...

I am a converging lens. As a magnifying glass used to focus a narrow beam of the sun's rays to ignite a piece of paper, so I can set a student's imagination on fire. I am the lens through which many diverse thoughts can be focused by a student and have them converge into one intensely burning thought, one exciting, motivating, life-directing idea. And with that focus, if properly pointed, I can change a dormant youth into a raging inferno of ambition, direction, and achievement, one that can set the world on fire...

I am a filter lens. As such, I can colour a student's world with all the colours of the rainbow – I can let them see the blackness of space, the blue of a Colorado sky, bullfight blood red, Mendelian pea green, and Sutter's Mill gold. I can take a drab concept of the world, and turn it into a cacophony of colours that bring alive the world with the flush and blush of life...

I am a prism. As such, I can take the ray of life and humanity, and separate it into the many hues of mankind. I can play these colours across the screen of students' minds, and indelibly impress upon them that the white light of living is in reality made up of a blend of yellow, and black, and red, and all colours of the spectrum. The lens must be constantly polished, if my students are to see clearly through me. It must be wiped with the cloth of new knowledge, the surfaces reground with new technology and the glass kept free of the dust of dogmatism.

My philosophy – and responsibility and fervent desire – as a teacher is to have each student pick up the spectacles of learning, and have their mind's eye look through the lens, and see the world in a new way – to see the world as it has been, as it is, and to see with clear vision what it can be.

Walt Tremer

ACKNOWLEDGEMENTS

One of the skill requirements of the Information Age is the capacity to collaborate effectively and share ideas with people from widely varying cultures, often far distant lands. "Upon What Does the Turtle Stand?" has been a challenging and rewarding practical exercise in this skill. Our sincere thanks to the sixteen authors who have contributed to this publication for their dedication to promoting a debate on ICT and Education, their willingness to share their experiences and projects and their outstanding ability to express their perspectives and that of their country. Several contributions were initially written in French. We are particularly grateful to these authors for accepting to be part of this publication despite the language barrier, and for their collaboration and understanding in developing the English versions of their text. Others authors are non-native English speakers. These we would like to thank for having accepted to write their contributions in English, despite the time-consuming efforts this has involved. Further thanks go to the members of the Global Educator Team, in particular to Paul Newhouse, who provided contacts with authors abroad, spent long hours proof-reading and whose commitment to education has been a continual source of encouragement. The help of Daniel Deberghes of the European Commission, Sylvia McKinley of the US Library of Congress, Alexis Werné from the Luxembourg National Education Ministry, and Anthony van Houts, has also been invaluable in providing information, addresses and ongoing support. Lastly, dear contributors, your extreme patience has not gone unnoticed. We sincerely hope that this is but the beginning of a joint international endeavor to ensure that the ICT-education debate will gather impetus and that our educational systems will embrace the opportunities offered by the challenges of the Digital Age.

One day the great Euclid was hypothesizing with his pupils about the origins of the world.
"Upon what does the world stand?" Ptolemy wanted to know.
"Upon the shoulders of an enormous giant", Euclid replied.
Ptolemy bowed his head and a moment later asked:
"Upon what does the giant stand?"
"He stands", replied Euclid, "on the carapace of an enormous turtle."
Then, raising his voice, he added:
"And underneath there are nothing but turtles all the way down!"

Carrière, J-C. *(1998). Le cercle des menteurs: contes philosophiques du monde entier. Paris: Plon*

AHARON AVIRAM & JANICE RICHARDSON

INTRODUCTION

A Turtling Tale, From Papert to Present

To those amongst the readers who have followed the complex relationship between education and ICT since its early stages, the term "turtle" might associatively recall the Logo turtle of the eighties, a creation that carried with it the promising message of radically changing education through the introduction of Information Technology (as it was then known). This was the message formed by Seymour Papert, founding father of *Logo*, who, for several decades now, has been preaching the constructionist gospel in an attempt to turn ICT (Information and Communication Technology) into the medium that transforms the theoretical teaching dominant in schools into practice-oriented, relevant and meaningful learning. (Papert: 1993, 1993a).

This message became, in various versions and forms, the *credo* of many educationalists and educational reformers in the nineties. Although well known and still powerfully "celebrated" on the level of discussions and declarations, it has actually made little advance "in the field" despite a dramatic augmentation in the power and impact of ICT and the exponential growth in investments in ICT in education. It could, in fact, be said that it has advanced – if at all – at a turtle's pace.

Such was the fate of other no less enthusiastic prophesies that saw in the emergence of the "learning machine" a new dawn for education, and one that could well succeed in resolving many of the fundamental problems from which it continues to suffer. The promises accompanying early enthusiasm for integrating computers in education have, for the most part, by no means come true, yet the process hasn't stopped. The opposite is the case: what in the eighties was still considered a somewhat esoteric – or at least secondary – aspect of educational change has, in the nineties turned into the flagship of all educational reforms, costing trillions of dollars or euros to tax payers. We have very good reasons to believe that this trend will continue to gather momentum in the present decade.

Surely someone has to raise the question: What for?

- What are the goals – which we could still relate to as meaningful, valid, and credible – of this extremely costly and largely unfulfilling endeavor impinging on educational systems all over the world?
- What goals could possibly justify such huge investments on the part of educational systems traditionally renown for economic restraint?

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 1–24.

Here we come to the signification of the turtle in our title. When asking "Upon what does the turtle stand?", we are really asking: What are the guiding values and principals that drive the extremely demanding enterprise of merging education and ICT, or educational culture and digital culture? For now, so it seems, the world of education is literally tottering on its axis for want of a valid response.

THE WIDENING VOID

As we move into the third millennium, the highly regimented, grade-oriented educational systems of Western democratic societies are reeling under the impact of an “Information Society” that arguably no longer promotes the values, patterns of behavior and views upon which our Industrial-Age educational institutions were built. While our educational systems are still to a large extent modern, often even based on pre-modern foundations, our *zeitgeist* and current modes of living are postmodern and changing at an exponential pace. The gap between our prevailing educational systems and structures and the outside world is therefore widening rapidly. To continue our metaphor, the proverbial turtle is having difficulty finding its feet…

The transformation of European culture from nomadic to agricultural or pre-modern structures probably took some tens of thousands of years. The transformation from the agricultural pre-modern to the industrial modern society was a four to five hundred-year process extending from the 15th century to the end of the 19th century. The transformation from modernity to postmodernity has taken no more than twenty years. Yet it is no less radical at all levels of human existence than its predecessors. This explains the “present shock" – to paraphrase Toffler's *Future Shock* – from which we are still suffering, and may explain our difficulties in taking these transformations into account, making sense of them and consciously and systematically responding to them.

Nevertheless, although we struggle to understand the changes Western culture is now going through, many social and economic systems have done quite well in adapting. Economic organizations, for example, on both national and multinational levels have implemented massive processes of "downsizing", "reengineering", "deengineering", "virtualization", "charodisation" etc. over the past two decades. Households are also managing to adapt to the process of accelerated change in communication, consumption, work, financial procedures and leisure patterns brought about by the ICT revolution, a revolution that first became visible in the eighties through the unexpected infiltration of personal computers. In the nineties, Internet and mobile communication gadgets invaded our lives and homes. Neither companies nor households had any real alternative. They had to learn to cope with rapidly evolving new circumstances or lose touch and suffer the consequences – perish in the case of economic organizations or, in the case of households, suffer from unemployment and various forms of malfunctioning.

Educational systems are proving much slower to respond to these changes. This is probably because of the superposed layers of obligation and monopoly that

protects them and overrides the necessity of having to face external pressures to the same extent as other systems. The traditionally and necessarily conservative nature of the educational process undoubtedly also prevents quick response. And so the gap between prevailing educational systems and society is rapidly widening as the void at their very foundations deepens (Aviram: 1996, 1999).

Once upon a time – just 20 or 30 years ago – answers to the question "What is this good for?" (that is, the educational system and the repertory of activities it entails) included:

- Transmission of the sacred and cherished values of Religion, Nation, Culture, Class, Reason, or –
- Preparation of children to the discipline, punctuality, subordination they would need in order to survive the cruel life on the production line, or –
- Channeling of young people according to their merit (or their fathers' income if we adhere to a Marxist or Neo-Marxist view of education), thus promoting mobility and social justice (or preventing mobility and social justice, depending on your viewpoint).

Today all of these good, (not so) old answers seemingly don't hold up anymore. Have they suddenly lost their validity in the postmodern context? Or is it simply that, for the past 100 years or so, they have not been valid reasons for educational practice after all?

The postmodern currents sweeping Western culture have undermined the sacredness of Religion, Nation, Culture, Class and Reason. Not only are they no longer cherished, in many cases they are not even identifiable anymore. Due to ICT, and the connected globalization and organizational revolutions, humanly activated production lines have disappeared and the human characteristics required to operate them have lost their place, at least in our Western society. Not that the world out there is any less cruel (some would say quite the contrary), but the personality traits that served our forefathers are becoming detrimental to our survival. Today diametrically opposed traits are sought for individual and national survival and success.

In a world in which a hairdresser, a DJ, a teen fashion model, a computer programmer, or the energetic entrepreneur who opens the "coolest" club in the neighborhood, may earn much more than a learned university professor, it would seem that the scholastic meritocratic ladder is out of step with reality. It is certainly no longer the **only** ladder or even the most respectable ladder "in town", if in fact it has ever been. Consequently the void beneath the prevailing activities of the educational system is deepening everyday.

THE TECHNOCRATIZATION OF EDUCATIONAL DISCOURSE

Hence, when confronted with questions concerning the aims justifying prevailing educational procedures, most individuals (teachers, parents, policy makers and

researchers) simply cannot give an answer. They can nonetheless not forsake former claims for want of any other reasonable justifications and lack of imaginable conceptions of alternative practices – as several papers included in this volume very powerfully illustrate, it is extremely difficult or even impossible both cognitively and emotionally for most individuals with "schooled minds" to contemplate "unschooled" or "de-schooled" education. Most people simply cling to their claims, as did their parents and their grandparents before them.

To quote an old Indian metaphor (borrowed by the Greeks), we could well say that the most basic prevailing educational, curricular and didactic procedures stand on an elephant that stands on a snake which in turn stands on a turtle – but the turtle, well nowadays the turtle stands on nothing or, as a famous philosopher once stated, "it simply turtles all the way down".

The incessant deepening of the void underlying our educational procedures has led to the "technocratization" of educational discourse and activity. A discourse is considered technocratic when it focuses on means rather than on three essential questions: What are the ultimate aims that these means are supposed to serve? What are the justifications for these aims? What are the criteria that can be used to judge the success or failure of these means? It is, of course, obvious that it is impossible to rationally answer the first question without answering the second, or to answer the third without answering the first: the criteria for judging the means can but stem from the aims they are supposed to serve.

THE HEART OF THE MATTER: ICT AND EDUCATION

There is no area in which the technocratic nature of educational discourse is more obvious and alarming than in the introduction of ICT into the education system. It is a platitude to claim that, as the whole world is adopting ICT, the education system cannot stay outside the game. So far, this has probably been the most remarkable, long-term and costly transformation that has taken place in Western education systems in the past two decades, and it is still barely underway. As it gains impetus it will sweep over the educational system, impacting all aspects of its activity for at least two decades to come. Billions of dollars are being poured into education systems all over the Western world to equip and constantly re-equip schools with the most up-to-date computers on the market, connecting to internet and training teachers to use the new equipment.

What is the purpose of it all? This is a question inadequately answered (and often not even asked) before decisions have already been made. When the multi-billion-dollar process began in the late seventies and early eighties, there was a lot of talk about computers serving as efficient "learning machines" on Skinnerian lines. From the mid-eighties onward, when we began to realize that computers offer no clear advantages in learning when limited to drills and practice, this talk was replaced by the "learner as scientist" scenario, with computers being attributed a role in enhancing "active", "experiential", "project-oriented", "research-oriented" "student oriented" learning. Then it dawned on many researchers and educationalists that, as in the previous stage, we had little empirical evidence to prove the relative

advantage of ICT from this perspective either. There is concern that, to date, computers have not brought about the desired change in pedagogical patterns, not to mention educational achievements however defined. There is a vast gap between what experts would expect teachers to do with technology and what teachers actually do, or rather don't do, with it (as clearly shown by all papers in the second part of this book, especially in the chapter by Pelgrum and Plomp). So today we are starting to hear more diffuse and less committing claims about ICT-based education as enhancing creativity, distance and open learning, collaborative learning, digital-literacy and so on.

If the issue were to be approached rationally, academics and decision-makers would begin by asking themselves the obvious question: What are the ultimate aims of education? Can ICT serve them, and if so, in what ways? Only then, when some sorts of answers to these questions were provided, should ICT be introduced – or refrained from being introduced – into education. However, ICT-oriented discourse and relevant patterns of thought and activity being technocratic to the core, first policy is determined and huge amounts of money invested and only then, in the best of cases, are aims and criteria examined. Furthermore, when empirical findings seem to indicate that ICT does not serve the aims specified, nobody is deterred from further investment in ICT. In a technocratic discourse the aims – when such exist – have to serve the means. Therefore, when it seems that the means do not meet the aims, the aims are changed but not the means (Postman:1992).

The issue of the merger of ICT and education is complex. We believe that if we don't examine it in light of desired educational aims and a broad understanding of the nature of the new postmodern era or cyber-culture and the widening gap between it and the prevailing (still) modern and print-oriented system, then it could lead to the "disintegration" of education or the loss of hegemony of public education systems in Western societies. Public systems are likely to be replaced by split ideological systems, each relying on their own vision. Or perhaps by even more disintegrated "systems" comprising various modes of home schooling, "flexi-schooling", charter schools (run by parents), education in the community – each household, group of parents and community relying on its own educational vision (Hargreaves, 1997). This prediction is based on the belief that education has never existed for a long period without a supporting and guiding vision, in disconnection from the society in which it prevails.

PLATFORM FOR DEBATE

In light of the above analysis of the crisis education systems are currently going through, and more especially the extremely costly ICT-based changes underway, we approached leading researchers, academics and decisions-makers from widely diverse backgrounds in the educational domain to find out their views on the subject. Potential contributors were invited to reflect upon:

- the desired guiding vision for the ICT-based transformation public education systems are undergoing and the predicted or desired future of these systems in postmodern society,
- the extent of the role that ICT should play in realizing their vision,
- their own level of optimism as to the educational system's ability to actually implement this vision,
- strategies that should be employed in the interim as we complete the journey from the modern society to the postmodern ICT-based society.

Not wanting to influence responses in any way, we gave authors *carte blanche* to choose the areas of debate they wished to focus upon and to select their own parameters of response. Authors contributing to this publication were brought to our attention because of the broad spectrum of attitudes they represent in the issues at hand. All are, in one way or another, actively expressing their view through practice in the field, usually on a very broad scale. As we wanted this book to be as representative as possible, and relevant and helpful to people from all paths in the educational domain, the above characteristics are the only common denominators.

Beyond the above, the contributors differ on at least four levels:

- Professionally, they come from a broad range of education-related occupations. They include decision-makers from education ministries, academics specializing in education and leaders of international organizations expert in the field of ICT and education;
- Geographically and culturally, they come from a broad array of horizons including Singapore, Australia, Spain, Greece, Luxembourg, the Netherlands, Poland, Canada, USA, Brazil, Israel, Morocco and France;
- Ideologically, they reflect very different world-views, and this criterion has been chosen as the basis for the order of presentation of their contributions;
- They discuss the issue from broadly varying perspectives: regional, national, pan-European or international.

Our aim in approaching such a heterogeneous group was to see if, beyond their various occupations, nationalities, ideologies and scope, there emerges either a consensus on the above questions and/or a meaningful debate to which the authors contribute different or opposed voices. In other words, we started with a methodological approach similar to the ‘grounded theory’ approach characterizing modern ethnographic researchers trying to gain insight into a specific field of practice. We simply entered the field, asked questions about the reasons underlying the merger of ICT and education, and subsequently analyzed responses in light of the patterns and structures that appeared to emerge.

The book can thus be seen as the first steps of a voyage of discovery into uncharted territory. Our approach offers the advantage of opening new possibilities inconceivable to us had we mapped our terrain first, and subsequently approached contributors with a pre-conceived schema in hand. There again, it may have led us to overlook important viewpoints existing in the field, or to interpret responses in ways that would fit the structures and patterns thus defined.

It appears that we have succeeded in identifying a broad consensus amongst the contributors as to the urgent need to integrate ICT in education. Authors further agree that implementation should be based on a new educational paradigm if meaningful changes are to be made in educational processes and activities. Above and beyond this basic consensus, we located two potential points of debates relating to issues that lie at the very heart of educational change. These concern:

1. the scope and nature of the desired alternative paradigm;
2. measures suitable for overcoming obstacles impeding the propagation of the new paradigm in educational practice.

FROM GLOBALIZERS TO HERETICS

In terms of scope and nature of desired educational changes and the visions guiding them, four major categories of responses emerge. We have therefore divided the book into four parts. Part One brings together the papers of authors who appear to see the integration of new technologies in education as a means of integrating the recently formed knowledge society and the global economy. They applaud the economic, organizational, professional and labor market changes deriving from and, in their opinion, extensively enhanced by ICT. These authors – for us, the Globalizers – support the integration of computers in education as a means of gaining a competitive edge in the global knowledge-based economy. Computerization for them is a process that can lead educators and students to master the skills and strategies necessary to use new technology efficiently and to mindfully navigate in the cyber-world. Although these writers emphasize the need for new skills (meta-thinking, critical thinking, creativity) and learning procedures in education as a result of the very nature of ICT and the global economy, they don't suggest that a **wholly** new educational paradigm is required. They could be said to prescribe to the old paradigm with the addition of a few meaningful changes in keeping with new times and new requirements.

Papers in the other three sections suggest (with differing levels of radicalism) that the successful merger of education and ICT, and adaptation to the new reality epitomized by the merger, requires a wholly new educational paradigm and vision. In Part Two – the Reformists – readers will find chapters from five authors who adhere to, but go beyond, this view to focus on the need for a holistic transformation in school didactics, advocating constructivist, active and student-centered didactics as well as curricular and organizational changes.

It is not always clear whether these authors envisage the new didactic paradigm simply as a means of achieving the goals put forward by the Globalizers (i.e.

competitive edge in the global economy), or because it rightly reflects the aims of education on an independent ethical and/or social basis. In the case of the latter, ICT could be seen as no more than a lever for realizing a form of constructivism justified for its own sake. Most authors in this section express a combination of both views, never clearly distinguishing between them.

Whereas the papers in Part Two focus on the didactic level and only hint at other levels or external values peripheral to their main line of thinking, the five papers in Part Three – the Humanists – refer not only to the need for new didactics but also the need to reshape education in light of considerations reflecting a set of Humanistic values. They go beyond didactics and the economic context to highlight a third level of considerations, to them apparently the most important. They claim that educational change in general and the computerization of education in particular should be conducted in light of what they deem to be generally desired Humanistic values. These differ from author to author, and range from individual and social to ecological aspects – a very meaningful difference that we shall elaborate on later.

This by no means implies that authors from the other three sections are not motivated by values. Enhancing economic development, promoting didactic changes in a constructivist spirit, and championing emerging new values whatever these may be, or at any rate ensuring they are not stifled by old fashioned "Gutenbergian" values, are all important motives for educational change. For example, Dr. Rochdi's desire to enhance the development of the Moroccan economy and of its citizens is more than likely founded on her desire to guarantee their well being, which is certainly a Humanistic value. The same can be said of most authors contributing to the Reformists' section. Basic Humanistic values – i.e. the development and empowerment of the individual or the strengthening of communal relationships appear to be important guiding values for all.

Nevertheless, whilst the Humanists' visions usually encompass the views expressed in earlier sections, they explicitly structure their papers on a set of basic Humanistic values. They:

- explicitly point to these as the ultimate aims of education and hence the integration of ICT,
- operationalize them to deduct a desired educational reform policy, and –
- make it clear that all other considerations can only be secondary.

None of the papers included in other parts meet all of these conditions.

Part Four – the Heretic – consists of just one paper by an author who, whilst adhering to the idea that education should be guided in light of ethically and socially desired values, goes further to question the possibility and desirability of us deciding values for the future. He claims that today's values can reflect no more than the current technological reality, which is changing at a dramatic rate. We therefore cannot and should not attempt to dictate values for future generations.

OBSTACLES TO OVERCOME

Responses to the second question about measures to be taken to overcome the obstacles now impeding the propagation of the desired vision within educational practice reflect a status quo. Most decision-makers, academics and educationalists, at least on the declarative level, share the constructivist view. Nevertheless, after almost twenty years of extensive efforts (with or without ICT) to implement this in the daily practice of teachers, there is still a long way to go. It is therefore understandable that the "Reformists" grapple with the challenging question as to why "it" (the "constructivisation" of education through the introduction of ICT) is just not happening. They seek causes for the large gap between (what they take to be) the desired vision and the reality, and means by which these can be removed.
In spite of the internal nature of this debate, it is to a limited extent relevant to the Globalizers and the Humanists, too. Both aspire to bringing about meaningful changes, be they more moderate or more utopian. Many of the latter group have, as practitioners or theoreticians, attempted to restructure educational institutions, though usually from within the constructivist "camp". Perhaps, once they reach the stage of seriously and systematically trying to implement their view as Humanists, their discussion will also turn to obstacles to educational change.

Our Heretic has little to say about overcoming obstacles. He seriously doubts our epistemological ability to form any vision that could guide the education of future generations since living conditions are changing so rapidly all the time (largely due to the ICT revolution). He also questions the epistemological possibility and ethical legitimacy of our editorial undertaking, and casts doubts on the truth values of the suppositions on which this book is founded, hence on the necessity and justifiability of the whole project. We obviously don't accept his view – if we did the book would have no reason to exist. We do, however, believe that the deep skepticism he expresses makes a valuable contribution, especially in a book dedicated to the enhancement of serious rational discourse on a subject that up until now has only been dealt with from a technocratic point of view.

We feel his paper offers an appropriate conclusion to a book organized in what could be called a "dialectical manner", each Part being in disagreement with the one preceding it, though encompassing and transcending the views presented by previous authors. This is exactly what Hegel and his fellow Idealists meant by the German term "*aufhebung*" which they used to express the essence of dialectical development enabling the advancement of rationality and understanding. By ending the publication with an "*aporia"* – another term in dialectics by the ancient Greeks to infer "lack of solution or decision" – we invite readers to ponder on the subject individually or with others sharing a similar interest.

Before we turn to the papers themselves, a few words of caution. We could have organized the book in any number of ways using as parameters countries of origin, professional identity and perspectives, 'northern' versus 'southern' perspectives, or educational visions. We chose the latter, because our ultimate goal was to develop rational and mindful discourse on ICT and education by seeking meaningful differences between prevalent visions. By focusing on *differences* we may have

skimmed over claims common to writers across the borders separating the four groups. We believe that the differences we located are real ones, but acknowledge that by emphasizing these differences perhaps certain common elements were insufficiently highlighted. We nonetheless believe that our ultimate goal, to extract the deepest and most meaningful questions and basic patterns of response to develop a foundation for possible and desirable debate, justifies our decision.

THE GLOBALIZERS

The opening paper from Singapore very effectively sets the scene for the debate as it clearly and systematically portrays the broad-scope policies and the immense effort and investment that one of the world's most advanced countries has made to introduce ICT into education. Because of the approach it has adopted towards ICT in education, Singapore is nowadays the object of envy for many educational professionals and decision-makers in countries the world over (cf. the positive references made to Singaporean policies by Drs Pelgrum and Plomp in a later chapter).

The information given on policies, effort and investment dedicated to ICT over the past few years in a country that serves as a model to many other societies sets a productive backdrop for raising key issues such as: What are the ultimate goals of the exercise? Are they being achieved (or are they achievable)? The paper itself only hints at responses to these questions, in particular in relation to the desire to enhance creativity and critical thinking through the use of ICT – attitudes or skills taken by the author to be necessary conditions for effective functioning and competitiveness in a global knowledge-based economy. Dr Chee-Kit Looi and Dr W.L. David Hung do emphasize the importance of other educational goals in the Singaporean society, in particular traditional social and family values, but they do so without indicating how these values are influencing or should influence the introduction or use of ICT in Singaporean education.

In juxtaposition to the previous paper, the second paper interestingly reveals similar visions guiding the computerization process from the perspective, however, of a former decision-maker. Dr Najat Rochdi, formerly Director for Cooperation and IT Development in Morocco's Ministry for IT and Postal Services and currently advisor to the United Nations' Development Bureau in Beirut, underlines the problems facing developing countries poor in Information Age resources and still struggling with basic issues such as school attendance, literacy and an acute lack of equipment. What for Singapore is a matter of daily reality is, for Morocco – as reflected in the paper – utopia. Common viewpoints are however evident, for example, when the Moroccan author states: “A new economy is emerging – an economy in which the mastery of technology, networks, services, and the production of contents in national languages will constitute the essential vectors of power within the framework of globalisation. However, no nation can afford to lose sight of the fact that, at the very heart of this veritable digital revolution, is Man. Man of today and, above all, Man of tomorrow. Man that we should be training and preparing to confront the challenges of the information and knowledge-based

society. It is therefore essential that we implement measures to reform our education systems, as only education can ensure the task of preparing men and women capable of handling not only ICT tools, but also the changes in modes of operation and culture that they will bring."

THE REFORMISTS

Whereas the Globalizers appear to suggest that efficient functioning and competitiveness in the global knowledge-based economy are the ultimate or most emphasized aims of education, the Reformists propound above all the need to meaningfully reform education in terms of approaches to learning. Their vision is presented in turn as either stemming from the previous aim or having an independent ethical value. The writers do not explicitly distinguish between the two and would perhaps, if asked, adhere to both. There are, however, fundamental differences in tone and emphasis among them on these issues.

The first paper in this part is very broad in scope, and was written by Drs Pelgrum and Plomp, from the University of Twente in the Netherlands. Both have been leading figures in the field of international research on ICT in education since the late eighties. They base their chapter on the findings of two large-scale comparative international surveys they directed for the International Association for the Evaluation of Education, as well as on more specific research in Holland.

Drs Pelgrum and Plomp compare research results to present an emerging educational paradigm, that focuses on active, constructivist learning. They examine the meaningful changes that have taken place in leading educational conceptions in light of this paradigm and the much more moderate changes evident in practice. They decry the acute lack of empirical research that is depriving us of adequate means for understanding this gap and the factors behind it. On the basis of the little available data, they hypothesize as to the reasons for the failure of the desired vision to modify educational practice, pointing to key issues such as:

- an inner contradiction between prevailing didactics and the requirements of the new paradigm,
- lack of sufficient computers and software in schools,
- lack of basic skills amongst teachers.

At one point they also hint (this time in a pessimistic and deterministic mood) at the inability of teachers of the older generation to come to grips with the wholly new concepts, goals and methods of the new paradigm.

The next four chapters adopt the basic claims made by Drs Pelgrum and Plomp, that is to say, the need for the educational system to move to a paradigm based on active, student-centered learning, the importance of ICT in this move and the fact that although this new paradigm is seemingly broadly adhered to, in practice it is very far from being influential. All four authors focus on the gap between theory and practice, whilst attributing the cause to different factors and prescribing different strategies to reduce it. The authors mention various possible, and often overlapping, factors, but emphasize the one they believe has more impact than the others.

The first among these is written by Dr Paul Newhouse from his perspective as an Australian researcher and academic working in the School of Education in a West Australian university. Dr Newhouse describes the move in Australia towards the new paradigm and the failures up until now to implement it extensively in the educational field. He then raises the possibility that it is the actual immaturity and unreliability of technology, and the stemming difficulties of teachers and students in using it comfortably, that hinder the practical propagation of the desired vision.

From here Dr. Newhouse proceeds to consider the possibility of the rapid spread of mobile, wireless computing that is expected to sweep all Western societies in the next years as a possible chance for removing some of the barriers hindering the practical emergence of the new paradigm. He bases his findings on research he has led in the use of mobile computers in Australian schools. His conclusions are far from conclusive: while he has detected some improvement in the extent and mode of computer use, the changes are certainly by no means revolutionary. He leaves readers to ponder on whether the expansion of wireless computing and the upgrading of mobile computer capacities and robustness in the forthcoming years will contribute in this vein.

Robert Bibeau, a Canadian educationalist and researcher responsible for several region-wide ICT based projects in Quebec over the past few years, takes quite a different approach. Like his predecessors, he too starts by emphasizing the need to enhance the emergence of the new paradigm in educational practice and the difficulties encountered to date. He sees the problem as being an organizational one – the lack of systemically concerted efforts on the part of schools and regions to bring it about. Thus he considers and recommends various factors that could contribute to change.

The following chapter was written by Dr Nikas Kastis, from the Lambrakis Research Foundation in Greece and CEO of Menon, a pan-European organization located in Brussels and working towards enhancing effective implementation of ICT in education. Dr. Kastis identifies another major obstacle to meaningful educational change: the obsolete structures of prevailing professional development processes for teachers and, more particularly, the sectarian division between pre-service and in-service teacher training. He therefore recommends a third strategy– a radical change in the most basic structures of teachers' training and a blurring of the distinction between pre-service and in-service training.

The final chapter in this section was written by Janice Richardson, consultant to the Luxembourg Minister of State for the implementation of ICT in education, culture and research. Analyzing the results of a four-country survey she carried out for the Education Ministry on implementation policies and findings from other research projects she has conducted, Ms Richardson points to many reasons for hope, from the constructivist perspective. She discusses the characteristics of ICT that have the potential of enhancing constructivist learning and raising the level of literacy in its broadest sense, and relates to several interesting success stories in this field. She nonetheless underlines the universal gap between the desired paradigm and the existing patterns of educational activities, and presents a theoretical model

that highlights three categories of variables that have to be dealt with simultaneously by schools if they are to support didactical changes:

- School climate, or the need for teachers to share "a common vision" of what they are striving to achieve and a strong commitment to making the transformations work;
- ICT knowledge, or the need for effective knowledge transfer mechanisms between pedagogy and technology knowledge domains;
- An effective ICT management system for the complex and sophisticated processes involved, e.g. work-plans, technical maintenance, evaluation, follow-up, etc.

Ms Richardson suggests that unless all three areas are addressed positively and simultaneously, the ICT-based active-learning model is not likely to be implemented in any sustainable way. She points out that guaranteeing even minimal standards in each of these areas requires not only adequate resources but also high-level skills, sophisticated strategies and a sustained effort from the school management or leadership. This, she considers, accounts for the few success stories and the many disappointments in this regard.

To conclude, the Reformists share a basic belief that an active-learning paradigm is needed if we are to practically transform education. They seem convinced that without this major paradigmatic change the huge potential of ICT will not be expressed, and that ICT has an integral role to play in the process. They are apparently aware and deeply concerned that the new paradigm is far from being a dominant feature of educational practice today. The present impasse is attributed to a variety of factors that differ broadly in terms of gravity and predetermination, that is to say, likelihood of being overcome. We can summarize these, in ascending order of predetermination (and hence pessimism in regards the possibility of sustainable change), as:

- Insufficient efforts to supply schools with suitable equipment and offer teachers opportunities to develop skills necessary for the integration of ICT (Pelgrum and Plomp)
- Fragmentary and unconnected nature of the change process accompanying the computerization process (Bibeau, Richardson)
- Lack of efficient ICT management in schools (Richardson)
- Obsolescence of prevailing professional development processes for teachers (Kastis, Richardson)
- Immaturity of technology – which is still not holistic, sufficiently mobile, wireless, ubiquitous or reliable (Newhouse)
- Cognitive barriers preventing teachers, especially the older generation, from really switching to the new paradigm (Pelgrum and Plomp).

In a world of endless resources, compatible policies could be developed to overcome these six categories of impeding factors, but this is currently not the case. Nowadays available budgets have to be fought over and priorities set for spending the taxpayers' money. We therefore propose that all six could actually be covered in four or five policy recommendations:

- the first factor calls for an extension of budgets to provide resources for more equipment and training for teachers;
- the second requires that extra funds be channeled into rethinking and restructuring change processes at the organizational level in order to create more concerted and systemic modes;
- the third and fourth involve a radical reshaping of teachers' pre-service and in-service training processes;
- the fifth factor seems to call for a 'sit-and-wait' policy (budgets hence being channeled in the short term to other areas where they are badly needed); if we follow the analysis to its logical conclusion (which the author himself does not do), the ensuing recommendation would probably be to stop wasting scarce resources and wait until technology is more mature; in the meantime investments should aim at pilot research and teacher professional development;
- the sixth leads to a similar recommendation for different reasons. Followed to its logical conclusion (once again the authors don't do this) it may follow that we just have to let the 'desert generation' die (or at least retire) and, in the meantime, why invest a lot of money that can't achieve much? Alternatively, maybe we should set ourselves more cautious and moderate goals but continue investing in the present generation of teachers (this seems to be the attitude adopted by the writers making this point).

In short, Reformists generally agree on the need to base educational practice on a new paradigm, on the lack of evidence to prove that this is being done on any meaningful, extensive or sustainable scale, and on the urgency to awaken serious debate on desired educational policies. So far, no real platform has been provided for such debate. We hope that by aligning contrasting views on the subject, we will enhance the development of discussion.

THE HUMANISTS

Although the Reformists' views predominate amongst professionals and decision-makers in the world of education, they are not unanimously acclaimed. In the third part of this book we introduce five authors expressing very different views about the nature of the desired vision. The common ground amongst them is their belief that

the vision for the integration of ICT in education should be built upon the (assumed) ethical values of a given society, values that are considered good in themselves and not simply derivatives of some economic or didactic need. All accept that education is about preparing for life in the economic world, but see this (and hence educational reform meant to enhance the merger with ICT and cyberculture) as a process that should serve the most elevated values – those that accord human life meaning and worth. They nevertheless reflect a fundamental disagreement as to what these values are, and as to their origins and source of legitimacy.

Each of the authors deals with the nature of the desired values in a declarative manner, without addressing the question explicitly or even hinting that other answers are possible. Basically, the chapters in this section can be divided into two categories, depending on origin and source of authority of the values promoted. The first category (the paper from Dr Deberghes) hints at a transcendental origin and source of authority, whilst the second (all of the other papers) refers to Humanistic or democratic social views representative of contemporary Western societies. In terms of nature of desired values, the authors appear overall to adhere to four different priority scales, with emphasis on:

- universal spiritual values (Dr. Deberghes),
- individualistic values (Dr. Aviram and, to a lesser extent, Dr. Sancho, Ms Naughton, Mr. Kulerski and Mr. Ryan),
- community and equity-oriented values (Dr Jacobi, to a lesser extent Mr. Kulerski and Mr. Ryan and perhaps also Dr. Sancho and Ms. Naughton)
- a deep commitment to the future welfare of our planet (Mr. Kulerski and Mr. Ryan).

Authors are not actually in contradiction with each other, since probably none would reject the values underlined by the others. In a world of scarce resources, however, even small differences in priorities can make very meaningful differences when translated into actual policies.

The first chapter expresses, in a poetical paraphrase of Saint Exupery's literary masterpiece *Little Prince,* the ideas common to all writers in this section. The author, Dr. Deberghes, makes it clear that for him education is a far broader project than teaching in the conventional understanding of the term. It means initiating pupils into the deeper meaning of life, and into the values that make the life of human beings worthwhile. He hints that these values are (but here we take the risk of wrongly interpreting Dr. Deberghes' rich and somewhat elusive poetical metaphor): understanding the unity basic to this universe, communication (in a deep non-trivial sense of the term), and love (which, when properly understood, is always non-trivial).

The poetical nature of this first chapter prepares us for the transition from the didactic paradigm of the Reformists to the more values-oriented paradigms of the Humanists. But Dr. Deberghes does not go beyond his metaphorical presentation of the ultimate guiding values of the educational process. Nor does he speak of origin or source of authority of the values which to him are universal and eternal and have

nothing to do with era or social circumstances. The rest of the chapters in this section follow a more conventional format and seem to point to a more worldly, socially-oriented set of values. Kulerski and Ryan, and also Dr Aviram, attempt to make an exhaustive list of desired values, with only the latter author offering operational definitions and a methodology for their implementation in education. Had the other authors done so, the differences between their views would probably have been accentuated, but for most these issues are still a challenge yet to be met.

Dr. Sancho takes us on a voyage of discovery to show that the implementation alone of ICT-based education will not automatically lead to the integration of the values we aspire to. She closes her chapter with three scenarios for the future. In the first, a default or "inertial vision" scenario, she states that "schools led by institutional inertia, ignorance, administrative pressure, lack of investment and the connivance and disinterestedness of certain teachers will maintain the same pedagogical and organizational structure" and will "integrate ICT in a technocratic and hence failing manner". In the second "technological vision" scenario, schools will end up "succumbing to the market desires" to become partially more flexible but basically serve only or mainly market values (a scenario quite close to the Globalizers' vision). In the third "social vision" scenario, she describes a society that recognizes "more and more the importance of education in fostering not only material progress but also the moral, spiritual and emotional advance of individuals and groups". It is quite clear that for Sancho this is the desired scenario, though the one she believes to be the least probable and the most "utopian" of the three (in her terms, the most "hypothetical").

In the third paper the author, Ms Rosemary Naughton, starts out by describing a more conventional skills-oriented and didactic understanding of future schooling, before moving on to a discussion of the social humanistic values underlying conventional didactic aims. In her terms it is "The increasing focus on the importance of the socialization of schooling" that should be emphasized, i.e. the need to direct ourselves in light of the ultimate aims of schools as ensuring that "students complete schooling with a positive self-image, the motivation to achieve, a values framework, a belief in themselves, a positive attitude to contribute to society and to continue learning after schooling". This obviously goes beyond the economic and the didactic. Ms Naughton examines the enlarged educational role that has to be accorded to schools now that the family structure – locus of responsibility for educating the whole personality in previous generations – is gradually weakening. In postmodern society no alternative locus of responsibility for education would be left were it not for schools.

Ms Naughton dedicates the central place in her paper to illustrating the general lines of what Sancho calls the "social vision" – it seems that both writers agree to the values guiding such a vision. She advocates a radical shift from teaching to tutoring, from dictated curriculum to curriculum formed by the learner, a move that requires schools to open their borders and integrate both the close and distant environment. Hence the huge importance of ICT: **"**In this world schools become physical and cultural sites of connection for communities. What, when, how and in what environments learning takes place is determined by self-managing learners.

Learning is accessed at any time or place and learners in communities work in partnerships with each other to enrich the quality of their lives".

Ms Naughton discusses the steps that will have to be taken in the short term to overcome the huge obstacles of inertia, fear and vested interest that are impeding progress towards the desired vision. The key concept seems to be "partnerships": **"**To manage a thriving learning community involves close integration of schools within local area business and community organizations that goes beyond tokenism. If done effectively, this will provide for greater identity with – and ownership of – the school by the community. The importance of ICT in this context is clear: "Information and communication technologies are generally the tools that initially connect the educational, economic and social aspects of these learning communities". At the same time Ms Naughton points out that ICT is no more than a (hopefully effective) means for the implementation of humane and social aims and that the technology should be subordinated to desired values and controlled by the mechanism "representing" them. "They (ICTs) are not however the panacea for all ills and constructive interpersonal relationship mechanisms must be set up to effectively maintain communication and initiatives."

The next paper is by Dr Aharon Aviram, head of the Center for Futurism in Education at Ben Gurion University. He has been deeply involved in national and international initiatives in the field of the integration of ICT and education in recent years. He shares many of the ideas expressed by Dr Deberghes and, on a more practical level, by Dr Sancho and Ms Naughton. He underlines the need to harness education to humanistic values, to go beyond the economic and the didactic, to take into consideration the changing circumstances stemming from the ICT and other connected postmodern revolutions, to make optimal use of ICT for this purpose and to subordinate it to requirements and mechanisms related to chosen educational values.

Perhaps the most important point of concurrence with the two previous authors is his claim that, within the new context, the school should completely change its mode of operation. From its former role as an institution supplying all the necessary services related to its social role within its own walls, it should shift focus to **educational responsibility** (in light of desired humanistic values), **communication** (between students, and with relevant learning partners and resources in their developmental process**)** and **tutorship** (based on basic educational values, to accompany students in the experiential process which would take place mainly outside the school's physical or even virtual walls).

In contrast to the two previous papers, written at micro levels and focusing on the process of school change and teachers' mobilization to this process, Dr Aviram examines the situation from the macro level. He takes a closer look at the large-scale education crisis Western societies are currently undergoing, and at systemic policies that could allow for and enhance changes to help overcome this crisis. He begins by analyzing the "void rapidly opening under the foundations of our educational systems", a void brought about by the disappearance of the basic educational aims that guided Western systems until a generation or two ago. Educational policies, he points out, should be based on strategic thinking corresponding to the needs of

postmodern democratic societies and taking into account three basic elements. The first is a coherent and in-depth understanding of postmodern culture, as well as of the impact of the ICT revolution and today's cyber culture on the basic concepts and suppositions inherent to prevailing educational systems. The second is the ethical perspective, i.e. a "clear, coherent and operational definition of the desired aims of education as they stem from the world-view or ideology of whoever decides upon educational policies". The third element results from the previous two: a strategic plan built on the **desired** educational aims in the **given** situation such as it has been analyzed.

Dr Aviram ends his chapter with recommendations recently put forward by a committee appointed by the Israeli education ministry to draw up a strategic policy for the merger of ICT and education. They are constructed from an ethical perspective on what he claims to be the three fundamental values of education in Humanistic and Democratic societies: the enhancement of personal autonomy, morality and belonging.

The assertions made in most chapters in this section are rather theoretical, even Utopic, with the exception perhaps of Aviram, though his recommendations have not yet been implemented either. The next chapter recounts the practical experience, and to some extent empirical finding derived from it, of Dr Pedro Jacobi, an economist and sociologist from Brazil. His chapter is most important from another viewpoint too: it is one of the two papers in this publication to be written from the perspective of a developing country. Dr Jacobi begins with a description of the huge social and educational problems existing in Brazil, largely due to the high level of poverty and social inequity. He then moves on to describe current and forthcoming projects in various Brazilian cities led by volunteer associations in the aim of providing underprivileged individuals and excluded social groups with access to ICT.

The author focuses more specifically on a project intended "to promote information technology as a means to social development, making it accessible to sectors of society with hardly any possibility of acquiring it otherwise" and "to strengthen notions of citizenship and human rights and promote social empowerment within communities, the premise being that through the development of partnerships it may be possible to help integrate those excluded from the digital era".

Although it would seem that Dr. Jacobi does not object to the guiding visions expressed by the Globalizers and the Reformists, it is clear that for him the priority lies in the promotion of ethically desired values such as social integration, social equity, empowerment of excluded individuals and groups, and the strengthening of awareness of human rights. Although all writers in this section would obviously embrace the values he presents, he emphasizes first and foremost the social values of equity and integration whereas the others focus on more individualistic values such as autonomy and self-realization. This could reflect an ideological rift. While Dr Jacobi expresses more communitarian views and sees the community and the social group rather than the individual as the subject of education, the other authors tend –

in varying degrees – towards more liberal or individualistic viewpoints. To them the community is mainly taken as a context for the development of the individual.

This could be due to no more than a simple difference in priorities. For Dr. Jacobi too, communal empowerment, social equity and integration are meant to ensure all individuals the potential for self-realization. Rather than being the ultimate aims, they may hence constitute the means that have to be met en route to realizing the very goals cited by previous authors. This difference in priorities is easily understandable given the poor living conditions of the majority of the population in Brazil that he describes in the opening section of his chapter. Whatever the case, these differences could have major implications when translated into actual policies.

The final contribution in Part Three is co-authored by Wiktor Kulerski, a former Solidarity leader and Secretary of State for Education in Poland who has since been more specifically active in promoting democratic values in education, and Terry Ryan, an American citizen and senior researcher for the international 21st Century Learning Initiative. These authors move from the descriptive practical perspective of the Brazilian author to the purely normative perspective adopted by the other authors in this section. Although Kulerski and Ryan adhere to the constructivist view of active, student-centered learning, they consider that changes in education should be driven by a vision based on the Humanistic and ecological values of self-direction, universal human rights and, to use their terminology, the respect for "the rights of nature", that is to say, a deep commitment to vast future-oriented ecological considerations. They present us with a third option on the Humanistic vision of education, transcending the individual and the social to emphasize a commitment to the ecological future of our planet.

To conclude, in contrast to authors in Parts One and Two who appear to view education as mainly consisting of learning and teaching *(*although they do make some allusions to possible broader goals that are not clarified), the Humanists seem to view education as a much broader *educating* process, that is to say, a process aimed at the development of the whole personality in light of basic values they consider "good in themselves". Although they all indicate that humanistic values should guide the educational process, there are meaningful differences among them in the understanding of these values, as different authors prioritize individualistic, communal, ecological or spiritual values.

THE HERETIC

All papers in Part Three point to desired values and hence, mutatis mutandis, express a belief in the ability to know what these are and in our right, or even our duty, to educate the younger generation in light of them. The same applies, to some degree, to papers in Parts One and Two which, although they don't actually point to "exalted" values as the desired aims of education in the future, do put forward some form of guiding vision. This cannot be said of the last chapter in this book. Author Dr Jim Dator, Director of the Hawaii Research Center for Futures Studies and for many years President of the World Futures Studies Federation, questions the very

assumption shared as a most natural starting point by other contributors – he doubts the epistemological possibility and ethical justice of propounding values or visions for the future. Hence the name we have given to Part Four.

Indeed, Dr Dator expresses the view that it is both impossible and undesirable even to attempt to form visions and value systems that will or should lead education in the future, since value systems to him are expressions of culture while culture is the result of the technology basic to it. According to him, the powerful ICT revolution is only in its initial stages and is certainly going to change our world in ways that exceed our capacity of imagination – we are still thinking and evaluating in light of a culture formed by the technology of the printing machine –, so there is no point in using our present values and conceptions to try to tame dramatic revolutionary changes. It is, he considers, undesirable to attempt to tie future generations to value systems that may be neither relevant nor meaningful to them.

Beyond the divide seemingly separating Dator from the "Humanists" and maybe also the "Reformists", a very deep difference is evident in the understating of the relationship between technology and culture. For the former group, values (the core of any culture) can to some extent at least direct and influence the development or use of technology, but for Dator (who echoes to a large extent the views of McLuhan) the truth is that it is technology that determines culture and values. Values for him are nothing but shared expressions of human modes of living (i.e. culture) shaped by dominant technologies. This highlights a deep conflict between technological determinism (Dator's view) and indeterminism (the Humanists' and maybe also the Reformists' view) that could have a major impact on the desired discourse on ICT and education

ALTERNATIVE READING TRACKS

We began this introductory chapter by claiming that most of the discourse currently taking place on ICT in education is technocratic. We decried the fact that few questions are raised about the overall goals and visions guiding this very demanding and expensive process confronting educational systems, and hence about the nature of our educational systems for the generations to come. By highlighting the (usually tacit) points of agreement and disagreement between the contributing authors on the most fundamental issues, we hope that we have enabled readers to draw up some sort of preliminary and tentative "road map" that will assist them as they work their way through the rest of the publication.

Beyond establishing a general map, we would like to suggest alternative "tracks" in the charted terrain that respond more directly to the preoccupations of different populations of readers. For practical purposes we will define reader groups as *students*, *researchers* and *policy makers*, though obviously this publication caters to the interests of a far broader population than that. The three tracks we suggest progressively "zoom in" on the subject to offer an increasingly detailed picture from three different points of view.

The first track is mainly intended for students and readers with little systematic prior knowledge on the subject and seeking a first overall view of the terrain. Such

readers would be recommended to begin with Part One in order to gain a bird's eye view of the overall vision of the Globalizers from the two opposite poles on the 'wealth continuum". Here we have, on the one hand, one of the richest nations on the globe struggling to keep its edge in the global economy and, on the other, a poor nation struggling to enter the global game. The basic value they promote is the same: competitiveness in the global economy. The basic view is the same: ICT-based education can "do the job".

Readers are recommended to approach Part Two in two successive stages, beginning with specific examples of what could be called the reformist vision, with all its frustration and enigma (when we take into consideration the low level of success in achieving the vision). Here we suggest chapters from Spain (the paper by Sancho), Canada (Bibeau), and Australia (Newhouse). They could then move on to Pelgrum and Plump's paper, which describes the same vision, frustration and enigma from a broader, international perspective. For readers who prefer to move deductively, the other order is recommended: begin with the latter that describes the general picture, before tackling more specific examples.

Readers could limit themselves to just two chapters in Part Three: alternatively that of Kulerski and Ryan, or of Aviram or Jacobi. The former two set out to define a normative 'grand vision' of ICT-based Humanistic education whilst Jacobi, on the other hand, supplies us with a concrete and moving example of how ICT has been used for educating street children in Brazil in light of Humanistic values.

To conclude, readers are advised not to miss Dator's chapter in Part Four, as he questions the very foundations of this publication or, as he puts it, the moral right and epistemic capacity to decide in advance on guiding values for ICT-based education.

The second track would lead readers to discover the two distinct sets of goals that apparently guide all authors except Dator, and to explore the relationships that authors tacitly or explicitly suggest exists between them. These goals – didactic and *social* – are expressed more or less emphatically. Social goals refer to the contribution education supposedly makes to individuals and society or, more idealistically, the ultimate good that society – and the individuals that make up society – expects from education (*Economic* vs. *Humanist*). Didactic goals refer to the desired content or learning methods, that is, the achievement of *higher standards of theoretical knowledge*, *higher levels of general and ICT literacy*, enhancement of *active learning*...

This track would appeal more to policy makers or readers who already have a bird's eye view of the terrain and wish to go into greater depth, since it underlines:

- the two basic options open as guiding aims for the computerization of education: social or didactic goals,
- potential relationships between different sets of social and didactic goals,
- meaningful policy differences stemming from various combinations of social and didactic goals.

The way ICT is introduced to education and educators will vary extensively depending on whether it is intended as a means of raising knowledge standards (Dr. Chee-Kit), raising levels of general and ICT literacy (Dr. Rochdi), or enhancing active learning (writers in the Reformist section). The three alternatives involve very different:

- modes of teachers training and support;
- computer programs;
- decisions concerning acquisition of computers and equipment;
- design of the learning environment and location of computer;
- modes of technological support (see Richardson's model on a holistic approach to the merger of ICT and education).

Readers following this track would therefore need to read both chapters in Part One, and select chapters from Part Two according to their points of interest. The chapters from Sancho, Naughton, Jacobi and Aviram would provide for broader insight in terms of social goals, whilst offering clear recommendations for policy-makers.

The third track goes a step further than the first and second tracks to critically focusing on the main problems stemming from arguments basic to chapters. The argumentation in all four sections gives rise to a rich array of interesting research questions. These need to be systematically tackled if we are to adopt a rational approach to integrating ICT in education.

Part One raises such questions as: Do higher standards of theoretical knowledge or general literacy really lead to a higher level of economic development? This is a debatable point. After all, certainly there are countries with a relatively low level of theoretical knowledge or general literacy and a high level of economic development? Or countries with a high level of theoretical knowledge and general literacy, but poor economic development (Bulgaria, for example)?

The concept of "Digital Literacy" central to Dr Rochdi's chapter is becoming a dominant issue, though its perhaps still too recent to have been given a clear definition and a sound theoretical and empirical backing. This opens up a whole new area of conceptual, theoretical and empirical research. Both chapters in Part One give rise to a far more basic question that few policy-makers have taken the time to consider: Do we have good enough reasons to believe that ICT can enhance theoretical learning? To put it more concretely: would Singapore be doing less well in this domain without ICT? Does ICT enhance the acquisition of general literacy? Or, more concretely: would Morocco's literacy campaign be any less successful without ICT?

In both cases, research to date can supply us with no simple, positive answers. Much more research is needed – especially comparative research on an international level – before we can even begin to respond.

One major research question will spring to the reader's eye in Part Two: Why has the constructivist vision done so poorly over the past twenty years, as far as practical implementation in education is concerned? All authors in this section of the book are explicitly and deeply bothered by this question. Each suggests his or her own hypothesis as to why it isn't working, and their hypotheses merit a thorough

examination if we have any intention of succeeding the merger from the constructivist point of view. This presents two major research challenges:

- The setting up of large-scale comparative studies such as those mentioned by Pelgrum and Plomp in order to discern, beyond cultural, national and regional differences, the elements that account for success or failure when implementing active, learner-oriented and ICT-based educational environments.
- The creation (to large extent on the basis of findings of the above research) of elaborated models for systemic decision-making on relevant issues at both the macro and micro levels.

The authors in Part Three raise research questions of another type, their visions being somewhat utopian and removed from the reality of everyday educational practice. We cannot help but wonder if there is any real chance that their visions could be implemented in the intermediate to long term on a systemic level? Or are these papers only intended to supply us with ethical horizons against which we can evaluate ourselves, knowing that we will never come close to implementing the views expressed in them? If we were to try to implement these visions, how would we go about it in the short term?

Questions stemming from Dr. Dator's paper in Part Four are conceptual and ethical, even metaphysical:

- *Can we* really avoid projecting our values on education while waiting for new values to emerge?
- And *should we* avoid projecting them? What if the new values emerging from the "digitalization" of our lives are evil? Should we still abstain and give the upper hand to technological developments (to paraphrase on Adam Smith)?

Each of the questions raised from all four sections are worthy or systematic research projects in their own right. If we don't systematically tackle these issues, it will be difficult to say that we, as policy makers, professionals and educators, are acting mindfully, or that our policies are indeed justified and can be effective and successful.

CLOSING REMARKS

In the Introduction we have done our best to trigger much needed discourse on the ultimate aims that should lead the most radical transformation process our education systems have ever gone through – a transformation process bound to change the very nature of education. We now leave it up to readers to follow their chosen track through the contents of this publication, and to compare the views, data, experiences and arguments presented. We hope this will assist them to define their own view on the merger of ICT and education, examine prevailing policies in light of the insight they may have gained and, more importantly, make their voices heard in the debate on the desired goals of education for the Digital Age.

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PART ONE

THE GLOBALIZERS

Now the true and lawful goal of the sciences is none other than this: that human life be endowed with new discoveries and powers. […] But arts and sciences should be like mines, where the noise of the new works and further advances is heard in every side.

Francis Bacon

CHEE-KIT LOOI AND W.L. DAVID HUNG

ICT-IN-EDUCATION POLICIES AND IMPLEMENTATION IN SINGAPORE AND OTHER ASIAN COUNTRIES

Abstract. We will start this article with an overview of the efforts of various Asian countries to initiate and drive the use of ICT in education. We hope to convey a sense of dynamism and enthusiasm of the various Asian countries and in particular in Singapore, in the planning and deployment of Information and Communications Technology (ICT) in schools and tertiary institutions. In the latter part of this article, we will delve more in depth into the experiences of Singapore's initiatives in integrating ICT in education. We discuss the potential impact and problems arising from this trend of ICT developments in education.

INTRODUCTION

Many countries in the Asia-Pacific region have initiated policies and strategies for the infusion of information technology into their schools. Like many other countries, they share the belief that a critical factor in the nation's economic success is how well their citizens can adapt and thrive in a global ICT environment. The countries' education authorities, the schools and the tertiary institutions have the role and responsibility of preparing the school population to live in and create a future in which ICT will be pervasive in all walks of life. The infusion of ICT may begin in the educational context, however, and over the course of development, the influence of ICT pervades into society where cultural and social beliefs and norms may be affected.

ICT-IN-EDUCATION POLICIES IN ASIAN COUNTRIES

In 1998, the Hong Kong Special Administrative Region (HKSAR) Government announced its five-year strategy plan for integrating Information Technology (IT) into teaching and learning in schools (Education and Manpower Bureau, 1998). In this plan, students are expected to develop a global insight of the knowledge society and be capable of using the large volume of information resources on the Internet. Teachers are expected to participate in staff development programs to contribute to the paradigm shift from teacher-centred teaching to learner-centred learning. Their government has taken on the leadership and co-ordination role by providing a range of support mechanisms. This includes adequate IT facilities such as the network infrastructure, computers and peripherals, teacher training, and other necessary support such as IT coordinators and centralized technical staff to support the schools. The goal is to foster a community-wide culture on the use of IT. Schools

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 27–39.

have conducted many IT-related projects in the past three years. Formally established on January 2, 1998 with an allocation of HK $5 billion, the Quality Education Fund (QEF) of the Education and Manpower Bureau of the HKSAR government provides an effective channel for the support of worthwhile project applications from the school education sector. See (Education and Manpower Bureau, 2003) for an evaluation of the IT in Education efforts.

Based on proposals for educational reform made in 1996 by the Ministry of Education in Japan, policies for a new standard curriculum in ICT education were formulated and reported in 1998, and they are to be implemented in all schools from 2002. Briefly, the scheme is for ICT to be studied as a subject and also used to assist in learning other subjects. The infusion of ICT into the curriculum varies from 'across the curriculum' to 'subject-centred' approaches. In elementary school, ICT will be mainly used as an instructional aid though the practical uses of ICT are viewed as important skills. In secondary school, a new compulsory subject, Information Study, will be introduced for all high school students. It consists of three major components: practical skills in using ICT applications, the scientific understanding of information processing and the understanding of ICT's role in society.

In order to implement ICT education, the Ministry of Education, Ministry of International Trade and Industry and Ministry of Post and Telecommunications, together with other organizations and societies, have conducted a variety of projects. For example, in the 100-school networking project, which began in 1993, schools participated in various activities, such as a collaborative learning project on acid rain, a study involving the weather bureau in which students compared weather charts with pictures produced by weather satellites, and cross-cultural education using real-time video exchanges with overseas schools. Projects such as these facilitated the emergence of research into schools.

Japan's education system remains largely very traditional, based on age-old traditions and old societal values. Since 1994, efforts have been made to initiate Internet use and applications into the school system at a National level. Having been a technologically driven society, Japan is now embracing the infusion of ICT into school practices, gradually transforming traditional epistemologies into forms which we have yet to witness.

In Korea, the concept of adapting education to the Information Age or 'educational informatization' was popularized after the announcement by the Ministry of Education in May 1995 of Education Reform Measures and the Comprehensive Education Information Plan. Adapting education to the information age aims to construct a social basis for open education and self-directed learning. In 1997 a three-year Plan for Building an Educational Information Base was implemented. This plan aims to provide an environment in which the customers of education, including teachers and students, have the capacity to use various educational resources. It seeks to enhance the efficiency of all educational processes and administration using information technology, and also initiates and nurtures various programs for reform-oriented voluntary forces that are eager to apply information technology to educational activities.

The main tasks of adapting education to the Information Age include providing technical infrastructure for all classrooms, the development and dissemination of educational resources, teacher training, and adapting educational administration to the Information Age. All teachers should already have participated in training programs so that they have the skills for using educational software and information network management.

In Taiwan, the Information Education Infrastructure Program launched by the Ministry of Education (MOE) in 1997, has endeavoured to carve out an information education blueprint for students and teachers in all schools. Through this plan, the MOE has set-up computer classrooms in every elementary and middle school (with one personal computer (PC) for each student), provided Internet access to elementary and middle schools and provided on-campus training programs for teachers in basic computing techniques. Two hundred and twenty thousand teachers have completed training in various IT workshops. In 2001, MOE launched a White Paper on IT in Education for K12. One of the goals of that white paper was to sponsor 600 schools with each school focusing on a particular subject using IT.

The MOE has also established software and resource centres in elementary, middle, junior high and vocational schools, and provides subject-based network materials for elementary and middle schools. Taiwan's Ministry of Education, apart from making efforts to get every school connected on the Internet, will continue to focus on the following tasks along with its information promotion initiatives: Internet access for each classroom; development of a new nine-year coherent curriculum for elementary and middle schools; integration of IT with other educational fields and the development of a uniform instructional guide; support and increase of teachers' ability in IT applications and the development of subject-based digitized teaching materials.

University researchers support elementary and middle schools through experimenting with in-class computer instruction and providing teaching materials and assessments. A prominent research project is that of the National Central University of Taiwan which developed the first education network city called EduCities (Chan et al., 2001; Young et al., 2002). To-date, there were 1.1 million EduCitizens, 2,300 EduTowns (schools), and 22,000 EduVillages (classes) in that virtual city. In addition, more than 2,400 courses have been offered in the School-for-All of EduCities with online teachers from different sectors of society.

In China, efforts are underway by the government to provide Internet access to as many provinces as possible. Web-based standards committees are also set up to ensure standardization across the many players in the ICT market serving this huge nation. Online learning is increasingly recognized and universities are awarded funding from the government for such work. Tsinghua University, Beijing Post and Telecommunication University, Zhejiang University and Hunan University are some of the universities amongst the first batch of higher educational institutions pioneering online education. Issues of good pedagogy and instruction through distance modes are relevant to the current state of development in China. The conventional ideologies of education and the seemingly traditional methods of teaching have become a major barrier for the effective utilization of ICT in

education. Online education calls for a new type of teaching-learning culture (Zhu, 1999). However, the majority of Chinese online teachers have not been ready to change their teaching culture. For example, although a large number of higher educational institutions have joined the online schooling efforts, most of them are continually using the conventional instructional methods. To them, the online educational efforts are simply an extension of the conventional classroom teaching.

Having briefly described the ICT-in-Education policies of these countries, we note that there are some differences in their approaches. Some focused on the teaching of ICT skills while others emphasized the use of ICT to enhance teaching and learning. On key factor that causes a significant impact to ICT development in a country is the government's strong mandate and support. In the next case, we illustrate how Singapore national policy in ICT impacts upon schools and tertiary institutions.

THE CASE OF SINGAPORE

Before, we start to discuss Singapore's initiatives in integrating ICT in education, let me briefly describe the education landscape in Singapore. Singapore is a small island state in South East Asia with a population of about 3.6 million people. Approximately 77% of the people here are Chinese, 14% are Malay, 7% are Indian, and the remaining 2% are of other origins. Singapore is a multi-racial, multi-cultural, multi-religious and multi-lingual country with four official languages: English, Chinese, Malay, and Tamil. English is compulsory in the schools with the mother tongue. Most Singaporeans are effectively bilingual. There are 363 schools in Singapore as at June 1999, with a total enrolment of about 498,192 students and 23,183 teachers (MOE Yearbook, 2001).

Lacking natural resources, Singapore's strength is its hardworking, adaptable, goal-oriented and resilient population. The Singapore workforce has consistently been ranked highly by international research institutes and consultancy firms such as the Business Environment Risk Intelligence (BERI), World Economic Forum, International Institute of Management Development and Political and Economic Consultancy Ltd. (PERC).

Singapore is generally known to have a good quality education system. It has consistently done well in international achievement tests. In The Third International Mathematics and Science Study (TIMSS), Singapore was ranked first in mathematics and science in an international study for 13-year-old students (MOE Press Release, 1997). Singapore shared the top spot with Korea in mathematics and was seventh in science in the same international study for 9-year-old students. The study was conducted by the International Association for the Evaluation of Educational Achievement (IEA), an international association for comparative study of educational achievement and an international authority on the study of educational standards.

A case in point of the quality of the education system was a report in the local newspaper about a high-school student in the United States who said his early education in Singapore helped him to get a perfect score in his college entrance test

(Singapore Bulletin, 2001). William Horn credited his feat partly to his schooling in a primary school in Singapore. The 17-year-old sat for the American College Testing examinations, similar to the Scholastic Aptitude Tests, in February and aced it with a perfect score of 36. He was the only one in Colorado and one of 11 in the US to get a perfect score. Altogether, 245,000 Americans took the test.

Singapore's educational goals are spelled out in a document on the Desired Outcomes of Education released by the Ministry of Education (MOE, 2000). The rationale for specifying these desired outcomes is:

> *Knowing exactly what we want allows us to assess how well our education system is doing. In the end, it is not what we do or how much we do that matters. What we have to assess is whether all that we do contributes to achieving the outcomes that we desire.* (MOE, 2001)

In spelling out the role of the Singaporean as an individual and a citizen:

> *Education does two things: it develops the individual and educates the citizen. Education is about nurturing the whole child. Indeed, this is the traditional Asian understanding of the term. Education means developing the child morally, intellectually, physically, socially and aesthetically. The foundation of a person is his values. From these spring his outlook on life and his goals in life. Together with the home, our schools have to work carefully and painstakingly to shape the morals of our children. Our children also have to learn to relate to other people – their elders and their peers, people who are like us and people who are different. Education also develops each child's unique talents and abilities to the full. Education teaches him to keep fit and healthy for life. And education teaches him to appreciate the finer things in life and the beauty of the world around him.* (MOE, 2001)

The government has defined learning outcomes for different levels. For example, the outcomes of the education process for graduates of our polytechnics and universities include being morally upright, being culturally rooted yet understanding and respecting differences, being responsible to family, community and country; believing in our principles of multi-racialism and meritocracy, appreciating the national constraints but seeing the opportunities; and being innovative – having a spirit of continual improvement, a lifelong habit of learning and an enterprising spirit in undertakings, thinking global, but being rooted to Singapore. The intermediate outcomes of education were also defined for the primary school, secondary school and junior college leavers.

SINGAPORE'S IT MASTERPLAN FOR EDUCATION

In Singapore, the MasterPlan for IT in Education was launched in 1997 as a blueprint for the integration of IT in education as a strategy to meet the challenges of the 21st century. The Singapore government committed 2 billion dollars ($1.29 billion) to the master plan. The underlying philosophy is that education should

continually anticipate the future needs of society, and work towards fulfilling those needs. The skills required for the future will centre on thinking skills, learning skills and communication skills. IT-based teaching and learning will be one of the key strategies for equipping the young with these skills.

The vision is that the computer revolution should reach every child whether he can afford to have a computer at home or not. Every student will be equipped with the thinking, learning and communication skills IT-based learning will offer. The master plan seeks to provide a broader base of access to IT among the young so as to achieve a levelling up in learning opportunities so that all children will be able to enhance their learning through an IT-enriched curriculum and school environment. The master plan is governed by four overarching goals: to enhance linkages between the school and the world around it, so as to expand and enrich the learning environment; to encourage creative thinking, life-long learning and social responsibility; to generate innovative processes in education, and to promote administrative and management excellence in the education system.

The MasterPlan (as conceived in 1997) considers four key dimensions, namely:

1. *Curriculum and Assessment* with the shift towards better balance between acquisition of factual knowledge and mastery of concepts and skills, encouraging pupils to engage in more active and independent learning, and assessment modes that will measure abilities in applying information, thinking and communicating.
2. Learning Resources with the acquisition and stimulation development of a wide range of educational software to meet curriculum needs, the facilitation of the use of relevant Internet resources for teaching and learning, and the provision of a system of convenient procurement to help schools obtain software easily and on time.
3. Teacher Development with training of every teacher in purposeful use of IT for teaching and the equipping of trainee teachers with core skills in teaching with IT.
4. *Physical and Technological Infrastructure* with a target of a pupil-computer ratio of 2:1, access to IT in all learning areas in the school, a teacher-computer ratio of 2:1, and the provision of school-wide networks and links between all schools through Wide Area Network.

In the year 2002, the MOE has further elaborated upon the goals of the master plan (now termed as MasterPlan II) to focus on the following:

1. The learner – with the emphasis on active learning where he or she is to be engaged in authentic problem-solving and projects. In this process, the learner makes connections between the curriculum, instruction and assessment through ICT technologies.

2. School capacity and leadership – providing schools with more autonomy to make their own decisions as to the infrastructure, funds and the ICT environment.
3. Active ICT research in learning and instruction – in order to strengthen the groundings through which decisions are made regarding ICT policies that are to be implemented. School teachers would be given the encouragement to engage in practice-related 'action research'.

The above objectives of the MasterPlan II were formulated as a result of the apparent overemphasis on infrastructure (in MasterPlan I) and the lack of focus on capitalizing ICT technologies for the active construction of knowledge and meaning-making. Thus, five integrated principles are emphasized in order to bind the many aims of education through ICT. These five principles are:

4. Teachers and students as knowledge producers;
5. Learning as a process of investigation and doing;
6. Development of learning communities;
7. Sharing of educational resources; and
8. Assessment as authentic performance.

Notable researchers in ICT from the USA and UK were engaged as consultants to the MasterPlan II and a framework for implementation was conceived. The tenets of the framework as suggested were grounded on the above principles.

In order to empower learners through the use of ICT, technologies will work as key enablers to facilitate visualization of difficult concepts, knowledge articulation which making cognitive processes visible, active multimedia authoring and construction, access to rich information resources, and content customization. Emphasis will also be accorded to the recent concept of learning communities which capitalizes on the notion of social constructivism. Learning communities through ICT technologies such as Knowledge Forum are implemented in various schools and plans are underway to foster a community-like environment for teachers to engage in the design of project work for K-12 students. International collaborations are also being fostered where similar research studies are conducted. In the above example on Knowledge Forum, collaborations are made with Ontario Institute of Studies in Education, University of Toronto and the University of Hong Kong.

The issue of assessment is a crucial concern for local Singapore schools. Besides the emphasis on examinations, authentic assessment practices are being formulated such as the use of digital portfolios and other forms of formative assessments. While Singapore schools have been ranked as one of the best in the world, particularly for their performances in international examinations, they have now to consider balancing other forms of multiple assessment modes to complement summative examinations.

Although the above mentioned plans are well formulated, the actualization of the new master plan has yet to be seen. The key factors that would facilitate the success of this initiative are:

1. the willingness of schools to 'forego' traditional epistemologies of instruction and move towards active and student-centred pedagogies;
2. flexibility in the curriculum where teachers are given the freedom to explore questions or ideas as borne by students;
3. more time to focus on pedagogical and learning concerns;
4. stable ICT infrastructure and supporting tools; and
5. reward structures which send clear signals to schools of the benefits of ICT technologies.

IMPLEMENTATION OF IT IN THE SCHOOLS

The MasterPlan expedited the infusion of technology to create IT-integrated learning environments at all levels from primary schools to tertiary institutions. In 2000, it was reported that all schools have been completely phased in. The teacher-computer ratios of 2 teachers to 1 notebook, and the student-computer of 5 students to 1 PC, were attained. In order to allow more time for the teachers and the students to use IT innovatively in the classroom, the MasterPlan supports the reduction of the curriculum of up to 30%. In 2000, at least 15% of curriculum time was based on using IT. All 23,000 teachers have had 40 hours training on IT for teaching.

The Ministry of Education set up the Educational Technology Division to implement the MasterPlan together with the schools. Their charter includes providing IT instructors to help the schools, working with local educational software publishers to develop educationally sound materials, evaluating commercial educational software and providing a recommended list of software for various subjects and levels, starting new innovative projects to explore new practices, and setting up the right infrastructure including a repository of teaching materials and resources. IT facilitators from the division went to some schools to advise, help and work with the school teachers in adopting and suggesting pedagogical approaches to the use of IT. In the months ahead, IT facilitators will be attached to ETD for periods of time for training and enrichment programmes in ICT. Opportunities will also be given to IT facilitators to work in teams with consultants and ETD members. Learning communities in the form of communities of practice (Wenger, 1998) focused on particular interests will be formed and facilitated.

In the Second Information Technology in Education Study (SITES) conducted by the International Association for the Evaluation of Educational Achievement (IEA) and released in 1999, Singapore ranked highly in the use of ICT in education, compared with 26 other participating countries or economies (MOE 1999). Singapore ranked among the leaders in having a clearly articulated policy on the use of ICT, which is widely supported by school principals, the provision of training to all teachers, and the provision of computers and peripherals to schools.

Top-down, there is a strong government and ministries push and support for IT usage for teaching and learning in the schools. Several schools have launched bottom-up initiatives for introducing IT for teaching and learning. These school

initiatives allowed different kinds of design experiments, suiting their own different conditions. Indeed over time, we will see more IT integration into lessons. Each batch of newly trained teachers now graduate with skills in using IT for pedagogical purposes. In Singapore, parents have high expectations for their students and from their schools. Our students are becoming more IT literate. All these efforts are boosted by a widespread culture of use of IT for productivity, innovation, entertainment and education in the community, workplace and home.

Thus Singapore has gone some way in the infusion of a culture for ICT use in the schools. ICT is now accepted as a part of teaching. We are approaching basic levels of competent use of ICT tools for routine office and school use, and for classroom lessons. The generations of students who are exposed to ICT in schools should be better prepared for jobs in their future working careers where ICT is likely to be pervasive. From the broad base of basic usage, we expect many more innovative efforts in applying ICT for teaching and learning to bloom and proliferate.

Teachers have become more positive about using ICT. They are sharing their experiences of using ICT in the classrooms through seminars and exchanges. Some principals and teachers will lead the way. Effective classroom practices will become a norm. We will see learning communities created and growing. Teachers will become fellow students in the learning community, learning from each other and finding new strengths and talents in themselves that they did not know they possessed. Students will find themselves in the role of teachers as they guide those less familiar into the ICT world.

More and more ICT will be used in the schools and in the homes as productivity tools. The dynamics of teaching and learning may not be changed radically but, over time, teachers will acquire skills and expertise to exploit ICT purposefully in teaching and learning. With the help of ICT, we hope that teachers can transform the less effective teaching and learning processes. Student learners are exposed to diverse communities of scholars and their learning relationships are extended outside and after school or university. ICT will support innovative changes in learning.

Singapore has a good technical infrastructure for the ready deployment of ICT. Half of all homes in Singapore have Internet access, 70% of the population has mobile a phone and 60% have computers at home (Straits Times, June 29, 2001).

As mentioned earlier, Singapore schools have been ranked highly for their excellent performances in major and international examinations. The success factors may be largely due to traditional modes of instruction rather than to active and student-centred forms of learning. This success needs to be balanced with learner-centered ICT foci and the use of tools for extending students' cognition. For such ICT technologies to become commonplace in schools, the equivalent version of success in relation to fundamental constructivist pedagogies needs to be crafted out. In other words, Singapore schools need to evolve ICT-constructivist strategies for adoption by teachers and students. To date, the use of ICT in the schools include:

1) cyber-conferencing,
2) web-based publishing and knowledge construction,

3) the use of cognitive tools, simulations and visualizations,
4) international collaborations with students from other countries,
5) wireless technologies with data-loggers, etc. increasingly, schools are making continued efforts in infusing these tools into project work and mainstream curriculum.

In general, educational technology is well ahead of our capabilities to make good use of them in education. We hope to see more significant portions of technological innovations translated into the school curriculum through research efforts. More research of how IT is used in the schools and its efficacy can be done. Thus, the MasterPlan (II) aims to integrate research in schools as part of the cycle through which findings can be translated into informed policies in the educational system.

From a technological perspective, more advanced infrastructures are being put in place or are now available, with broadband networks, virtual collaboration, and the use of mobile devices. Now with the mindset of the principal stakeholders such as the school principals, teachers and students generally supportive of ICT as an integral part of the educational landscape and most of the infrastructure, such as PCs in the schools and home, in place, industry will find ways to develop useful educational technologies and tap on the educational market. Many ICT-related companies have also sprung up as a result of this huge market. Schools and educationally related ICT companies need to work in unison to foster the learning epistemologies embedded in the MasterPlan II. With infrastructures mostly in place and schools expanded in terms of space, Singapore schools are now more prepared to face the challenges of changing epistemologies in learning.

Singapore needs to quickly reconcile her dilemma of changing educational practices that are absolutely necessary for her economic survival, yet keep a balance of her past academic achievements – a balance which is difficult to appropriate. The challenge is to recognize the tenets that need to be preserved and those which have to be forsaken.

DISCUSSION

From the various ICT efforts in the Asian context, we have observed the phenomena of diminishing traditional divides such as the digital divide due to ICT developments, and yet new emerging problems arise. We discuss some of the potential impacts of ICT advancements in this region.

To begin with, it would seem that most Asian countries unwittingly adopt ICT and the theoretical underpinnings of online and borderless learning as being unquestioned phenomena. Inevitably, ICT developments in the near future will inherently be more "constructivist" or learner-centred in orientation.The epistemologies and philosophies in Asian countries such as Japan and Taiwan are very traditional with beliefs of authority and piety as core values. With the predominance of post-modern thinking and constructivism through ICT, core traditional values will very quickly be mingled with Western thought. We envisage that, in the coming years, greater overlap between Eastern and Western cultures will

be evident as youths struggle with both traditions intermixed through media and communications.

The dominance of Western culture and the English language through the ICT medium is also a concern for Asian countries that persevere to preserve their national language as a heritage. Increasingly we find that students have to be proficient in the English language, although we are increasingly seeing language-interpretation mechanisms on the Internet. The current state of language interpretation tools is still immature, and huge investment in research is needed in this area of development. In Asia, Japan is leading in this area of research.

ICT technologies are also gradually breaking down the barriers of time and space, making learning more flexible and accessible. As a result of this accessibility and flexibility, online learning is changing the landscape of education. The content of eminent universities is invariably becoming accessible to a larger audience, for example, MIT's free access to its course materials. Now, Asian countries need to quickly solve the digital divide issues of accessibility and provide ICT access to its people as far as possible. Universities will also have to be more flexible in terms of their degree offerings, possibly going beyond the traditional mindsets of semesters and modular structures. Asian citizens need to develop life-long learning dispositions where learning can be anywhere, at anytime, and at any age. The emerging mindset of learning 'after graduation' is a trend that Asians will have to embrace. However, easier and more flexible access does not imply better learning environments. This aspect of producing or evolving better learning contexts and environments is an area of research that can be complemented by research from the USA, Europe and Australia.

With increasing access to ICT technologies, the divide between 'virtuality' and 'reality' is also diminishing. Today, companies are demanding more online 'on-the-job' training rather than formal face-to-face training sessions for their employees. Asian people also need to adopt similar practices where online access to materials and on-the-job information predominate. Simulations such as for skill practice are becoming commonplace and the distinction between what is virtual and real is may start to blur. These virtual technologies may also create new and emerging problems of sociality which, in the Asian context, has always been an important issue.

Moving to more cultural issues, Asian countries such as Singapore, Taiwan, Japan and Hong Kong have similar educational settings where examinations play a crucial role. Increasingly, these nations will have to balance between examinations and multiple assessment modes such as engaging in authentic projects. Formative assessments also need to play a larger role in these nations. The divide between traditional modes of assessment and more formative modes needs to be minimized. Entry criteria into universities will have to be adjusted to cater for students with portfolios and other forms of evidence of learning performances. Recognizing this increasing trend towards formative processes, the universities in Singapore have made the necessary adjustments to cater for this varied need. In Korea, virtual universities catering for the job-market have grown significantly in recent years.

Finally, the divide between real work and school work is increasingly becoming less prominent. Many proponents of learning have now introduced real-world, ill-

structured authentic activities into school contexts. Schools must now grapple with this new form of learning requirement which is heading in the right direction. Schools have increasingly recognized the demands of the knowledge-based economy and the need to prepare students for the challenges ahead. Because of the ambiguity of the Asian economies which at one stage in the 1990s were relatively stable, educational policies are being overturned in order to prepare students to stay competitive in the real world.

To summarize, we recognize that the increasing presence of ICT in Asia has blurred the distinctions between:

1. traditional and constructivist conceptions of learning;
2. eastern and western cultures;
3. formal and informal educational settings;
4. face-to-face and online training/learning;
5. learning in school and after schooling as in life-long learning;
6. formative and summative assessment modes; and
7. real world work and school work.

These are issues Asian countries are faced with or will soon be facing. As a result of these developments, cultural norms will evolve in the midst of ICT advancements.

The regions of Hong Kong, Korea, Singapore and Taiwan seem to be more progressive in the adoption of ICT technologies. China has yet to resolve her large-scale accessibility issues. Japan being a very traditional culture has yet to embrace ICT tools into the school system widely, although it has significant developments as far as research into language systems and expert systems is concerned.

CONCLUSION

In this article, we have presented several aspects of policy relating to ICT for supporting education in some Asian countries and regions, and in particular Singapore. We have discussed recent developments in ICT and Education in the schools. Hopefully, this article will promote more discussion on the practical implementation of ICT policies in other countries. Singapore is presented as a case study in how ICT-in-Education in the schools is being planned, and what it takes to go there.

A comprehensive policy for ICT in education needs to consider several key success factors: infrastructure, content and learning resources, teacher training, curriculum, and assessment and evaluation. Research projects like the Apple Classrooms of Tomorrow have emphasized the importance of teacher training and professional development. All of these factors are important and evolve together. If we change just one or two of them, the rest of the structure will work to change things back to the way they were. The effectiveness of the use of ICT in education is determined by the weakest link among these factors.

Albeit the problems of ICT integration, Asian countries, for example Singapore, have a more centralized government able to initiate macro policies which may at times be painful to the masses, and carry them through. With the ability to conceive

large-scale multi-million dollar plans for ICT, countries such as Singapore, Hong Kong and Korea are able to implement large scale ICT integration into school contexts. Such an 'advantage' may be less evident in Western nations.

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NAJAT ROCHDI

CONFRONTING THE CHALLENGE OF THE INFORMATION AND KNOWLEDGE SOCIETY IN DEVELOPING COUNTRIES

Abstract. Developing countries such as Morocco face particular difficulties in addressing the opportunities presented by the ever-increasing presence and influence of ICT across the globe. This chapter will argue that only education can ensure the task of preparing citizens not only to use ICT tools, but also for the changes in modes of operation and culture that these will bring. It examines the reasons and mechanisms with which Morocco has responded to these challenges: the Education Training Decade and e-Morocco programmes. Finally, the danger of further widening the digital divide through inappropriate policy is addressed.

INTRODUCTION

> *Morocco is a land rich in human and natural resources. It is a land of dialogue, tolerance and entrepreneurial freedom. The conjunction of these elements makes it a land rich in opportunities.*
>
> (His Majesty Hassan II, the late King of Morocco)

Ten years after its integration in the Euro-Mediterranean market, Morocco continues to build the future of its economy under the sign of continuity. In this task it is backed by the confidence of a nation united under its new sovereign and supported both by Moroccan and foreign business sectors. The major priority of Morocco is to succeed its "*entry into the third millennium guided by a clear vision of the future*". The country is doted with several key advantages, not the least of which is its exceptional geo-strategic location and close proximity to European markets. Many of its traditional activity sectors provide excellent development opportunities (energy and mining resources, agriculture, fishing, food-processing and textile industries) and others are already proving to be vectors of rapid growth (tourism, electronic and pharmaceutical industries). Above all, it possesses a high quality labor force.

Nevertheless, slow growth rates in production and employment (the annual growth rate has stood at approximately 3% over the past decade), an insufficient level of savings and investment (gross capital formation per GNP has stood at about 20% for over a decade) and a large public debt are but a few of the obstacles it is struggling to overcome. Financial equilibrium remains fragile due to unstable revenue, overheads that are almost impossible to reduce and a trade balance deficit. Social indicators, too, remain relatively disconcerting. Despite uncontestable progress, schooling, literacy and social security coverage rates are

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 41–50.

Inadequate unemployment rates in urban zones rose from 14.7% in 1987 to 17% in 1997, and the standard of living per capita has risen on average just 1% per year over the past decade. Social and spatial inequities are a matter of grave concern. In an attempt to overcome these difficulties, the government has recently implemented a global development strategy that is articulated around two central objectives. To ensure the transition:

1. from a relatively stagnant economy to a strong and durable growth economy serving as a vector for increased employment;
2. from a socially and spatially inequitable society to one that is constantly striving to reduce social and geographical disparities.

It is therefore imperative that Morocco learns how to integrate ICT and gains the maximum benefit from these powerful new tools. There is but one means of doing this – by investment in its people. In this way, ICT will contribute to creating an egalitarian society, the developmental policy of which will guarantee social cohesion.

MEETING THE CHALLENGE OF THE INFORMATION AGE

The mutations that modern societies are undergoing today are certainly greater than at any other time since the industrial revolution. They are profound, global and rapid. They concern far more than just technologies, and are a challenge to each and every citizen no matter where they live. Bridling these transformations represents a major economic and social challenge, especially for developing countries such as Morocco. Information technology is a heavy burden on the economy, surpassing the capacities of even the most solid traditional industrial sectors. By the same token, it is an essential vector for increasing the competitiveness of the economy and represents an indispensable lever to the development of all societies, the most advanced and developing societies alike.

The economic sector is a strategic sector. New occupations are emerging; it is necessary to learn how to fill them. Innovative products and services are emerging, people must know how to produce and provide them. Companies are being forced to evolve, to adopt integrated operating systems for all production processes from the design of products right through to their distribution to consumers. New dynamics are at work, and employment will play a determining role. By providing the necessary impetus and human capital, developing and emerging countries will ensure themselves every chance of success in this mutation.

All of these processes are being accelerated by globalization. Developing countries must also be capable of playing an active role, and not simply content themselves with being consumers. But at the same time no country can afford to lose sight of its own history, its identity, culture and environment, all harbingers of innovative projects. The very tools that are revolutionizing the workplace, education and modes of thinking also provide the means of producing and transmitting the

contents that will lead to opening up a multi-centric world and offer increasingly rapid access to cultural diversity. The focus today is incessantly placed on increased productivity, reinforced efficiency, added value and greater transparency. A new economy is emerging – an economy in which the mastery of technology, networks, services, and the production of contents in national languages will constitute the essential vectors of power within the framework of globalization.

However, no nation can afford to lose sight of the fact that, at the very heart of this veritable digital revolution, is Humanity. The Individual of today and, above all, the Individual of tomorrow. Individuals that we should be training and preparing to confront the challenges of the information and knowledge-based society. It is therefore essential that we implement measures to reform our education systems, as only education can ensure the task of preparing men and women capable of handling not only ICT tools, but also the changes in modes of operation and culture that these will bring.

Several major factors appear to be increasingly important in today's knowledge-based economy. Firstly, the ability to innovate and create, coupled with the capacity to adopt a modernist approach to national identity, traditions and values. Secondly, success in transforming the information society into a knowledge-based society also depends upon a solid knowledge of markets, technological know-how, talented "Knowledge Workers" and, above all, the ability to transform knowledge into added value. Only by bringing about evolutions in our educational systems and other learning institutions, developing an adequate pool of skills, and raising the level of human resources can we respond to the challenge of competence and win the wager of intelligence.

In preparing to meet the challenge of the digital age, schooling is therefore a top priority. In Morocco, 50% of the overall population of 30 million inhabitants is under twenty-four years of age. These are the young people, the future generations, that we must work together to prepare, and this cannot be done unless we develop the use of Information Technology at school and in vocational training. Our goal should be to attain widespread mastery of the new communication tools that will be indispensable for tomorrow's citizens.

Because information technology represents the means to acquire knowledge and access culture in today's world, it is necessary that we, as teachers and decision-makers, develop our own capacities to exploit the wealth offered by multimedia as a pedagogical tool. The first step towards this goal in Morocco is to set up multimedia centers, first in universities and vocational training institutes, then in high schools and colleges and, as rapidly as possible, in primary schools. At the same time, we need to set up resource centers to produce pedagogical content in local languages, content that is interactive and adapted to the particularities of our own culture, national identity and the needs of all learners. Effective interactive pedagogical multimedia content can only be designed and produced, if such centers are doted with the most up-to-date means of development and pedagogical expertise. Once the multimedia industry is well underway, resource centers could subsequently serve as support and assistance platforms for learners and teachers, and constitute the basis for centers of excellence in new educational technology.

Learners have far greater opportunities to develop autonomy and to progress at their own rhythm through the integration of multimedia-assisted learning and auto-didactic learning programs into our educational systems. On-line access to lessons given by leading specialists offer a further means of freeing learners from the constraints of time and space, thereby guaranteeing greater equality of opportunities. Ambitious action programs must therefore be launched and developed to ensure that a sufficient number of graduates in higher learning institutions and universities, engineering schools, training institutions and technical colleges successfully integrate Information Technology, not only in their learning tools but also as a field of knowledge and expertise. It is only in this way that we can prepare or redeploy the workforce to fill the new occupations that are emerging in the field of Information Technology.

Needless to say, if developing countries are to increase their competitive edge they must strive for broader integration of Information Technology in the aim of allowing each and every citizen to assimilate Information Technology-related knowledge and skills. However, whilst making a determined effort to integrate the information and knowledge-based society, every effort must be made to ensure that the new Society does not become the source of another social fracture.

The young people we are educating in our primary schools today are those who will be supporting and leading our societies and countries in the year 2020 and beyond. Given the current explosion of knowledge, communications and multimedia, no-one can really predict what our society, our culture, our work, our leisure and our family life will be like in 2020. The problem therefore goes far beyond simply introducing Information Technologies at school. Schools will have to be completely remodeled if they are to succeed in educating citizens for the year 2020, and not citizens with their heads buried in past decades.

In life, everything is dispensable except the Essential. In the information and knowledge-based society, the Essential consists of men and women who are educated, prepared, pro-active, innovative, creative. If we are to succeed in producing the Human Capital that can guarantee durable and equitable development, then our systems – and learning and knowledge-transmission processes – will have to be well adapted, flexible and evolutionary. To win the wager of intelligence and prepare future generations to face the challenges of the information and knowledge-based society, the training policy objectives of the government should aim not at acquiring more information but rather at increasing knowledge and know-how. Should the contrary occur, we will not only have to overcome the problem of the digital divide, we will have to surmount ever-deepening divides of another type: economic, cultural, scientific…

Although it may be possible to attain electronic "literacy" through a 15-day training program, we can only achieve the goals we have set ourselves if electronic literacy is accompanied by a much broader form of literacy. This broader form takes some 15 years to prepare and must begin at a very early age, that is, from the moment children start school if they are to assimilate the mutations of modern society and be able to navigate within it as agents of change and production.

Conscious of these requirements, Morocco has implemented two major programs. The period 2000 to 2010 has hence been placed under the aegis of an Education-Training decade. A major universal schooling program has been implemented and is already producing encouraging results. The second initiative is the e-Morocco program that was launched at about the same time.

EDUCATION-TRAINING DECADE OBJECTIVES

It is estimated that the overall number of children attending basic public schooling establishments in Morocco in 2000-2001 increased by about 5.5% over figures from the previous year, with a total 4,722,000 pupils attending school. 3,664,000 of these pupils were enrolled in public schools (lower elementary cycle), representing an increase of 4.8% on figures from 1999-2000. Approximately 453,000 six-year-olds are now attending public schools, bringing the rate of schooling up to 84%. 1,057,000 pupils were enrolled in public high schools (upper elementary cycle), representing an increase of 8%.

A new pre-school program launched in partnership with local municipalities aims at enabling approximately 50,000 pupils aged between 4 and 5 years to attend pre-school establishments set up throughout the entire Kingdom of Morocco. One of the top priorities of the government is to accelerate the rhythm of development of schooling. The ambitious objectives it has set itself are outlined below.

By the year 2002:

- Provide schooling for all children turning six in the year 2001: the net enrolment rate for 6 year-olds should increase from 32.7% (1997-98) to 100% in 2001-2002. The number of newly enrolled 6 and 7 year-olds should rise from 522,394 (1997-98) to 731,100 in 2001-2002, representing on average an increase of 9% per year.
- Provide lower elementary schooling for all children aged between 6 and 11 years in 2002. The school attendance rate should therefore rise from 68% (1997-98) to 100% in 2002-2003.

By the year 2008:

- Provide upper elementary schooling for all children by the year 2008. The rate of school attendance should consequently rise from 53% in 1997-98 to 100% in 2008.

By the year 2010:

- Ensure that, in each age cohort, 60% of the population has completed senior high school studies and 40% graduates from secondary studies. Figures for secondary school attendance are consequently expected to rise from 399,466 (1997-98) to 1,094,700 in 2010, representing an average increase of 8.8%.

RESULTS OBTAINED

Early results obtained through the implementation of this ambitious policy to place Education and Training amongst the top political priorities for the development of the country are more than promising. They illustrate that today it is possible for Morocco to provide an elementary education for all. In the annual census conducted throughout the entire national territory in November 1998 and October 1999 the following results were registered:

1. School attendance for 6 year-olds has today reached 66.5%, showing an appreciable increase when we consider that in 1997-98 figures stood at just 37.2%. By the 2001-2002 school year, all 6 year-olds should be attending school.
2. Today 80% of 6-11 year-olds are attending elementary school; in 1997-98 the figure stood at 68.6%. All children in this age bracket should be attending school at the beginning of the 2002-2003 school year. Over the past two years this figure has risen annually by about 6%, and shows on average a threefold increase on data recorded over the previous decade.

Table 1: School attendance rate for 6-11 year-olds

School year	School attendance rate
1996-97	66.5%
1997-98	68.8%
1998-99	73.7%
1999-2000	80%

3. The school attendance rate for 12-14 year-olds has now reached 59%, once again confirming a recent movement in the desired direction and showing that figures are gradually rising to meet the year 2008 target of 100%.
4. The growth rate for elementary school attendance in rural areas was 20.6% between 1997-1998 and 1999-2000. An overall nation-wide growth rate (i.e. for both urban and rural areas combined) of 13.5% was registered over the same period.
5. School attendance for girls: efforts to ensure elementary education for girls have produced similar positive results, with an increase of 17% in urban and rural areas combined over the 1997-98 to 1999-2000 period. In rural areas alone, an increase of 34.8% was registered.
6. Report from the 1999-2000 school year: a total 3,698,554 children were enrolled in public or private elementary schools, representing an increase of 6.8% on figures from the preceding year. Before 1998, the average annual increase was approximately 3%. Elementary school pupils from rural areas

account for 1,702,214 of the overall figure, showing an increase of 9% on data recorded in 1998-99.

A total 989,731 pupils are now following the upper elementary cycle in either public and private schools, representing an overall increase of 4.6%. In the year 1999-2000, overall school attendance figures in elementary and secondary cycles combined reached 5,159,375, which is 6.3% more than in the 1998-99 school year. Figures had increased by 5% from 1997-98 to 1998-99 and just 2% from 1996-97 to 1997-98. 471,090 pupils are now attending secondary schooling establishments, representing an increase of 6.3%.

It is evident from this data that Morocco is rapidly realizing its objective to provide universal schooling, serving as the basic foundation for the implementation of ICT.

E-MOROCCO – NATIONAL STRATEGY FOR INFORMATION SOCIETY DEVELOPMENT

The National e-Morocco Action Plan sets out an overall framework and strategic priorities for the implementation of ICT throughout Morocco for the next decade. It focuses on five key themes for facilitating the role of knowledge in development and for the effective use of ICT: Education, Governance, Private Sector development, E-commerce and Access. The implementation approach is constructed on the joint participation of the public, private and non-government sectors as well as of members of civil society. It endeavors to combine the efforts of all development shareholders to promote the active use of knowledge for development and take advantage of ICT to facilitate information sharing, communication, new applications of technology and foster democracy and moralization of public life using ICT as a central tool to eradicate corruption.

The program is built on the potential of ICT to create new opportunities to position Morocco in the global economy, provide new tools for economic and social development, open new employment opportunities and also slow down the emigration of skilled workers. It is acknowledged that every societal actor has a critical role to play in the ICT integration process and that the Action Plan should provide a framework for creative partnerships designed to maximize the inclusion of all: public administration, private sector local authorities and citizens. The plan aims at identifying and articulating practical and measurable activities around which all of the actors involved can carry out their mission. The role of the private sector is proving invaluable in encouraging more equitable access to, and use of, ICT, particularly in terms of investment to ensure universal access and services to populations in rural areas.

Areas of the e-Morocco program that more specifically deal with educational system are actions aimed at:

- Creating education-to-employment strategies; assessing skill needs in the ICT area;
- Developing educational strategies to close gaps;

- Improving the educational system's ability to develop valuable ICT-related skills among the population;
- Improving knowledge-based education systems through the integration of ICT at all levels: primary, secondary and university as well as employment reconversion;
- Working with Education Ministries to reform education and integrate ICT to enable teachers and students to create knowledge; providing technical training for teachers;
- Improving the teachers' and students' ability to process information and development understanding to create knowledge; improving professional skill development.

The plan also includes measures intended to increase the participation of women in business, handcraft and agricultural sectors, to raise the level of literacy in society in general, and to give isolated rural communities a sense of solidarity and identification with national development goals.

Although no analysis of the impact of the National Plan is so far available, some tangible results are visible, mainly in terms of increased employment and entrepreneurial opportunities through the creation of service providers, cyber cafés and other ICT-related activities. An academic and research network that connects all universities and engineering schools through 16 nodes countrywide is having a profound impact on interactions between teaching staff and students both within the country and overseas.

Current priority development targets include the acceleration of national content production and the extension of Internet access in rural areas. Education will continue to be the central priority for the coming years, Human Capital being the critical factor if Morocco is to succeed in positioning itself among emergent markets by the year 2005.

BACK TO THE FUTURE

Today educational policy must cater to the learning needs of all citizens, if not, the risk of not only a social but also a digital divide will become inevitable. Indeed, science, technological progress and economic and social development are inextricably linked in a world such as ours undergoing rapid mutation. In our "globalized" world, technological research and development are progressing at an increasingly accelerated rhythm through exchanges between researchers, and information and scientific findings circulate from one country to another ever more freely and rapidly. Science and technological development are simultaneously contributing to the globalization of the economy and being increasingly sought as a means of meeting the challenges facing society.

Consequently, if the Formation-Education and *e-Morocco* action plans were to be limited to simply equipping schools and introducing ICT courses, they would undoubtedly be offering but a partial solution.

The necessary economic and social impetus can only be provided in Morocco, indeed in all countries of the world, if educational policies become integrated policies, policies that aim at developing not only knowledge but also know-how and technological research. Economic growth in a competitive, global environment is dependent on innovation and creativity. The skills available on the labour market in the information society depend both on the way youths have been prepared for their future life and the life-long learning opportunities accorded to the existing labour force. If education and training are to be adapted to meet the needs of the knowledge-based economy, then the policies implemented must aim at augmenting both physical and human production potential, as well as improving production operations. This implies training qualified staff capable of learning, re-learning and also de-learning throughout their whole lives.

From this perspective, in my opinion, it is particularly important that the content made available on-line be developed in local languages and that all citizens, even those in the most isolated areas, be provided affordable access to Internet. If this is not the case, the divide will deepen not only in terms of economic and social development but also, to an even greater extent, in terms of access to information (the "Haves" and the "Have nots").

Public access to Internet must be developed rapidly, more especially in schools, universities, training centers, public libraries, post-offices, etc. to the point where all citizens are connected. Although the Moroccan Government has set up a program that will run to the year 2005 to equip schools and colleges with access to Internet, currently the ratio ICT to number of pupils remains far too low to ensure adequate integration of these technologies in the learning process.

ICT literacy for teachers constitutes a condition sine qua non for the use of these tools and information society contents in education. Major efforts still need to be made if Morocco is to attain its target of ubiquitous use of these technologies by teachers before the end of the year 2004. Greater effort is also needed to set up regional and national funding mechanisms, integrating participation from the private sector in a spirit of solidarity and citizenship as a means of digitally linking rural regions.

Existing associative agreements with Europe are permitting Morocco to work in close collaboration with key European players in the field of Education and more particularly within the framework of the *e*Learning initiative: "Thinking Education for Tomorrow". This important initiative aims at mobilizing educational and cultural communities. Cooperation with economic and social partners in Europe will also help to accelerate changes in the education and training systems as Europe completes its own transition to a knowledge-based society.

ICTs should not be perceived as substitution tools; on the contrary, they should serve as a means of enhancing complementarities, diversification and added value. If education and training systems are able to adapt – and there is no reason why they can't – new opportunities will be opened to all. In this event, ICT will further contribute to forwarding the interests of humanity by fostering greater social

inclusion, competitiveness, professional progress and, quite simply, active and enlightened citizenship.

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PART TWO

THE REFORMISTS

It is because modern education is so seldom inspired by a great hope that it so seldom achieves great results. The wish to preserve the past rather than the hope of creating the future dominates the minds of those who control the teaching of the young.

Bertrand Russell

WILLEM J. PELGRUM & TJEERD PLOMP

THE TURTLE STANDS ON AN EMERGING EDUCATIONAL PARADIGM

Abstract. This chapter contains a characterization of the current popular policy visions on ICT and education. A description of the potential implications for educational reform are given and empirical data from recent national and international assessments are used to estimate what elements of this rhetoric are accepted by educational practitioners. The fuzzy character of the reform discussions is reviewed as well as potential implications for research.

INTRODUCTION

In many national educational policies that existed around the millennium change (Pelgrum & Anderson, 1999; Plomp, et al., in press) the stimulation of the integration of ICT in education was a high priority item. The first wave of introducing ICT in education started around 1985 (Pelgrum & Plomp, 1993). At that time this innovation was mostly technology-oriented. In many schools new subjects (called introductory informatics or computer science) were introduced that enabled students to learn how to operate and program computers. Near the end of the 1980s it appeared that many governments became less oriented towards encouraging the integration of ICT in education. The second wave of ICT-stimulation started around 1995, when the Internet rapidly became very popular in business and society at large. This was accompanied by a huge production of policy documents from many different sources (European Commission, 1995; ERT, 1997; Panel on Educational Technology/PCACT/PET, 1997). Most of these documents pointed in the same direction of a common underlying rhetoric, which can be very briefly characterized as follows: as a result of ICT the life-cycle of knowledge will increasingly diminish and therefore all citizens need to be prepared for life-long learning. This can only be realized if the prevailing educational paradigm will change from a focus on reproduction to production of knowledge.

The aim of this chapter is at first to describe potential elements of a new educational paradigm and secondly to offer – on the basis of empirical data from an international comparative assessment – a judgment of the extent to which educational practitioners are ready to adopt these elements. This will be followed by a discussion on the question of how the current fuzzy definitions of a new educational paradigm can be further clarified.

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 53–68.

POLICY ORIENTATIONS AND ELEMENTS OF AN EMERGING EDUCATIONAL PARADIGM

Our society is changing (and in some countries already has changed) from an industrial society, in which industrial production (making of 'things') is the central focus, *towards an information society* in which dealing with information has become a key element in the functioning of people, both in their profession and outside. Western economies can be characterized as 'knowledge' economies. As more and more manual and cognitive activities have been taken over by computers and other ICT applications, a new balance has evolved between men and machine in the area of information retrieval and information processing. Knowledge is no longer knowing facts and theories by heart and being able to reproduce them when necessary (*'old' knowledge*), but knowledge has become the ability to find relevant data and to derive meaning or information from it (*'new' knowledge*). The information society demands from its citizens not only *reproductive* skills, but also *productive skills,* enabling them in new circumstances to generate and evaluate answers to open, non-standardized questions. This necessitates analytical, creative and synthesizing skills. It also calls for a more *student-controlled*[1] teaching-learning process, as opposed to the (traditional) *teacher-controlled* approach.

Today's education system faces the challenge to prepare individuals for the information society in which a *new balance* is needed between 'old' knowledge and 'new' knowledge and therefore between the mastery of reproductive skills and of productive skills. It is not a trivial change that is needed, as our present education system evolved over a long period of time in an industrial society. This implies that changes needed in education refer not only to *what* has to be learned, but also to questions of *how* to learn, and also for upper secondary education, higher education and adult learning on *when* and *where* to learn.

Within the society the mission of the education system is to provide balanced, personal, social, and vocational education, facilitating personal growth and development of citizenship, and providing preparation for a profession. *Quality of education* can be defined as the amount to which education is capable of realising these goals. As these goals have to be worked out differently in an information society than in an industrial society, our notion of good quality education has to change accordingly.

Beside the challenge of preparing individuals for the information era, the education system is also facing other challenges (COMMITT, 1996), such as the expectation of contributing to the solution of social, cultural and economic problems of society, offering individualized and flexible forms of education suitable to specific needs, and meeting the needs for life-long learning.

The challenges for the education system are resulting in a need for new definitions of education with a new balance between 'old' and 'new' knowledge, and between existing and alternative forms of education. They are also calling for new forms of teacher education and new forms of support in education. ICT has the potential to play a role in every stage of the change process needed.

At present the organization of the learning process in most educational institutions can be characterized as predominantly 'teacher controlled': usually the

teachers (or lecturers) are acting as 'tellers' and orchestrators. Adjusting education to the needs of the future (the information society) means that schools have to enable learners to become more active and to make them more responsible for arranging their own learning process (student-controlled). Only in this way can learners acquire 'productive' skills, problem solving skills, independent learning skills and/or skills for life-long learning. Stimulating and supporting these processes of active learning implies organising learning processes in which the learner learns how to become more or less the architect of his/her own learning process, with the help of professional coaches.

Voogt and Odenthal (1998) have summarized, on the basis of an extensive literature review, potential elements of education of the future, in the following list of characteristics:

Goals and contents

1. Skills are accentuated in education (information-, investigation-, communication and social skills, meta-cognitive skills).
2. School subjects and parts of school subjects are combined with each other.
3. Boundaries of subjects are crossed.
4. Existing/new contents are linked with real life.
5. Existing/new goals are tested with a variation in learner evaluation (open test methods, portfolios, diagnostic and summative tests).

Roles of students

1. The student is active.
2. The student is independent (plans learning path).
3. The student is responsible (plans and monitors own progress).
4. The student is a team member.
5. The student becomes an expert on certain topics or aspects.

Roles of teachers

1. The teacher uses mainly instructional methods directed at stimulation of active learning (group- and individual assignments, practical work).
2. The teacher focuses his/her transactions on interests and needs of the individual student.
3. The teacher actively creates a learning environment for students (organiser).
4. The teacher guides the cooperation between students.
5. The teacher supports the learning process of students actively and interactively (gives direct feedback, stimulates reflection, evaluates progress).

6. The teacher shares responsibility with students for their learning process.

Materials and infrastructure

1. ICT applications are user-oriented.
2. There is a variation in the use of ICT.
3. No/less structured information sources (other than ICT) are used.
4. Use of ICT creates a learning environment for the students.
5. There is use of study pointers promoting independent learning.
6. Physical environments are suitable for learning individually or in small groups.
7. Learning is flexible in time.
8. Learning is flexible in location.
9. Multidisciplinary teams of teachers work together.

According to this review, learning is seen as a process of active knowledge acquisition; as a social activity and not just an individual one; as not bound to specific content and context, because for transfer of knowledge and skills a variation of situations and contexts is needed. In such an approach more emphasis on independent and self-directed learning and good self-regulation is important.

The terms 'teacher-controlled' and 'student-controlled' refer to the actor who is most active and responsible for the arrangement of the greater part of activities belonging to the learning process. There is no absolute distinction between both approaches; they represent the opposite dimensions of a continuum. This means that both teacher-controlled approaches and student-controlled approaches have many different representations and that, in an information society, a new balance between the two is needed.

POTENTIAL OF ICT IN EDUCATION

It is assumed (in many policy documents, amongst others European Commission, 1995; ERT, 1997; Panel on Educational Technology/PCACT/PET, 1997) that a shift from teacher-controlled towards more student-controlled arrangements of the learning process can be facilitated by ICT. Until now the potentials of ICT have hardly been utilised in education. Many of the current ICT-applications are used to facilitate teacher-controlled arrangements of the learning process. Applications of ICT are adapted to the existing education beliefs and teaching routines, and are being used just as a *substitute* for other media. The beliefs and attitudes of teachers towards their teaching practice have not changed, and basically in elementary and secondary schools the teaching and learning process itself has not changed (ten Brummelhuis, 2000; Pelgrum, Janssen Reinen & Plomp, 1993).

It is important to note that the use of ICT as a substitution of current teaching and learning activities can be seen as the first of three phases through which the implementation of new technologies generally diffuses (Itzkan, 1994). These three phases of technological diffusion are shown in Figure 1 here-below.

In the substitution phase, the technology replicates or automates the existing instructional practices. The technology is used for already existing educational activities, for example, drill and practice exercises on the computer refer to the use of computers as electronic paper. In the transition phase, new instructional methods begin to evolve, like the use of e-mail in foreign language classes to communicate with peers who are native speakers. In this phase the technology is used for activities for which it was not necessarily brought in, and it is challenging old instructional practices. In the transformation phase, the technology provides completely new instructional situations and the old customs become obsolete. According to Itzkan (1994) the instructional tasks for which the technology was originally acquired, may no longer be desired.

The underlying rationale of the phases of technological diffusion is that it is a mistake to suppose that new technologies will continue to fit existing or old practices. And the other side of the coin is that when we continue to use ICT for substituting existing practices, ICT will not contribute to solutions for today's problems in education.

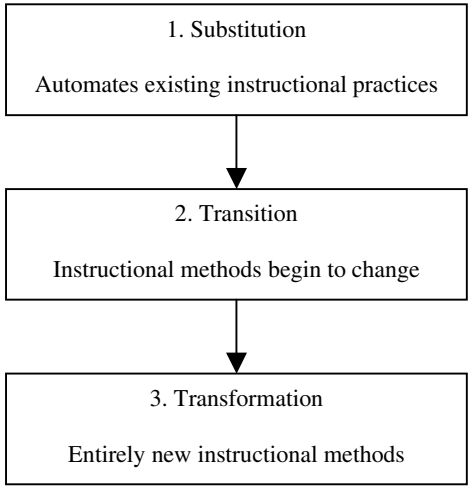

Figure 1: Phases of Technological Diffusion (Itzkan, 1994)

Conscious and carefully planned actions are needed to get beyond ICT use just for substitution. There are many possibilities to use the new technologies in a 'transition' phase serving a student-controlled, constructivistic approach to education.

ELEMENTS OF REFORM IN EDUCATIONAL PRACTICE

Of the many initiatives that were taken by national governments one would expect that they would (ultimately) result in visible changes in educational practice. In order to determine the developmental trends in educational practice, one needs to monitor nationally representative samples of schools, teachers and students.

At the end of 1998, the IEA[2] collected in a project called SITES (Second Information Technology in Education Study) data regarding indicators of 'pedagogical practices and ICT' from national samples of schools (at the primary, lower secondary and upper secondary level) in 26 countries. The intention is to recollect part of these indicators in 2004, so that developmental trends can be made visible. The IEA has also conducted other studies that contained a few indicators of ICT-availability and use (TIMSS-1995, TIMSS-1999). As at this moment there are no other international agencies that conduct ICT-assessments in education, this means that at the international level hardly any trend-data on pedagogical practices related to ICT are available. Hence, for the international assessment, we need to rely on the base line data that were collected in 1998. A potential source for getting an impression of developmental trends is a recent report from the so-called Dutch ICT-monitor (Pelgrum & ten Brummelhuis, 2001). In this monitor, currently for a period of three years, data on ICT-indicators are collected from national representative samples of school principals, ICT-coordinators, teachers, and students.

The data from IEA and the Dutch ICT-monitor will be used to address the following questions[3]:

1. To what extent are educational practitioners aware of and willing to adopt (elements of) a new educational paradigm?
2. To what extent is ICT facilitating the implementation of (elements of) a new pedagogical paradigm?
3. What are the obstacles for realizing the ICT-related objectives of schools?
4. What expectations exist for the (near) future?

Awareness and adoption

From the data that were collected in SITES as well as in the Dutch ICT-monitor there are clear indications that the policy discussions have also affected educational practitioners. A first observation comes from SITES. In this study, school principals were asked to write down their most satisfying experience with ICT in terms of, amongst others, content, student activities, and what teachers and students gained from such activities. From the analysis of these data (Voogt, 1999), it appears that:

> *Quite a number of school principals across countries reported on the contribution that ICT made to new curriculum approaches (such as cross-curricular[4]), different roles for teachers, and productive learning activities for students.* (Voogt, 1999, blz. 215)

Another observation stems from the Dutch ICT-monitor, which included questions to school administrators and teachers about their expectation for the future with regard to characteristics of teaching and learning. Two indicators were constructed, that contained judgments of the current and future relevance of certain practices expressed in the following two sets of items:

Teacher-controlled teaching and learning:

- Testing the whole class at the same time
- All students start with new content at the same time
- Students sit in fixed seating arrangements
- Whole class teaching
- All students work at the same time and on the same content
- The teacher is the most important source of information

Student-controlled teaching and learning:

- Student frequently apply self-monitoring
- Students work at own pace
- Students work in groups or individually
- There are enough work places for group work
- There are different work places for group work
- Students at risk get separate instruction
- Instructional materials are available in the corners of the classrooms

From the results (see Figure 2 for illustration) it appears that teachers (at secondary level) see teacher-controlled education as the main characteristic of the current educational settings, but they expect that student-controlled education will be much more important in the future. The same observations were made on the basis of judgments that were made by school principals for the same two sets of items.

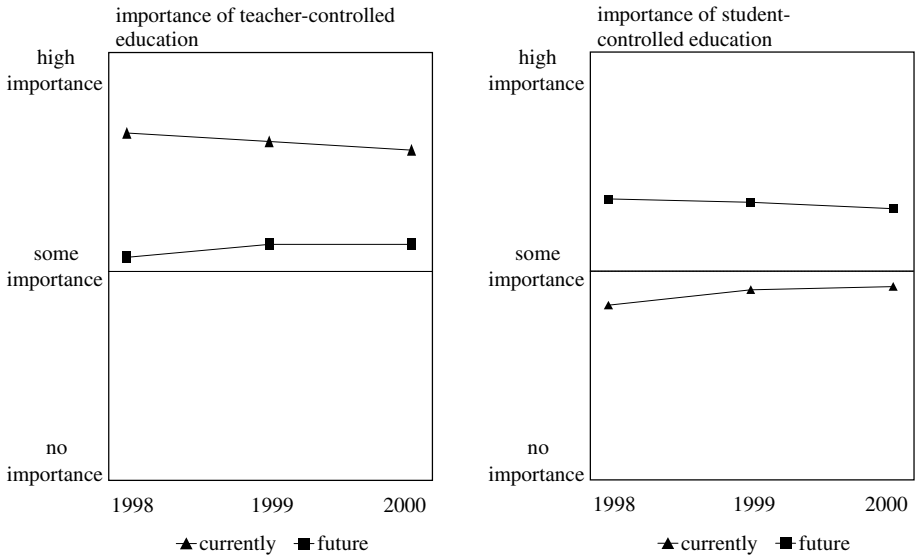

Figure 2: Indicators of teachers' perceptions (in three consecutive years) of relevance of teacher-controlled and student-controlled education, now and in the future (Pelgrum & ten Brummelhuis, 2001).

From the above, one may tentatively conclude that there seems to be an awareness and even willingness among educational practitioners to accept the importance of student-controlled learning.

A next question is, to what extent student-controlled learning practices have already been adopted in schools. The data from SITES may throw some first light on this question. School principals from lower secondary schools in 24 countries were asked about objectives, presence and ICT-facilitation of a number of pedagogical activities that are potentially indicative of student-controlled learning. For the purpose of our presentation, here we will focus on the practice of independent learning by students.

Table 1 shows the percentages of school principals per country who answered that it was their school's policy to encourage independent learning by students. It also shows the percentage of school principals who indicated that this activity was already present a lot in their school**.**

Table 1: Percentages of school principals (in lower secondary schools) answering affirmatively to questions about policy, presence and ICT-facilitation with regard to independent learning.

Country	Policy to encourage	Present a lot	Realized a lot with ICT
Belgium-French *	62	28	7
Bulgaria	71	45	21
Canada *	70	46	28
China Hong Kong	85	4	13
Chinese Taipei	80	22	30
Cyprus	67	27	40
Czech Republic	65	15	24
Denmark	68	44	16
Finland	92	27	15
France	78	20	13
Hungary	82	65	39
Iceland	82	8	5
Israel *	92	20	34
Italy *	72	24	10
Japan	67	5	12
Lithuania	89	24	16
Luxembourg	62	16	12
New Zealand *	75	39	12
Norway	87	64	16
Russian Federation *	33	31	13
Singapore	89	15	25
Slovenia	90	46	15
South Africa *	66	38	16
Thailand	62	37	24

ICT-FACILITATION

At this stage we need to be cautious with interpretations because not much empirical evidence on the validity of the questions in table 1 is yet available. However, it is interesting to note firstly the variation between the items and, secondly, the variation between the countries. In many countries school principals at the lower secondary level indicated that is was their school's policy to encourage independent learning by

students. In general, the percentages of principals indicating that this practice was present a lot was much lower, but in quite a number of instances it was already substantial.

As readers will see from the figures in Table 1, we can tentatively conclude that student-controlled pedagogy is starting to be adopted in educational practice, but is not yet implemented in most countries. However, the extent to which this is the case and the implications for the traditional curriculum (e.g. how much is dropped?) need to be much more intensively studied in-depth.

In the policy rhetoric that was reviewed above, the facilitating role of ICT has been mentioned. Interesting is the question to what extent educational practitioners perceive ICT as helpful in realizing student-controlled pedagogy. An indicator of the extent to which this is the case is the perception of school principals. As shown in Table 1 it seems that quite a number of school principals (when compared with those who said that the practice of independent learning was present a lot) attributed a lot of facilitating power for realizing this goal to the help of ICT. This could be taken as an indication that according to educational practitioners' perceptions, there is some faith in the tenability of the policy assumption about the facilitating role of ICT. Another indication of this 'faith' comes from the Dutch ICT-monitor, in which school principals' and teachers' opinions were elicited about the current and future role of ICT in teaching.

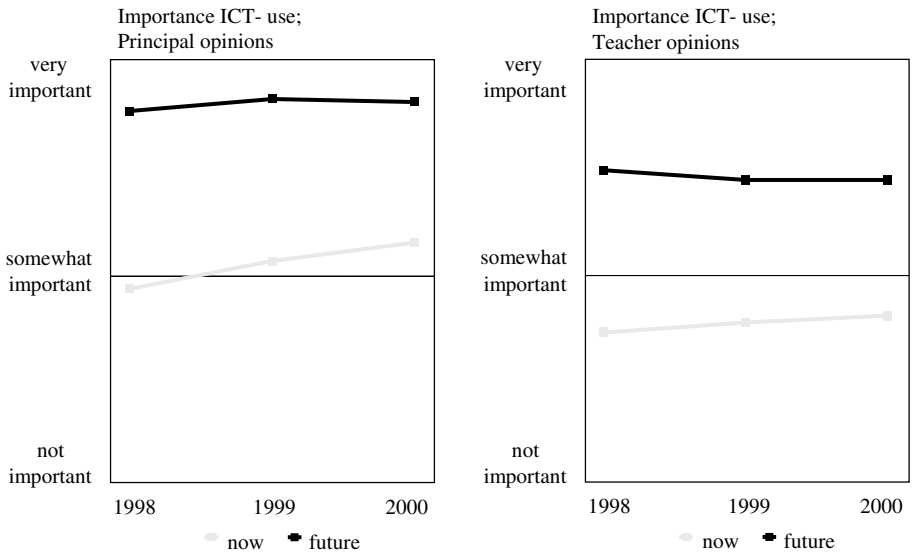

Figure 3: Indicator of perceptions of school principals and teachers on the current situation and the future with regard to the importance of ICT-use in education.

OBSTACLES

On the basis of the IEA CompEd surveys that were conducted in 1989 and 1992 (Pelgrum & Plomp, 1993), it was concluded that ICT was mainly an add-on to the existing curriculum: most schools had introduced courses to teach students about computers. However, the integration of ICT in the teaching and learning of existing subjects hardly occurred at that time. Indicative evidence for this conclusion was that students hardly used computers for learning mathematics and even less for other school subjects. This situation had hardly changed in 1995 when evidence from the IEA Third International Mathematics Study (TIMSS) became available. TIMSS was repeated in 1999 and allows for a further inspection of the integration of ICT in mathematics learning. Table 2 contains the percentages of students who indicated that they used computers at least once in a school year for learning mathematics. The increase in this indicator over a period of 4 years is for most countries quite low. The most notable increase occurred in Singapore, which is an exceptional case in terms of the huge investments and very ambitious plans for ICT-integration that have been in operation since 1998.

Also from the Dutch ICT-monitor, it appears that the integration of ICT in regular instructional practices is more or less stagnating. Over a period of three years (1998-2000), notably in a period of intense governmental stimulation of ICT in education, the percentage of teachers using ICT in their lessons hardly changed and remained stable at a level of about 30%. On the other hand it appeared that teachers as well as students increasingly use computers, but this occurs mainly outside the instructional practice.

This observation leads to the question of why the integration of ICT in education is changing so slowly. Our hypothesis at this moment is that this is caused by a combination of factors of which the most important are:

- Difficulty to integrate computers
- The lack of teacher skills
- Insufficient number of computers

The reasons for highlighting these potential causes are theoretical as well as empirical. Theoretically one may argue that *the integration of computers is difficult*, because a traditional pedagogical paradigm does not offer much room for ICT use at the secondary educational level. Whole class teaching presupposes that all students do roughly the same things at the same time. ICT can be supportive in such a paradigm for demonstration purposes, drill and practice for remedial purposes. However, usually the rather rigid scheme of lesson schedules and the location of computers in a few computer rooms hardly allow for much flexibility for students to sit apart for individual drill and practice. So, if teachers want to apply ICT they need to apply pedagogical methods for which *most do not have the skills*. Moreover, if teachers really did frequently use ICT, most schools would *not have enough equipment*.

The empirical argument for pointing to these three obstacles is that they were in the top three of a list of 38 obstacles which were rated by respondents who participated in SITES-1998 (Pelgrum, 1999).

Table 2: Percentages of students using ICT for learning mathematics at least once in a school year, measured in 1995 and 1999.

	1995	1999	Difference
Australia	23	29	6
Belgium (Fl)	6	7	1
Canada	18	33	15
Cyprus	27	19	-8
Czech Republic	12	16	4
England	55	54	-1
Hong Kong	9	25	16
Hungary	8	8	0
Iran, Islamic Rep.	8	4	-4
Israel	24	33	9
Japan	23	24	1
Korea	7	17	10
Latvia (LSS)	9	5	-4
Netherlands	19	20	1
New Zealand	21	27	6
Philippines	22	20	-2
Romania	22	7	-15
Russian Federation	6	3	-3
Singapore	10	54	44
Slovak Republic	6	5	-1
Slovenia	11	19	8
Thailand	9	15	6
United States	31	39	8

REFLECTIONS

In the section above, we have tried to argue that a new educational paradigm is looming before our imagination as a result of societal changes that emerge from an increased embedding of many aspects of life in an information technological infrastructure. We have described the main features of this new paradigm in terms of characteristics that seem to be embraced by substantial numbers of policy-makers and educational practitioners. In this section we offer a critical reflection on the notions that were introduced earlier in this chapter by posing a number of questions that may be critical in gaining a further understanding of the current developments.

A first question is whether ICT is really essential for implementing the new educational paradigm. An associated question is how new the paradigm actually is. One may argue that the characteristics, which we described in earlier sections, resemble very much the approach that was adopted and implemented by many

reform schools that followed approaches developed by educational visionaries such as Montessori, Freinet, Dalton, Steiner, etc. As these approaches never gained real momentum (in terms of large-scale adoption in the educational system), one may wonder whether it is realistic to expect that suddenly, as a result of ICT, large-scale implementation of analogous principles would be possible. The reform movements have often be seen as elitist because, amongst other reasons, mainly students with a high degree of self-discipline and who are stimulated and supported by motivated parents are able to survive in these systems. On the other hand, maybe the hypothesis is tenable that large-scale implementation of these reform-pedagogies was not possible, in part because of the load it places on teachers in terms of coaching large groups of students with individual learning tracks. Such problems might be overcome by ICT-applications that take over part of the administrative and monitoring tasks of teachers.

A second question relates to the potential risks that could be associated with adopting the new paradigm. Although educational practitioners seem to underscore the importance of the new paradigm (as argued in previous sections), there are also indications that they are aware of potential dangers. In a recent workshop in the Netherlands (November 2000) on the future of education, where many participants were in favor of the new paradigm, a teacher asked: 'Do we want to put a whole student-generation at risk?' Related to this is the question of whether an educational change as implied by the new paradigm can be introduced gradually or whether it is more a matter of switching the new paradigm on while at the same time switching the old one off, more or less analogous to changing road traffic from driving left to driving right. One may wonder whether gradual change is possible: one may hypothesize that the new paradigm requires a lot of curriculum time and adequate sequencing of learning situations from primary to secondary education. This additional time is needed for students to acquire basic competencies related to higher order skills inherent to the core objectives of the new paradigm, such as: cooperation, autonomous learning, teamwork, communication, information handling, etc. A pertinent question is how much of the traditional curriculum content needs to be sacrificed in order to free-up time for creating opportunities (over a prolonged period of time) for students to acquire these competencies. An indication that such sacrifice is needed, comes from Singapore. Teng & Yeo (1999) wrote:

> *To facilitate the development of such a learner-centered environment (supported by the availability of technology and digital resources), a 10 to 30% reduction in curriculum content was instituted towards the end of 1998.*

Unfortunately there is not yet empirical evidence available that documents the extent to which the new paradigm could be successfully implemented. Even worse, at the moment of writing this chapter it is not known how to measure (reliably, validly and efficiently) the competencies that are at the core of the new paradigm. Still many countries have not yet started the voyage of discovery beyond the horizons of the current educational system. Sometimes only a few schools are involved in such operations aimed at exploring the future. But also examples are known of countries

where major parts of the educational system are involved in this mission, for instance the Netherlands and Singapore.

From qualitative and quantitative studies that were collected in the Netherlands (e.g. Voogt & Odenthal, 1998; Brummelhuis, 2000) one may tentatively infer that innovating schools according to the new paradigm is a very complex process. The qualitative studies in the Netherlands indicate that:

- Teachers are not very much in favor of multidisciplinary approaches
- Teachers need good examples of learning environments that are based on the new paradigm
- Teachers need new approaches for monitoring and evaluating the progress of learners
- Teachers do not have a good understanding of their new roles

The quantitative studies in the Netherlands point out that, at the secondary school level, a proper balance between three crucial factors (ICT-infrastructure, teachers' beliefs, and teachers' knowledge and skills) is lacking.

At this moment the knowledge base for answering the exemplary questions that were posed above hardly exists. Even the knowledge base for testing new skills is hardly available. Also widely accepted definitions of core concepts of the emerging paradigm are lacking. This means that in many countries discovery tours to unknown territories are undertaken, while the navigation tools are lacking or in a preliminary stage of development. Only by intensive cooperation between developers and researchers and with a program of large-scale monitoring (in an international context) is there a chance to offer information about the actual position of the education system and to minimize the risks of serious navigation errors in these operations.

On the basis of information that is currently available, it seems that in the forthcoming years the reform of the education system around the world may pose several challenges for educational designers. Reflecting on our experiences so far, it seems that special attention is needed for an approach that fully acknowledges the implementation perspective. Among the major challenges, the following especially seem to be important:

1. Crossing the boundaries of the traditional subjects is a central theme in the emerging paradigm, but not yet for the current generation of teachers. Therefore, good examples of (multidisciplinary) learning environments with learner-controlled ICT use need to be developed.
2. New approaches of learner evaluation are needed because a number of the new educational goals are process goals.
3. Teachers are still uncertain about their new roles and do not possess new routines yet. Therefore, new didactics are needed.
4. With respect to *in-service* education, it seems important to pay attention to:
    a. influencing beliefs of teachers, especially addressing the question of what is 'good' education for the future.

b. focus on pedagogical knowledge and skills related to ICT use.

5. Given their new roles, teachers have to develop as designers of learning environments.
6. School boards and administrators need to develop school policies reflecting a better balance between the three factors mentioned above (factors: ICT-infrastructure, teachers' beliefs, and teachers' knowledge and skills).

NOTES

[1] The terms student-controlled and teacher-controlled are still quite fuzzy, but are used in this paper as alternatives for terms such as 'student-centred' and 'student-oriented' respectively 'teacher-centred' or 'teacher-oriented', which one often encounters in relevant literature.

[2] The International Association for the Evaluation of Educational Achievement, see http://www.iea.nl/

[3] For space considerations, the focus in this section will be on lower secondary education

[4] That is: approaches that are multidisciplinary and address content from several school subjects at the same time.

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C. PAUL NEWHOUSE

PORTABLE COMPUTING CHALLENGES SCHOOLING

Abstract. Since the nineteen-eighties emerging computer technologies have shown the potential to support the processes required to deliver high quality education to more students. Developments in ICT have led to the emergence of low-cost high-powered portable computers, and improvements in the capabilities and operation of computer networks that may unlock more of the potential for computers to support learning in schools. This chapter explains why I think that portable computing offers the opportunity to provide better education in schools and challenges current schooling practices. This is presented in terms of a progression of my experience associated with the development of the technologies. While these developments should be welcomed in schools it is not clear that they will have any more impact on schooling than previous developments in technology. My research has highlighted key issues in terms of the implementation of the technology in learning environments that need to be addressed and suggests that while portable computing addresses some of these issues, there are others concerning teacher beliefs, pedagogy, curriculum and school organisation that it will challenge.

INTRODUCTION

It was the year 2000 and here I was with a Year Seven (12 year olds) class helping students to create digital videos. One student from each pair went to the trolley to get a numbered, small, brightly coloured portable computer. Back at the desk the computer was opened and almost immediately sprang to life. A movie file was opened and each pair began work putting the finishing touches to a 30 second 'commercial' presenting their school camp. Two girls informed me that their whole two week video project had somehow been deleted, but not to worry they would quickly do it again (1 hour later it was completed – they had learned a lot). I showed one pair of students, using my portable computer, how to record a voice-over for part of their movie, they had a few 'takes' and then showed the next pair and so on. The sound files were saved to the shared directory on the network server so on returning to their computer each pair imported their sound files into their movie, without connecting any wires. This was almost '2001 A Classroom Odyssey'.

I cast my mind back to 1979 when I was standing in front of my first class (Year Eight) as a teacher, the possibilities were so much more now than then. The idea of Year Seven students creating videos, web-sites, interactive multimedia products and sophisticated documents would have seemed ridiculous then but was almost mundane now. I mused that if the technology had been available when I was first a teacher how much more I could have done and how much better I could have

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 69–92.

fulfilled my role as a teacher. Now, as a researcher, I knew that while I was helping these Year Seven students and their teachers use the technology to provide high quality learning experiences this was not the norm for most children across Western Australia. Most of them would find the learning experiences I could offer in 1979 innovative over 20 years later. Here was the paradox that while newer technologies were expanding the possibilities, most children's experiences at school were limited to a small set largely dependent on older technologies.

WHY CHANGE SCHOOLING?

When I was an undergraduate honours-stream Physics student most people told me I was foolish to want to become a teacher when I could go into almost any field I wanted. Teaching was for those who couldn't do anything else better paid. I had developed an interest in teaching as a senior secondary student when I found that I could successfully tutor other students in 'difficult' subjects such as mathematics. It had always been important to me that I understood all that I was required to learn, this was more difficult but seemed to pay off in the long-term. Two of my teachers reinforced this approach but when I reflected on the actions of all my other teachers I knew things could be so much better. Most of my fellow students had little understanding of what they were being taught, their parents could not help them, and they did not seem to have the confidence or the ability to make their own decisions.

The government school I chose to begin teaching at required an essay on my philosophy of education as one of the criteria for employment. What I wrote then was very similar to that which I would write now. For me education concerned the provision of opportunities to develop the individual potential of a person and also to empower her/him as a decision-making citizen. While this could, and should, occur throughout life and in many different contexts (e.g. home, work, clubs, churches) it was critical for children, and school provided the only context where it was possible to guarantee an adequate level of opportunity. Schools have many different functions from baby-sitting to indoctrination but they do provide a common context for all children in which educational opportunity can be afforded. However, I believe that most children in countries such as Australia are not afforded adequate educational opportunity. Most of what they are provided with at school does not allow them to develop their individual potential in any realm (cognitive, social, physical etc.) nor to become empowered decision-makers in our increasingly changing and complex society. Instead the opportunity is often wasted on trying to coerce children into remembering data and repeating skills that a small group of people thought we needed, often many years ago.

I have seen schools and worked in a school where the focus is on the individual needs of children. The curriculum is developed and implemented to give children the opportunities to develop their understanding of themselves, their environment and their society. These schools are organised to provide an environment where children develop confidence and decision-making capabilities within a context of respect and responsibility. In many of these schools the sheer number of students and the economically required ration of one teacher for 30 students means failure

more often than success. Added to this the limitations of all of us as teachers, including limited access to information, will lead to failure. However, even this provides much better opportunities for children than the vast majority of schools provide. Perhaps with improved technological support, particularly ICT, we can overcome some of these limitations and thereby encourage more schools and teachers to risk offering a real education for the children in their care.

POSSIBILITIES EXPANDING

In countries such as Australia, there has been a vast and accelerating investment by governments and school systems in computer technology, mainly hardware. This has been encouraged by the obvious logic behind the arguments for the potential benefits of such flexible tools to students, teachers and school systems and arguments concerning the computer literacy of students. However, for nearly 30 years consistently the research finding has been that computer technologies have had little impact on mainstream schooling (Morrison, Lowther, & DeMeulle, 1999; Plomp & Pelgrum, 1992). For many years the reasons given for this apparent discrepancy included access to an inadequate amount of hardware, poor quality software, unreliable hardware, and the complexity of operating computer systems. It is difficult to sustain this reasoning today with the increasingly high quality hardware and software available for reducing costs.

It is now a realistic possibility for all students in an Australian school to be provided with portable computer processing. Becker (2001) discussed the potential negative and positive impacts showing how the cost of the portable option is comparable with classroom desktop computer options. While it is relatively safe to contend that most students in the future will have some form of portable computer processing, given the historically robust nature of schools it is difficult to predict in practice what impact this will have on schooling and the curriculum.

Over the past decade there have been a reasonable number of studies into the use of portable computers in schools. For example, Walker, Rockman, and Chessler (2000) provided a comprehensive comparison study from the Microsoft's laptop computer programme. They reported on eight 'laptop schools' with three matched 'non-laptop schools'. They found that 'laptop teachers' showed a shift toward the use of more constructivist pedagogical practices. Also they found that the students using laptops had improved writing skills and confidence in computer use, but results on standardized tests were inconclusive. Laptops were used to support an increasing range of activities and for increasing amounts of time at school and home. These findings support those of many other researchers (e.g. Ainley, Bourke, Chatfield, Hillman, & Watkins, 2000; Becker, Ravitz & Wong, 1999; Marcinkiewicz, 2000).

Over the 1990s I conducted research into the use of portable computers in schools and found that for a range of reasons very few teachers consistently facilitated the use of computers to support the learning of their students (Newhouse, 1999). Among other things there were many barriers teachers felt they needed to overcome, some of these were technical, others involved the structure of the

curriculum, the organization of schools and their own level of computer literacy. Students also perceived some technical barriers such as short battery life, heavy weight, and the difficulty of connecting to networks. When Apple first introduced their iBook computers and Airport wireless networking (refer to www.apple.com), it seemed that these technical barriers may have been removed. Perhaps finally the technology would support us in improving school-based education, however, history is littered with discarded educational technology solutions. The use of portable computers must be viewed in the broader contexts of the development of computer technology, the history of computers in schools and the nature of schools and schooling itself.

THE EARLY YEARS OF COMPUTERS IN SCHOOLS

I was introduced to my first computer when I was 16 years old. A small group of us were ushered into a cold room in the Physics building at the University of Western Australia and shown these huge cabinets with flashing lights and buttons. I was not very impressed with the fact that we could fill in a stack of cards to get this computer to add two numbers together. I was a little more impressed with the opportunity to issue instructions to control a pen to play a hole of golf using the computer. However, any relationship to learning or even living in our community did not occur to me at the time.

In 1979 I began to teach at a secondary school that had a computer terminal that used a modem to connect to a remote mainframe computer. By this stage evidence of the impact of computers on our lives was starting to emerge. I could replace my passbook at the bank, I could book an airline seat a few minutes before take-off, and some supermarkets had checkouts with bar-code readers. I became a teacher to help children develop their potential and empower them for life in our community. It was clear that computer technology was going to be the power behind the organization of our community so students needed to know about the technology. But how do you do this with one computer terminal and 1,000 students? Firstly, I had to learn more myself, so I went back to University to study Computing. Secondly, I began to teach children to master the technology by programming it.

There was a text-based game called KING on the mainframe, a simulation of running an island economy. If you did well you were the King, if not you were expelled or worse. This kept me and my students occupied for hours and, not surprisingly, they seemed to learn all sorts of things from strategies to concepts. I knew that in my younger years I had learned a lot out of creating and playing simulation games of strategy. I learned in my computing course about the data processing capabilities of computers and then in 1980 we bought an Apple II microcomputer and some simple simulation software such as ‘Stockmarket’. Now I could see the potential of these machines to support a vast array of learning experiences for children but there was still the problem of rationing access, and there was very little software.

WHY ARE COMPUTERS IN SCHOOLS?

In the 1960s, educators and interested community members began to consider realistically the potential for the use of computers in education both at the tertiary and school levels. In the mid-1970s, access to computer processing became available in Australian schools, initially limited to one terminal and later to a number of microcomputers. Today most Australian schools, as is the case in other developed countries, have substantial numbers of computers, some to the extent of one computer per student (Ainley et al., 2000). For example, the Auditor General of Western Australia reported that 59% of schools already exceeded the 2002 target student-to-computer ratios for government schools of 5:1 (secondary) and 10:1 (elementary) (Auditor General of Western Australia, 2001). In the USA the National Center for Education Statistics reported in 2001 that the average student-to-computer ratio in public schools in the USA had improved to 5:1 (Cattagni & Farris, 2001).

Gardner et al. (1994) give the rationale for computers in schools as the perception of computer literacy for employability, to improve work output, to improve motivation, to improve "learning environments", and to empower students by releasing them from tedious repetitive tasks. Educators (e.g. Mandinach & Cline, 1996) describe these things using different terminology, but in general they can be distilled into four main categories of application to education: computer literacy/awareness, computer science, computers in teaching and learning (computer-supported/based learning), and computer-supported administration. Two of these categories are particularly relevant to this chapter, those of computer literacy/awareness and the use of computers in teaching and learning.

The terms computer literacy and computer awareness have been defined in different ways with the relative merits of each definition hotly debated (Johnson, Anderson, Hansen, & Klassen, 1980; Kay, 1993). However, most definitions tend to have common themes. Rowe (1993) defines computer literacy as part of "personal capital" (p. 17), to do with the possession of those skills, attitudes, concepts and knowledge that allow persons to make use of computers to complete tasks and solve problems in relevant areas of their life. Gardner et al. (1994) define computer literacy as "both familiarity with the various forms of the technology and the ability to use technology in a natural and competent manner to meet our own needs, and where appropriate, those of others" (p. 5). Perhaps it could be considered that computer awareness has to do more with the possession of knowledge and understanding of concepts concerning the use of computers within society, while computer literacy embodies the ability to make use of computers.

The importance of computer literacy/awareness for all persons also has been debated at length (Hansen, Klassen, Anderson, & Johnson, 1979), with many authors suggesting parallels for this form of literacy with writing, reading and mathematics (Carleer, 1984; Johnson et al., 1980). The need for the average person in our technologically-based society to be comfortable with using computers is a basis for arguing that all members of our society need to acquire some level of computer literacy (Carleer, 1984; Hannafin & Savenye, 1993; Rowe, 1993). Collis

(1989) appears to support this need by stating that, "the need for information accessing skills is going to escalate so much in society that the educational community will agree that there is a need for systematic experiences with this type of access throughout school" (p. 7). In Australia, political leaders have debated the need to overcome disparities in information technological literacy (Lundy, 1997).

How to achieve an adequate level of computer literacy for all students is also hotly debated and depends significantly on the conception held about the relationship between the person and the machine (computer system). In parallel with other forms of literacy, Rowe (1993) states the aim of computer literacy in terms of to "make the computer part of oneself" (p. 71). This, she argues, requires an understanding of the machine and the development of a synergetic relationship with it. Lynch (1990) has a similar conception, arguing that computers are dynamic parts of the social system, that they embody social values and have different impacts on different individuals. Thus it can be argued that computer literacy is relative to the individual, and that computer literacy needs will differ between students.

The final area of debate concerns whether schools should offer specialist computer literacy and/or awareness courses with specialist teachers or whether appropriate levels of computer literacy and awareness should be fostered through "cross-curriculum" activities with all teachers involved. It should be noted that the same argument could be applied to any of the other types of literacy, such as language literacy, numerical literacy (numeracy), and general technological literacy. The approach to computer literacy in schools has tended to mirror the approaches to other literacies, with more specialist courses for older students and more cross-curriculum approaches for younger students.

Some educators (Haydn, 1993; Newhouse, 1989; Oliver, 1985; Rowe, 1993) doubt that appropriate levels of computer literacy will occur by following a purely cross-curriculum approach to computer use in schools. Such an approach may lead to what Rowe (1993) terms "cook-book approaches" rather than allowing students to become self-sufficient, which is required if the computer is to become "part" of them. Collis (1989) and others (Sutton, 1991) also raise the issue of equity, which may not be afforded without "systematic experiences" (p. 7). However, the other extreme, where computer use is largely limited to specialist computer literacy and computer science is equally unsatisfactory. Students may develop a good understanding of the machine, but are unlikely to value it since it has little or no application to their lives (Oliver, 1985). Therefore, as is supported by Collis, Kass and Kieren (1989), it is important that students not only develop operating skills and an understanding of the machine but also that it has a significant and valued place in their lives as learners at school in a wide range of activities.

There is no doubting that computer technologies have a significant and critical place in Australian society today and are increasingly becoming integral to the operation of most workplaces. As a result there is a continuing need for students to develop competence and understanding in the use of computer technologies. Within technology education it is legitimate to focus on computers as an area of study where students will learn about computer technologies, how to use them and their

place within society. Computers may also be used as a learning tool, but this is a different issue.

For Australian society, computer technology is the pre-eminent and most pervasive technology and therefore we would be negligent not to afford it a significant place within technology education. Any school/teacher not including computer technology within learning programmes for technology education is not providing a broad enough or relevant enough range of technologies. Schools must ensure that the provision of computing as a part of technology education is distinct from the provision of computers as learning technologies. However, the use of computers to support learning across the curriculum will rightly be the major focus of computers in schools.

COMPUTERS ARE THERE BUT NOT USED

In one of the last units of my graduate computing course at University, we had a guest speaker who was an eminent leader in the state education authority. He explained how it was important for children to learn about computers because computers were important in our society, and how they could learn to become programmers through the use of stacks of cards. When our lecturer raised the issue of microcomputers and said he had read an article where French schools were getting 10,000 microcomputers, the reply was that microcomputers had no place in schools because they did not support a card reader. I last heard that this gentleman had moved into running a home hardware store, probably just as well, although there have been far more eminent persons making far more short-sighted predictions.

After 3 years of teaching, my school had 3 microcomputers to add to the terminal so we could organise some access for every Year Eight student and many older students as well. The computers were used almost every hour of the school-day. They had to sit on old library trolleys so we could take them to the students. I could see the potential for storing administrative information so I wrote a package to do this for the school. The secretary had to fight for access so the Principal decided to buy one just for administration.

I had two classes of Year Nine lower ability mathematics students and was struggling to make the content relevant. So I decided to create a simulation of weekly budgeting. The students worked in pairs to complete a one-page budget each week that included a fixed income, some fixed expenses, some regular expenses, some discretionary spending and some banking. I prepared a catalogue of items for their discretionary spending. Each week I collected their budgets, marked them, recorded their banking and items they had bought – a lot of work for me. The simulation worked but wore me out so I decided next time to get the computer to do the hack work. Next term I organised one of my top computing classes to help me write BASIC programs to process the data from the budgets. Now my computing students entered the data from the sheets my mathematics students generated, the computer programs checked the data, recorded the banking and items bought, and finally printed out a status sheet for each student. Later I refined the program using Hypercard (an early hypermedia authoring environment).

At the same time, the first word processors began to appear and having used programming text editors, I could immediately see the value of this new application. I was writing books using Zardax but because cheap laser printing was not available a typesetter still had to re-type from my print-outs. At school we were using Wordstar coming to terms with <B> tags for boldface. My Year Eight students took 6 weeks at 1 hour a week to type less than one page and correctly claimed that they would have been better off hand-writing.

By now I had learned that when choosing to use a computer application to support learning I had to make sure that I was focussed on a problem, that the software addressed the problem and that it increased the productivity of either the students or the teacher. The budget simulation database allowed me to successfully implement a simulation that addressed a problem of relevance, and reduced the amount of work I had to do. The Wordstar word-processor decreased student productivity for students who did not have a problem with writing.

USE OF COMPUTERS IN TEACHING AND LEARNING

Computers have been used in a variety of ways to enhance the processes and outcomes of teaching and learning (Collis, 1989; DeCorte, 1990; Greenwood, Peterson, & Sideridis, 1994; Hativa, 1994; Rieber & Welliver, 1989). Irrespective of how the computer is used in teaching and learning, or how many computers are available (Sheehy, 1997), it is being used as an educational technology. Educational technology is typically defined in terms of the technological tools that teachers and students use to support the processes of teaching and learning. This encompasses a wide range of technologies related to blackboards and chalk, pencils, books, and slide-rules to television, facsimiles and computers. However, Rieber and Welliver (1989) define educational technology more as a process involving, "a systematic approach to identifying instructional problems and then designing, developing, implementing and evaluating instructional solutions" (p. 22). They argue that, "In order for the full potential of educational technology to be realised, it must be viewed more as a process rather than just the implementation of educational tools" (p. 22).

While there is a wide range of technologies to support the processes of teaching and learning, their impact has varied for the majority of students in any particular community (Hannafin & Savenye, 1993). For example, the most prevalent technologies in Western Australian schools are the manual writing technologies (e.g. chalkboard), books and video-tapes. In some less economically advantaged communities, such as those in many African countries, even technologies such as books and films are not pervasive. Some argue that particular technologies may never be pervasive having missed their opportunity to have an impact (Rieber & Welliver, 1989).

FROM COMPUTER-BASED TO COMPUTER-SUPPORTED LEARNING

When the potential use of computers in schools was first mooted, the predominant conception was that students would be "taught" by computers (Mevarech & Light, 1992). In a sense it was considered that the computer would "take over" the teacher's job in much the same way as a robot computer may take over a welder's job. Large computer systems were field-tested, particularly in universities, to teach students a variety of content (Chambers & Sprecher, 1984), with the software used by these systems typically referred to as either tutorial or drill and practice (D&P). It was considered that once the cost of computer processing became more reasonable, similar systems could be implemented in schools. Collis (1989) refers to this as "a rather grim image" where "a small child sits alone with a computer" (p. 11).

During the late 1970s and early 1980s, computers became more affordable to schools permitting a rapid decrease in student-to-computer ratios. While tutorial and D&P software continued to be developed (Chambers & Sprecher, 1984; Maddux, 1984), a range of other educational software was developed which was not based on the premise of teacher replacement. For example, during this period much simulation software (Glenn & Rakow, 1985), modelling (Papert, 1980) and tool software (e.g. word processors) were developed and applied to school learning programmes. However, still the major argument used to support the introduction of greater amounts of computer hardware into schools concerned the perceived need to increase the level of computer literacy of students (e.g. Carleer, 1984; Downes, Perry, & Sherwood, 1995; Hansen et al., 1979; Maddux, 1984).

Towards the end of the 1980s and into the 1990s, while the computer literacy argument still remained (Hannafin & Savenye, 1993; Hussein, 1996), the major argument for having computers in schools was much more about the need to use computers to improve student learning. Discussion related to why very little seemed to have been accomplished, despite an installed base of computers most educators would consider sufficient to achieve some of the potential of computers for learning in schools. Numerous studies (Collis, 1989; Marcinkiewicz, 2000; Plomp & Pelgrum, 1992) showed that few teachers facilitated student use of computers in their learning programmes. There was also little evidence that schooling or classrooms were changing as a result of the presence of computers (Plomp & Pelgrum, 1992). At the time the United States Office of Technology Assessment found that "even in schools where computers were available at more than double the national average, only about one teacher per school had integrated the computer into the classroom" and that there was "a strong sentiment of disappointment and disillusionment among teachers regarding educational technology" to the point that it "does not agree with the views of its supporters and patrons" (Marcinkiewicz & Welliver, 1993, p. 2).

Educational authorities in Australia began to take seriously the potential of computers to support both school and non-school based learning programmes (Australian Capital Territory Department of Education & Training and Children's Youth & Family Services Bureau, 1996; Frank, Younger, Brearley, & Lelah, 1996).

Governments and private schools committed significant proportions of their budgets to providing hardware, software and training. Bogle (1997) reported around $200 million spent in each of Victoria and New South Wales, and gave the example of small government schools, such as Yetman Public School with 38 students, having student-computer ratios of between 5:1 and 10:1, and Internet connections. However, Downes, Perry, and Sherwood (1995) were concerned that changes in the Australian political landscape may lead to the ignoring of the pedagogical role while emphasising the instrumental role. Further, the use of computers was criticised by Ilana Snyder from Monash University, who is reported as saying, "Very often you can go into schools and see that they're using computers like books. All the potential is there, but there's not that much going on" (Bogle, 1997, p. 5). Miller and Olson (1994) suggest that some of the fault lies with the enthusiasts,

> *[…] pioneers in technology frequently see computers as a powerful vehicle for changing education, one capable of creating a revolution in teaching and learning. Unfortunately, many of these trail-blazing notions tended to be overblown, which prompted critics to identify numerous reasons for the unfulfilled promise of computers, especially as an influence on learning outcomes and teacher practices.* (p. 136)

To consider the impact or potential for impact on teaching and learning it is necessary to consider what is known about the processes of teaching and learning themselves. Collis (1989) argues that there is a need to know a lot more about learning before the application of computers becomes prevalent and also that unless applications have "pedagogical relevance" to teachers they will at best be implemented as a "one-time, interesting activity" (p. 5). Based on her research, Rowe (1993) concludes that "for the computer to bring about a revolution in our schools and education more generally, this technological innovation must be accompanied ... by changes in the organisational structure of classrooms, schools, the curriculum and the broader learning contexts" (p. 3).

REFORM OF SCHOOLS AND CURRICULA

The calls for change to schooling and curricula have arisen not only from a consideration of the use of computers but also from concerns about the lack of relevance and effectiveness of current systems (Carter, 1993; Cuban, 1990; Fullan, 1995; Schlechty, 1997). Banathy and Jenks (1993) point out that for as long as schools have existed there have been those who have wanted to change or reform them (e.g. Dewey, Neill, and Good - discussed by Riel (1994)). However, over the past 20 years there has been an increasing number of educators who have been arguing for the necessity of reforming school-based education (Banathy & Jenks, 1993; Collins, 1990; Hord, Rutherford, Huling-Austin, & Hall, 1987; Riel, 1994; Schlechty, 1997). Their arguments typically are based on changes in the community, usually associated with new technologies, and the different learner needs that these present. For example, Laszlo and Castro (1995) argue that,

> *The current global educational system is oriented toward the production of "knowers" instead of "learners" and consequently threatens the formation of individuals capable of responding effectively to rapidly changing environments.* (p. 7)

The 1984 USA National Task Force on Educational Technology report raised four important points towards improving schools through using technology in learning: that it may be necessary to change the current system or curriculum, that the financial costs were higher in the short-term, that it would involve not just computers but the "identification of instructional problems and development of realistic solutions" (Rieber & Welliver, 1989, p. 22), and that it was not a panacea for educational woes.

Almost all those who advocate major reforms of schooling have the view that learning needs to be more informed by constructivism (Bodner, 1986; Cunningham, 1992; Driver & Bell, 1986; Fishman & Duffy, 1994; Hannafin & Savenye, 1993; Marshall, 1988; Pines & West, 1986; Riel, 1994; von Glasersfeld, 1991; Vygotsky, 1978) and that such a reform will need to be supported by computer-based technologies is asserted by many (Collins, 1991; Collis, 1989; DeCorte, 1994; Dwyer, Ringstaff, & Sandholtz, 1991; Frick, 1991; Hopkins, 1991; Laszlo & Castro, 1995; Mandinach & Cline, 1996; Marcinkiewicz, 1994; Means et al., 1993; Miller & Olson, 1994; Morton, 1996; Narracott, 1995; Olson, 1988; Owen & Lambert, 1996; Perkins, 1992; Plomp & Pelgrum, 1992; Reeves, 1992; Rieber & Welliver, 1989; Riel, 1989; Rowe, 1993; Ryser, Beeler, & McKenzie, 1995; Salomon, 1994; Sandholtz, Ringstaff, & Dwyer, 1992; Schank & Cleary, 1995; Schofield, 1995; Sheingold & Hadley, 1990; Sivin-Kachala & Bialo, 1994; Thornburg, 1992; Turner, 1995; Van Den Akker, Keursten, & Plomp, 1992; Vosniadou, 1994; Waxman & Huang, 1996; Welle-Strand, 1991). For example,

> *[…] inadvertently, technology seems to be coming down on the side of constructivists, who have been trying ... to change the prevailing societal view of education.* (Collins, 1991, p. 31)

> *The [reform] efforts seek to move classrooms away from conventional didactic instructional approaches, in which teachers do most of the talking and students listen and complete short exercises on well-defined, subject-area-specific material. Instead, students are challenged with complex, authentic tasks, and reformers are pushing for lengthy multidisciplinary projects, cooperative learning groups, flexible scheduling, and authentic assessments.* (Means & Olson, 1994, p. 16)

> *As long as school organizational schemes remain the same, it is very difficult to accommodate differential acceleration among students.* (Collis, 1989, p. 4)

Often arguments involve the need for students to develop higher-order thinking skills and the failure of current schooling methodologies to provide the opportunity (Campione, Brown, & Jay, 1990; Loader & Nevile, 1991). In the extreme, the

technologies of the information age are perceived to be an irresistible force (Mehlinger, 1996).

Many projects involved with the use of computers in schools align themselves with this reformist view of schooling. For example, the principal of an Australian school in the forefront of using portable computers commented that, "While traditional curriculum dominates at [his school], every attempt is being made to move to a more constructionist approach that is learner-centred" (Loader, 1993, p. 13). He specified that the aim was that learning programmes should be based on Piaget's constructivist approach (constructionism as a particular application of constructivism is discussed by Jonassen, Myers and McKillop (1996)). A teacher at another school implementing portable computers was quoted as saying, "We believe that the child-centred, process-orientated, problem-solving style of education requires a different approach, a different style of teaching and different tools to those used in traditional computer labs" (Weekes, 1993, p. 17). Increasingly, the lack of reform in schooling towards a more constructivist approach is cited as the main reason for the lack of impact of computer use on schooling (Hannafin & Savenye, 1993; Moersch, 1997).

There are however educators who do not support this technology-associated reformist movement. For example, Loveless (1996) claims that computers will only "become an important tool of classrooms when they are rooted in the commonplaces of schooling, in classroom work as it is currently constituted, not as reformers believe it should be constituted" (p. 2). In fact he believes that the “technologists” have neglected the teacher's central role and oversimplified the complexities of classroom settings. A social psychologist, MacKay (reported in Yelland (1996)) was concerned that “we are modifying our behaviour to fit in with technology” (p. 52). However, this is clearly not supported by leading reformers such as Hannafin and Wilhelmina (1993).

Even those who enthuse about the potential of computers to transform learning in schools warn that, "putting computers in classrooms will not in itself lead teachers to view teaching and learning differently" (Swan & Mitrani, 1993, p. 41). Rieber and Welliver (1989) argue that, “There seems to be an innate desire on the part of educators to believe that there will exist one day a delivery medium which will enhance instruction and create superior learning environments by its mere delivery qualities” (p. 25). Miller and Olson (1994) criticise the view that computers will change the way teachers teach and/or will change the curriculum. They use a three year case study of a grade one primary school teacher to illustrate that teachers use computers to fit with or enhance their existing pedagogy by using applications such as a database and word processor. Marcinkiewicz (1994) points out that while the teacher demand for computers is low, the patrons of education such as governments, parents and school administrators expect teachers to use computers, perhaps to justify the cost.

The link between technological development and the transformation of learning is clear in history, for as Rieber and Welliver (1989) point out, "the lecture-and-text-based model of teaching and learning is itself the product of the introduction of a new technology, the printing press, into 16th-century European culture” (p. 25). The

question then is how will the participants in school-based learning adapt and apply the technology, and what models of teaching and learning will result? From the premise that "experience with computer tools can fundamentally alter teaching", Miller and Olson (1994, p. 136) argue that an important neglected reason "why computers have not altered curriculum in the manner predicted by some educators" is the "influence of traditional teaching methods and routines of practising teachers". They conclude that, "Although critics raised numerous questions concerning the unrealized potential of computers, few looked at how traditional classroom practices affected its use" (p. 126). Collis (1989) reasons that "many elements of traditional school organization will, and should, remain regardless of IT's potential" (p. 17), and suggests that teachers will always need to be instructional leaders, that there is always a need for human-to-human interaction and motivation. Also Becker (1994) points out that it will be necessary to produce systematic evidence that the teaching practices best supported by computer-use such as discovery-based learning and problem-solving, do result in improvements in student competencies. Even if this is the case, Fullan (1996) argues that such systemic change is complex and difficult to achieve, particularly at the classroom level.

Levin and Donitsa-Schmidt (1995) used experimental and control groups with classes using word processors to write. Their findings suggested that "the implementation of computers in an educational setting has a broad effect, far beyond the scope of computers alone, and that the use of computers may lead to other significant changes in the make-up of the entire teaching and learning process" (p. 338). Hannafin and Wilhelmina (1993) suggest that there is reason for optimism that such effects will be widespread as our society becomes increasingly aware of the problems confronting schools and the need to make meaningful changes in education and the operation of schools. Such changes in school-based learning incorporating the use of computers may be considered in terms of computer-supported learning environments.

FINALLY, TECHNOLOGY THAT WILL WORK WITH US

In 1986 I was working on my Masters thesis that I knew would require a lot of writing and inclusion of many tables and figures. One evening a friend showed me a funny looking 'box' computer with a mouse attached. I was so impressed with the word processor and drawing software, MacWrite and MacPaint, that I immediately applied for a loan from a bank and bought a Macintosh 128K computer. Finally, a computer system that would work with me and using which I could easily create my thesis. It was a 'luggable' computer that I could carry to and from school, this I could see was the way to go – take the computers to the students not the other way around. As computers have become more and more portable I have finally seen the opportunity for the vast potential in education to be fulfilled.

My research became more focussed on realising this potential through the use of portable computers. At first I would take 2 or 3 portables into a classroom to assist a teacher in implementing an activity but finally I was researching in the utopian environment where every student had a portable computer. If only this environment

had been possible when I had first started teaching how much more I would have been able to do for my students. However, over the period of 5 years of research in this environment I found that few teachers shared my enthusiasm. Some saw a threat in every student having a computer and others couldn't see the relevance to what they were doing. Certainly there were a few obstacles to overcome such as short battery life, cables and difficulty in networking. But even with the advent of wireless networking and long-life batteries I could see that there were always going to be many teachers who would not facilitate the use of the technology.

COMPUTER-SATURATED LEARNING ENVIRONMENTS

Learning environments that involve computers can be configured in many different ways to provide access to computer processing. There are a number of fundamental parameters which can be used to describe the place of computer systems in a learning environment. These parameters include the ratio of computers to students, whether the computers are in the "normal" classroom or a laboratory, whether they are networked or stand-alone, whether they are portable or fixed, whether students freely access them or gain access through a roster system, and whether students work at the computers individually or in groups.

Most educators, particularly school reformers, perceive the ideal computer configuration as a learning environment in which it is possible at any time for every student to access an adequate level of computer processing and software relevant to their learning needs. In essence it implies the potential for students to have unrestricted access to computer processing. In practice it means that either the students are in a computer laboratory with the potential for one workstation each or they each have a portable computer. Collis (1989) describes a combination of these, "Some see the potential extension of local area networks to be a situation where every student has his [sic] own portable computer and can access the central resources of the school through any workplace of his choice" (p. 15). Gardner et al. (1994) argue that portable computers "hold out the promise of putting convenient and personalised computing power not just in pupils' hands but in teachers' hands too" (p. 1). Typically the discussion is dominated by the quantitative provision of computer processing units, increasingly portable units. In many places the term "computer-rich" is used to describe portable computer programmes, however the term "computer-saturated" may be more appropriate as it is a quantitative term where the former could be interpreted in a qualitative way as well. McMahon and Duffy (1993) conducted naturalistic research in environments (Buddy System Project) that provided a similar facility but used home computers, classroom computers and networking instead of portable computers (Miller & McInerney, 1995).

PORTABLE COMPUTING

During the 1990s I set out to consider the impact of student-owned portable computers on the learning environment offered to school students. For much of the

time I found that the computers were not used widely enough nor consistently enough to warrant their pervasive presence. However, encouraging signs emerged where more student-centred approaches to learning were employed. Access to portable computers increasingly facilitated the development of a greater degree of confidence, skills, understandings and attitudes which are likely to enhance learning and be applied to future situations (e.g. workplaces).

Despite the increasing success of implementation, the computers were still not used at school by most students for a large amount of time, but were used by all students at home for a reasonable amount of time. The limited use of the computers at school by even relatively interested teachers is consistent with the findings of wider surveys reported by researchers such as Becker (1999) and government reports (e.g. Meredyth, Russell, Blackwood, Thomas, & Wise, 1999). For example, Becker (1994) notes that in one survey of computer-using teachers, only 11% of English teachers had students using spell-checkers and only 1% of mathematics teachers regularly facilitated the use of spreadsheets.

In my main study, the portable computers were essentially used for word processing by all students and they were viewed by most students as necessary for preparing assignments. However, there was a common perception amongst the staff that the computers were non-essential and merely supplementary items in their classrooms. This was reflected in the types of tasks which they allocated to the computers, typically replacing writing and at a low cognitive level. Most teachers had difficulty adapting the use of the computers to their own personal teaching style and subject curriculum. Fundamentally, to be successful, more teachers needed to employ student-centred approaches to learning more often in their learning programmes. Becker (1994) identified only 5% of computer-using teachers as being exemplary and claimed that such teachers had a greater interest in effective teaching and learning, a deeper academic interest in the subject matter, and more use of student-centred strategies.

While logically it could be argued that teachers may use the availability of the portable computers to support various types of learning environments, it became increasingly clear that generally the teachers who chose to facilitate the use of the computers did so to support predominantly student-centred learning environments. An increasing number of studies are supporting the assertion that using computers in classrooms tends to accompany a shift from teacher-centred activity to student-centred (or learning-centred) activity (Becker et al., 1999; Gearhart, Herman, Baker, Novak & Whittaker, 1994; Schofield, 1995). I have found that these types of classroom learning environments tend to match student preferences better than others.

MY FINDINGS ON THE USE OF PORTABLE COMPUTERS IN SCHOOLS

In my research, as I have considered the classroom learning environment and the use of portable computers I have identified key findings associated with four entities within the environment: the computer systems, the students, the curriculum, and the teachers.

The Computer Systems

Students have little difficulty using portable computers and most teachers and students find that they are more flexible and less intrusive in the classroom. However, for most students the role of the computer is limited largely to that of a writing machine to replace paper and pen. This reduces the application of computers both in terms of subject area and amount of time spent using them. As a result this severely reduces the cost-effectiveness of portable computers.

Students are inhibited in their use of computers by some features of portable hardware, particularly the short battery life and perceived heaviness of the computers. Real battery lives of over 3 hours are required. Although most portable models do not appear to be sufficiently robust for school life, this is not a major inhibiting factor for either students or teachers.

The Students

Students quickly develop a reasonable level of computer literacy and associated independence, but they prefer choice in the use of a computer, expect them to be used regularly to replace the need for paper-based files, and expect the school to provide systematic training. It is likely that about five percent of a student population will have negative or under-confident attitudes towards computer use irrespective of how well their use is implemented.

The outcomes of using portable computers are more positive the more often students use the computers and over longer periods of time. While most students express concerns about carrying the computers, maintaining them and keeping the batteries charged, these difficulties do not appear to adversely influence their perceptions or use of the computers. However, a perceived lack of use of the computers does influence the attitudes and behaviours of some students.

The Curriculum

The subject area in the curriculum is a major determinant of the amount of computer use and the breadth of applications used. Students are more likely to use the computers for classes associated with subjects such as English language and social studies in which teachers tended to require a significant amount of document production. Both students and teachers perceive that the use of the computers for document production improves the quality, quantity and ease of production of the documents. However, there is often little evidence to support this perception.

Computers are less likely to be used in classes with older, higher ability students than younger and/or lower ability students. This seems to be a result of teacher perceptions of the requirements of preparing students for external examinations and the lower academic risks in trying innovations with younger and/or lower achieving students.

The Teachers

In responding to the presence of the portable computers in a class, a teacher's actions can be classified into three types: actively facilitates the use of the computers (Active), permits the use of the computers by those students choosing to do so (Passive), or unconsciously or otherwise discourages the use of the computers (Negative). Only teachers who want to create classroom learning environments which are characterised by student-centred learning features tend to be active and use portable computers significantly to support the development of the environment. Where teachers employ an instructivist pedagogy, students are either required to use computers for only the limited role of a writing machine or are rarely required to use the computers to support learning activities.

THE FUTURE!

While I was writing up my PhD thesis I had the pleasure of reading a book titled "Engines for Education" (Schank & Cleary, 1995). I read statements such as,

> *Today's schools are organized around yesterday's ideas, yesterday's needs, and yesterday's resources (and they weren't even doing very well yesterday).*

Yes that summed up a lot of my frustration with schools. Further that,

> *Enough is already known about natural human learning to start the process of change via the computer.*

I reflected back on my own secondary school teaching experience in which I had seen a lot of the theory work in practice. And now,

> *Good software has the potential to open worlds that were previously off limits, impossible, dangerous, or simply avoided by school systems.*

I knew that with today's technology we could have done even more and perhaps the support was now there for many others to put into practice the good theory. In Schank and Cleary I felt like I had found a kindred spirit. In a sense they seemed to have connected with my experience, said it as I had experienced it, and tied the theory and experience neatly together. Later I went to their web-site at which the contents of the book are represented nicely using the linking technology. So, have we arrived at a point where there can be no more reasons why we can not implement well known and researched learning theory for children in schools?

The era of portable computing has definitely arrived with a range of hardware configurations from the size of a watch to a handbag. A variety of wireless networking options including radio, infrared and connections to mobile phones adds a further dimension to the portability of our computing. Most recently I have conducted research in classes where students use iBook portable computers, purpose built for schools, that incorporate the Airport wireless networking technology.

Teachers have marvelled at the seemingly boundless opportunities this provides for variety in learning environments and experiences.

As more and more schools and children enter this era of totally portable computing, what do we now know from research? Firstly, it is now well documented that where good quality simulation, modelling and tool software is used improvements in student learning occurs. So we want to provide computer access to students, the question then is whether portable or desktop. Certainly in many case studies the flexibility of access has encouraged more teachers to try a greater range of strategies in the application of computers. The minimum of physical intrusion in the classroom has added to this. However, while some see the increase in student control of the technology a benefit others are concerned with the resulting changes to their own role. Students can personalise the tools but then perhaps the teacher is no longer the expert with the tools.

In the past, some of the problems teachers have found with portable computers are that they are difficult to network with cables and to provide access to power. Portables tend to be less robust and more expensive than desktop equivalents. Finally both physical and logical security has often been a problem. That is, they are easier to steal and the less supervised access by students permits greater opportunities for inappropriate access to networked material. Most of these problems may be overcome through improved management by both teachers and students.

With the newest batch of portable computers with wireless networking and long-life batteries, most of the technical problems have been overcome. As a result I believe that some form of portable computing is likely to become the predominant strategy in most schools in the near future. This will then only leave the problem that most teachers have found it difficult adjusting their pedagogy to facilitate portable computer use. This may have more to do with their beliefs than what they are capable of doing.

CONCLUSIONS

For about 30 years there has been serious discussion and research into the application of computers to school-based education. As each major development of computer technology has occurred, discussion and research have tended to focus on the application of the new development to schooling and suggest that this will lead to significant impacts on schooling. However, apart from isolated cases, the development of computer technology has had very little impact on the experiences of students and teachers in schools. In the 1990s, a significant development in computer technology was the emergence of low-cost, high-powered portable computers. This resulted in a substantial number of school-based and educational system projects to implement the use of these portable computers into classroom teaching and learning programmes. It is currently not clear whether this technological development will also have little impact on schooling or whether it will facilitate the changes in schooling which have been discussed and predicted for a number of decades.

Most leading researchers in educational computing (e.g. Collis, 1989; Marcinkiewicz, 1994; Rieber & Welliver, 1989; Rowe, 1995) regard the integration of computer applications across learning programmes to support the learning of students as an important aim. Marcinkiewicz (1994) foresees that, in time, either it will be demonstrated that such integration is not possible, or integration will be facilitated by changes in the selection and training of teachers, or by the restructuring of schools. Such restructuring is often advocated even without reference to technological change (Fullan, 1995). Marcinkiewicz (1994) sees this as an ongoing and perpetual process due to the changing nature of computer technology in which "it will be increasingly necessary to help teachers adopt innovation as a way to keep current with and have access to increasing amounts of information" (p. 233). Collis (1989) argues that information technology (computers) has tremendous potential for schools but that there are many constraining factors. She believes that "our task is to better identify which of these factors we can be most successful in manipulating so that the potential of IT to create new educational situations can be actualized" (p. 2).

As I think about my experiences with those 12 year olds last year researching on drugs, designing the presentation of information, making web-sites and movies, I wonder whether these experiences are now likely for all the other 12 year olds in Western Australia. It should be. As I reflect back on my reasons for becoming a teacher in 1979 and my struggles since then, I wonder whether we will use the technology that I find so personally empowering to empower our children in schools. It seems to me that the means are now abundantly available to provide the quality of learning experiences we want for our children, the question is do we, collectively, have the will.

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ROBERT BIBEAU

THUS SPAKE VENITIA

From traditional schooling to transdisciplinary schooling

Abstract. How can information and communication technology be used to transform schools and render pupil's education and learning more efficient? It is important to take the time to define the roles and the actors involved in the scenario currently playing out in school. By giving up on the technocentric and promoting an anthropocentric approach, focusing on the pupil as the central actor, in the educational tragedy. Piloting the change paradigm and progressive integration of ICT in schools is above all the role of administration. Once change is really underway how can technology improve things for teachers? Finally, the successful integration of ICT in schools cannot be measured by pupil:computer ratios but by the degree of competency that pupils reach in the diverse domains of training and learning thanks to the technologies which, in fact, can no longer really be called new.

INTRODUCTION

Venitia teaches in a school in Montreal. The other day her friend, a doctor, was talking about the importance of specialization. "Specialization," he insisted, "Is a pre-condition for professional success. Look at me; I am specialized in nasal disorders". "Which nostril?" Venitia had retorted! She could just imagine a vision of the world reduced to the size of a nostril; her friend probably couldn't even see his patients' faces, let alone the society surrounding them.

Thus spake Venitia! And as she thought it was time she broadened her own vision, she began with an examination of several key concepts that could serve as markers in a peregrination to the heart of the educational universe of her pupils. Venitia believed that reflection on her profession should be guided by transdisciplinary humanism. Weren't the four pillars of her teaching practice, after all, *learning to know, learning to do, learning to be and learning to live together?*

Does learning have to be just a conglomeration of hermetic disciplinary specialties? Can't the transdisciplinary approach complement the disciplinary approach, enabling us to inter-articulate disciplines emerging from new data to forge a new vision of Nature and Man? A new vision that can only be formed if we manage to transcend the borders separating subjects and build links and intersections between knowledge fields, that is to say, develop transversal competencies? Aren't information and communication technologies (ICT) the very tools needed for transdisciplinary humanism?

The information revolution, commonly known as the Internet revolution, is founded basically on technical innovation… on *norms*, that is basically on a few

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 93–119.

singular specifications that have been internationally accepted and used, and which render telecommunications possible, easy, pleasant and universal. Well, almost universal, because one problem does exist, Venitia recalled. All these "vernacular" languages that resist English, the worldwide language of the Internet, shouldn't they perhaps be seen as balls and chains attached to the feet of our students? "Is the French language really an enrichment or a handicap for pupils?" she wondered.

Multimedia and *hypertext, networks* and *shared intelligence*, *interconnection* and *telecollaborative work, network culture* and *resource sharing* – these are the key words in the telecommunication revolution. But do pupils in the knowledge society really have access to such modern tools? Do they use them in their school learning? *Do traditional schools provide the education that pupils today need?*

Huge investments have been made in Western countries to set up educational infrastructures (schools, school transport, didactic equipment, computer and the Internet). Despite these gigantic and recurring investments, education is still undergoing a crisis and its performance is judged as not up to par. The school system is expensive and inefficient, or so people say. Schools are not sufficiently specialized, it would seem!

Surveys in Canada suggest that 33% of the population never complete high school and 20% of 16 to 25 year-old youths are illiterate.[1] Statistics further reveal that 30% of Canadian youths are unemployed, very often after having trained for sectors where employment opportunities no longer exist. At the same time, skilled labor shortages exist in sectors still relatively unknown. An OCDE study, for instance, forecasts that by 2002 there will be a shortage of "bio-computer experts"![2] Since the explosion of the video-games market, we are already suffering a shortage of infographists.[3]

If the education system is undergoing a crisis, it is because it constitutes one of the final strongholds against information and communication technologies (ICT). Today ICT is everywhere in society… except in schools, or so the computer salesmen complain. Then isn't this a very good reason for Venitia to transform her class by integrating new technologies. Well, there are a lot of "cultural assets" that are found more or less everywhere in society – pornographic and "hate" literature, for example – but does this mean that they should be introduced into class?

Why should we transform the school by integrating technologies? Quite simply because the traditional school, designed in the 19th century by educational reformists to replace inefficient rural and sectarian school systems, no longer responds to modern needs. Our schools are organized on what is commonly known as *"grading by age and subject area"* models inspired by the 19th century mass production models. They are characterized by grade levels (from pre-school to high school), a universal curriculum divided into subject areas and attainment objectives, a set timetable, an annual rite of sending pupils "up" or keeping them back a year, and a quasi-unique path towards university entry. One of the reasons that schools were organized into a standardized system and curriculum was so that pupils could move about on the national territory without their schooling being disrupted. Innovations introduced in the 20th century such as the blackboard, the ballpoint pen,

photocopying machines, textbooks and exercise books all served to guarantee perfectly regulated mass education.

However, the rapid evolution of the tertiary sector (office, service and entrepreneurial industries), the *automation* of manual tasks and the *robotization* of assembly lines, the increased number of people *working from home*, the *multiplication* of knowledge domains, *specialization* and *piece work*, the widespread integration of computers and the broad use of the Internet have all led to the *emergence of new knowledge domains* and a *fragmentation* of subject areas. The school is finding it ever more difficult to accommodate. The densification of population, more frequent cultural *confrontations* and increasingly unstable family ties are further complicating the issue. As society changes and becomes more *complex*, educational needs become more *diversified***.** The school has to find ways to follow this evolution and adjust to the new social reality.

In order to respond, should schools become even more specialized? Should we set up more international schools, more dancing, music, language, scientific and technological schools? Wouldn't one solution be to transform the traditional "grading by age and subject area" schools into humanist cross-disciplinary schools integrating information and communication technologies?

ROLES AND KEY ACTORS

Let us not limit pupils to what we learnt, for they are living in another age.

The post-industrial society, built on information and communication, has generated both new educational needs and modes of learning. It is encouraging to note that the social and technological changes that are generating the new needs are also offering modes of response. Technological tools are at the same time a source of and a solution to problems in schools.

Three key actors play leading roles in the ICT-based teaching-learning process at school: the administration, the teaching staff and pupils.[4] We shall present hereunder a vision of the role of each and the ways in which technology can be integrated to transform school and pedagogy.

The administration is responsible for initiating ICT-based pedagogical innovation and piloting the re-engineering process within the school. It is up to the teaching staff to innovate and transform their teaching by introducing new paradigms, guiding pupils in their learning and informing them not only of the enormous potential but also the limits of technology. Together the school team has to ensure that technology contributes to consolidating the pupil-teacher relationship and rendering it more humane. Under no circumstances whatsoever should technology replace teachers or diminish the privileged relationship they have with pupils. It is imperative that emerging pedagogy, supported and amplified by technology, responds to the individual needs of each pupil. The role of the pupil is to learn and to acquire knowledge. Learning is an act based on personal commitment. We cannot learn for our pupils, we can only motivate them and show them how to learn. They alone can assume their learning, with a little help from technology.

It isn't more specialization that schools need, but rather a syncretic, systemic and transdisciplinary vision that will serve as a guide for action and innovation and, above all, a better understanding of the pupils that have been entrusted to their care. Thus spake Venitia!

FAILURE OF THE "TECHNOCENTRIC" VISION

Let us use all forms of technology, but be slaves to none.

If we are going to use technology for pedagogical innovation, the needs of the pupils must be placed before the needs of the technology. This constitutes the very foundation the humanist, transdisciplinary, "anthropocentric" vision and the socio-constructivist and systemic approach to innovation in education upon which the ICT-assisted re-engineering of the school should be based. We are not transforming school organization to take advantage of new technologies. This is to some extent why it is so difficult to integrate ICT into pedagogy. During the 1983-1993 "wave" of technology in education supposedly "for all"[5], administrators and pedagogs, or at least the "early users" amongst them, were singularly concerned with the purely technical potential of technology. They focused insufficient attention on the repercussions this would have on academic organization and relationships between teachers, pupils and knowledge.

A survey conducted in 1996 by L. Proctor on the ways the Internet was being used in schools in the city of Saskatoon in Canada showed that teachers were not integrating the Internet as rapidly as hoped. But the author pointed out that the idea of teachers having a very low level of technological expertise is a misconception. In Quebec more than 75% of teachers have a computer at home and use it regularly for their administrative work. However, according to the survey only 53% of primary school teachers and 17% of secondary teachers use computers with their pupils for at least one hour per week in class (Danvoye, 2000). Surveys in the United States reveal that 84% of teachers consider that the use of computers and access to the Internet improves the quality of their teaching and introduces pupils to new learning resources. Only 26% of these teachers use the Internet in class.[6]

New technologies are not being used in class and innovation is not more widespread at school due to strategic and administrative problems including lack of impetus from the administration, lack of quality digital contents, lack of preparation time for teachers and lack of technical support (Bibeau, 1998).

A spring 1995 survey on the use of different types of technology by American primary and secondary school teachers shows that insufficient information, training and time are considered to be the major barriers to the use of technologies in class (Pons and Piette, 1997). A 2001survey confirms these findings:

> *(…) On average, teachers spend less than 30 minutes per day on Internet. Several explanations are offered. The major ones listed by the teachers are lack of classroom time, technical network-related problems and lack of leadership from administrators.* (NetDays 2001)

Research conducted on this issue in Canadian schools by Statistics Canada and the International Association for the Evaluation of Educational Achievement (IEA) indicates that eight factors potentially slow down integration:

1. insufficient number of computers,
2. insufficient amount of software,
3. lack of lesson preparation time,
4. difficulties integrating computers in class,
5. difficulties scheduling use of computers,
6. absence of opportunities for exploring the Web during school time,
7. insufficient knowledge and ICT skills and, lastly,
8. insufficient training opportunities.[7]

Table 1 shows the percentage of primary and secondary schools pupils affected by these factors.

Table 1: Percentage of primary and secondary schools in Quebec affected by the obstacles to greater use of ICT, 1999.

		Primary	**Junior High**	**Senior High**
Teacher training	Insufficient training opportunities	56	57	17
	Insufficient knowledge & ICT skills of teachers	70	84	62
Teaching	Absence of opportunities for teachers to explore web	53	46	42
	Difficulties scheduling use of computers	37	45	46
	Difficulties integrating computers in class	56	62	60
	Lack of lesson preparation time	72	60	63
Software	Insufficient amount & variety of software	67	54	51
Computer equipment	Insufficient number of computers	55	47	48

Similar problems are noted in France.

> *Difficulties encountered by teachers: often several pupils ask for help at the same time. Teachers have to be able to solve the inevitable problems connected with equipment and software. They must be familiar with the software used and scrupulously plan utilization sequences. They must be capable of managing the stress, restlessness and noise often resulting from*

> *this type of work. The computer laboratory is not always free for use when they need it.* (Lamontagne, April 2000)

All of these factors relate to academic organizational parameters. If teachers are to be encouraged to integrate ICT and use technological innovation to reform traditional schooling, we must overcome these constraints and rid ourselves of the "technocentric" vision.

AN "ANTHROPOCENTRIC" VISION

The school is not undergoing a crisis, it is undergoing a mutation, that is to say, internal and external forces are rocking its foundations and bringing about a gradual transformation. To organize and plan this mutation, *teaching teams should begin by reflecting on their educational role* within the new information, communication and knowledge society and on the *new educational needs of their pupils.* They should adopt an "anthropocentric" vision towards new technologies, a systemic approach to innovation, and base their pedagogy on a socio-constructivist and cross-disciplinary paradigm. *The goal is not to integrate information technologies in education at any cost, but to respond to pupils' new educational needs with the help of technology if, and only if, this corresponds to the needs identified.*

Schools can only adapt to technological change and integrate computers and the Internet if the pedagogical vision is founded on a school ecology that is supported by the concept of computer-assisted learning environments. When we define the school as a pedagogical environment, we refocus on learning and, by the same token, on a more rational use of resources. When children and adults are placed in a rich pedagogical environment, real or virtual, that integrates powerful cognitive tools, they learn and develop both intellectually and socially (Bordeleau, 1994).

An "anthropocentric" approach is one that aims at transforming pedagogy by using technology to better cater to the training needs of pupils. Indeed, why should Venitia force herself to introduce costly and cumbersome tools into her class if not to transform pedagogy? In a socio-constructivist context, ICT becomes an intellectual partner offering extremely powerful cognitive tools. The integration of technology does not guarantee that pupils will obtain better school results. Numerous factors play a crucial role in obtaining results, notably an individualized approach and the way the technology is implemented and used in the class.

REVISING THE CURRICULUM, INTEGRATING TECHNOLOGIES

The Quebec education ministry is in the process of completely revising primary and secondary school curricula[8]: learning contents, subject grids, teaching time, study programs, modes of evaluating learning and, in light of the new context, information and communication technologies[9]. The major challenge in introducing technology into the curriculum is not multiplying the number of computers in schools[10]. We cannot measure the educational success of pupils through pupil/computer ratios or

the Internet transmission speeds. Nevertheless, such variables do have an impact. It is understood that all classes need computers and the Internet connections.

> *In this context, it goes without saying that many teachers both from primary and secondary schools, would like to have equipment available in class in order to better incorporate ICT into all pedagogical activities.* (Rioux, 2000)

The more computers in class, the greater the access to the Internet and the more likely teachers are to use computers in their courses. According to the findings of an American study[11], corroborated by recent interviews conducted in innovative schools and classes in Quebec, teachers who have more than five computers in their class integrate them in class activities more often than those who have less.

> *We are much more likely to see the pedagogical application of computers when 5 or 6 are placed together in small computer laboratories.*
>
> (Gervais, 2000)

The real challenge in terms of effective use of these learning tools in pedagogy is, however, not technical but anthropological[12]. It is not the technological features that are the most important factor for teachers, but their *pedagogical potential in teaching and learning*. In computer-assisted learning activities, teachers transform their teaching practices and pupils their learning practices by combining their know-how with the power of the technological tool to develop expertise and acquire competence.

Competence is the ability "to do" based on the mobilization and use of a combination of resources. It infers that pupils are becoming equipped to act, communicate, make decisions in problem solving, and present the fruit of their labor in the form of a unique product.

Skill is the ability to act, and its components generally concern *use in context, expertise* and/or *assessment* of the effectiveness of use (regulation). For example, writing is a skill practiced in the context of writing but to write in a context on a given subject and to communicate a piece of information one must also master, outside of the specific context and at a suitable moment, *certain tools for learning to write*. One must, moreover, constantly assess the efficiency of one's written communication in order to regulate learning and hence progress. One good way of checking the efficiency of communication and the regulation of learning is to publish-disseminate what one has written in order to see how readers accept it. Digital editing and publishing tools assist the pupils in such tasks (Bibeau, October 1998). Some technological tools aim at equipping learners to write, others support *communication* or assist in *decision-making* and *problem solving*.

DISSEMINATING INNOVATION USING A SYSTEMIC APPROACH

Only too often information technology is implemented in schools in a spontaneous or improvised manner. We used to believe, and the "pioneers" still believe, that innovation is disseminated in education through a process of osmosis or is

contagious through contact. The Utopic vision of the process goes something like this: Venitia sets up an innovative project using ICT in her class. Her colleagues, intrigued by the innovation and jealous of her success, spontaneously and suddenly wish to transform their own pedagogy, innovate and share her educational success. This is sufficient for the expertise to be transferred. The innovation propagates and soon the whole school is "contaminated" by new technologies!

Unfortunately innovation doesn't work like that in the world of education. We must admit that neither "deliberate" nor "spontaneous" strategies have brought the expected results. Several million early users have not succeeded in spreading innovation in schools. Venitia's colleagues have no spontaneous desire to innovate, nor to revolutionize their own pedagogy or rewrite their teaching programs. It cannot even be taken for granted that the success of an innovative project is due to technology when it is an element in an innovative project. In contrast to the "spontaneous" approach there exists a systemic approach.

In this approach, the dissemination of innovation is based on the principle *that all elements that make up a system are interconnected.* As the "school system" is constituted by a set of interdependent sub-systems, any modification to one of these sub-systems will necessarily have repercussions on all of the others, hence multiplying the effects of the innovation. Computerizing the library, for instance, has an effect on the whole school. This is why it is preferable to envisage ICT-supported pedagogical innovation as the implementation of a set of concurrent interventions in a global and planned approach[13].

ICT school plans, based on a global and coordinated approach, should be considered as much more than simply filling out an order form for computers, peripheral equipment and Internet connections. They imply that the whole school staff is working together, respecting collective decisions and rigorously following up the implementation process. The ICT school plan represents a commitment and a contract binding the key actors in a school.

In a systemic approach, *a system tends to regenerate itself by absorbing change*. Hence, technological innovations are picked up by all actors who spontaneously attempt to continue doing the same as before, but more rapidly. Computerizing the library, for instance, will only be effective if the librarian gets the rest of the school staff involved in the process and ensures that the multimedia workstations connected to the Internet are accessible to learners for educational projects and adapted to study programs and pupils' expertise[14].

Any system that has reached a point of equilibrium and cohesion refuses and rejects factors that may upset this equilibrium and create instability and tension. It is noted that in most pilot projects the majority of educators involved do nothing more than adapt electronic means to their former pedagogical approach, an approach characterized by the use of text and exercise books in an explanation-exercise-exam routine (triple E pedagogy).

When introducing an innovation into a school these characteristics should be taken into account and certain implementation and dissemination strategies employed in order to overcome the "*reducing*" and "*regenerating*" tendencies of school "systems" (Basque, 1996)[15].

PILOTING CHANGE AND INNOVATION: THE ROLE OF SCHOOL PRINCIPALS

When technology is poorly introduced in a school, it becomes an obstacle rather than a solution. It has to be introduced according to a planned model of change adapted to the school context. In education, the way in which change is piloted or disseminated is every bit as important as the change itself. For instance, the Internet was recently introduced into a school, but in the worst way possible. The outdated software used included a rigorous access protection mode that perturbed access to the Internet. It took two hours to receive email, transferring files was a headache and the transfer of diacritical signals a disaster. The remedy was far worse than the ill and innovation became a real ordeal for teachers. In this case, innovation was a nightmare rather than a solution.

If you want to innovate, you must feel the need for change, because when you innovate you come up against all sorts of constraints. For certain school staff these constraints have a limiting effect, whereas for others they are seen as challenges to be overcome. Innovation implies *creating new problems and redefining areas of tension*. Innovation means accepting that you cannot control the future, but you can pilot change. To innovate, you sometimes have to disrupt habits and upset routines. The most important instrument for piloting innovation is not the technical procedure but the pilot itself. Innovation cannot occur if the school administration does not participate or provide some sort of leadership. The school principal must support and encourage innovative teachers, at the same time avoiding to stigmatize teachers who are slower to take up innovations.

A survey conducted in Canadian schools reveals that poor planning, lack of analysis and insufficient support from the administration are the primary factors accounting for the failure of innovation and technology implementation projects. But we shouldn't put all the blame on the school principal. Nowadays this is an extremely complex and demanding position, so much so that in certain countries there are no longer enough candidates for the job. Union claims, scheming from "discontented" parties, pressure from the school board, the clumsy impetuosity of young teachers and the disillusionment of the more experienced ones, dissatisfaction of certain parents, ethnic confrontation, "bullying" and other forms of delinquency… this is the daily lot of the school principal.

Piloting an innovation means:

1. taking current pedagogical practices into account as a means of acknowledging, analyzing and ultimately modifying them;
2. accepting that if practices and habits are not modified there can be no real innovation;
3. being equipped to the greatest extent possible to handle trouble-shooting and make changes in complex situations;
4. being aware that trial, error and uncertainty give rise to resistance, fears and anxiety, but that all are inherent to the process of change;

5. not tackling innovation as a goal in itself but as a means of improving teaching and as a collaborative process in which nothing is gained or decided in advance (Pelletier, 1996).

We advise setting up a *school co-ordination committee* comprising administration and staff delegates who can take charge of the planning and organization of ICT-supported pedagogical innovation projects (Bibeau, 1996). Furthermore, school principals have to be ready to accept and promote the idea of co-operative leadership and be active in getting the staff to work together towards the goal set by the co-ordination committee. Co-operative leadership ensures bilateral responsibilities; authority is reciprocal, entailing shared responsibility but also accountability. This is why the school administration needs to set up a network of collaborators first before setting up a network of computers. If principals lose sight of this elementary truth, they may well lead their school team into failure and frustration. Look at what happened, for instance, to Ms Bennett, an American teacher involved in the Apple Classrooms of Tomorrow (ACOT):

> *Some of her colleagues were not happy about the project and accorded more importance to the resources Ms Bennett received than the time and effort she invested. To relieve the tension, the principal decided to give non-participating classes a larger share of other school resources such as library time and paper, and so Ms Bennett found her means diminished. Infuriated that her pupils were almost completely deprived of access to the library, she gave up the project.* (Sandholtz et al., 1997, pp. 31)

On the contrary Ms Lee, a teacher in another school involved in the ACOT project, received support from her principal and persevered in the project:

> *The school principal took a certain number of steps to integrate the project into the school culture, thus avoiding comparisons between participating and non-participating classes and encouraging teachers to take an interest in major innovations that were taking place in the school. Moreover, the principal gave non-participating teachers time off to visit ACOT.*
> (Sandholtz et al., 1997, pp. 31)

It is the co-ordination committee that implements the "ICT school plan". It sets out the modalities of the *information technology integration* which must *correspond to the overall educational project* of the school. Pedagogical and technological innovation are processes that demand certain physical conditions (computers, contents and software, a local network, Internet connection, electricity and adapted furniture in each class) as well as a real commitment from everyone involved (support from school or regional administration, commitment from teachers) and expertise (for teacher training and technical support). All of these aspects should be covered in the ICT integration plan[16]. Lastly, the plan should reply to two fundamental questions: "Who will benefit from the technology?" and "How will pupils and teachers benefit from the technology?"

ENSURING THAT TEACHERS BENEFIT FROM TECHNOLOGY

Transforming mentalities

The systemic approach caters to a progressive shift in the attitudes and mentalities of teachers. In ICT-equipped classrooms technologies certainly should not be omnipresent, but teachers must make an effort to modify their practice through the way they perceive and use them. Let us once again quote the researchers in the ACOT project:

> *Pedagogical change is impossible if you don't change beliefs about teaching and learning. And teachers' beliefs will only be changed when they find themselves in the fire of action, having to take risks and face up to uncertainty. Profoundly modifying our way of educating children is a complex enterprise mined with traps for the unwary.* (Sandholtz et al., 1997, pp. 53)

American researchers report that the aims and pedagogical practices of teachers before ICT is integrated in their class is far more a determining factor in effective ICT use than the technology itself (Miller and Olson, 1996). The Canadian research network Rescol[17] notes that in contexts where new technologies play an important role, teachers progressively come to consider knowledge less as chunks of information to be transmitted, and more as a continuous research process in which they share the difficulties and results of their pupils (Grégoire et al., 1996).

Rescol researchers have found that innovative teachers reject the paradigm that knowledge is extraneously transmitted to children by the intermediary of a "master" who knows and transmits. On the contrary, they adhere to the socio-constructivist[18] paradigm whereby the teacher is a mediator who chooses the goals of knowledge, directs learners accordingly, monitors learning activities and helps formulate hypotheses, construct meaning, verify and contradict findings. The teacher thus aids learners in the regulation of their learning process, leads them to question certitudes and even prejudices, and opens up paths to solutions that the learners themselves will implement[19].

The socio-constructivist approach also implies project-based activities, working in groups, negotiating with fellow team-members and tutors, and striving together to complete set tasks within deadlines[20]. Cross-disciplinary projects lead to the development of multiple transversal competencies. In a transdisciplinary paradigm the individual differences, needs, interests and approach of learners are placed above subject areas and school disciplines. This approach, unlike pluridisciplinary and multidisciplinary approaches, generates new disciplines that encompass but go far beyond the original ones. Transdisciplinarity finds its place around and across the space occupied by the world of disciplines. The transdisciplinary vision does not break knowledge into chunks, but rather offers a transversal opening that "penetrates" disciplines and goes beyond them, says Edgar Morin (1999).

Developing a network culture

In order to overcome the isolation of teachers we have to provide them with the means, that is to say, the time, training and computer and telematic tools, to help each other and pool their resources. Here is how ACOT researchers describe a teacher working in their project:

> *(…) she works within the confines of her classroom and has few opportunities to observe other teachers or even to discuss what she is trying to do. From her point of view, the ACOT co-coordinator is an evaluator rather than a colleague with whom she can talk about her ideas, successes and failures.*
> (Sandholtz et al., 1997)

A survey report on schools in Quebec states:

> *If only we could eliminate the heavy organizational constraints, we could start getting school teams wanting to innovate. Why not give teaching staff global tasks instead of breaking them up into pieces that are timed down to the last minute?* (Inchauspée, 1977)

We could encourage teachers to cooperate and use telecollaboration tools to convert their *personal projects into collaborative projects* by taking into consideration the competencies of every teacher. In schools, small teams of teachers could be set up to take care of the same pupils for two consecutive years, or to assume together the entire program in a teaching cycle. The education ministry suggested in a statement on educational policy that:

> *We need to encourage professional autonomy in teaching staff by leaving pedagogical choices – methods, strategies, approaches – to their discretion and structuring programs to take up only about 75% of their time allocation. That would leave them the margin of freedom necessary to enrich or adapt contents in keeping with the needs of pupils.*
> (Quebec Education Ministry, 1997, pp. 20)

Information technologies and the Internet provide a framework and opportunities for telecollaboration.

> *Telecollaboration is a structured activity in which pupils and/or teachers use telecommunication resources, electronic mail, chat, the Web, or file transfer facilities to communicate and collaborate in order to gather, exchange, analyze, process and present information.* (Lessard & Bibeau, 2001)

Telecollaboration is the pedagogical activity that the Internet is most frequently used for. It can lead to the "twinning" of two classes or two correspondents, with pupils communicating on either set subjects or subjects of their own choice. Electronic mail and chat programs allow pupils anywhere in the world to rapidly exchange messages, images and audiophonic sequences to get to know and understand each other better. They can conduct research together, exchange information and write reports on their exchanges for publication on the Web. Correspondence activities

create ideal conditions for developing skills such as story planning, writing and editing text, thereby improving native language or foreign language skills[21]. Telecollaboration activities motivate pupils to write, since they know that their work will be read by an audience with whom they have established a real and ongoing relationship (Bibeau, May 1998).

The school is opened up to the rest of the world through ICT and multimedia, accessible locally or on-line. These technologies offer access to an incredible mass of data, too much data, an ocean of data. Pupils are threatened by *'information bulimia'*. It has been said that the Net offers an ocean of data, a river of information and a few drops of knowledge[22]. *For information to become knowledge, it must be organized, integrated and cultural associations made* (Bibeau, 2001). Pupils need to learn how to "sift" information if it is to become useful to them[23]. Pedagogy therefore should now include '*information dietetics'* to help pupils confronted with an informational overload to choose the ingredients necessary for their training[24].

Accessing information in the language you learn in, sorting for pertinent information in a given domain of investigation, processing information to extract knowledge useful for a research hypothesis, communicating results in an efficient and comprehensible way using digital editing and publishing tools – these are tasks made to measure for the school. The school can no longer limit itself to teaching techniques, it must also teach procedures and methods for learning. Above all, as Philippe Breton points out, the school must stimulate the love of learning.

> *Primarily, the educational process is more a matter of asking why pupils should want to know rather than providing access to knowledge. Improving access to information - already catered for - will not make an iota of difference in sparking a pupil's desire to learn.* (Breton: 1997)

Taking time to respect individual learning rhythms

Above all, we shouldn't neglect the long training and skill development process teachers need to improve their expertise. They will only adopt technology if it offers a solution to their problems, if their experience with these tools is satisfying and if their rhythm in adapting to technology is respected.

Research has shown that technology has less effect on the quality of learning when used only to support traditional teaching and learning modes. Consequently, the use of computers and the Internet call for a complete restructuring of curriculum, teaching methods, the physical space of the classroom and school timetables. How can we support teachers as they learn to adapt to technologies? Are they given sufficient training to enable them to integrate digital contents into learning activities? It seems that a majority of teachers request more training and technical support.

Researchers identify seven steps in the process of disseminating an innovation:

1. non-utilization;
2. interest;

3. initial training;
4. automation;
5. independence;
6. integration;
7. reform.

These varying levels of **integration of innovation** are associated with another six **levels of commitment**:

1. awareness;
2. becoming informed about innovation;
3. personal implication;
4. implementation organization;
5. observation of consequences;
6. collaboration in integration;
7. integration into the system (Hall & Hord, 1987).

Furthermore, four phases have been identified in the process of adapting to technologies:

1. *Initiation*: period during which teachers should learn all about technologies and re-learn professional skills. Pedagogical activities are simple and aimed at learning to use computer tools;
2. *Adaptation:* period of progressive integration of technological tools in daily teaching practice. Activities with computers are more complex and teachers try to integrate the new tools into previous practices, hence creating tension that they will gradually learn to overcome;
3. *Mastery-integration:* during this phase, new technology is completely integrated into teaching practice. Pupils regularly use the tools and pedagogical productivity becomes the dominant theme. The mastery-integration phase is a step in the evolution of teacher-users who progressively change their attitude to new technologies. Teachers gain greater control over resources and can use them to accomplish tasks and conduct complex projects with their pupils;
4. *Innovation:* in this phase, teachers explore new pedagogical methods and experiment. As a greater number of teachers reach this point, life in the teaching establishment is transformed. There is no turning back once this point has been reached[25].

Research and interviews conducted with hundreds of Quebec teachers indicate differing thresholds for the integration of technological innovation, depending on the level of commitment.

- *The enthusiasts:* about 15% of staff have already adopted ICT and make wholehearted efforts to overcome obstacles and offer their pupils opportunities to use ICT and the Internet. Most of them have reached the *innovation* phase and are at level 5 or 6 on the integration of innovation scale. We should use these teachers to train and support peers.
- *The skeptics:* approximately 60 to 70% of teachers don't categorically refuse ICT but, like Venitia, wonder if the pedagogical benefits hoped for are worth the effort they must make[26]. They become easily discouraged by obstacles and give up using technology if conditions are not favorable. The *skeptics* are at the *adaptation*, or perhaps the *mastery*, phase. They are situated at levels 3 or 4 on the integration of innovation scale. This group can be divided into two sub-groups: the *fearful* and *the insecure***.** For the former, the computer is a magic box, the functioning of which is somewhat mysterious. They use it as little as possible for fear of breaking it. They are not familiar with many software programs and don't know much about the potential of the computer and the Internet. They are at the *adaptation* phase and at level 3 on the integration of innovation scale. *This group requires a lot of effort in terms of training and support* (Lamontagne, 2001). The *insecure* sub-group, which accounts for about 20% of teaching personnel, consists on the contrary of people who have started to learn how to use the computer and regularly use ICT to prepare their lessons and look for information. However, they feel insecure in using it in class with their pupils. They are at the *mastery* phase, and at step four on the level of commitment scale. It would take very little – appropriate contents, suitable training focusing on their role in class, technical support – for this group to join the enthusiasts (Garnier & Gauvin, 2000, pp. 23). The greatest efforts in schools should probably be turned towards upgrading the skills of this group.
- *The rebels:* approximately 15 to 20% of teachers are not convinced that technological tools are pedagogically useful and use them only in administrative tasks and to prepare exams. This user group, at the initiation phase and level 1 or 2 on the level of commitment scale, requires a lot of training and technical support.

If we want to integrate ICT, we must take into consideration the overall *training and support service needs* of teachers in their professional practice. These include classroom management, school organization, provision of courses, training in use of ICT, supervision, monitoring and mentoring, "collaborative" learning with peers, co-operation and the development of a *network culture.*

Surveys and research prove that teachers hold the Internet and multimedia in high esteem. Almost three out of four consider it a disadvantage not having the Internet in their classroom and believe that the Internet allows them to introduce new resources in their teaching (NetDay 2001). However, teachers are very prudent and have every right to be. They know better than anyone that all that is multimedia or hypertext or moves on the screen is not necessarily enriching for pupils. The integration of text, images and sound on a same support is undoubtedly fascinating, but no guarantee that its usage in education is pertinent. We sometimes forget that text, image and sound involve different logics of perception and imagination. We must resist the illusion that a quantitative modification in access to information will bring about a qualitative mutation. *More information doesn't guarantee better learning*. Let us look at some of the pedagogical traps hidden within technology that render the mediation of teachers indispensable if the microprocessor is not to become a micro-professor.

ENSURING THAT PUPILS BENEFIT FROM TECHNOLOGY

> *It is impossible to teach anyone anything. We can only help them discover things for themselves.* Galilee

How do pupils benefit from technology? To answer this question, we must first ask ourselves who are these pupils attending our schools at this turn of millennium? What are their training needs? How can we begin reforming school if we haven't first taken a close look at the pupils for whom we wish to create new schools and provide new modes of learning?

A survey conducted in 1995 in Quebec reveals that today school children are encountering difficulties in *understanding* and *mediating* information, and in *memorizing, conceptualizing, structuring* and *integrating* knowledge. As a result, they lack *motivation* and *interest* in school activities and learning processes (Roy, 1996).

Mediating, "sifting"

> *Many youths of today, born into a different context than their parents, reject ideas and projects dear to the hearts of their parents as having no relevance in their own lives.* (Jongeward, 1978)

> *Although modern children are exposed to a greater number of stimuli, they have less real mediation tools and opportunities and therefore seek closer links with knowledge.* (Roy, 1996)

Two things contribute to developing children's intelligence: exposure to a great variety of stimuli and the mediation of adults to help them decode these stimuli and understand the meaning of their environment. Whilst pupils are exposed to an

increasing quantity of information, opportunities for mediated learning are decreasing due to broken homes, working mothers, fathers losing contact with their children, smaller families, itinerant and abandoned children…

> *People treat their children with indifference, irritated by their presence and the responsibilities they represent. One survey indicates that 700,000 unwanted children are born each year in the United States.* (Jongeward, 1978)

The school must once again become a space of integrated and mediated knowledge, that is, a place where there are close links between staff and students and where students can learn the art of "sifting" – this is the basis of the "anthropocentric" perspective and the humanist-transdisciplinary approach. Learning is a social activity. Without interaction and mediation, little learning takes place. The myth of the learned hermit who lives in reclusion, far from social interactions, belongs to another era. The school is not a décor, it is an integral part of education. The role of the school is to make learning happen by promoting quality interactions and mediation through, amongst other things, telecommunication technologies.

> *Practitioners consulted insist that even though the computer optimizes receptivity, this is short-lived without the* ***mediation*** *of a teacher. Only if this triangular schema exists can children talk about what they are doing (objectivation) and understand the connection with other activities and discoveries. This once again illustrates the importance of integrating ICT into a broader methodology.* (National Reading Observatory, 1997)

If the use of the computer and the Internet in class isolates learners in a mediatic shell, then the school is failing to educate pupils and integrate new technologies into the curriculum.

> *[Telecommunication tools] above all cannot solve the socio-affective problems of children which account for 80% of schooling difficulties. They will never replace parents. Neither can they overcome what I call the "pathological distance", that is, the lack of self-confidence that prevents certain children from learning. Similarly, Internet will never replace the teacher. The "presential", in opposition to the virtual, will always be necessary. When books first appeared everyone thought they would replace schools, however, they actually became the cornerstone of them.* (Saget, 2001)

Schools connected to the Internet must place the pupil at the heart of their priorities and promote the development of solid relationships between adults and pupils. To do this, some schools put teachers in charge of a same group of pupils for several consecutive years. Others attempt to ensure optimal stability when assigning specialist and supply teachers. In a recent statement on educational policy, the Quebec Education Ministry suggested placing small teams of teachers in charge of a same group of pupils for two consecutive years, or at least getting the same teachers to carry out all of the teaching in their subject area throughout a whole school cycle. If tutors are to have a real influence on pupils and contribute to the mediation of knowledge which is so vital, they must hold an important place for the child and

therefore be present. The "pairing" of older pupils with younger ones in the computer laboratory can also help develop sibling-type relationships and, at the same time, the feeling of belonging[27].

> *Having school principals and/or parents/co-educators set up "pupil/expert" committees is a highly effective way of backing up the work of the teacher. Pupils develop specific skills enabling them to use a variety of specialized equipment. The co-operation established between children of different ages facilitates peer learning and hence creates a veritable assistance network.*
>
> (Gervais, 2000, pp. 5)[28]

Pupils are already living in the age of telecommunication. Just look at their enthusiasm for on-line chat. It doesn't take much to transpose their delight in communication into the school context. Several convincing pilot projects have been conducted in this area: Registre classes@classes[29], Prof-Inet[30], and Histoires croisées[31].

Memorizing

Nowadays we tend to underestimate the importance of memory. We have switched from a learning "by heart" pedagogy to an "on screen" pedagogy. Using the pretext that we can easily find all the information we want on technological supports, we no longer consider it necessary to memorize. The Internet and the CD-ROM seem to have become some sort of cognitive prosthesis.

> *Young people are really infatuated with NICT. They have fallen into interactive images like Obelix into his magic potion, the mediatic language is culturally natural to them. This portends a gap between the interactive image-oriented younger generations and their linear writing-oriented teachers that will become increasingly wider. Culturally speaking, the presence of the school in the industrial society is progressively diminishing.* (Cartier, 1997)

We should beware of the preconceived idea that children spontaneously manipulate technologies and use them with an astonishing level of instinctive skill. Data from the Coffey and Stipp survey (Pons & Piette, 1997, pp. 50) show that half the children aged between 3 and 11 don't use computers at all and less than 10% of them use the Internet. The small number of children who are active on the Internet spend only half an hour per month navigating on the Web. This is an infinitesimal fraction of the time they spend at school.

Knowledge is not constructed spontaneously just by visiting image banks and databases. It is constructed mainly through the accumulation of words, notions, concepts and basic experiences upon which the brain relies to carry out complex reasoning processes by means of reference, analogy, induction, comparison, deduction and generalization (Aubé, 1996). Acquisition is a complex activity necessitating a good individual and collective memory, the teacher serving as an interface and mediator between the two. Education is not primarily a matter of access to knowledge, but rather a way of asking fundamental questions, a matter of

will and of ways of learning. Improving access to information will have no effect on education if pupils don't want to learn and haven't developed appropriate learning methods. Memory plays a crucial role in the whole process.

In a report from the National Reading Observatory in France, researchers note that:

> *Multimedia images have a real impact on comprehension in certain conditions, more particularly when used by children to detect essential details (the wheel in gears, parts of an insect, certain key words, etc.). Detection activities like this depend both on children's prior representation of the subject and the way details are presented in the animation. [...] Animated books awaken a sustained interest in children, [...] but the constant change of focus seems to perturb their capacity to memorize the story: animation versus reading. This phenomenon must be relativized. If children revert back to the text several times, [...] then they will read in a deeper, more continuous manner.* (National Reading Observatory, 1997 pp. 20, 21)

Youths today cannot memorize much more information than earlier generations. A pupil's intellectual capacities are determined by the speed of anthropological evolution, not by the speed of the technological revolution. With on-line information, distance is no longer important, but the gap between the amount of information to which pupils have access and the amount of information they can memorize, process and use has increased considerably. It is therefore vital that they be trained in information skills; defining subjects, identifying and finding information, selecting, organizing, evaluating, processing and communicating information are all cross-disciplinary skills that pupils must learn from documentalists and teachers[32].

> *Youths are conscious that their ability to use ICT is limited, and some stress the importance of school in helping develop broader skills. 'I have been working on a computer 3 hours a day for about 10 years,' one student declares. 'I've always been involved with computers! At school, you learn things thoroughly, in depth. For instance, I know all the Excel formulae now, I learnt them at school.'* (Rioux, 2000, pp. 9)

> *When Internet is used at school, it is used very differently than at home because usage is more "controlled" in terms of frequency and nature. Internet use at school focuses mainly on doing rational research with research engines (…), pupils are more organized and seem more inclined to explore the possibilities that Internet offers.* (Pons & Piette, 1999, pp. 7)

Conceptualizing

Information technology reinforces the idea that knowledge is something that exists extraneously to the individual, such as a Web site to visit rather than a dynamic process under construction in the mind of the learner. It undermines the principle of

pedagogical relationships and gives the impression that interaction between learners is superfluous in the elaboration of knowledge. In our age of "zapping" and "rapping" where we package information rather than analyze it, it is not surprising that a tool as marvelous as the Internet has been reduced to "surfing" on the Web (Aubé, 1996).

> *We have noticed that children use information systems mainly for games. [...] They are content to move objects around within diverse parameters without making any effort to find logical explanations for the interactions they create between the different variables. [...] We must devise teaching strategies to overcome this weakness.* (Pierre Nonon, cited in Meynard, 1989)

Doing research using programmable automates or "intelligent" agents, sophisticated tools the constraints and limits of which are not readily apparent, does very little towards developing personal problem-solving strategies. Our pedagogical role is to inform pupils of the constraints and limits of these tools and the way they should be used to develop discrimination, critical judgement and a sense of analysis.

That is to say, all informational tools are not of equal value. The genie is not in the tool, since engineers don't consider that all tools are equivalent. A few years ago, there was a big debate between CAL (computer assisted learning) specialists. One of them claimed that one software program in class – an integrated office-type program – was enough to resolve all learning problems. Other participants believed that educational software should be especially created to assist pupils in learning, and in particular in writing, designed as a sort of "personalized tutor" that gives ideas and advice on the way to structure, write, edit and publish texts. Today this has become so obvious that all professional word processing programs offer this type of assistance.

Nevertheless, the myth persists in education that the process for reaching an objective is of the same nature as the objective targeted. Hence, to teach public speaking, should we expect pupils to prepare speeches on their very first day in class? Learning to speak in public could well begin with other forms of learning, other procedures and methods of preparing and presenting a speech.

Structuring

Organizing, sorting, classing and structuring knowledge enables it to become meaningful to pupils and contributes to developing their capacity for critical evaluation. Because all data on the Web is accorded equal status, the value of knowledge is influenced as no distinction is made between examples, specific cases, conjecture, sophism or axioms. This creates a conceptual fuzziness that the virtual world probably accentuates. Furthermore, there is the *problem of validity of data offered on the Internet.* Pupils must be warned of these dangers and assisted in developing validation strategies for checking out data obtained on the Web.

The French national education ministry has registered the label RIP (Reconnu d'intérêt pédagogique - of Validated Pedagogical Interest) in an attempt to support French teachers and pupils seeking valid and credible information on the Internet.

> *The national education, research and technology ministry has created the "RIP" label as a guide to teachers and parents in the world of pedagogical multimedia. This logo identifies software and multimedia products responding to needs and expectations of the educational system. It guarantees the pedagogical quality of contents: scientific validity, quality of expression, pertinence of use of ICT in the pedagogical process, interactivity, level of documentary research, development of autonomous or collective skills.*
>
> (French Education Ministry: 1999)

The computer is more than an intellectual work tool, it is a cognitive mirror that leads pupils to reflect on their own cognitive processes, verbalize their strategies, better understand their learning processes and objectively perceive and structure their learning approaches. It acts like a catalyst on both the skills and knowledge of pupils as well as on the mechanisms through which they acquire knowledge and aptitudes.

Pons and Piette (1997) report that one pupil they spoke with, a frequent computer user, preferred the library to the Internet because he had been taught how to search in a library and information in books seemed to be more structured and pertinent. The pupil explained that you have to be methodical if you want to be efficient on the Net: "directly asking for what you want with a single very specific word doesn't usually work; you have to begin with broader themes and narrow down your search as you go on. If you try to move ahead too fast or haphazardly, you get lost and lose time." (Pons & Piette, 1997, pp. 83)

The National Reading Observatory in France notes that "in more open systems like the Internet, navigation is more complex. The corpus is unrestricted, even infinite. Rare are the occasions when navigators can immediately find what they are looking for. In a context where the extreme segmentation of knowledge can make you give up, you have to keep making decisions all the time and your project is often modified. This implies the use of skills that are much more advanced than finding the right path to reach the right information." (National Reading Observatory, 1997, pp. 18)

Integrating, extracting meaning

> *In terms of cognitive development, pupils today acquire more knowledge, but very often this is not as well integrated.* (Roy, 1996)

The immense mass of data accessible through the Internet consists of chunks of knowledge that are often meaningless for pupils. The contents of the school curriculum, too, are usually broken up into segments and subject areas that have little or no meaning for pupils. For instance, in 4th year primary school in Quebec the study programs consists of no less than 638 specific learning objectives, that is, 3.8 objectives per day spent in class. The overall programs for primary and secondary school contain some 9,000 specific learning objectives. How can we plan a school timetable with cross-disciplinary pedagogical activities if our heads are full of such a catalogue of requisites?[33]

Education is still based on the Taylorian model. We are content to take the study program, divide it up into hours of the week and spread it across the whole school year. It is obviously impossible to add new disciplines because that would make just too many lessons. We must learn to break down the borders separating fields of study, to integrate subjects through a transdisciplinary approach[34].

School learning is a vital challenge that only too often we consider as being won: from a limited number of learning situations we postulate that it is possible for pupils to handle an unlimited number of situations in life.

> *Learning usually takes place in a given subject and context, but it is essential that links be created with other subjects and contexts so that pupils can transfer learning to other pertinent contexts. Integrated learning responds to the need of generalization. True integration goes way beyond the simple juxtaposition of common themes and project-based pedagogy because it is cross-disciplinary by nature and the objectives targeted are generic abstractions: fundamental skills, cognitive processes, general concepts, working methods, attitudes [...]. Integrated learning means using what has been learnt to structure the way we think, communicate and organize our actions.* (Roy, Henry, Cormier, 1997)

Technologies should be used not only to access information, but also to provide opportunities for the mediation, creation and structuring of knowledge. Relational databases and new telecollaboration tools enable us to search for and process information from several distant sources at once in a matter of minutes. The Internet provides extraordinarily interactive support that is well adapted to educational needs: electronic mail and listserves to collaborate with several people on a same project and conduct group discussions and debates, chat sessions for synchronous exchanges and the Web to publish information. These are three indispensable tools in developing new technology-assisted pedagogy. Teachers should take full advantage of these new opportunities to improve mediation and integration of knowledge[35].

Socializing, collaborating

The changes in contemporary society are rapid and profound. The gap between generations is forever deepening and adults are finding it very difficult to transmit their ideas on life, their aspirations and ideals to the younger generations. The school is no stranger to this metamorphosis.

> *As time goes by, new ideas and prospects see the light of day: cultural developments, making money, pleasure seeking and looking for a meaning in life. Today the American scene is overcrowded with people and possessions, the curtain is rising on a new decor. When a large enough percentage of the population adopts themes counter to the current culture, the style of that culture begins to change. And whilst certain transitions are painless, others take a lot of sweat and tears.* (Jongeward, 1978, pp. 14)

> *Today's children and adolescents have to learn certain social skills from peers if they are to live harmoniously in groups. Pupils need each other in order to develop, yet their relationships with friends are more conflictual. Nowadays they resort more frequently to violence at school.* (Roy, 1996)

Nevertheless, they do need others in order to learn and they are aware of this. In a survey conducted by Pons and Piette (1997), youths were asked about the "things they can't do without in life". 49% of respondents ranked friends first, far ahead of all other factors. 5% rated the Internet first because apparently it is a vast meeting place for them, something like a planetary agora.

Students consider that the important things happening at school don't only occur during the teaching process (in class), but also alongside this process: during encounters with other students, anywhere culture and norms are being inculcated. Undoubtedly this explains the longevity of the organizational forms of schooling that so many authors consider outdated. This is why Venitia doesn't believe that virtual schooling, deschooling that takes place anywhere, anytime, is ready to replace local schools. Youths come to school mainly to socialize and meet each other, to learn to live together, Venitia insists[36].

As long as we ensure appropriate training for teachers, and more particularly training in communication and media, new technologies can provide powerful opportunities for co-operative learning and problem-solving, for encouraging pupils to collaborate, plan and divide work up into sub-problems, sharing the task of investigating the mine of information available. Ultimately they can pool the results of their research using hypertextual multimedia to render it accessible to the whole community on the Internet. This is a proven means of collaboration and socialization.

Developing responsibility, guidance

Youths perceive schooling as a key to the best positions in the labor market. They don't value the contents of their studies, but the diploma it permits them to obtain. Quite often they find learning contents somewhat boring, abstract and decontextualised – simply something imposed by the school program. However, they want their diploma and are ready to "endure" school long enough to get it (Paquette, 1996). We must admit that school is relatively unmotivating for most pupils, particularly boys. More girls attend high school than boys. The difference in boy:girl high school attendance rose from 2.7% in 1977 to 14.5% in 1994. At university it has increased fourfold, from 2.4% in 1985 to 10.2% in 1993, and continues to rise. Why? Because many young boys construct their sexual identity and status on defying teachers and school rules or playing the fool in class and they finish up falling behind at school, failing and dropping out (Agence Science Presse, 1997).

If the school is to reverse this tendency it must shift from the *teaching* paradigm, where the teacher "works" and pupils more or less absorb knowledge passively to "produce", to the *learning* paradigm where pupils assume responsibility for their learning and actively construct knowledge, guided and supported by the teacher but,

more importantly, in co-operation with peers. "Knowledge is not constructed by one person alone, it is the result of complex transactions between knowledgeable subjects in which imitation and transfer play a determining role and in which reciprocal validation strategies intervene, as the peer becomes a critical point of reference for the conceptions elaborated." (Aubé, 1996) Teachers play an indispensable role in the process, a role that new technologies can accentuate even further.

We should underline a further danger that could limit the integration of ICT in education. Systemic recourse to multimedia has given rise to a new form of individualism, undoubtedly because it is based on indirect, even asynchronous, communication without any real encounter with the other person. Messages circulate in an increasingly abstract, unreal, intemporal universe manipulated by mediatic intermediaries of all types. *We must watch out as we could well be creating a society in which we communicate more, but actually meet less and less* (Breton, 1997). Venitia knows that this is not what her pupils want.

Motivating, awakening interest

> *Nowadays pupils' attitudes to school learning are more mitigated than in the past. They have a keener sense of awareness and curiosity, and are more critical and demanding.* (Roy, 1996)

Teachers have to compete with countless other information, knowledge and cultural agents, and it is hard for them to capture and keep the interest of their pupils. From this point of view, new technologies are certainly powerful tools for accessing and presenting information dynamically. They provide an opportunity to motivate pupils and restore the credibility of the school on condition, however, that we don't use them as a gimmick but as a means of structuring the learning process through the research, processing and communication of information.

> *Most pupils show a more spontaneous interest in learning activities incorporating new technology. [...] When they use new technologies, they are willing to concentrate on activities much longer than when they work with traditional methods.* (Grégoire et al, 1996)

We may wonder if increased motivation and interest are not simply fleeting manifestations that can be put down to the novelty of technology. Researchers in the ACOT project examined this hypothesis:

> *As our research took into account the long-term consequences of computerization on pupils' level of interest, it showed that it is not the novelty of the computer that is the critical factor but the use made of it in teaching.* (Sandholtz et al, 1997, pp. 104, 105)

Favorable and long-lasting effects on pupils' level of interest are produced only if:

1. ICT is used with other teaching tools in a broad didactic repertory including multiple pedagogical approaches;

2. technological resources are integrated into the overall structure of the school program and specifically included in it;
3. focus is placed on applications such as word processing, editing and multimedia tools;
4. the use of technology is adapted to the interests and aptitudes of pupils.

> *Researchers concluded, amongst other things, that the integration of computer-assisted learning in class increases by about 20% the time that pupils effectively consecrate to learning, encourages individualized teaching and improves follow up of the learning process of each pupil.*
>
> (Van Dusen & Worten, 1995)

THUS SPAKE VENITIA

> *At the end of the day, man must decide for himself! All education should ultimately aim at developing his faculty to decide.* (Victor Frankl)

Some people believe that traditional schooling, inoculated against the poison of new paradigms, will manage to "swallow up" new technology-triggered reforms just as it has preceding reforms. However, it is not the new technological tools that are responsible for social changes, but the social and demographic changes that have pushed society at a certain moment in time to develop new tools in order to confront the challenges imposed by social changes.

ICT offers powerful cognitive tools that can help solve the problems of traditional schooling, but will be useless in class if teachers refuse to transform their pedagogy and principals refuse to restructure schools. Thus spake Venitia!

NOTES

[1] Illiterate applies to anyone who cannot read an instruction manual to operate a currently used appliance.

[2] Bio-computer experts use computer tools to model molecules and simulate operations for conducting experiments on virtual molecules.

[3] Infographists design video games of all types.

[4] Parents, non-teaching professionals, support staff and other participants exterior to the school (employees of other organisational entities) should also be considered as playing an important role.

[5] Note from translator: this refers to the "Informatique pour tous" (Computing for all) programs set up in many French-speaking countries in the eighties.

[6] And yet 80% of American classes have access to Internet.
http://www.infometre.cefrio.qc.ca/fiches/fiche315.asp

[7] Statistics Canada. "Second survey on information technology in education (SÉTIÉ), International Association for the Evaluation of Educational Achievement (IEA) and the Centre for Statistics in Education", Ottawa, 1999. Table 3.32, page 238.

[8] New school programme for Quebec schools
http://www.meq.gouv.qc.ca/dfgj/program/1cyclep.htm The revue Virage regularly presents an

overview of activities and documents concerning curricular reform in Quebec at http://www.meq.gouv.qc.ca/virage

[9] Transversal competencies and technologies
http://www.eduq.risq.net/DRD/program/competence/TIC8_3.PDF

[10] A survey conducted by the Education Ministry in Quebec schools indicates a ratio of 6.5 pupils per computer (Danvoye, 2000).

[11] National Center for Education Statistics, September 2000.

[12] Science studying all aspects of man including relationships with fellow man and technology

[13] Relevant information for the implementation of a school plan can be found on web-site of the Department of Didactic Resources at http://www.eduq.risq.net/DRD/planific/

[14] The site Infobourg contains numerous projects. Its news bulletin proposes meaningful pedagogical activities concerning current affairs http://www.infobourg.qc.ca

[15] Josianne Basque, at the Tele-University, has put out some interesting recommendations on efficient strategies for disseminating technological innovation in schools. Basque, Josianne (1996) http://www.grics.qc.ca/cles_en_main/projet/strategi.htm

[16] Useful resources for drawing up an ICT school plan are available on the web-site of the project École informatisée Clés en main http://www.grics.qc.ca/cles_en_main/projet/plan-tic.htm

[17] http://rescol-schoolnet.ic.gc.ca/f/

[18] The socio-constructivist theory, inspired by the works of Jean Piaget, states that individuals construct knowledge using their physiological senses.

[19] Regulation includes all functions and actions aimed at maintaining the balance of a complex system despite interference from the environment or, alternatively, all functions and actions aimed at modifying a system to enable it to adapt to environmental conditions.

[20] The French-Quebec contest "Histoires croisées ».
http://concours2000.educationquebec.qc.ca/index.html

[21] See web-site Méthodologis, a site for French as a foreign language (FLE) at http://www.ifrance.com/methodologis/, the site Lettres pour les professeurs de français at http://www.lettres.net/ and the web-site Lili (Literature on line) at http://www.bibliopolis.fr/html/lili/html/fs_lili.htm

[22] The acquisition of knowledge is a necessary but insufficient condition for developing skills, which are themselves necessary but insufficient conditions for developing competence.

[23] In the Fench text "rapailler", a Quebec neologism used by the poet Gaston Miron to mean gathering, grouping, classing, structuring, and integreting one's ideas and thoughts to make them meaningful.

[24] See site Formanet on developing information skills at
http://www.fas.umontreal.ca/ebsi/formanet/index.html

[25] Researchers from the ACOT project identify five stages of integration: introduction, adoption, adaptation, appropriation and invention (Sandholtz, J. et al., 1997 pp. 38 à 45)

[26] Here is a list of questions asked during the interviews: Do we have the required means? Are we being pressurised by major information industries? Have the real pedagogical needs of schools been defined? Have we defined and acknowledged the benefits of using ICT in learning in primary education? (Gervais M., 2000, pp. 17)

[27] See pedagogical activities and communication tools for encouraging exchanges between pupils and tutors on the Allô-prof project web-site at
http://www.parentsdaujourdhui.com/html/education/allo_prof/index.htm

[28] (Gervais M., 2000, pp. 5)

[29] http://io.rtsq.qc.ca/scripts/t3cgi.exe/Tango3/final/Wizard.taf?fonction=Recherche

[30] http://www.cslaval.qc.ca/Prof-Inet/aai/collab/telecoll.htm

[31] http://concours2001.educationquebec.qc.ca/

[32] See web-site "La recherche d'information en classe" http://www.csaffluents.qc.ca/rmi/

[33] The policy statement made by the Ministry and indicated on page 24: "when presenting school programmes, it is preferable that objectives are limited in number and that knowledge and skills to be acquired are clearly expressed. Horizontal integration of these is also desirable."
[34] Transdisciplinary approach: action by means of which educational projects are implemented and didactic problems resolved by interlinking and combining data and approaches from different disciplines.
[35] See "La Toile éducative" web-site for suggestions on classing educational resources available on Internet at http://ntic.org/guider/textes/div/bibtoile.html
[36] The educational mission of the school is carried out via all school activities including extra-curricular activities and other school functions

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PROFESSIONAL DEVELOPMENT FOR TEACHERS AND QUALITY IN SCHOOL EDUCATION[1]

Abstract. This chapter focuses on the role of professional development in the educational sphere, and its effect on the outcomes of the integration of ICT in school life. A major obstacle to meaningful educational change is the obsolete structures of prevailing professional development processes for teachers. This is evidenced in the inappropriate sectarian division between pre-service and in-service teacher training. This chapter argues for a radical change in the most basic structures of teacher training, including the blurring of the distinction between pre-service and in-service training. It examines the problem holistically to include the economic, social and environmental issues that affect both teachers and pupils as groups and as individuals. Finally, some examples of initiatives in Greece lead to strategic recommendations for the implementation of training processes to enhance the potential of ICT in education.

INTRODUCTION

The notions of "quality" and "change" that dominate the social realities of schooling today – at a time when Information Technologies, computers and the Net are penetrating every aspect of our economy, working life, education and society and causing major changes in perceptions, attitudes and practice – have set the scene for renewed discussion on teacher training and professional development. Both the quality of education and educational change are intrinsically and strategically linked to the training and development of teachers, especially in today's evolving Information Society and knowledge-based economy.

Teachers live in a changing world and are expected to prepare the future generations for this changing world. The new questions being raised and the new answers to old questions that are emerging call for much deeper reflection on social and economic change than former "traditional" standards of education systems. To put it more clearly, teachers are being asked, much more intensively than in the past, not only to transform or adapt their classroom practice, but to come to grips with a "culture of change" brought about both by the new "digital" means of handling and presenting information and by social changes ("school openness"), all facilitated by the widespread use of ICT in almost every activity and facet of daily life. This requires new learning skills and roles for both teachers and students. In today's context, educational systems, schools and teachers are invited to interpret new realities and find ways of working that will enable students to interpret and cope with these new realities. The "culture of change" dominating today's society has made continuous professional development a very crucial issue.

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 121–134.

Teacher training and development seem to be viewed as a professional right and obligation, yet this can be problematic. Training entails notions of professional accountability as well as self-fulfillment and development. It is linked to a general problem of "professionalism" as defined by the multiplicity of stakeholders in teaching practice. In our societies, teachers are meant to simultaneously serve pupils, parents, the local community, the school and society in general. And so we end up with a kind of "need overload", and even conflict, tension and anxiety.

At the same time, the notion of teachers' professional status and role is being politically challenged. It has been argued that the increased *intensification* of the teacher's workload, coupled with the increased demand for *continuous professional development* and *de-/re-skilling*, have led to a situation that deprives teachers of essential control over their work and the ability to respond to or initiate change. Teacher training and continuous professional development add a further dimension to the debate. In other words, the demand for increased teacher training should be linked to a re-definition of their professional role and status as implied by the current realities of teaching.

While there is already strong evidence regarding the importance of teacher training and the way that it should be organized and effectively delivered, teachers' professional development is not yet being dealt with as a priority in the agenda of policy makers in education, teacher associations and society at large. It seems that although certain clear findings have emerged from pilot projects and case studies, the means are not being provided to put these into action, since:

- in-service training[37] and professional development are generally considered as processes supplementary to initial (pre-service) teacher training, allowing teachers to refresh their knowledge and acquire a broader understanding of subject matter, or
- teacher education is conducted as a means of facilitating the implementation of innovations and changes in the school system and is centrally organized to support the introduction of change/innovation (short-term perspective).

What chance is there that things will improve? In the present chapter, we highlight critical aspects and pertinent issues related to teachers' professional development as a driving factor in raising the level of quality in education, at the same time presenting our analysis from a positive perspective. The author shall also use this opportunity to recount experiences and recent developments in the Greek education system as a case of reference for the majority of European countries.

THE EMERGING TEACHER TRAINING "MARKET"

In a number of policy documents drawn up in Europe and other countries of the world, the focus is placed on the need to improve the quality of education and encourage innovation. To this end, reference is inevitably made to the importance of teachers' in-service training as a catalyst for the continuous adjustments that have to

be undertaken in any dynamic system such as education. A variety of approaches are being deployed to respond to this need, in keeping with the social, historical and cultural traditions of the countries concerned as they are reflected in the objectives and specific characteristics of national education systems. A dearth of information is available on the number of teachers actually wishing to participate in in-service training programs for one or more of the following reasons:

- in-service teacher training activities have been too recently established in national education systems for relevant facts and figures to be available;
- public administration systems in certain countries are insufficiently developed or simply do not provide relevant documentation, especially in this field;
- de-centralization of decision-making and teacher-training on offer between various regional, state and local authorities makes it impossible to obtain an overall idea of the numbers of teachers involved.

This constitutes a major obstacle for planning and decision-making in the sector. It further adds to the difficulty of developing a coherent strategy to address problems related to the teaching profession as well as to other emerging professions in our educational systems (for instance, course administrators, resource planners, communication consultants, educationalists, managers…).

There is a clear need to:

- adjust teacher training practices to respond to the demand for new pedagogical approaches (didactics) and also to meet short- and mid-term priorities;
- provide sustainable teacher professional development which could guarantee the existence of a socially effective school system in the Information Society.

Is it possible for existing European teacher training institutions to meet this need? Do the presently active teacher training "providers" (mainly public education establishments such as academies, universities, etc.) possess the necessary competencies, know-how and resources to address the critical mass of European teachers sufficiently rapidly, that is, within the next 3 to 5 years? In the meantime, public education authorities are going to have to undertake concrete measures, both in terms of "demand" – by estimating teacher training needs and setting quality standards – and "supply" – by planning relevant integrated teacher-support schemes.

The first important area of teacher training concerns the implementation of changes and the introduction of innovations in education systems. The process of implementing an innovation is actually a learning process; hence staff development (teaching professionals) and implementation go hand in hand. The majority of past and currently running training programs in Europe and the US correspond to this specific area of training needs as defined by decision makers and education planners (top-down procedure).

A second area of training and support needs is related to the culture of the school as a work place. This implies addressing overall institutional development as a means of bringing about the changes that will increase a school's performance and its capacity for continuous improvement. This calls for a more spherical and holistic approach to change and quality upgrade in education, the main issue being to refocus teachers' professional development and/or their needs so that these become part of a strategy for institutional reform. In this way, a great deal of "learning" will actually take place in the school environment and involve as many teachers as possible. This can be considered as a bottom-up approach.

CONTEXTUALISING TEACHER TRAINING: THE CONTEXT, THE INDIVIDUAL, THE MASS

Teacher training provides a natural starting point for initiating the process of change. It is interesting to focus on certain aspects of teachers training particularly – but not exclusively – related to the ICTs.

- *The distinction between pre-service and in-service training is no longer relevant*. In today's context, pre-service teacher training is better considered as a preparation not only for the pre-determined role of the teacher but – and more importantly – for effective participation in a continuous (life-long) teaching-learning process.
- *Distance education (learning) is no longer a valid (distinct) category*. The relationship between teaching and learning is becoming a dialectical one, based on communication between human beings who jointly "create meaning". Separation in space and time (seen as characteristics of "distance" education) is merely an option based on convenience or appropriateness in context rather than necessity.
- *"Learner education" must go hand in hand with teacher education*, since teachers (the "teacher/learners") must start by learning if they are to become good learners. This requires a lot of discipline, patience, resourcefulness, open-mindedness, creativity and flexibility. If we are to plan for "learning communities" where learners (students) sometimes take the teacher's role, students must, at the same time, learn how to "teach" their peers and their teachers as well. Thus teacher education must, at times, involve students (learners).
- *The new Information and Communication Technologies must not be viewed as replacing the human element in teacher education*. Due to the growing frustration with existing professional development systems for teachers, ICT is sometimes seen as a solution to the problem (e.g. a means of bypassing the assumed weak link in the "chain", that is, the lack of competent teacher trainers). This, however, is totally

> misleading and teachers would be best prepared for their new role (tasks) in a humanizing environment where they encounter models of the behavior expected of them and in which ICT enhances rather than detracts from the human aspect.

As in all working environments, an operational and effective in-service training system is dependent on the professional motivation of the staff. Individual and team motivation is certainly inherent to some aspects of the problem. It is important to stress that "good" teachers are those backed by "good" teams (colleagues). Thus, school development is closely related to teacher training.

In some countries, performance-related payment systems have been adopted for teachers. In such situations, a number of problems arise due to the difficulties of measuring performance whilst encouraging collaboration. Needless to say, it is not an easy task finding ways of rewarding good teachers without losing them from teaching (through promotion in the hierarchy). Thus it seems that a major policy priority has to do with the identification of well-justified and organized teacher remuneration schemes as well as of consistent professional development cycles. The aim should be to promote and strengthen collaborative approaches in teaching whilst at the same time providing for individual performance measurements (self- and peer evaluation).

Nowadays, schools are facing the same problems as businesses some years ago. There is no other alternative for successfully developing organizations but to encourage team work. In schools, people inevitably work together, not only because of the increased complexity of tasks and assignments but also because of the increased availability of communication means which facilitate collaboration.

The measurement of the performance of teachers and schools is considered a socially delicate issue (external/internal evaluation, peer review, etc.), due to the fundamental question of whether parents/families have the right to select the school they send their children to. If we do not allow for rationalization in the school system (with social support for the less effective schools), we run the risk of ever-increasing social discrepancy because then (the good) schools will actually "select" their pupils (good enough to sustain the school's competitiveness).

EDUCATION SYSTEMS AND POLICIES: BUILDING TEACHER SUPPORT MECHANISMS

In-service training can no longer be seen simply as a remedy for deficiencies in initial training. It has to be considered and established amongst the various stakeholders as a long-term, ongoing educational process. Whilst today this concept is widely recognized, it is also becoming more complex.

There is an evident lack of well-documented evaluations and performance measurements of in-service training programs addressing large numbers of teachers. The evaluation and related review results that do exist are more reflections of aims and objectives than actual observations, analyzed in such a way as to support the merits of the teacher training schemes adopted. Nevertheless, it is widely accepted that the weaknesses of established training schemes addressing large numbers of

teachers are, firstly, the inherent transmission loss in so-called "cascade models" and, secondly, the gap between training on offer and the realities in the field. ICT is often considered as a means (through the facilitation of distance learning practices) of overcoming these problems. However, this is a narrow-minded application of ICT, the major benefits of which in teacher education should concern the following:

- *Adopting, promoting and widely establishing participatory teacher training schemes* that may be further enhanced by the intermittent participation of learners (students).
- *Offering flexible training "products" (programs)* to respond to the specific but varying needs of teachers using individualized approaches.
- *Implementing in-service teacher training as an ongoing on-the-job process*, thus opening up opportunities for teachers for career-long and career-wide activities and ensuring an environment propitious to professional development.
- *Overcoming the traditional dichotomy between subject matter and pedagogy*, with the inherent tendency to place the emphasis on the "subject matter content" rather than the process. Teacher training must be re-focused on learning (learners) with both subject matter and pedagogical elements properly integrated.
- *Increasing the media literacy of teachers*, thereby developing their capacities to experiment and interact with various media (including "old" technologies – print, radio and TV) and creatively reflect upon the way these are best used in different learning setups.

One of the main difficulties nowadays facing training systems is the insufficiency of human training resources (both in terms of competence and sheer number). A *major priority* for education systems therefore has to do with properly designed *actions to "train the trainers"*.

Through a well-established initial training system, the teaching profession could be upgraded and perhaps even accredited across Europe, thereby contributing to the mobility of teachers (and hence the transfer of practices, attitudes and learning styles) between national environments. Would this be a useful approach? Or is it better to focus European-wide on specific areas of (basic) initial training that are similar and independent of national particularities and priorities, e.g. familiarization with the technologies and relevant skills?

The emphasis we currently place on processes serves to set in-service training apart from mere re-training. In-service training is also a means of responding to teachers' personal and professional needs and encouraging the development of autonomy. Viewed in this way, it would seem that in-service training can improve the quality and effectiveness of education systems, promote teachers' mastery of technical and scientific advances and enable us to anticipate changes.

The content of training programs on offer illustrates a new focus on internationalization in training that extends far beyond the current framework. The inclusion of teacher mobility programs as part of in-service training is a strategy that may lead to greater openness in the development of new skills and more effective exploitation of the possibilities offered by a European-wide educational arena. The great potential offered by the use of ICT and networking in this direction is evident.

The problem of professional development for teachers calls for radical reflection and more effective integration at three levels – that of the individual (teacher), the school and the local/regional authority:

- Those involved in teacher training should *think and act holistically* in regards to the personal and professional lives of teachers.
- It is absolutely necessary to work more closely (more "organically") with the *school as an organization*. The school is becoming increasingly complex and is resistant to external influence (change). There have been many cases – mainly in pilot projects – when collegiality among teachers was achieved to a certain point but was not sustainable in the long run because the workplace (school) conditions were not conducive to maintaining collaboration.
- Finally, *decision-making and administration systems for training budgets* need to be reorganized. Neither centralization nor decentralization has succeeded in bringing about educational reforms. Developments involving individuals, schools and local authorities require close collaboration between all parties within and outside of schools.

COST EFFECTIVENESS, SUSTAINABILITY AND QUALITY

Cost-effectiveness is frequently cited as a criterion in addressing the exponentially increasing needs for teacher training. Scalability seems to be an answer to this issue. Furthermore, scalability may function as a regulator and augment the effects of market competition.

Several recommendations can be made for rendering the process of implementing teacher training more effective:

- focus on selecting teachers who will actively respond to training (probably not the older teachers),
- standardize processes, materials, hardware and software tools,
- promote and encourage "school leaders" (innovation agents),
- increase the modularity of training courses (individualized learning),
- aim at involving end-users in the production-development of the services,

- adopt ODL (open and distance learning) practices and techniques as a means of reducing costs.

The issue of sustainability of continuing professional development systems must be thoroughly examined. Sustainability necessitates the involvement of teachers and the "re-engineering" of education, which is a very expensive task. In this context, training centers may act as service providers and at the same time subsidize costs with revenues from schools/teachers/local educational authorities.

Training experience in the industrial sector highlights the following principles as regards the provision of training services: (a) short sessions; (b) needs-oriented training; (c) modularity.

Another crucial issue has to do with choosing training priorities, in other words, in deciding which teacher groups should be targeted first. Should it be those considered as being more influential or should it be the younger ones? Should all the teachers be kept well-informed anyway? Teachers participate in professional development programs mainly for career purposes. Their motivation is basically "extrinsic". For this reason, teachers approaching the end of their career are not particularly interested in professional development. It seems that teachers who express an interest (self-selection) in such programs do so from a realistic standpoint.

Relevance is an important factor in ensuring quality and, at the same time, sustainability. The following can serve as guidelines in this regard:

- *Acknowledgement of existing individual competencies of trainees:* in a continuing training perspective, recognition of competencies acquired on the job is fundamental both to motivate learners and to achieve a complete picture of competencies available in a given group.
- *Formation of inter-sector user groups:* the importance of creating inter-sector user groups (including teachers from school, university, vocational training and industrial training) is motivated by the need to break down long-established teaching attitudes and stereotypes.
- *Integration of classroom, ODL and context-based learning:* teacher training should attempt to integrate ODL modules, including face-to-face sessions and project work, based on the working context of the teacher.
- *Integration of ODL scenarios:* ODL is no longer a single-paradigm approach; in addition to tutored self-managed learning, teachers should have the opportunity to participate in "virtual classrooms" and networked collaborative learning activities in order to experiment the advantages and the limits of each approach on their own learning, before proposing them to their trainees-learners.
- *Core-content on standard competencies:* the "content" base of a teacher training system should be focused on agreed standard

competencies, directly related to the design, management, support and evaluation of the teaching/learning process.

- *Openness to new, non pre-codified contents:* as a "balance" to the previous principle, "content" should, however, not be a closed set of knowledge; openness should be built into the system in order to incorporate new content-modules corresponding to changing needs and specialised competencies.
- *Support to contextualization:* every effort should be undertaken to show the relevance of competencies offered by the system as a support to problem solving. Activities should encourage immediate testing of newly acquired knowledge and skills in the school environment.
- *Mixed funding:* all stakeholders in teacher training should have a stake in the overall "investment" in order to prove their commitment. This does not necessarily mean cash: working time and other forms of material and immaterial support are considered of major importance.
- *Evolution towards demand-based training:* although, in the initial phase, a public authority may define training objectives and contents, in the medium and long term the teachers' demand should be taken into consideration, the training system progressively evolving towards full responsiveness to users' needs/requirements.
- *Concerted strategy and autonomous management:* although it is absolutely legitimate and advisable that all interested parties are consulted and possibly involved in training-system decisions, the day-to-day management of the system should be autonomous in order to guarantee reactivity, effective trouble-shooting and accessibility to the responsibility center.
- *Plurality of content and service providers:* a training system for teachers and trainers must maximise access to relevant resources and services and should be open to competitive offers.
- *European design and implementation:* all training systems designed nowadays for teachers and trainers should reflect the process of European integration and provide users an opportunity to communicate with teachers and trainers in other European countries, collaborate with them in various teaching areas and share evaluation approaches.

Decisions on the above-mentioned issues concerning quality and sustainability are also related to the type of evaluation and assessment framework set up. In terms of evaluation frameworks, practice shows extremely diverse approaches ranging from attempts to interrelate analysis of needs and formulation of expectations to views

that nothing happening during in-service training can be assessed because it concerns the personal development of individuals. More precise evaluation of the effects of in-service training on pupils would necessitate not only research into the different types of training and their effects, but also the acquisition of tools enabling development in teachers' professional practice to be evaluated.

TEACHERS TRAINING IN GREECE: THE "INFORMATION SOCIETY" CHALLENGE

The conditions prevailing in teacher training in Greece are similar to those in most European countries as regards scope, organization, objectives and effectiveness. However, the teacher training system is less productive in the Greek environment due to the historical inefficiencies of public administration. A formal, abstract description of the teacher training programs that have been running over the past six years (1995-2000) – mainly financed by the European Structural Funds – can be found in the recent EURYDICE reports. It is, however, necessary to pinpoint some critical aspects concerning relevance in the long-term planning of the system:

- Schoolteachers in secondary education are not provided with a systematic pre-service training agenda. Pre-service secondary teacher training is conducted under the responsibility of Schools of Education and takes the form of rather scholarly and partisan lectures and projects in the final years of the Humanities and Science Departments' cursus.
- Primary school teachers follow a four-year university program in the so-called Departments of Primary School Education present in a large number of Greek universities.
- The school education system, consisting of some 10,000 school units and involving approximately 110,000 teachers, is not organized in such a way as to ensure effective professional development opportunities for teachers. At the same time, teacher associations are adopting rather defensive approaches to ensure minimum professional quality standards – thus easily attained by everyone – in the name of maximum employability for all those with a university degree.
- In the de-facto, a widely accepted framework of minimal quality standards does exist but there is no assessment of educational results – at macro-, meso- (school) and micro- (teacher) level –, and no serious attempt has been made to establish a consistent in-service training system. Training curricula are occasionally offered by university-driven (academic) and other initiatives, but these often have no real relevance to the existing training and support needs of teachers. The training is provided in so-called short (20-40 hour) seminars as well as in longer courses of 3-6 weeks.

- This ineffective training framework (functioning without any real objectives or form of management) is expected to assume the responsibility of addressing the recent, highly demanding mandate set by the Ministry of Education (January 2001) by providing training for the use of ICT in learning (both digital literacy and learning-focused usage) to some 75,000 teachers within the next 3 years – the "Information Society" challenge (in the framework of the European *e*Learning Initiative).
- Educational decision-makers and planners are being forced to focus their attention on the necessity of creating an effective teacher training system in Greece because at present there is no serious quality framework for the education offered in public schools, and because discussion on integrated pre- and in-service training and professional development for teachers has become a topical issue in most European countries.

We are hoping that a set of guidelines drawn from the past 30 years of experience in Europe and the rest of the world since the early 70s will be taken into serious consideration in the above-mentioned ambitious Greek project, as they have been in most European education systems,. Some of these guidelines are indicated hereunder.

A FEW CLOSING REMARKS

We shall now attempt to present some issues of interest to policy makers and designers of teacher training programs for further reflection. Many were raised at the "Teacher Role & Teacher Training" Workshop in the European SchoolNet (EUN) Conference held in Brussels in March 2000.

Issues related to needs and changing practices in schools

- It is important to define a productive way of progressing from innovation to consolidation of knowledge and training, from pioneering to establishing new roles and practices.
- Motivation of teachers and schools to continuously upgrade quality and level of self-fulfillment could be linked to a "performance measurement" system based on self- and peer-evaluation procedures, both at the level of the individual and the school team.
- Teachers need to learn how to become less isolated in their teaching (through collaboration with colleagues, parents, and learners).
- We must deal with two categories of teachers, those willing to move ahead and those who implement only marginal changes; in-service training must address both categories.

Issues related to organizational aspects and support mechanisms

- Operational policies are necessary for setting up teacher training systems capable of meeting the need for increased "supply" (i.e. training on offer), upgrading quality and reaching a critical mass of teachers. These should incorporate sophisticated strategic planning and project management (not part of the routine tasks of subject-matter experts and traditional educationalists today).
- In some countries the only legitimate providers of teacher training are state institutions (research centers, universities, etc.). There is strong evidence that these establishments are not capable (in terms of know-how, resources and practices) of addressing the continuously increasing professional development needs of teachers in the years to come.
- At the same time, there is a trend towards "opening up" the teacher training "market" through the participation of actors from the private sector. This is being done either by accredited – by public educational authorities – providers (where the schools become "buyers") or with teacher training contracts offered to consortia (sometimes public-private initiatives). Public education authorities should face up to these trends and strengthen their regulatory role on the "training markets", rather then maintaining a traditional "supplier" profile.
- In any case, there is a clear need for regulatory frameworks to be established in order to define quality standards for teacher training. A more open approach to the market could facilitate collaboration with the private sector, resulting in greater commitment on behalf of the latter and the transfer of "management-by-objective" attitudes and practices.
- A very closely related question concerns the administration of budgets allocated to teacher training. De-centralization of relevant decisions at the regional and school level ("school autonomy") will be more productive if accompanied by well-defined guidelines for planning (of teacher training programs) as well as standards for quality and evaluation.
- One of the weaker points in budget-effectiveness measurement systems in the field of teacher training arises from the inherent "need" for short-term returns. Professional development for teachers would be better approached as a long-term investment in the educational system (with a codification of relevant program assessment frameworks).
- Along with budgetary aspects, "cost effectiveness" and "sustainability" should be taken into account. It is necessary to

aim at "cost effectiveness for quality and sustainable school development".

- Sustainable school development means that schools become capable of diversifying their offer and flexible enough to meet varying needs (thereby addressing the problem of segmentation of learning needs, learning differences specific to social and ethnic groups, etc.).

NOTES

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[2] The terms "teacher training" and "teacher education" are used interchangeably in this document.

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JANICE RICHARDSON

LITERACY, OR THE ART OF INTEGRATION

Abstract. This chapter argues that while there are characteristics of ICT that have the potential of enhancing constructivist learning and raising the level of literacy in its broadest sense, ICTs often underline the gap between the desired paradigm and the existing patterns of educational activities. Thus it is important to examine educational goals and address the crisis of reorientation by broadening common definitions of literacy to include those forms that underpin successful ICT integration. A theoretical model is presented that highlights three categories of variables that have to be dealt with simultaneously in order to support successful didactical changes. Minimum requirements involve not only adequate resources but also different groups of high-level skills, sophisticated strategies and a sustained effort from the school management or leadership. Finally, some examples are provided of research and integration initiatives in Luxembourg.

INTRODUCTION

When asked what the fundamental aims of education are, it seems that only one answer is possible: enable citizens to develop their full learning potential in order to successfully integrate society. This was the underlying objective of the educational program Rousseau propounded for the young Emile (Rousseau, 1762), and has been the driving force for many of the leading educational theorists – for example, Dewey, Montessori, Freinet and Neill (Houssaye, 1994) – who have influenced educational practices over the past two centuries. Admittedly, sociologists and philosophers have a tendency to proclaim that the mass-production modes permeating every level of society from work to leisure and education to social structures during the Industrial Age have subjugated educational aims over the past century to the more lowly needs of a disciplined workforce. However, the exponential rate of scientific and technological advances made in countries where education is compulsory compared to countries where it is still the reserve of the elite would seem to indicate otherwise. These are the very evolutions that have led more privileged countries out of the Industrial Age into an era commonly called the Information Age and which, in turn, will carry us forward into new eras as yet undreamed of.

It is not the fundamental role of education systems that need to be modified from one era to the next, but rather their mode of operation within the changing social, cultural and technical contexts. The education system, just like the social, legal or any other type of system, is a set of interconnected and communicating elements, the relations between which are completely modified when new elements are

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 135–149.

introduced. If new elements are to be successfully incorporated, new relations and interconnections have to be set up and a whole new system created. This is the process of integration. To understand the upheavals education systems are going through today in an attempt to define a guiding vision to lead them out of the crisis, it would be necessary to analyze the new elements that are intervening both in the systems and in the social context in which they operate.

Arguably there are many points of focus that could be discussed, however for the purposes of this essay I shall limit my discussion to factors directly related to literacy since, in my opinion, this is the key to developing one's full learning potential and successfully integrating society, at least in the Western world. At the same time I shall attempt to formulate a guiding vision for achieving goals intricately linked to this fundamental aim and discuss some of the obstacles that must be overcome. Then will follow a short description of a project underway in Luxembourg to develop new forms of literacy. In conclusion, I will discuss the findings of a recent survey conducted in four countries to highlight the variables that appear to determine successful, systemic integration of information and communication technology (ICT) in schools.

CHANGING EDUCATIONAL GOALS

Striving for broader literacy

The greatest changes brought about by ICT in society are mainly due to the enormous information storage and dissemination capacities the new technologies offer and their rapidity in processing information. Let us very briefly examine the history of information and communication technology, at least in the Western world, to understand why this is the case. In the Stone Age, the only means of transmitting or receiving information from sources outside of closed family or tribal communities was by etching or painting figurative symbols on rock faces, though perhaps there were also more transitory signals of which we have no record today. The information support could not be moved, so interpretation and dissemination of the message was temporally and spatially limited to the initiated few able to understand the symbols and physically present at the spot they were displayed. Civilization developed and the responsibility of the information "provider" progressively increased as we moved from the stone tablets and the hieroglyphs of the Egyptians, to the creation of the alphabet (or ideograms) and parchments that could be more easily carried and interpreted from place to place.

The need for literacy progressively grew as information "receivers" had to be able to correctly and increasingly rapidly interpret the message. Finally, when Guttenberg invented the printing press in the mid-fifteenth century, information providers began reaching a far broader audience. This radically modified the structure of society and dramatically reinforced the information divide between the "haves" and the "have nots" as already literacy was a form of empowerment. It opened the door to far greater opportunities for those who possessed it, enabling

them to extend their knowledge and learning and consequently gain access to greater social mobility.

This traditional form of literacy, and here I refer to the skills of reading, writing and arithmetic as we knew them until twenty or so years ago, is still the fundamental objective of most prevailing, largely print-based school practices, but it is certainly no longer enough. Moreover it seems that schools are often unable to fulfill even this basic requirement. A survey in Europe several years ago estimated that 20% of adults haven't even mastered the traditional functional literacy skills necessary to understand and fill out questionnaires current in daily life, or to read user instructions on domestic appliances (European Commission, 1995). More recently figures from France reveal (November 2001) that 6% of 18 year-olds have not mastered basic literacy skills, and that 10% encounter serious problems in functional literacy[1].

Can these alarming figures be put down to the fact that teachers are inadequately trained to cater to difference in learning styles and rhythms in our multi-cultural society? Or are teaching methods and learning content not geared to reflect the realities of society and therefore learners rapidly lose interest in school? Regardless of where the responsibility lies, literacy must remain a fundamental aim of the school curriculum, as it is the only means for deciphering the thousands of print-based messages that surround us. It is also a sine qua non to ICT literacy. Despite predictions that computers will shortly recognize and obey verbal instructions, at present the keyboard is still the principle input device and most output remains text-based. A solid knowledge of concrete mathematical operations, another aspect of basic literacy, is also essential to functioning in society, as mastery of such operations is at the basis of more abstract operational reasoning and problem-solving skills (Adey & Shayer, 1994; Rowe, 1993).

Nowadays the connotation of literacy needs to be extended to include the skills needed not only to effectively use ICT, but also to navigate with discernment in the labyrinth of information it opens to us and to sift this information for appropriateness, coherency, relevance and even verity. Because of the rapid knowledge "turnover" brought about by technological advances, some 15 to 20% of our knowledge base is becoming obsolete every year. Literacy has therefore become an important part of problem-solving skills: selecting key words to look up information, skim reading to sort through the mass of information available, reading between the lines to understand possible hidden objectives of information producers of the information gathered, analyzing sources to ensure that it is still up-to-date.

The changing structure of the labor market has further made basic literacy and ICT-literacy all the more necessary to daily life. Some four of five years ago it was already estimated that two thirds of the work force in "developed" countries spend the major part of their time processing information, and information itself accounts for about 75% of value-added in most activity sectors (Stewart, 1997). This has led to corresponding evolutions in the very structure of both the work force and the work place, and today workers can expect to change occupations several times during their professional career. Since literacy is basically the key to further learning and operational thinking, those with an insufficient level of literacy will have

difficulties mastering new skills that will enable them to confront these new challenges (Haggis, 1993).

Updating curriculum content and assessment to meet evolving needs

Literacy in its deepest sense therefore involves higher-order thinking including analytical capacities, creativity or lateral thinking, problem-solving and information handling skills. For this reason, a fundamental aim of education systems should nowadays be to include in the curriculum both instruction aimed at content objectives and intervention in cognitive development processes aimed at raising levels of thinking to improve the learner's potential to gain from instruction (Adey & Shayer, 1994). If we are to believe Piaget's theories on stages of child development (Inhelder & Piaget, 1958) which appear to be well-proven in the world of education (Adey & Shayer, 1994; Rowe, 1993)[2], the early years of primary schooling should be primarily devoted to instructional content involving concrete thinking. Only towards the age of 10 or 11 are most children ready to develop higher-order thinking and their capacity for formal operational reasoning and metacognition. It seems that rarely are these developmental stages taken into account in the curriculum, since instead of diminishing as children reach "the age of reason" instructional content becomes progressively heavier as they advance through the compulsory school cursus. Despite the fact that most national authorities are loudly proclaiming the need for higher-level cognitive skills as part of the fundamental aims of education, tests and national exams continue to systematically focus on content.

This anomaly raises one of the major obstacles impeding progress in ICT integration at school. A recent three-year survey in the United States (Rockman, 1999) suggests that the positive impact of ICT in learning appears to diminish as students reach the final years of education because the efforts of even the most innovative teachers are bridled by pressure from final exams. Even worse, to my knowledge "open-book" exams don't exist at any level of compulsory education, so it would seem that rote-learning still takes up the lion's share of the school agenda and these enticing "new" information skills we read about in curriculum objectives are but fancy words on paper.

To continue with the curriculum, what instructional content can be valuably included in the early years of schooling to take advantage of children's natural learning stages and rhythms? Beyond the mathematical and native language core skills already discussed, content could also include foreign language learning that once again enriches literacy. When we consider that by the age of six (when compulsory schooling usually begins in Western countries) most children have learnt a vocabulary of approximately 10,000 words – without any conspicuous or formal instruction (Smith, 1998) – it seems that this is a period particularly propitious to language learning. It also implies that children are already masters of the art of "learning to learn" and peer-learning strategies (Vygotsky, 1978, 1981) by the time they reach school, so why change their learning methods only to attempt to encourage "lifelong learning" strategies at a later point in schooling?

It is interesting to note that by the time most children in Luxembourg leave primary school they are already fluent in three languages (Luxembourgish, German and French) and sometimes four, since at least 20% of the population are non-native speakers of any of these languages. Methods used are largely based on peer-learning. Secondary schooling takes place in all three official languages. Yet when students go abroad to study in foreign universities, their general achievement level is much the same as students attending university in their homeland and studying in their native language. My point is that by respecting natural learning rhythms and stages of development, we can modify the learning load to open up far more opportunities for our younger generations to succeed their integration in a multi-cultural world.

Media literacy

Perhaps one of the major paradigmatic shifts that took place during the 20th century, and one that is rarely taken into consideration in schooling, was the move from a print-culture to an image-culture. We are inundated by images in magazines, advertisements, at the cinema and on television. Images are a terrifyingly powerful means of spreading messages that are endangering the very tenets of society. A certain level of ICT literacy is required to access computers and the Internet, but unfortunately everyone in the world involuntarily and passively accesses most of these images whereas only a relatively small sector of the population master the means of disseminating them. Over the past half-century images have fanned the fire of consumerism and brought the tragedies of the world into our homes just minutes after the events have occurred in the far-flung corners of our planet. It is real-time access to information through the media that has effaced geographical borders and turned the world into a social, political and economic global village, the very phenomenon that is undermining the role of educational institutions as repositories of the social and cultural values of society.

At the same time, disinformation has become a byword and a powerful means of swaying public opinion. Because most of us in the Western world are lucky enough to live in democratic societies where everyone has the right to vote, this can have a highly negative effect on public policy. The effect in non-democratic countries can be disastrous, as recent world events have shown.

All media messages have embedded values that define the way we see the world, but few of us are able to "read" in depth such messages and hence pinpoint the values being put across. This calls for a new skill in the school curriculum: media literacy. Media literacy is based on the principal of enquiry, of deconstructing and understanding the hidden codes of media messages that often go by so quickly there is no time for thoughtful reflection on what is being said. It implies seeing how media is put together and how it shapes what we know and understand about the world. Only by developing insight into this new creative language can citizens become aware of its grammar, syntax and metaphor system, and so become less susceptible to manipulation. As media is one of the major influences in society – the money-spinning industry of fashion and the world-shaking, ultra-rapid swings of the

stock exchanges are just two prime examples – in my opinion it should also take an important place in the basic goals of education. The major obstacles to its implementation are not only the vested interest of the powers that be and a lack of awareness in other sectors of the population, but also our narrow-minded approach to thinking of ICT in schools only as the computer, or perhaps in more innovative classes also the telephone. To overcome such obstacles it would be necessary to set up new forms of professional development for teachers combining the expertise of professionals from diverse fields including media and ICT.

A CLOSER LOOK AT THE LEARNING AGENDA

Most researchers nowadays concur that computers can make major difference to learning by enabling children to:

- work in open-ended, interdisciplinary, meaningful and collaborative ways;
- become more involved in complex and challenging learning situations in keeping with their level of cognitive development, through greater freedom, responsibility and ownership of their work;
- express greater creativity in tackling problems, decision-making, work presentation and self-expression (Cox & Johnson, 1993; Richardson, 1996; Rockman, 1999).

Self-expression (and, in turn, literacy) largely improves through computer use because students can spend much more time organizing their ideas, editing and revising until they are satisfied with the finished product which, due to the professional nature of their tools, can be presented in an attractive manner to real audiences through e-mail and the Internet. Teacher's corrections and comments can be incorporated without spoiling the overall presentation. On the other hand, frequent ICT users are at a great disadvantage when expected to produce under standard examination conditions, and write for an examiner rather than in the real-life context they have become used to.

From the teacher's point of view, computers support constructivist modes of learning as they offer children the time, space and a non-judgmental environment to try out their concepts and so construct their knowledge at their own pace (Inhelder & Piaget, 1958; Adey & Shayer, 1994). However, although many teachers are now convinced of the need to embrace a constructivist model they are often faced with both material and methodological obstacles. Firstly, due to the insufficient maturity of ICT and insufficient equipment to offer children access when and where they need it. These two aspects are discussed at length by Dr Newhouse in an earlier chapter of this book.

However, there exists another obstacle of a far more disturbing nature. Teachers usually develop their teaching skills through teaching practice in the classes of older, "more experienced" teachers who base their methodology on what Bernstein (1996) calls, the convergent or performance teaching model. In this model, teaching is

aimed at producing results that meet predetermined criteria set by the teacher, the curriculum and examination objectives. Teachers select "input" materials to set the desired learning context and maintain firm control over the learning environment by sequencing and pacing their lesson, defining the order of activities and how long these will take place. The output of learners is systematically judged and graded according to pre-determined criteria that children come to recognize and internalize as recognition and production rules respectively. Children's output is controlled by tight regulatory boundaries through the regulative discourse embedded in all forms of pedagogical discourse. The future is thereby constructed on the past of others – the complete opposite of constructivism –, little room is left for divergence from standard norms and creativity is generally stifled.

ICT has completely overturned this model which also applied to a large extent to the pedagogical discourse emanating from other traditional socialization agents such as the family, church and local community. This is perhaps an essential key to the "void that is deepening at the basis of the education system". With the advent of the various forms of ICT, our former socialization agents have lost all control over input and therefore over regulatory boundaries and regulative discourse. A large majority of the pedagogical messages children and adults receive are globalized, accultural messages coming through the media. This once again emphasizes the importance of media literacy. Although it is impossible and even undesirable to control "pedagogical" input nowadays, it is certainly possible to lead children to understand the "language" that is being used to manipulate them.

With computers and hence the Internet and e-mail in the classroom, input sources have exponentially increased. When activities are student-centered and project-based and when a cross-curricular approach is adopted, students gain control over three important elements that set the regulatory boundaries: input selection, order and sequencing. Bernstein calls this the divergent model. To take it to its logical conclusion, divergent criteria should be used to enable children and teacher to assess processes and products rather than performance, assessment therefore becoming a means of providing valuable feedback which children can use to advance their learning and set themselves new learning goals. Obviously here lies a major point of contradiction that is preventing widespread change in education. The situation worsens in secondary schooling. Because lessons are broken into subject areas and tightly scheduled time slots, teachers can more easily resist working together to set up interdisciplinary programs. Furthermore, final examination requirements offer the perfect alibi to stick to the old convergent, performance-based model.

ICT AS A TOOL TO AID SOCIAL INTEGRATION

Innovative research is underway in Luxembourg within the framework of a project entitled Multimedia Interfaces for Research and Authoring (MIRA), to examine the use of digital video as a teaching and learning tool for pupils and teachers. The overall aims of the project are to use multimedia in order to:

- analyze (by sampling within contexts) how ICT may benefit all children in their learning, reflection and development of personality;
- analyze the parameters supporting successful ICT integration, and more especially practices stemming from equity-related factors such as gender differences, as a means of providing feedback to teachers on their classroom practice;
- develop guidelines to enhance "classroom" learning through the use of ICT;
- broaden use of ICT in the classroom by designing tasks that challenge its potential.

I shall discuss findings related to just two of the various areas that are proving particularly conducive to better social integration: oral expression and media literacy. Oral expression is an area often overlooked in school activities, yet a very important aspect in terms of successful integration in society. The traditional teacher-centered classroom environment provides few opportunities for pupils to practice the oral skills they will need in their adult life. Interrogation more than discussion describes many classroom situations in prevailing educational practice, with teachers playing an authoritarian role that in no ways offers a model that can be applied to real-life situations. The most important element in self-expression, both written and oral, is the capacity of meta-cognition.

Meta-cognition involves the power of observation, evaluation, synthesis of ideas, critical and lateral thinking, problem-solving and communication skills (Bruner, 1986), elements which determine a person's capacity to present his or her ideas pertinently and confidently in public. Indeed, metacognition plays an important role in all interactions, since it refers to the capacity to reflect on our own processes and motivations and the expectations and actions of others (Giordan, 1998). Adey and Shayer (1994) furthermore illustrate with their findings from the CASE (Cognitive Acceleration through Science Education) project that children who are taught to reflect on their own learning processes do better in all areas at school.

In the aim of developing meta-cognition and assisting pupils to analyze their own processes and interactions with others, digital video is being used within the framework of the MIRA project to make context samplings in primary school classes. The methodology is to record events during group work sessions in class, then invite the children involved in sequences considered potentially fruitful by the class teacher and researchers to watch the video clip with their teacher in order to reflect and comment on their own behavior. This "annotation" session is also recorded and later the teacher works with researchers to analyze the information contained in the context samples. Alternatively, children can watch the full video recording to select the clips they wish to work on.

The video annotations have produced some surprising results. For example, depending on social background, children sometimes have very different concepts about the purpose of group collaboration and therefore have little idea of how to constructively contribute. By taking time to reflect upon their behavior and forms of expression outside the fire of action, they develop a greater understanding of

attitudes and interactions and can set themselves goals for the future. This is particularly effective as a means of evaluation when video clips and annotations are kept all year long in a portfolio. A video is far more telling than a short comment on a report card, and provides for stronger links between parents and school.

Digital portfolios are also being used as a much more "child-friendly" system of monitoring the progress of children with learning disabilities. They reduce the need for these children to be confronted with stressful psychological assessment sessions with an intimidating stranger, at the same time enabling teachers and psychologists to define together the educational modes most suited to their well-being. A final advantage of context sampling is the unique but private opportunities it provides teachers to observe their own behavior and interactions in class. In this respect, digital video could offer an invaluable tool in teacher training.

The major contribution video is making to media literacy is that it opens children's and adults' eyes to the fact that for a same event there can be multiple points of viewing (Goldman-Seagall, 1998). When the digital camera is linked through a firewire port to a computer equipped with a simple movie-processing program (incorporated as standard software on many computers when purchased), children can cut images to a fraction of a second and maintain only those useful for substantiating a hypothesis they choose to illustrate. Other children can use the same original recording to present an entirely different story. They can use a similar methodology to analyze scenes they see in movies, using the empowering medium of ICT to reproduce similar events and therefore understand how audiences are being manipulated. They can add music and sound effects to reinforce their message, at the same time developing insight into the language of the media.

These are simple applications of ICT that take very little time and easily transportable equipment to conduct. They enrich the school curriculum and make it meaningful to everyday life, and assist in the development of higher-order thinking and other skills essential to living in harmony with their environment. How many parents could offer their children such enriching experiences without the facilities that schools, and teachers doted with the necessary technical and pedagogical expertise, have to offer? For these and many other reasons it appears that schools have a fundamental role to play in society, and that ICT is playing a significant role to opening up paths to equity, on condition that ICT integration is equitable. Let us now look at the ways various countries are attempting to integrate this valuable teaching/learning tool.

FACTORS DETERMINING SUCCESSFUL ICT INTEGRATION AT SCHOOL

What is successful integration?

In 2000, the Luxembourg education ministry commissioned a survey to examine in four countries – Australia, Canada (Quebec), Finland and Israel – the criteria that determine successful ICT integration in schools from K1 to K12 (Richardson, 2001). The starting point was therefore to analyze the stated fundamental aims of education in the four countries in order to understand what they mean by successful

integration. Australia's policy aims appear to be fairly representative of the countries included in the survey, and can be resumed in the following policy formulation of the Australian Commonwealth Government:

> *The underlying philosophy [is] that today's students must expect to work and live in environments requiring competence in computer use and in convergent digital technology. As living and working environments will also increasingly require citizens to accept innovation and adapt skills and understanding to change, it is considered that information skills should be conceptualised broadly, focusing on learning how to learn, rather than the acquisition of specific technical skills that will need to be frequently unlearned. Students' skills in using information technology are considered inseparable from their analytical abilities and their capacity for creativity, teamwork, problem-solving and communication skills.* (DETYA, 1999)

Finnish educational authorities further emphasize the responsibilities of citizens and educational institutions:

> *At the same time, citizenship skills must meet the needs of a networking, constantly changing and internationalizing way of life. These skills include technical, communication and consumer skills, and the capacity to influence Information Society policy. As more and more tracks are becoming available in lifelong learning, it is also increasingly important to guide pupils to develop the ability to "learn to learn". In terms of positive information society development, this necessitates not only intensified use of ICT, but also the development of an operational culture in educational institutions.*
> (Finnish education ministry, 1999).

The goals would therefore seem to include the higher-order skills mentioned earlier, as well as an understanding of and an increased opening to the broader living, working and cultural environment. Today this latter aspect is becoming, to a very limited extent, a reality through partnerships set up between schools, local communities and business sectors. Partnerships that have been set up range in scope from the sharing of expertise and the provision of financial support in the drive to integrate ICT in schools, to the exploitation of supplementary sources of knowledge that the community can offer. This goes far beyond the use of the Internet as a learning resource.

Schools in certain areas of Finland, for example, have developed a form-free, modular approach to curriculum delivery and lesson content in the final two years of secondary schooling (Helsinki City Education Department, 1999). Students are able to tailor part of their own study program by choosing suitable courses in other schools or vocational institutions then follow them in the order they choose, sometimes without having to physically attend lessons. Finland has further expressed the aim to launch a multidisciplinary graduate school in learning environment research that will primarily include educational science, psychology, media sciences, applied linguistics, computer sciences and information research. This is certainly proof that the closed microcosm of education is striving to open up its doors to valuable external resources.

Other innovative links between the school and community in other countries include cooperation with local media sources to develop "media education" modules aimed at developing citizenship skills by educating students to understand and judiciously implement media sources. On another level of exchange, a private school in Australia, the Jean-Paul College in Queensland, recently launched it own information community web portal for students, teachers and families. This provides an e-mail account and web-site for each family in addition to student and staff accounts, advertising for family businesses, a radio station run by students, web streaming of cultural and sporting activities, and professional development activities for staff, students, parents and other associates of the school.

However, evaluation is proving once again a major stumbling block in the ICT integration enterprise in two different ways. Firstly, national exams and other techniques currently used to assess pupils' learning outcomes dictate practices that are incoherent with prescribed educational aims. Secondly, sound macro-level evaluation of the long-term effects of ICT-embedded learning is almost completely lacking. No country in the world, at least to my knowledge, has or intends to set up a long-term evaluation system to monitor whether students who complete an ICT-integrated school cursus are actually any better equipped once out in the workforce to accept innovation and understand and adapt to change than students who have not intensively used ICT at school. Until conclusive findings in this area are produced, many teachers and parents will remain skeptical and not give their full support to attempted changes.

The ICT integration process

National integration strategies have changed considerably since the top-down pilot-project approach of the late eighties/early nineties. Major changes in education can only be achieved through a consultative process involving the equal participation of four key levels of actors – national and local educational authorities and the broader community, teacher development institutions, school administration and teachers. Students also play a key role in ICT-based changes. They often possess more advanced technical knowledge of hardware and software than their teachers and can therefore offer vital technical support that will help make the changes work. As successful ICT integration calls for a systemic bottom-up approach, I will focus here only on the process at the level of the school. It appears that three variables basically determine the capacity of schools to absorb ICT-based changes: the *school climate*, the capacity transfer to *ICT knowledge,* and the modalities of *ICT management* within the school.

School climate

A school is a network of diverse interactions between teachers, administrative staff, pupils, parents and knowledge. These interactions are driven and constrained not only by the motivation, aptitudes and objectives of each of the partners, but also by cultural factors, externally imposed aims and evaluation requirements, the past

experience of participants and the personal relationships that exist between them (Levy, 1990). For this reason, no single ICT-implementation policy can meet the needs of every school, and no major transformation can possibly succeed if schools do not formulate their own vision of the goals they are striving to achieve and the direction they will take to achieve them. This implies that each school needs to conduct its own in-depth analysis of both the macro and micro aims of education in terms of the context in which it operates. Only then will teachers, parents, students and the administration be aware of what they are working towards, and be able to overcome problems of conflicting external and internal requirements and expectations. Once a common vision has been drawn up, schools can create their own school plans defining means, methods and necessary forms of professional development. Although it is necessary to provide for centralized decision-making, task forces in specific areas play a vital role in researching practical and theoretical aspects necessary for developing a coherent and pertinent school plan. The level of information sharing that takes place between ICT providers and users, teachers and parents is an important factor throughout the whole integration process, but more particularly at this point to ensure the commitment of all key players.

ICT knowledge

The purchase and upgrading of equipment, software and peripherals requires technological expertise foreign to many teachers. Because pedagogy and technology are very different fields of knowledge, an overlap between these two competency domains is vital for the transfer of knowledge to take place. Teachers need to be kept constantly aware of technological possibilities and knowledge sources when they encounter difficulties or wish to implement new ideas. On the other hand, technicians can only develop adapted applications if they have a sufficient basis in pedagogical theory. Knowledge transfer between these domains has been insufficiently examined to date. Perhaps initiatives such as that of the Finnish government to set up interdisciplinary training centers could provide a response.

ICT management

The third variable is the way ICT is managed within the school. This includes factors such as allocation and management of budgets for material and professional development programs, and provision of technical support to ensure that technical obstacles do not obstruct meaningful integration of technology in the learning process. Adequate tools are required to evaluate the impact of ICT on teaching and learning, and also to modify assessment practices to correspond to new pedagogical approaches. As with any innovation, it is necessary to set up systems to monitor progress and provide pertinent feedback, therby enabling timely adjustments to be made during the change process.

A model for ICT integration in schools

The following model illustrating the three major variables that determine successful ICT integration in schools is based on a model originally developed further to research carried out on organizations in the USA to define their capacity to absorb innovation (Cohen & Levinthal, 1990). It was first adapted to the ICT implementation process in schools in research conducted in Israel by Ora Oz (2000). Each of the factors identified by Oz were examined in light of data collected in the Luxembourg survey (Richardson, 2001), with some new elements being added and others modified if they were seemingly less important in the international context. Information has also been drawn from the works of Ten Brummelhuis (1995) concerning school readiness to adapt to change.

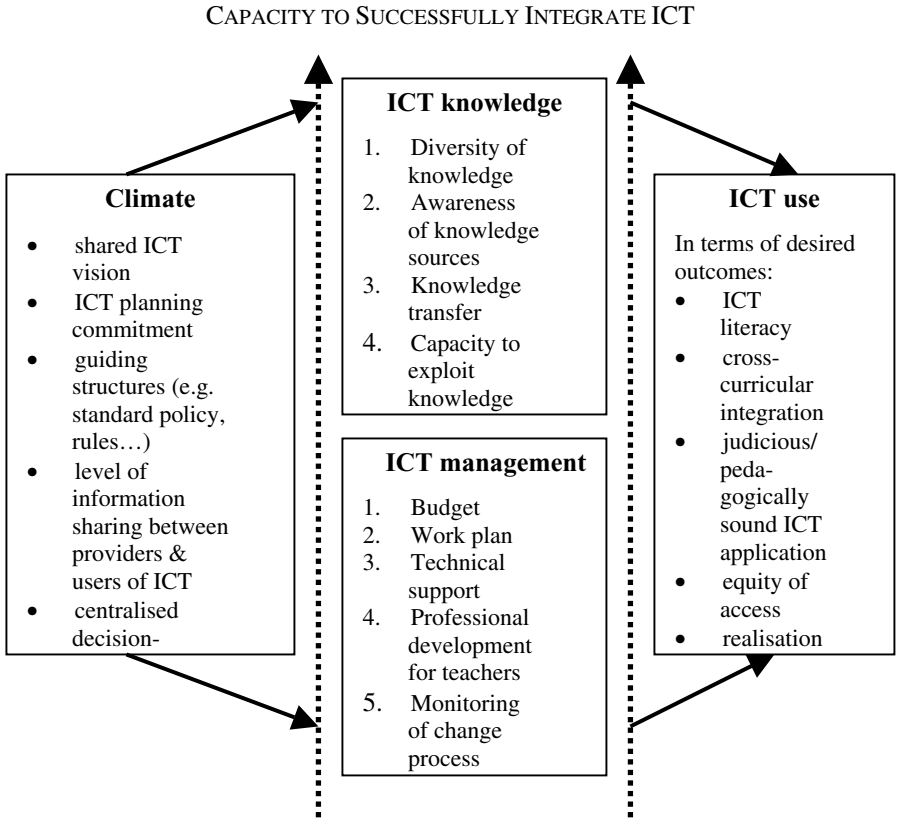

Figure 1: Factors contributing to successful ICT Integration in Schools

To come back to literacy, which was the starting point of this peregrination through the educational system, the effects of ICT, can in many ways, be compared to the effect books had when they became more pervasive in society in the 18th and 19th centuries. Both have forged an information divide that reinforces social inequities and determines the capacity of individuals to realize their full learning potential. However, with ICT the stakes are certainly much higher. It has invaded every facet of life, from leisure and professional opportunities to consumerism and citizenship, robbing those who do not master the broader skills of literacy of almost all chances to enter the workforce or contribute meaningfully to constructing the future. Current world events show that the price of such a situation is becoming increasingly harder to pay. Citizens who do not possess the skills to interpret and analyze new information dissemination modes are in increasing danger of falling prey to the multiple destabilizing influences propagated by the ill-intentioned forces which can use such skills to their own ends. Our education systems, having confronted numerous challenges in the past, are certainly capable of meeting those of the Information Age, on condition that all partners concerned unite forces to define realistic goals and the means for achieving them as we continue on the path of evolution towards the future.

NOTES

[1] TF1's 8p.m. televised news broadcast on 11th November 2001: the survey was carried on 18 year-olds out during compulsory national service days that recently replaced army conscription.

[2] Both publications review literature criticising Piaget's suggested developmental stages and provide substantiated arguments through more recent research to show that although certain chronological aspects within the developmental stages may be questioned, the basic theory sets rational markers for developing formal operational reasoning (Adey & Shayer, pp. 28-30, 119-121; Rowe, pp. 101-104).

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PART THREE

THE HUMANISTS

It is not enough to wire the world if you short-circuit the soul. It is not enough to probe the hostile environment of distant galaxies if we fail to resolve the climate of mindless violence, ethnic and racial hate here in the bosom of Mother Earth. It is not enough to identify the gene that predetermines the prospect of Alzheimer's disease if we go through the prime of life with a closed mind.

Tom Brakow, 1999

DANIEL DEBERGHES

RECREATION

In homage to Antoine Saint Exupery

Abstract. This chapter, a lesson in the fundamentals of education, is intended for school pupils and their teachers alike. The first part sets out to demystify the "computing machine" in the eyes of children by resituating its basic functions at their own level of learning. The second part alludes to theme-based pedagogical strategies aimed at inculcating the invariables of education and hence preparing the present generation in their role as active citizens. The whole is constructed in the form of a tale that recreates fundamental guideposts in education with the help of Information and Communication Technologies.

INTRODUCTION

> *The most essential thing about a profession is perhaps its power to unite people; human relations are, after all, the only true luxury that exists.*
>
> (Terre des Hommes)

Snowflakes tumbling from the icy blue sky spin through the bare branches of the trees in the playground and mingle with the playful cries of children. In the classroom amid the odours of chalk, ink, the leather school satchels and scattered notebooks on wooden desks, the old schoolmaster strolls across faded floorboards to the aged oak desk standing on a raised platform in front of the class. He is tired of the rigors of the long, hard winter, tired of all those conflicts in the world, the veritable massacre of our children. A question turns endlessly in his mind: "Why? Why is it that the pupils in his class are lucky enough to live a carefree life whereas all the poor little children in Central Asia, in Africa…?

He is lost in his thoughts as he turns away to stare into the glowing embers of the old black stove at the back of the classroom; in his dreams he sees a planet, a blue planet, and above it a good fairy scattering incessantly a sprinkling of twinkling stars… "Perhaps, yes perhaps… are there really arid lands where nothing can grow?" he wonders, seeking solace in the eternal mysteries of life. Just as the end of recreation is about to ring the wood and cathedral-glass door swings open, letting in a flurry of wind and snow. He blinks and rubs his eyes. There in front of him stands a pupil in grey pinafore, rough blue wool scarf, old wooden boots, blond curls tumbling across his forehead. Deep azure blue eyes stare trustingly up at him. The old schoolmaster struggles to overcome his astonishment, tries to remember which class the child comes from. Suddenly the little fellow before him, hardly waist-high, pipes up with:

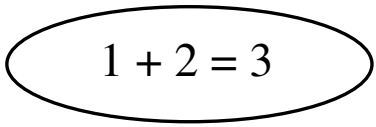
A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 153–157.

"Draw me a School!"
Taken aback, speechless with surprise, the old man playfully picks up a piece of chalk and draws a schoolhouse on the blackboard.
"Here, here is your school", he replies.

But the young child stubbornly asks once again:
"Please, draw me a School."

The old school "master" chews on the stem of his pipe and rakes his hand through his silvery white hair as he reflects on just what this little chap expects of him. Teaching, the thought suddenly springs to his mind, is "showing the way", with the overlying concern of assisting pupils to learn to live autonomously. And Education? That implies "leading from one system to another", for example, leading a child from childhood to the world of adults. Now he draws a factory next to his schoolhouse, complete with trusses and smoking chimney. He adds a road winding up between the two, a road that a child can follow hand in hand with an adult. (Now he remembers that the Romans called the person charged with accomplishing this task a Pedagog.)
It is a beautiful drawing, but alas, the little fellow is still not satisfied.
"But please, draw me a School!"

The schoolmaster starts losing patience. Any moment now his class will come



running in through that door. Mistaking his pipe for the chalk, he almost breaks it in two. Suddenly his eyes fall on the arithmetic lesson he was giving this morning, and, with an authoritative gesture, he chalks in a circle around the sum on the board.
"That's exactly what I wanted!" exclaims the strange visitor, jumping up and down as the pupils noisily invade the classroom and order is slowly restored. At this moment, the schoolmaster takes his courage in both hands as he attempts to explain simply to his pupils the events of the past few minutes.
"My dear children, on this blackboard:

- I have WRITTEN
- I have ADDED
- I have COMPARED 1 + 2 and 3
- I have READ in my own language,

and this is exactly what we are learning about this year. Then he adds, "These are the **only** and **unique functions of computers** like those that are being installed in our school."

Hushed amazement from the pupils who had, on seeing a computer, all believed it to be a magic machine. Now it seems that it doesn't even know as much as they do. Timidly a child raises its hand: "Well please, sir, why do we have these machines then?"

"Because they have three features that will play an extraordinary role in our lives:

- An enormous memory, as big as the world,
- A calculating speed as fast as light,
- A communication capacity dense as a spider web woven across our planet."

The children marvel at this for a moment, then another hand is raised: "Please sir, what is communication?"

The schoolmaster paces back and forth in front of the blackboard, waving his ruler as if he beating the measure or orchestrating a secret melody springing from the depths of time. He moves to the back of the class for a little warmth from the stove. With stupefaction his eyes once again settle on the sum he has written on the board and now he is ready to answer his pupil's question. He moves across to the blackboard and writes:

"To **communicate** is to **transmit 1 + 2 = 3**. The ONE represents the Unity of Man, Knowledge and Speech. This is the famous point Ω cited by scientists, by philosophers, by theologists and by Nations – a permanent horizon in a dispersed universe… (for example, the point of unity of the four fundamental interactions of Matter). The TWO represents the Relation between ourselves and others. There have to be at least two entities before a Relation can be established; Relation is the source of all Life, and 'In the beginning there was the Relation'. This refers to the measure of distance between human beings. The THREE represents Creation through imagination because it takes three elements – Knowledge, Relation and Imagination – to create a plane and to erect on it a pyramid (Andropos), like the Holy Trinity we hear about in the Bible. This is the fabulous mystery of Mankind based on Matter, Life and Creation."

Turning back to his pupils who are watching his every move in stunned silence, he exclaims with joy, "And it is marvellous to communicate all of that, because this is LIFE that we are transmitting."

He realises all of a sudden that his class is watching him in amazement, bemused, loving the beautiful story that he is recounting, but… hunger soon brings them back to earth as the lunch bell starts ringing. As the children stream out of the classroom amid peals of laughter, the old schoolmaster remains motionless at his desk reflecting on the strange turn the morning has taken and wondering why he has just given such a lesson. He sees himself as a child again, filled with the implacable need to know why. The law of causality that sparks the curiosity of children from the very moment of the awakening of their soul and places in their mouth the tireless

question "WHY?" has now awakened the child within him, the child that slumbers within every person.

He remembers his own Master, Nobel laureate and Professor, researcher on dissipative structures of Nature and Time. He begins pondering on a remarkable possibility: what if the **recreation** during which the children are dissipated by the joy of imagining, playing together, is a but a "**dissipative structure**" where creation takes shape before they come back to the order in the class?

Following this line of reasoning like a dissipated child, he ponders on the fact that, after all, we do nothing more than re-create because God has based creation on Love, and even if Love doesn't create joy, joy, on the contrary, creates Love. Well, well… God who is Love must have an immense re-creation ground… and there he must be having a good laugh at the joke of having created us in his own image!

The schoolmaster, certain that he has been exploring the explorable and serenely venerating the unexplorable, is filled with an inner happiness. He explodes with laughter, seeing in his mind a little child in Central Asia playing together with that other child, the one who came to visit him, during e-recreation.

And, oh surprise! As he leaves the sun-filled meadow, the Man discovers thousands of stars winking at him like a complicit thank you springing from the hearts of millions of children playing before him in the great recreation ground of the Universe.

P.S. If you encounter this little chap with his black beret and his pocket filled with marbles, his soldier biscuit in one hand, and his knees grazed in the field of labour, please be kind enough to let me know.

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JUANA M. SANCHO

WHAT KIND OF TECHNOLOGIES FOR WHAT KIND OF EDUCATION?

Abstract. The main aim of this chapter is to discuss whether the organisational and symbolic structure of our schools is the most suitable "technology" nowadays to provide students the kind of education needed to live in a complex, controversial and information-overloaded society. I start by exploring the difficulty of thinking about formal education outside of schooling. Then, using recent reports about people's educational needs in the Information Society, I summarise the characteristics of an educated citizen, and point out the limitations of current educational systems to contribute to the education of citizens of this kind. I then propose three possible scenarios for today/tomorrow, along with their limitations and challenges. I conclude by suggesting a few policy recommendations.

INTRODUCTION – A DEEPLY ROOTED CONCEPTION

> *The school is a technology of education in the same way that cars are a technology of transport* (Mecklenburger, 1990: pp.106)

Some years ago, while teaching a course on Teaching Systems and Models to students in the final year of their Education degree, I set an assignment in an attempt to combine accumulated educational knowledge, imagination and creativity. I wanted my students to realise that one fundamental endeavour of educational experts should be the design, development, implementation and evaluation of the best possible milieu to foster people's learning capacities and personal and social development.

In fact, the most significant contribution of highly recognised educators, from Comenius to Dewey, Pestalozzi, Fröbel, Steiner, Decroly, Montessori, Freinet or Stenhouse, has been the attempts of rethinking and redefining the aims of education, the physical and symbolic educational space, and the teaching resources or pedagogical artefacts used in the teaching and learning processes. All agreed on the limitations of traditional schooling arrangements to provide children and adolescents with the best possible, and the most intellectually and emotionally appealing environment to learn. All looked for a scientific foundation, based on the available knowledge about child development and the nature of knowledge, to justify and defend a "system", a "method", and the use of all available resources. This usually implied a specific way of interacting with children, organising the school as well as the physical and symbolic space of classrooms, and using specific teaching materials. Some of them tried to "break down" the hard walls of school buildings,

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 159–175.

looking for higher involvement with the community and more “authentic” educational experiences for youngsters.

In spite of all these ideas and proposals, always partially and only to a limited extent implemented, the most widespread organisational technology of education continues to be "the school" – an institution with prison/hospital-like buildings and classrooms of pupils classified by age or even, at times, by intellectual capacity as shown in tests[1]. Classrooms where a teacher (or several, but one after the other) teaches, with the aid of textbooks, worksheets and more and more audio-visual aids and computing facilities, a rather abstract curriculum divided up into subject areas usually in time slots of 40 to 50 minutes. Closing the circle there are, periodically, paper and pencil tests to prove how many answers students can get right.

This vision of formal education is strongly rooted amongst university staff teaching education degrees, too. It is even taken for granted in the curriculum of students who are training to become educationalists rather than primary or secondary school teachers. That is to say, educational professionals who should be able to “reflect” upon educational phenomena, to carry out educational research, to advise on educational processes and to propose and foster educational change and innovation. This means they are educated inside a metal frame that prevents them from looking for divergent ways of examining educational issues and radical (literally meaning from the very roots, or from scratch) ways of raising educational problems.

In my view, this can be compared to physicists still working from a Newtonian perspective, doctors still adhering to the humours' paradigm, biologists knowing nothing about complexity or astronomers still clinging to pre-Galilean conceptions.

Many universities still hold, in both the content of their courses and the way they teach them, a rather “Platonic” view of knowledge. For Laurillard (1993), the idea of academic knowledge as an abstract Platonic conception, as an abstract Platonic form, has been given new impetus through the development of information processing models of cognition that use the metaphor of knowledge structure or conceptual structures to describe mentalistic entities that can be changed through instructions, or even represented in computer programmes. So academic knowledge is seen more as something that *is*, rather than as something that *becomes*. This perspective gives students a more reproductive than productive role, with very little room to undertake challenges and develop creativity. This is the case for many university degrees and my hypothesis is that the situation is even more accentuated, if possible, in the field of education. In light of such lines of thought and practice – which would, with the boom of ICT applications in education, eventually lead me to begin systematic studies on “new learning environments” – I set for my Teaching Systems and Models’ students a problem-solving situation they were to explore before getting back to me with an answer of some sort. They were asked to take into account existing educational knowledge, within the limits of their own possibilities.

> "Let's imagine that you are sailing the seas and your ship founders on a remote island without a formal education system. The islanders, knowing that you were studying to become an education specialist, ask you to help them organise an educational system. However, they warn you that they have heard of the big problems generated by the current school system and its inability to meet all students' educational needs. They do not want their children educated in these closed places, where knowledge and people become separated, where learners are so "enlightened" that, after a short time, they lose their sense of curiosity and pleasure to learn. They want a flexible system, able to propitiate diverse activities, able to bring people together, to bring knowledge and action together, so that learners can develop mutual respect and learn from each other, a system ready to consider all available knowledge and skills and to use the most suitable means. The final aims of such a system would be to meet the educational needs of children. They do not want the learners to be the ones to become adapted to the system but rather a system that will help their children become the best possible human beings, intellectually, morally, ethically and emotionally developed".

That was the problem I set my students. They could try to come up with a solution individually or in groups. All solutions would be considered good if they were well argued and sustained on a sound theoretical base. A third important assessment criterion would be the students' ability to anticipate to the greatest degree possible problems and obstacles in the hypothetical implementation process of their proposal.

This was the task. We agreed on the date the project was to be submitted. I reminded them that they could receive individual advice – either at specified times or as a group within the class – throughout the whole project process. Then we continued with the course. After three teaching sessions, students asked me to talk about this assignment in class. I agreed, of course, and was ready to provide them with as much support as they needed and as I could. However, it wasn't advice or support they were seeking, instead they begged me not to "force" them to do this project. I asked them why. They told me that, at the beginning, they had found the task really challenging and exciting. They had felt really enthusiastic about carrying out an activity that nobody else had ever proposed, and they had felt really engaged in it. In fact, this looked like a good start. Until the "Sanford effect" (Terenzini, 1999) set in.

Sanford characterised the learning process as a challenge and answer process. According to this author, we learn when we have to face something different from what we have previously known or experienced. "Different" can refer to an idea, a perception of what is real, an experience, a belief or an attitude. Somehow, the stage for learning is set when we meet the new, the different, the challenging. Challenge, from an internal or external stimulus, induces change because it disturbs an existing balance. The resulting instability requires an answer. The individual strives to reduce the tension caused by the challenge in order to diminish the imbalance. The

severity of the challenge and the way in which it is responded to will determine if and to what extent learning is produced.

It was clear that, in the case of my students, the challenge was too big, the difference too great, and the imbalance too deep. Therefore excitement turned into fear and enthusiasm became panic. The students acknowledged an unbearable level of distress. They could not think of an educational process outside of a school building, a subject-based curriculum, textbooks and classes where teachers teach and students learn. They felt frozen and frightened; they could find no ground where ideas could be sought. They could not ask me for advice because they did not have the slightest idea of what to ask. They felt cut off from everything they knew, with no reference points to orient them. Their impression was that they did not have the intellectual and emotional tools to face the challenge.

We talked for a long time to analyse the reasons underlying their feelings and fears. It was a very productive conversation. We all learnt a lot. We all realised how much we had taken for granted a given structure, to the point of considering it not only as "natural" but also as the "only possible" structure. And how this vision was preventing us from analysing, exploring and proposing other ways of organising the learning experiences of children, adolescents and adults. In fact, we were making a big mistake by confusing a "technology of education", that is to say, the school, with "the" technology of education (Mecklenburger, 1990). It is like pretending that the only possible transport technology is cars, the only food technology is preserves and the only health technology is hospitals.

It should be added that these same students were very surprised when confronted with the account of an infant school teacher who was organising her teaching through project work. They found it difficult to believe, even though it was the teacher herself who was relating the experience and showing the processes and results that six years old pupils were able to produce, the kind of questions they were raising and the kind of knowledge they were learning. My students' own learning experiences, even at University, were preventing them from understanding how these children were able to explore rather complex situations, find answers to the difficult questions emerging in the inquiry process, and make explicit the conclusions they reached. How was it possible that these pupils in a low- to middle-class state school could learn all of these things if they were not in the syllabus and the textbooks of infant and primary school? How could six years olds go to the principal's office to call an embassy to ask for information? How was it that they were asking themselves why kangaroos are killed in Australia if what these children should be learning at their age is how many legs kangaroos have, what they eat and where they carry their babies?[2].

It seems evident that undergraduate education students, like most people, have a very clear and set idea about the educational system. That is to say, about what schools should be like and the kind of things students can (or cannot) learn in their different courses. In other words, the most basic structure of the so-called "school grammar" (Hargreaves et al., 1996) is totally embedded in everybody's mentality. We all learnt this lesson through 8, 10, 12, 14 or 19 years – or more if we went on to post-graduate courses – spent in front of teachers who explained things that, most of

the time, could be read in a book or found in the multiple sources of information available. In front of teachers who taught students only what they themselves knew, decided which links could or could not be established, and ignored everything that was neither planned nor previewed.

This is the legacy of an academic and bureaucratised vision of education (Darling-Hammond, 1997). A legacy that the cultural, social, economic, political and technological changes – at the same time cause and consequence of the Information Society – is converting more and more into a drawback for educational change. A legacy that has led schools to prepare students for the certainty of facts, making it difficult for them to cope with the uncertainty of research and interpretation.

Most educational organisations, from infant schools to universities, do not seem to encourage risk, do not seem to foster people's interest in raising and pursuing problems, do not seem to recompense understanding and interpretation. Successful students quickly learn that a "correct" answer in a test is more highly valued than a deep understanding of phenomena, if they don't give the teacher the required answer at the required moment. Most students therefore orient their efforts to passing exams, not necessarily to learning. But then, when confronted with a highly motivating problem or a really challenging situation – not only during their education but also in their professional career – where ready-made answers do not exist, they panic. They realise that they lack an adequate understanding of the phenomena; they have not developed intellectual and emotional tools to cope with the "unknown". So, if possible, they elude the problem. If that is not possible, they try to apply ready-made solutions that lead them to repeat the same kind of mistakes. At this point, the circle of ignorance closes and the spiral of frustration grows.

By contrast, the corporate and cultural world rewards and praises creators, those able to imagine new visions and actions. However, most people obtain their qualifications by repeating, copying and memorising legitimate established models. Exercising a responsible citizenship and accessing qualified, well paid and socially valued jobs, requires complex capacities and skills that imply higher-order thinking processes and good emotional equilibrium. Nevertheless, most educational institutions still hold very traditional views on education and training and are equipped to perform their tasks looking more to the past than to the present or future. Students are expected to be quiet, to listen and respond, when asked, to exactly what they have been asked. Most efforts to change the physical, symbolic and emotional environment of education collide not only with the existing buildings, furniture, walls, teaching resources, curricula and timetable, but also with the conceptions of teachers, families and administration, with interest groups[3] and legal dispositions[4].

THE MEANING OF A RENEWED EDUCATION

If we were to interpret in a very strict sense most of the educational reforms or reports launched in the nineties about the educational needs of individuals in the 21st century, educational systems would need to undergo a very deep and radical (from

their roots upwards) transformation. This transformation would affect the architectural aspects of schools, the use and distribution of space and time, and the selection and use of material and human resources at the school and community level.

As an example, the Spanish educational law (LOGSE) enacted in 1990, states that the aims of education are to foster values shared by an important majority of people; aims such as "The holistic development of pupils' personality", "The education of pupils to respect the basic rights and freedom of all and exercise tolerance and freedom within the democratic principles of living together", "The personalisation of education to foster in pupils comprehensive knowledge, skills and moral values in all the ambits of their personal, family, social and professional lives", "The development of creativity and critical thinking"[5].

Recent reports issued by highly influential institutions such us the Organisation for Co-operation and Economic Development (OCDE, 1998), UNESCO (Delors et al., 1996), the European Commission (Study Group on Education and Training, 1996) or the European Round Table of Industrialists (ETR, 1995) have defined the so-called educational needs of individuals living in the Information Society. All of these reports state the necessity of educating citizens:

- to become well-rounded individuals;
- able to achieve self-realisation and discover themselves fully;
- able to overcome tensions between world-wide and local communities, the universal and the singular, tradition and modernity, long- and short-term, indispensable competition and a concern for equal opportunities, the extraordinary development of knowledge and their own assimilation capabilities, the spiritual and the material;
- with a wide range of skills including the capacity to operate with numbers, read and write, to exercise critical judgement and apply basic knowledge in mathematics, science, technology, humanities, economy and social sciences;
- able to think and not only to accumulate facts;
- self-disciplined and ready to adapt to endless change and challenges;
- with a well-developed capacity for communication, linguistic skills, creativity, group work and problem solving;
- with the ability to make judgements by learning to analyse and understand their own life circumstances and values in comparison to those of other individuals and groups. The skills involved here are analogous to research skills, in particular those practised in modern ethnography or developed through intercultural education. More simply, these skills involve making the familiar strange and the strange familiar, being able to switch between standpoints and identity positions, and between empathy and critical distance;

- ready to work with and use new technologies, exercise responsible citizenship, enjoy individual self-satisfaction, maintain an independent spirit of inquiry, uphold the right to and the integrity of work, and aware of their social rights and responsibilities.

For the European Commission's Study Group on Education and Training (1996), learning most of the skills needed by individuals and groups is, to some extent, a matter of using techniques and training observational-analytical capacities; but it is also a matter of having the confidence to switch positions and, more particularly, to regard oneself critically and to tolerate personal and social ambiguities and contradictions. For this Group, the idea of 'border pedagogy' is a significant attempt to catch what is meant by education for empowerment. Media education has an important role to play in developing border pedagogy as a practical tool for teaching and learning. Both traditional media (for example, written policy documents) and the new ICT media (especially the highly visual forms) offer new opportunities for learning how to look critically at the construction of images, representations and texts and their 'hidden messages'.

A common element in most of these reports and educational reforms is the need to foster among students the development of higher order thinking skills. This kind of thinking is often considered a professional skill needed by a small group of elite workers holding jobs entailing a high degree of freedom, creativity and responsibility. However, independent of the kind of job one does, every individual in a democratic society, and even those unemployed, need such an ability if they are to develop independent political thinking and an understanding of the complexity – including the cultural differences – of the world in which they live. Moreover, there is a wide consensus about the fact that highly technical societies require a high level of abstraction and independent thinking in order to deal with the complexity of everyday life.

Explicitly or implicitly, all the reports underline the exponential development of ICT and predict that these technologies will lead to profound transformations in education. Some even talk of a new paradigm which will overturn educational processes and methods, the roles and positions of educational actors, and even the concept of education itself[6]. In spite of this, no one can, at present, predict the direction these changes will take and how they will affect education.

However, according to the members of the Study Group on Education and Training (1996) there will be no substitute for school[7], nor for the human relationships established between pupil and teacher. No form of virtual technology and no automatic system will ever attain the richness and intelligence of direct human communication. It may even be that human communication will take on an added value once the limitations to communications by technology are realized. Nevertheless, the world of education must take advantage of the considerable opportunity offered by these digital technologies, not only by using them, but also by participating in their development.

WHERE ARE SUCH CITIZENS EDUCATED?

It seems evident that the set of actions needed to facilitate the education of pupils, students or citizens of this kind are far removed from the physical, cognitive, emotional and technological possibilities of most current educational institutions. If schools want to become places that provide the kind of education glimpsed or proposed in these and other reports, they will have to undergo deep and fundamental changes (Stoll and Fink, 1996; Darling-Hammond, 1997; Sancho et al., 1998, amongst others). And the most important of these are not related to the introduction of ICT in schools and classrooms. The key changes are of a social and pedagogical order, and related to:

- The necessity to rethink the basic function of compulsory education. Morin (2000) suggests that the main mission of education is to transmit not pure knowledge but a culture that allows us to understand our condition and helps us to live and, at the same time, to foster a free and open way of thinking. For this author, knowledge does not make us better or happier. However, education can assist us to improve and, if not make us happier, can at least teach us to assume the prosaic part of our life and to enjoy the poetic one.
- The need to transform our comprehension of the nature and types of knowledge and the modes of its production. In this respect, one of the most worrying aspects is the increasing gap, every day more pronounced, between chunks of knowledge classified into disciplines and today's realities and problems that are ever more multidisciplinary, transversal, multidimensional, cross-national, global and planetary (Morin, 2000).
- The transition from a subject-based vision of the curriculum to a more transdisciplinary, holistic and integrated approach. The disciplinary development of science has brought with it not only the advantage of labour division but also the inconvenience of super-specialisation, rigid classification and the breaking up of knowledge. This evolution has produced not only knowledge but also ignorance and blindness (Morin, 2000).
- The way different people learn and the set of variables involved in the learning process. It is necessary to understand more fully how people learn, taking into account not only cognitive aspects (Bransford et al., 1999) but also emotions, affections, feelings, contexts and biographies (Bruner, 1990; Bolet, 1999).
- Where we place the focus in teaching and learning processes. Traditionally teaching has been teacher-centered, with the teacher taking the prominent role. S/he has carried out most of

the activity and controlled curriculum content, space, time and teaching resources. In new learning environments offering educational potential for all students, the focus needs to be re-situated and a very special place given to students, knowledge, assessment and the community.

- The way teaching and learning environments are conceived. The basic organisational metaphor of school will have to be expanded and undergo a deep transformation. The classroom as a privileged place for learning will have to become a set of multiple learning environments where students will be able to develop and acquire the knowledge, skills, abilities and values they need to live in their society. ICT will probably have a prominent role in such learning environments. This will imply the need to develop and acquire new educational knowledge in relation to the planning and follow up of students learning in the most diversified situations.

A lot of things will have to change in current educational systems (from infant schools to universities) if we want to draw a better picture for individuals and society. Most of these changes do not directly depend on the teachers' will. There are also issues related to legislative decisions, investment in human and material resources, professional development programs, working conditions for educational staff, general social conditions, etc. Other changes are the direct responsibility of teachers, directors and all those involved in daily educational practice. Then there are aspects concerning their professional knowledge, their attitude and predisposition to learn and change. This is why the professional development of teachers and of all those involved in education is constantly underlined as a key factor for educational change.

Finally, it is not a matter of simply seeking the most convenient technologies or deciding how many computers we need or what the connection speed to Internet should be. The problem is to rethink education as a whole. It is about daring to try new ways of understanding the contexts in which people teach and learn, the content of teaching itself, the role of all those involved in the process (from administrators to teachers), the means used and the ways they are used.

WHAT KIND OF EDUCATIONAL SCENARIOS CAN BE ENVISIONED?

To foster discussion among readers and advance some ideas about how education could evolve in the next few years, I offer, in this last part of the chapter, three possible scenarios.

Scenario 1: The inertial vision

Most schools led by institutional inertia, ignorance, administrative pressure, lack of investment and the connivance and disinterestedness of certain teachers will

maintain the same pedagogical and organisational structure. Due to market pressures, the most important changes will relate to the provision of ICT applications that schools will or will not use, depending on their willingness, readiness or teachers' working conditions. Schools will differentiate themselves, as they do nowadays, through staff collegial decisions with more or less participation from families, and so shape the meaning of students' learning experience. Students' conflict levels will relate to the social conditions of the moment.

Educational staff will encounter great difficulties when trying to improve their educational actions and practice because of the very organisation of the school and the curriculum arrangements. The implementation of teaching methods able to provide students with exciting teaching experiences to promote their development as autonomous and collaborative human beings will conflict with these organisational and symbolic structures. To integrate and use information processing tools – independently of the way this is done – schools and teachers will have to cope with the multiple difficulties that are encountered in the current situation when they attempt to update their teaching resources by introducing ICT in the learning process. The discipline-based curriculum will continue to be the greatest obstacle encountered in any attempt to integrate, globalise or provide transdisciplinary knowledge for the development of more participating methodologies and the use of more diversified teaching tools. The second biggest handicap will be found in the spatial distribution of students and teachers in the watertight compartments of their classrooms at pre-set time intervals.

The professional development of teachers will still be based on the vision of teachers more as subject experts than as teaching or educational experts, and will be limited by the physical and symbolic conditions of the above-mentioned structure. Teachers will therefore confront the same difficulties in focussing on learning rather than teaching, introducing more collaborative methods of teaching and learning, and using different teaching resources – especially those related to Information and Communication Technologies.

Scenario 2: The technological vision

Market pressure and the decreasing cost of ICT products will have a real impact in the shaping of schooling. Most schools – or those that can cope with periodic episodes of vandalism and/or maintaining and upgrading costs – will have digital resources spread across classrooms, library and labs. Students will work in small groups or individually in front of the computer. Distant education facilities will be increasingly available for younger students. New educational professionals related to the production of digital teaching and learning materials and the administration of information systems will be needed. The role of teachers will be more and more dependent on the available educational software and their real capacity to make the choice. In this respect, school budget and teachers' knowledge will be crucial, along with their ability to combine these resources with their way of understanding teaching and learning processes. Literacy – textual, visual and graphical – will become the learning crux of the matter. A big effort will be placed on promoting

distance education and, if this is done with rigor and honesty, the high cost of quality education using the interactive potential of ITC will be made evident. Once the "novelty effect" of using different delivery tools has worn off and students' motivation disappears, gaining control over their attention and predisposition to learn will depend again on the school's capacity to connect with student's interest, emotions and worries. Issues such as school discipline, students' capacity and assiduity in engaging in learning tasks, etc. will still form part of the repertory of concerns in most schools.

The way knowledge is understood and represented, the curriculum content and articulation, and assessment systems will continue to be decided out of schools. However, centralised administrative decisions may undergo substantial change, especially for older students. Software producers, computer scientist, instructional designers, corporations, etc. will have a more relevant role in deciding about the set of learning experiences made available to students.

The way the teacher's function is understood will be highly important. Personal relationships with students will be crucial in fostering their integral development. If teachers become mere "children-carers" or "consultants", then new levels of deprofessionalization and alienation will be reached. Or, even worse, schools may consider employing less qualified personnel to carry out technical activities such as responding to students questions with ready-made answers, solving small technical problems with the computing system, etc. This decision would be a milestone in the process of converting education into a simple technique, far away from the highly controversial and demanding activity that involves assisting students' progress towards responsible citizenship in a complex and contradictory world. If, on the other hand, schools think in terms of highly implicated teachers with a capacity to create a teaching and learning climate nearer to research than to the memorisation and repetition of information, then they will have to put a lot more attention into teachers' professional development and their working conditions.

Scenario 3: The social vision

In this hypothetical scenario, society as a whole will recognise more and more the importance of education in fostering not only material progress but also the moral, spiritual and emotional advance of individuals and groups. Investment in education will be substantive. However, ICT won't take "the lion's share". It will be allocated to all those important aspects involved in the educational process, according to *all* students' needs. This is to say, funds will be used to develop the required "technologies of education" and not only technologies of information and communication.

Schools will be open spaces, with different learning environments shaped by the most appropriate methods and tools to promote the achievement of valuable educational goals. There will be a great deal of flexibility in curriculum and timetable. From the very beginning, students will enjoy an important degree of freedom to choose and, consequently, a good deal of responsibility. Different aged students will be able to enrol in different kinds of educational tasks and activities

and to complete them at home or in other places. These schools will have all possible educational tools, including the most advanced ICT applications available. Staff will consist of a diversified group of educational professionals ready to perform the various activities required. This kind of school will be open most of the day and practically the whole year. Educational staff, just like staff in many other jobs, will work in shifts. Some of them will be able to do part of their work at home.

The key points of this vision, the major difficulties and, at the same time, the most important sources of creation of pedagogical knowledge in action will be found in:

- developing an educational climate – physical, symbolic, and artefactual, in which all students can find a place to learn;
- planning and designing a diversified set of activities that will provide students with a high quality and balanced education;
- the development and re-utilisation of teaching materials and resources;
- monitoring and assessing students' learning.

The active participation of all educational staff and part of the community in the different tasks and in the very organisation of the school will be the guiding principle of this kind of educational institution.

This new way of understanding teaching and learning, in coherence with the foreseen educational needs of Information Society[8] citizens, will call for educational staff with a sound pedagogical education in order to foster:

- transdisciplinary and integrated visions of knowledge,
- professional autonomy,
- deep understanding of educational processes,
- knowledge about contemporary approaches to students' ways of learning and culture,
- learning capacities,
- good understanding of educational technologies, not only ICT,
- understanding of the contemporary society, its political, technical, scientific and cultural trends and its contradictory values.

At the same time, the new educational professionals needed to design and develop educational technologies will require a solid pedagogical education that allows them to understand the nature of the problems to be solved in this professional area.

POLICY RECOMMENDATIONS

To be coherent with the deep and broad outlook of this paper in relation to the need to develop more complex and suitable educational technologies to respond to the educational challenges of our society, policy recommendations should be made at many different levels.

Governmental reforms launched at the end of the 20th century and beginning of the 21st in countries such as Canada, United States and the most recent one, Spain, do not seem to take into account the educational challenges and needs of current society. As shown by research carried out in Canadian and United States schools, they are profoundly damaging many schools intent on converting themselves into learning communities, communities of professional practice and learning organisations (Hargreaves, 2003). Even more, the high stress put upon teaching instead of on learning, and on test results rather than on students' understanding and sense-making, might have a recessive effect on the integration of ICT in the teaching and learning process. Teachers have such a long list of topics to "teach" that they don't have the time to pay attention to students' learning. Students have such pressure to pass exams[9] that they are forced to learn answers to tests and postpone their learning and understanding of the world, and even of school subjects.

This standards-oriented curriculum does not meet the challenges and needs of current society and individuals. It creates a school that looks back to the past rather than to the future. And, even worse, it removes all possibilities for ICT to become a "catalyst of change" as many technological enthusiast would want (Papert, 1993, Gates et al., 1995). A catalyst is a chemical element that speeds up the performance of a given mix. However, it does not add anything to the already existing ingredients. So, if the basic conditions are not there, and recent reforms seem to play an active role in not providing the necessary conditions, then ICT cannot be a catalyst for change and improvement.

In the conclusions reached by attendees at the 2nd European Conference on *Information Technologies in Education: a critical insight* (http://web.udg.es/tiec), it was agreed that the use of ICT to improve education implies an additional workload for teachers, not always recognised and supported by the educational community and the administration. Furthermore, innovative, widespread integration of these resources requires determined institutional support. Educators who are willing to renew and improve education through the use of ICT feel themselves trapped by administrative and organisational structures. The educational communities seem to be more ready for the changes that the incorporation of ICT involves than their working conditions, current laws and budget allocations allow them to be. In this sense, bottom-up initiatives should be promoted or acknowledged via structures that enhance them, rather than repress them.

The above considerations lead me to believe that at present deep change and improvement in education cannot be left to governmental policy alone. Civil society, teachers, students, parents, educational researchers, all those supporting educational processes, social thinkers, etc. should have a role to play in the redefinition of the functions and content of schooling. We cannot leave all the power in the hands of governments that do not take into account the needs of all, do not pay attention to findings from educational research, and seem more interested in maintaining the status quo and the power structures in place than in meeting the best possible conditions for education.

To be coherent, my recommendations cannot simply be policy recommendations. Building on evidence collected over more than 30 years in research on educational

change promoted by governmental reforms, I can reasonably express my doubts about the willingness and the real capacity of governments to foster any meaningful and sustainable change that would make a difference for the better in the world of education.

Policy alone has done very little to help transform educational processes. However, on many occasions it has had a very strong impact on interrupting promising educational initiatives instigated by educators. In some cases, the underpinning philosophy of policy can give a lot of room for schools to introduce and develop pedagogical strategies in term of curriculum, time, space and evaluation arrangements. However, when the general policy is converted into decrees and regulations for practice, a similar situation always arises. Resources are never sufficient, teachers are not provided with adequate professional development and support, those who monitor the implementation of policy often dramatically change the whole meaning of the proposal, etc. If there is not a continuous interaction between educational actors, if their voices are not legitimised and acknowledged for their real worth then governmental policy will, at least for some schools, act as a slow-down mechanism on advanced educational practice. The opposite can also be said. When governmental policy promotes pedagogical practices that call for fundamental changes in the way most teachers think and perform, there is very little chance that such policy will have an effect on transforming and improving everyday practice in the school unless a consistent and meaningful support device is implemented at school level.

In spite of what has been said here-above, we cannot ignore the fact that governments current hold most of the decision-making power in relation to education. I shall therefore focus my suggestions on the government, which needs to consider educational issues from a more holistic and comprehensive point of view, regarding education as a real system and not as a set of parts that can be separately "repaired".

1. In order to meet current educational needs and challenges, scholars and experts must go beyond the current organisation of educational systems and work on more creative and suitable proposals. This would mean, in most countries, a profound redefinition of educational research and innovation policies.
2. Teachers and all educational professionals should be more involved in the whole educational process, from the specification of educational aims to the selection or development of educational methods and means. As Lawrence Stenhouse once said, "*teachers, like anybody else, are not good implementers of somebody else's ideas"*. The best way to reduce disparities between decision-making and implementation is therefore to make sure that people share ideas, feelings and perspectives.
3. Teachers should find the conditions to create and maintain their own professional communities of practice where they can

reflect on their own problems and find collegiate ways of tackling them; where: they can confront and debate educational theory and enrich it by enriching their practice; where they can try out and develop their own views on education; where they can analyze governmental policy and come up with well founded arguments about its strengths, weaknesses and potential effects.

4. Schools should create the necessary conditions to work as learning organizations and learning communities, where: teachers, students and parents can define their responsibilities and rights; the school as a whole can analyze and interpret its own needs and find ways of meeting them; all members of the school community can find their place to learn.
5. Educational researchers should look more closely to school-based problems and provide analysis and interpretation frameworks to help teachers, students and parents understand their situation and look for ways to improve their performance.
6. Educational systems should become less technologically dependent on other society ambits. Instead of struggling with the adaptation, implementation and use of information processing artefacts (Cuban, 1986), they should have the funds and the time to develop and try their own technological devices. Probably these technologies would not only be artefactual, but also organisational, symbolic and, who knows, maybe also biotechnological[10]. This would mean a radical change in the interpretation of research programs, both at the public and private level.
7. In the Information Society, media are powerful socialisation agents. They are increasingly being recognised as having more educational power than schools and families (Steinberg and Kincheloe, 1997). In this context, educational systems and media systems should agree, if not to a common agenda, at least to a not so conflicting one.

NOTES

[1] As it has been repeatedly proved in research and studies, school failure is not always related to an individual's intellectual capacity. Other factors such as social and cultural background, predisposition to learn, school inability to connect with students' interests and emotions, etc. (Bernstein, 1973) can convert a bright kid into a dull student.

[2] The infant school teacher explained to my students the process and results of a work project about kangaroos in which the key question raised by children was: why do Australian people kill kangaroos? Investigating these questions led pupils and their teacher to perform an interesting set of activities. These activities ranged from writing a letter to an Australian newspaper and getting the English teacher to translate the letter into English (when they realised that Australians do not speak Catalan or Spanish), to finding out how to send their

letter to an Australian journal, developing their own explanations and comparing them with those given by the people who answered their letters.

[3] There is an important economy web around current educational systems, involving a good number of enterprises, organisations and people.

[4] In May 2000, the European Union, within the framework of the IST 5th framework programme, launched a call for proposals for the "School of Tomorrow". However, many European schools were not able to participate due to their lack of autonomy. They have to carry out the administrative provisions and organise themselves according to laws passed in the nineties and based on a rather bureaucratised and behaviourist view of education (Darling-Hammond, 1997), in spite of the increasing use of discourse with a constructivist flavour.

[5] Ironically at the moment, as is happening in other countries, the curriculum designed in relative coherence with the principles of this educational law is being re-reformed in the most traditional possible way. Teachers' associations are lobbying to see more hours of their subject in the curriculum. Subjects such as History and Literature are becoming more hard fact-oriented. "Lighter" subjects such as Music and Fine Arts are losing ground. Apparently all those with the power to dictate "what all children should know by the time they leave the compulsory education system", have never heard of contemporary theories of knowledge, the complexity paradigm or the emerging modes of knowledge creation. Or perhaps they have, but believe it "safer" for students to learn what they, successful politicians or academics, learnt when they were at school. In any case, what they really fail to consider is that to foster a lifelong learning (not a lifelong forgetting) attitude, "how" is a more central question than "what".

[6] Cf. 'The educational paradigm shift', report of the Task Force of the International Council on Distance Education, Standing Committee of Presidents, June 1996.

[7] It is also interesting to point out that all reports hold a rather traditional view of schools. They propose new educational aims to be achieved in the same kind of educational organisation, with a touch of ICT and more research-based methods. However, as suggested in the latter part of this paper, the sameness of physical and symbolic organisation of current educational systems seems to be the biggest hurdle to the effective integration of ICT and more student-centred methods.

[8] Information Society here takes a broad perspective that accounts for all the problems and issues of current society (Martín, 1995; Castells, 1996, 1997, 1998; Estefanía, 1997; Ramonet, 2000) and not only those phenomena strictly related to the production and use of ICT.

[9] We have apparently forgotten the high criticism displayed in regards to tests in the 60s, as being a very poor technology to give account of students' learning. Authors such as Bernstein (1971), Broadfoot (1979), Perrenoud (1981), Noizet and Caverni (1983) and Elliott (1985) suggested that part of school failure originates in the very procedure used to assess student learning: mainly tests.

[10] In the United States, drugs such as Retalin, Conceta and Metadata CD are increasingly being used for kids with attention deficit and hyperactivity disorder (ADHD). Laboratories are developing publicity campaigns directly addressed to parents, using slogans such as "a new hero for attention deficit and hyperactivity disorder patients". Even if, for some children and their families, this kind of remedy seems to bring great relief, the long-term effects of such drugs are still to be seen; little is known about how the drugs work, and apparently an increasing and illegal traffic of powerful and dangerous stimulants has been created (New York Times, August 9, 2001, p. 1). This is a field that obviously needs further research and testing, not only from a Pharmaceutical Laboratory's point of view but also from a psychological and educational perspective.

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ROSEMARY NAUGHTON

POLICY, PRACTICE AND THE 'SPACE' IN BETWEEN

A discussion about information and communication technology policies and practices

Abstract. For decades now we have been told that information technology will transform education. Why has progress been so slow and how much is really happening? This chapter draws its themes from a literature search, a Churchill Fellowship study tour of nine countries involving seventy seven interviews with policymakers and practitioners, as well as ongoing feedback from a number of teachers on implementing information and communication technologies (ICTs) in learning programs. It examines the change process facing schools and teachers, and focuses on the range of variables which operate and contribute to tensions in the relationship between ICT policies and the ways they are interpreted at an institutional and practitioner level.

INTRODUCTION

Although this discussion relates to primary and secondary schools and teachers, the problems facing 'school' as an institution are similar to the experiences of government, business and community agencies worldwide as they come to terms with making changes to structures, practices and work flows as a result of the increasing pace of technology. The chapter is organised as follows. Firstly, there is a general discussion about ICTs and their influence on institutional cultures. Secondly, the expectations that are often outlined in educational policy are summarised and strategies that are currently being implemented in schools are identified. Thirdly, the variables that contribute to the tensions between policy and practice are examined. Fourthly, there is a discussion about the features of the space between policy and practice. Finally, the implications and possible future directions are explored.

ICTS INFLUENCE ON CHANGE TO INSTITUTIONAL STRUCTURES AND PRACTICES

Let's begin with an analogy to understand how the cultural and political dimensions of information and communication technologies (ICTs) influence change to structures and practices in government, business and the community. Images that emanate from the *Information Highway*, a term which is perhaps dated but often used to describe the technical infrastructure of ICTs, provide a good starting point. Firstly, as travellers come in all different shapes and sizes we would hope the 'highway' is constructed with the needs of travellers in mind. Travellers embark on

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 177–190.

their journeys in privately owned vehicles; take public transport or hire vehicles. Others remain passengers through choice or circumstance, and there are always those content to walk, or find that the only way they are going to get anywhere is by hiking the highway verges. Secondly, there are those travellers who know where they are going and then there are others who aimlessly go where the road leads them. There are extremely nervous travellers who put their brake lights on as they anticipate the movements of others and there are those hopeless at navigating, who take side roads and always get lost exploring unfamiliar terrain.

The relationship between the 'traveller' and the 'highway' is extremely important. For there to be fewer collisions, less victims of road rage and for a smooth flow of traffic, the highway has to be well designed. It needs signposts, which identify the rules and possible destinations. For travellers to know the various ways of reaching possible destinations and to readily access and enjoy scenic spots along the way, the language/s on the signposts need to be understood by everyone. Travellers must also know how to drive and observe the road rules. They must respect other drivers and be sympathetic towards vehicles that may not be in peak condition and which go slower and sometimes breakdown.

The point being made is that the highway on its own has little purpose. Without travellers it is nothing. The dynamics of the 'space' between the travellers and the infrastructure of the highway strongly influences the way it is perceived by those who are encouraged to use it: for example, not all highways are constructed to ensure smooth traffic flow. Not all highways are well sign-posted to help travellers know where they are going. On the other hand, travellers are not always predictable. They can be influenced by a range of factors that have nothing to do with the highway's construction. Because action is taken by 'those responsible' for maintaining the highway, and because travellers themselves can change over time, the 'culture' of the relationship between the travellers and the highway is complex.

This extended metaphor provides a base from which to understand the complexities of the relationship between ICT policy development in government, business and community organisations and its ensuing effects on change, or lack thereof, to various institutional structures and practices. Like the highway, albeit the institutional arrangements of an organisation, there needs to be close examination of the relationship of ICT initiatives outlined in policies and the actors influencing change or resisting change.

In recent years there has been more awareness and understanding globally from governments, businesses, community organisations and the general community of the mediative aspect of ICTs and their power to alter environments for thinking, communicating, and acting in the world. In every country there is increasing pressure to use ICTs in rethinking structures and governance processes as a result of the impact of technologies themselves, global economies, rapid social change and changes in the nature of the labour market.

ICTs can be used for carrying out the simple routine tasks and procedural rules and conventions of any organisation. They can be used to network and integrate data and information resources that can be stored on more than one computer. They can provide opportunities to establish one to one, one to many, many to one and/or

many to many communication strategies in local or global networks (Parvez, 2001, Fountain, 2001). They can encompass educational multimedia, web-based learning, as well as other related topics (Oliver & Bradley, 1999), or be about flexible delivery of programs through on-line services. ICTs are also becoming increasingly interactive and hold an abundance of materials including text, voice, music, graphics, photos, animation and video. Drawing them together vastly expands the range of opportunities to relate ideas to each other.

There is little doubt, if one considers the uptake rate of Internet usage and networked computers, that a major factor in reengineering business processes is cost savings. The Internet is helping companies lower costs dramatically. Barber (1999) explains that 'in five years time a company not using the Internet for some or all of its services will be destroyed by competitors who are" (pp.5). Fountain (2001) points out that movement from paper based to web-based processing of documents and payments will bring about savings of roughly 50%. Governments have recognised quickly the lucrative market in digitising businesses and services. Fountain, however, is quick to add "the technical infrastructure is no substitute for the institutional infrastructure required to support coordinated practices, procedures, cultures, incentives, and a range of organisational, social and political rule systems that guide behaviour and structure of agencies" (pp.6).

Governments also envisage ICTs communicating information to constituents and for constituents to have more of a voice in democratic decision making; for example, there are already many opportunities for people in the community to feedback about

various issues and political voting on-line is not too far away (Herlihy, 2001). Although a commercial venture, consider the volume of feedback from the 'voting off' procedures through the Internet and/or telephone in the television program "Big Brother", which was localised in context, across a number of countries in the world. Fountain (2001) points out that part of the influence on decision-making is about ease of access, and "to date the use of the Internet for political participation remains biased in favour of the educationally and economically advantaged" (pp.23). "Those who are not educated, who lack access to communications and lack confidence will be excluded from computer networks and become information poor" (Barber, 1999, pp.5).

WHAT ARE ICT EXPECTATIONS FOR EDUCATION?

With the power of ICTs at the forefront of strategies for changing the way people and organisations communicate and do business with each other, educational policy usually outlines a visionary scope for education that sees ICTs becoming key features of learning communities. Learning is being defined in new ways.

The rhetoric of educational policy globally promotes literacy and numeracy for all, along with the establishment of much stronger foundations for young people to develop positive attitudes to learning for life, of integrating work skills with general education to support the development of a wide skill base (Caldwell 2000). It advocates as essential, a greater focus on the application of skills such as problem solving, risk taking, team building, creative thinking, enterprise and active

citizenship. In this new world, learning environments will be constructed so they are active and emphasise individualised and integrated learning experiences that are relevant and meaningful. Learners will be expected to demonstrate high levels of independence, self-reliance, entrepreneurship and the capacity to exercise initiative across a range of contexts. Moreover, there is an expectation that team-working models will reflect community and industry demands, and that students will be skilled and measured in terms of their ability to listen, question, reason, evaluate, collaborate and be a part of democratic decision-making processes (McGuinness, 1999).

Schools will become physical and cultural sites of connection for communities. What, when, how and in what environments learning takes place will be determined by self-managing learners. Learning will be accessed at any time or place and learners in communities will work in partnerships with each other to enrich the quality of their lives (Beare, 2000). Responding readily to the diversity and integration of information to create new knowledge that continually morphs and intersects different realities will be commonplace.

Flexible learning programs will be available for the whole community. Schools will become brokering agencies for other educational providers and contract specific expertise in the community outside the parameters of the current arrangements in the school day. Strategies such as collaborative learning, mentor programs outside the school or local community, collegial on line cultures, and cyber and physical spaces will reflect an information age culture (Beare, 2000).

How are schools meeting policy expectations?

The intentions of policy such as that outlined above have challenged curriculum developers, schools, teachers, parents, students and the wider community to question old assumptions about learning in order to get ready to accommodate these new expectations. Schools, like businesses, are trying to find new ways in which to manage and exploit their intellectual assets, especially of their teachers (Hargreaves, 1998).

While further and higher education institutions have made greater inroads into the development of ICT through on-line learning technologies, on the back of flourishing markets in distance learning and in maximising the potential of the current learning for life trend, primary and secondary schools are only just coming to terms with the opportunities and threats of ICTs in the learning process. As primary and secondary schools have different sets of variables that influence action, including the social and physical development of young people, it is not useful to draw comparisons.

To set up learning models for this new world, ICT initiatives in primary and secondary schools are being developed in many countries. In general, an initial focus has been to set up hardware and architectural infrastructure to support future strategies. Alongside this has been the establishment of training programs for teachers as well as emerging endeavours to embed ICTs into learning programs. There has been, in a number of cases, comprehensive upgrading of ICT in schools,

such as underwriting the purchase of computers. Some other initiatives have included supplying disadvantaged students with computers in their own homes; providing after hours access to assist those without home access, including Internet-based homework clubs; setting up school Intranets with integrated learning systems with other schools and communities; developing sites for teachers to access latest information in science and technology; ICT learning communities in town centres; establishing ICT links with museums, libraries, art galleries; environmental education networks; employing expertise of specialists drawn from industry; and seconding teachers to industry to learn new strategies to transfer to educational contexts.

POLICY INTENTIONS, SCHOOL STRUCTURES AND CULTURAL PRACTICES

This section wrestles with factors which affect the journey along the 'ICT highway' such as relating to other travellers; feeling constricted by traffic flow and road rules; remaining in a particular lane when you want to exit on a ramp that leads to unexplored territory; slowing down to negotiate 'speed bumps'; and learning how to 'steer' the vehicle in different types of weather. Grappling with the range of variables that affects the purpose of schooling, the roles of teachers in the beginning of the 21st Century and the change process in schools invites consideration of the extent to which schools can increase their multi-dimensionality before they cease to function effectively in traditional ways.

A new mode of transport to travel from the present to the future

'Travelling' to this utopian learning community may require new modes of 'transport'. Schools, teaching and institutional practices, in the past, have never been easy to transform and we are informed that this new 'terrain' will test even the best. While there is overwhelming recognition of the importance of schools and teachers to enable individuals to adapt and learn in a new knowledge-based economy at local and global levels and to actively participate in civic society, meeting the multi-dimensional challenge of becoming learning communities entails moving well out of current comfort zones (Beare, 2000).

It would be generally agreed that when called upon to identify images of where and how learning takes place, that only a minority currently see learning in the future happening beyond the school gates. It is more than likely, that what will still spring to mind will be stereotypical images of school buildings with classrooms and teachers, days organised into set blocks of time and arranged with lessons clock-worked on a daily basis. These factory-based representations of learning with children lock-stepped in year groups, working on syllabuses and aiming to perform to set standards are hard to shift from education's cultural psyche.

In the past, education in schools focused on imparting knowledge defined as essential. We now know that ICTs have changed the ways we relate to knowledge. Likewise, they have also changed the nature of work and the skills required from

employers and managers. As well, there is more demand for specific knowledge of products, and there is a higher service sector proportion of the workforce as well as changing work practices insistent on new skills and enterprise (EMTF, 1995). Alongside this, there is a popular conception of ICTs facilitating the spread of democratic values (Ess, 2001).

> *There is a mindset that schools have always been part of the social fabric designed to conserve what society considers worth preserving.*(Kennedy, 1993 pp.3)

Nevertheless, futurists tell us that traditional representations of learning will not suffice in a world where global, social, technological and economic factors are likely to maintain current levels of unemployment for many young people and the proportion of those employed in casual part-time work is also likely to increase. Furthermore, there is an expectation that education will need to represent itself quite differently, if it is to play a 'key role' to reduce the widening gap between the advantaged and the disadvantaged and provide quality education to lessen the groups of 'never employed' and second and third generations of poverty (Beare, 2000).

Increasing social responsibilities

This 'key role' to lift educational standards, hand in hand with ensuing social demands, is often beyond schools' capacity to respond effectively; for example, in recent years schools have taken on what were, in the past, considered family responsibilities. There has been an increased focus on the importance of the socialisation of schooling. Schools and teachers, often with limited resources and minimal support from families and the wider community, are now expected to be primary responsible agents for ensuring that students complete schooling with a positive self-image, the motivation to achieve, emotional strength, a values framework and a belief in themselves.

Schools, even with the best technology available, are not and never will be the panacea for social and economic inequities. Nevertheless, such rhetoric weaves itself through much educational policy. Unfortunately, more often than not, policymakers fail to acknowledge the multi-layered social complexities that are played out in the 'before and after school lives' of an increasingly majority of young people. There is also limited understanding at policy level about effective use of technologies, as well as commitment to funding technology to support full care service models for those at risk of achieving social and educational outcomes. Wrapped around this is privacy legislation, which blocks the realisation of full potential. Nevertheless, some cutting edge initiatives are beginning to emerge: for example, at Wheathampstead in the UK, data is managed across a range of agencies to provide seamless tracking of young people at risk and there are strategies, which connect care givers and officers to case manage more effectively (www.hertsdirect.org).

Business agendas at odds with social responsibilities

With increasing exposure to ICT in the general community and its accompanying discourse, there are terms creeping in from the business and government sectors, such as students becoming 'customers' and schools becoming 'one stop shops.' Some applaud the notion 'what user pays then user gets, or what they don't pay for they deserve', while others, who philosophically advocate a different paradigmatic view about learning, find themselves at odds with this approach to young people's education.

Some protestors question vehemently the appropriateness of 'commercial speak' and the 'technocratising' of the schooling process in a world that holds more uncertainties than certainties for young people. The pressure to provide social anchorage, custodial and pastoral care for many young people in the community, with a teacher population with limited formal training in these areas, is often unachievable alongside other demands that compete for resources, time and space in an already "crowded curriculum where there is little scope for schools or individual teachers to exercise creative professional judgement in their programming" (Pascoe, 1998, p.6). While the wider community expects teachers to relate effectively with children, accept their different profiles, encourage them, have high expectations for achievement, be fair and inspire a love of learning, it is rare to find effective support structures that involve families and schools working together to develop flourishing learning communities that foster the development of self esteem, love of learning and values across the curriculum.

Meeting policy expectations that lack clarity

Schools' attempts to cover all bases in regards new challenges, as well as remain firmly accountable to current benchmarks for standards, are not always successful. It is extremely problematic to design and implement ICT learning opportunities to meet the demand of policies that lack clarity due to their stabs at predicting future needs where the rate of knowledge is doubling in a very short time and there is limited awareness of new skill requirements. Without a doubt, there are many teachers, informed through policies that information technology is *only a tool, a means to an end,* who do not fully understand how to actualise new expectations that underpin policy directives and 'best practice learning' through the use of ICTs in specific disciplines and interdisciplinary subjects. One head teacher interviewed on the Churchill Fellowship tour put it aptly;

> *We dump ICT on our staff and then moan that they do not use it.*

Attempting to meet conflicting demands

Much of the literature about ICT in education highlights features that promote the 'individual' over the 'group'. Many teachers who have been acculturated in traditional models of education and who aim, in the learning process, to recognise

and respect certain fundamental cultural values and distinctive communication preferences (Ess, 2001) find themselves at odds with new norms, assumptions and associated discourses that privilege individualisation. The shift from serving the needs of the whole group to serving each individual can turn a teacher's preferred socially mediated and cultural practices of the learning process upside down. As well, the expectation to shift to new practices alongside carrying out current teaching duties, which include designing learning environments that not only provide for differentiated individualised programs in an average class-size of thirty students but also encourage team-working skills and community involvement in the learning process, is generally beyond the capacity of most schools' budgets and current expertise. More funding is often called for to provide the extra time and resources considered necessary for an understanding of new directions, the development of programs and for the teachers' professional development needs.

IDENTIFYING FEATURES OF THE SPACE BETWEEN POLICY AND PRACTICE

The most significant feature of the 'space' between policy and practice is the various interpretations of the language used in documentation. There is a tendency for policy to make invisible the range of values and assumptions that different practitioners and the wider community bring to the meaning-making process. Policymakers, with all good intent, cannot position what they write as value neutral. There is always manipulation of language to accept that what is proposed is the best way forward. This results in conflict in the 'space' between policymakers' representations of the needs of the new world and that of the practitioners trying to accommodate policy proposals. Those practitioners who do not share the 'world view' represented in policy documentation are considered to operate outside the preferred value system. Consequently, minority groups form and are marginalised if they enact their own cultural norms and practices.

Leading on from this is the range of social, cultural and political values that could be operating and impacting on each other at any given time. The various dimensions of communication per se clearly show that technological discourse is not value neutral nor is the 'space' between the learner and his or her human or technological tool of learning. While many practitioners may not think about the dynamics operating in this 'space', there are those who challenge what they believe is a move to accept sameness and cultural homogeneity in the 'electronic global village.' In what is fast becoming a "McWorld" (Barber, 1995), the shaping of structures and processes including the discourse, content, mediation processes and transfer of goods and information that cannot be accessed equally are challenged by those who do not want to see the world move in this direction. Universal acceptance of one set of socially mediated practices may never be possible, or desirable. Yates (1996) explains that ICTs themselves, their codes, software, protocols and interface designs all incorporate a western cultural bias that limit the ability of users from other cultures to maximise their potential. The impact of ICTs on "the obliteration of cultural distinctiveness" (Ess, 2001, pp.5) often results in desperate reactions from minority cultures in order to cling to remnants of their former identities.

Napoli's (2001) report of an address from the United States Governor of Maine to an audience at a technology conference in Camden, New England, on 19th October 2001 draws together a range of issues facing technology and culture in light of the 11 September attacks on the World Trade Centre in New York. Governor King explained how the Internet and technology played a role in the hatred directed toward Americans in recent terrorist attacks. *"It is a natural human tendency to pull together with those who share similar interests – we are a 'series of tribes'*," said the Governor. *"Getting those 'tribes,' previously fragmented by geography, to co-exist, is something we have never had to address before now. We are inadvertently attacking their tribe, their culture, in deep, very deep fundamental ways."*[1]

The Delors report (1996) argues strongly for international cooperation with the educational agenda in order to be attuned to global needs. It cautions individual countries about the dangers of insularity and points out that accelerated population growth, the wastage of natural resources, chronic poverty, oppression, violence and injustice from which millions suffer calls for more resources so that large scale remedial action can be implemented.

An example of differing perceptions

Parvez (2001) asserts that ICTs cannot be understood on their own, in isolation to the way they are employed and appropriated. Social structures provide the framework and institutional arrangements for action. Because they are socially mediated they are not fixed, which means they can change over time. As with most historical change, what we may find difficult to accept now may be considered primitive within a short time.

Parvez's explanation of socially mediated processes could be applied to current perceptions about flexible delivery through on-line learning. Some may perceive online learning as providing broad opportunities for people to access a wide range of data in order to extract information required at any given time, while others may perceive the use of the Internet as a distribution tool, a narrow conception of learning, where there is more emphasis on information transmission rather than learning.

Similarly, policy in recent times has become saturated with the term 'learning facilitator.' It attempts to describe the role of teachers in an on-line learning environment. Although it may have been originally intended to shift the focus of the teacher as the 'vessel of all knowledge' and encourage responsibility on the part of the learner, it has inadvertently led to perceptions of the disenfranchised teacher in the learning process. As a consequence there is uncertainty about how to play out this new facilitative role.

If 'learning' happens in a 'space' where the 'engagement' of the learner is not only influenced by the socially mediated practices that underpin the information presented but are also a part of the processes set up in the learning experience, the key to 'quality learning' must lie in the practices set up to maximise the 'engagement' process. So what is the role of the teacher, albeit the learning facilitator, if what happens in the 'space' between the learner and the tool (computer

or 'live' teacher) is critical to the quality of learning? At what stage does the learning occur? What prompts the learning?

Herein lies a key-contributing factor to current tensions about ICTs' potential or limitation in improving learning. Although there are various arguments, beyond the scope of this chapter, it is clear that the teacher's role can significantly influence the 'engagement' process. Stigler and Hiebert (1999) argue that teaching is not a loose mixture of individual features thrown together by a teacher. The individual features only make sense in terms of how they relate with others that surround them. Oakeshift (1989) concurs that teaching is a variegated activity, which may in the engagement process include hinting, suggesting, pointing out, conversing, guiding, instructing, demonstrating, testing and so on. If, in the future, there are increased opportunities for online learning on a much wider scale, then the 'learning space' needs to provide high quality 'engagement' strategies to ensure that students are not disadvantaged.

IMPLICATIONS FOR THE FUTURE

The 'space' between ICT policy in education and practice, or the vision and the reality, requires a wider examination of policy directives, their perceived lack of clarity, the various interpretations of their ensuing expectations, and the lack of accommodating and coordinated infrastructures to support schools and teachers. The changing purpose of schooling, the roles played by schools, teachers and communities in meeting a range of new expectations, assessment paradigms that are inconsistent with new learning, and lack of effective leadership and training programs to shift to new ways of learning and teaching – all contribute to hindering success on a large scale.

The roles of the school, teacher and community

It is widely acknowledged that teachers, the greatest resource of schools, are central to the implementation and management of the changes that will be required to meet new expectations for future educational needs for young people. Additionally, to manage a plan to actualise a vision and to carry out the range of administrative duties in increasingly complex school organisations requires strong leadership skills. These are often different from the skills of a good teacher. Prospective candidates need special training in leadership, communication skills, conflict resolution, management of time and budgets as well as a deep understanding of ways to apply effective strategies to create new realities and maintain thriving learning communities (Collarbone, 2000).

To manage a thriving learning community that incorporates ICT as a key feature involves close integration of schools within local area business and community organisations that goes beyond tokenism. If done effectively there is greater identity with and ownership of the school by the community. Examples of ways some schools and wider communities are beginning to form partnership models include:

local shire programs to draw schools into community activities; task-oriented parent working parties addressing particular issues; participation of students in community service programs; education as a joint tenant of a community-based facility; shared used of specific facilities – library, computing centre, performing arts and sporting venues; use of community experts on a part-time and/or voluntary basis to bring "real world" expertise to the classroom; and cross-generational activities.

In addition to localised partnerships, to improve outcomes for young people who are identified at risk of achieving, and to cater for different cultural groups in the community, there needs to be more concentration on setting up arrangements that include the coordination of government and private agencies at the highest policy and local operations level. This includes: the connection of field workers from relevant agencies on a case study basis; knowledge-based kiosk connections from government agencies and business to school networks; and development of cultural awareness strategies across agencies.

It is imperative that constructive interpersonal relationship strategies be set up to effectively preserve communication and initiatives as ICTs alone will not be able to connect and maintain educational, economic and social aspects of learning communities.

Content and assessment paradigms that work against best practice learning technologies

While there would be general agreement that the developmental needs of the 'whole' person should be central to the design of learning opportunities, the primary focus of teachers for learning in schools, and to which they are accountable, still tends to be as delivery agents of content that students are required to regurgitate in test situations.

In many countries funding is now being directed to the development of online learning objects with the intention of learners and teachers accessing and manipulating according to learning needs. Over-emphasis on the production of digital learning objects without due attention to the engagement of the learning process itself will continue to serve content-driven agendas, which are supported by institutionalised infrastructures that place emphasis on measuring students against 'manufactured' achievement criteria, which privilege particular types of intelligence and learning styles (Bayliss, 1999). Moving away from a 'content' approach and stepping into a life-long learning model will require extensive review of rigid curriculum and assessment structures, which discourage divergent creative thinking and self-management on the part of both teacher and student in the learning process.

ICT policy often pushes for change at a classroom level and gives little attention to current accountability structures that tend to work against effecting change successfully: for example, high status curriculum and assessment in education systems often bear little resemblance to images of teachers and students feeling comfortable about legitimising time to explore the potential of ICT in the curriculum, or understand knowledge relationships and their social and political discourses, let alone reflect on the beliefs and values of their learning experiences. If

we are serious about getting students to think critically and develop a wide knowledge base as a critical component of interpreting the wide range of values and attitudes in a global society, rather than simply knowing a lot of facts, the assessment and measurement methodologies must respond aptly to reflect these new dimensions of learning. Without this policy directive and the supportive infrastructure required to underpin change, teachers will, and rightly so, continue to fulfil requirements to which they are currently accountable.

Training and support for teachers

Fullan (1998) asserts that the more powerful technology becomes, the more indispensable good teachers will be. ICT generates a glut of information but it has no particular pedagogical wisdom, especially regarding learners constructing their own meaning for deep understanding. This means that teachers must become experts in pedagogical design. It also means that teachers must use the power of technology, both in the classroom and to share with other teachers what they are learning.

High priority therefore needs to be given to training teachers to use ICTs confidently. Current training and possible opportunities for learning with technologies are often piecemeal, limited, inadequate and very expensive for the return that they provide. As with all learners immersed in new territory, teachers must be provided with the appropriate building blocks to modify their repertoire of strategies. Above all they must understand educational technologies based on their use as a means of communication as a tutor and a tool to customise learning and to capitalise on their value to enrich the overall learning process. Little (2001) points out that it is too hard for teachers on their own to effect change on a wide scale. There needs to be a collaborative approach from much larger groups of educators to develop and apply understandings to new approaches about learning as well as to what technology can bring to learning experiences.

CONCLUSION

For decades now we have been told that the only constant is change itself. What has begun to permeate through our economic, political and cultural psyches is a view that permanence is no longer valued. While this may apply to the economically rationalist-driven business world, it does not transfer to the world of those endeavouring to secure social and emotional stability and some type of ‘permanence’ in the lives of many young people. The structures and processes in schools and classrooms, including what and how teachers teach and facilitate the learning process, represent the biggest investment any country can make in the development of its future leaders.

In the first instance it will be important that the ‘ICT highway’ is user-friendly, can be navigated with ease and can accommodate all types of ‘travellers’. It is also essential that ‘travellers’ on the ‘ICT highway’, who or wherever they may be, are guaranteed equal access to destination points to avoid increasing the digital divide

between those who have and those who have not. To be successful, in any country, young people must be able to access data, critically evaluate the representations of information and create new knowledge appropriate for a range of situations on a daily basis throughout their lives.

Secondly, the 'ICT highway infrastructure' needs to be maintained with great care. This means that change processes must be managed effectively and be accompanied by supportive infrastructures, which provide adequate resources for learning with technologies and training for teachers. Policymakers should acknowledge more openly that it takes time to implement change successfully. They must be prepared to budget for change strategies, conduct extensive research and set achievable goals for schools and teachers. Moreover, an adaptive approach to change should be established that includes a genuine evaluation and analysis of strategies. New ideas should build on current strengths and best practice in schools. Teachers should be secure in knowing that what they have done in the past and are currently doing in their classrooms is valued and contributes to new directions. They need to be immersed in environments with other teachers to enable the sharing of ideas, peer review and mentoring. Furthermore, they need to reflect and evaluate their current programs in order to move forward to meet the challenges of new expectations in education.

Finally, it is important to note that not all predictions about the future have been accurate. Ideas change shape as they are influenced by the cultural and socially mediated practices of individuals and institutions in our society. Similarly, not all the rhetoric in educational policy plays out the way it was originally intended. What is most important in deciding future directions for ICT is the human factor. It is essential that we know and understand the range of possibilities we can pursue, as well as the limitations. Likewise, we must be cognisant of the implications; of what might be lost through the gains that are made. With this level of confidence, decisions can be made about the extent to which ICTs drive the educational agenda. Foremost in our decision-making about what is essential for future generations to learn should be a focus on the value systems that are the most appropriate for young people to become responsible and active citizens in a just and harmonious global society.

NOTES

[1] http://slashdot.org/article.pl?sid=01/10/22/0122205&mode=thread; http://www.hertsdirect.org

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AHARON AVIRAM

WHY SHOULD CHILDREN GO TO SCHOOL?

Abstract. In the first part of this chapter I defend the claim that most thinking on ICT and education is presently taking place within technocratic discourses. These discourses are means-oriented, ignoring the basic-values or aims questions, and focus on small-scale issues disconnected from the whole picture. I further claim that it is vital (for the health and survival of postmodern Western societies) to complement this kind of discourses with macro-strategic discourses. Such discourses should "go deeper and wider" (to paraphrase on a sentence by A. Hargreaves). They should start with the search for the most basic grand visions, (also) supplying answers to the question in the title, and systematically refer, in their light, to all aspects of the educational process: ICT and education being one of the most important among them. In the second part I supply the reader with an example of such strategic thinking – the conception of the computerization of the Israeli system recommended to the Israel Ministry of Education in 2002 by a committee chaired by myself.

INTRODUCTION

My aim in writing this article was to stress the urgent need to complement the piecemeal technocratic and reformist thinking now dominant in the field of ICT-based education, with a strategic thinking. Such strategic thinking should be aimed at guaranteeing the "humanization of technology", or in other words the harnessing of technology to the implementation of the most fundamental humanistic values.

I defend these claims in this chapter by two major steps each made in a separate part of the chapter. The first part involves a defence of the claims:

- That for the first time in Western history we have no answer to the question in the above title (Why Should Children Go To School?), or in other words, that the grand visions that have supported Western education throughout history have collapsed in the last generation - with no alternative seen in the horizon (first section);
- That the crisis-situation caused by this collapse creates an anxiety which has led most educationalists and thinkers on education to retreat to a purely technocratic or means-oriented small-scale discourse (since, given the lack of supporting grand-visions they cannot handle "aims oriented" large-scale rational discourse on the subject);
- That ICT is introducing us to a wholly new environment which we are all going to live in and which redefines all the aspects of our life-styles and hence the meaning of "being a human-being";

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 191–220.

- That, ethically (or Humanistically) speaking, this redefinition of the human condition, now intensively and rapidly taking place, is double-edged: it contains both the potential of leading us to Paradise as well as to Hell;
- That this extra-ordinary stare of affairs requires (also) educational thinkers, decision makers and educators to face a huge challenge consisting of the search of ways of optimising the impact of ICT (i.e. reducing potential harms and enhancing potential benefits) from a Humanistic point of view;
- That the prevailing technocratic approach cannot "contain" this huge challenge, and
- That therefore there is an urgent need to replace the technocratic and reformist modes of thinking now dominant in education in general, and especially in the area of ICT-based education, with an entirely different mode of thinking (and hence decision-making and acting): strategic thinking (second section);
- That such strategic thinking is not to be found in the foundations of actual policy-making in Western postmodern societies (third section).

I end the first part with three sections explaining the nature and necessity of the three basic ingredients of missing strategic thinking: the cultural perspective, the ethical perspective and the action-plan stemming from their combination (fourth, fifth and sixth sections).

The second part of this chapter presents a specific example of such strategic thinking, based on the fundamental humanistic values, as recently developed by a committee set up by the Israel Ministry of Education. In this part, the cultural (first section) and ethical (second section) ingredients of the recommended Israeli policy are presented together with the educational consequences stemming from the ethical perspective (third and fourth sections). These are followed by a description of the various aspects of the action-plan stemming from the combination of the cultural and ethical ingredients (fifth section) as well as the overall vision underlying this plan (sixth section).

STRATEGIC THINKING: THE ONLY APPROPRIATE RESPONSE TO THE CRUMBLING OF THE FOUNDATIONS OF POSTMODERN WESTERN EDUCATIONAL SYSTEMS

The turtle stands on an abyss (or: On the sudden collapse of the justifications for the prevailing educational practices)

When asked why children should go to school, the only candid and rationally sound answer in respect of school as it is today in the prevailing postmodern context is

that, as a matter of fact, they shouldn't! In other words, while we can easily explain how prevailing educational practices came into being (Tyack, 1974), together with the systems of interest, thinking habits and inertia that have enabled them to continue functioning (Hurn, 1978), we must admit that we can no longer justify them as being ethically good or as being functional to society or to its citizens (Aviram, 1986, 1996, 1999a, 1999b; Perelman, 1992; White, 1997).

This is the background to a huge abyss which has recently opened up and is now rapidly deepening, eating away at the foundations of prevailing educational patterns. This abyss is the result of the crumbling of what were, until a generation ago, the sound justifications for educational practices. This is a radically new phenomenon in the history of Western education and in education in general. To continue our metaphor, until our most recent generation the turtle was firmly standing (or educational practices in the West were relying) on two robust pillars:

1. The *ethical-epistemological justification* immanent in Western culture since Plato, connecting *knowledge* with *morality* and *happiness,* and conceiving all three to be essential elements of the Good Life. This justification was, in turn, firmly grounded in the belief in objectively evident Truths, or at least based upon what was thought to be so in Western cultures at large, since Plato's times. The specific nature of these (alleged) Truths changed over the last 2,500 years, with the shift in dominant world views, but the belief in their existence, and in our ability and duty to know them and live and educate in light of them, remained intact until the last postmodern generation.
2. The *practical justification* based on claims related to the necessity of literacy and school diplomas for functioning and socio-economic advancement in our societies, which in turn was firmly based on cultural and socio-economic realities (at least in the modern era).

In other words, on the epistemic-ethical level, since Plato and until a generation ago, the knowledge of objective truths has been conceived as a necessary and sufficient condition for a moral and happy life, and hence the Good Life. Since educational practice has been based on theoretical learning or the "search for Truth", it has been automatically justified within Western culture. On the other – practical – level (which became dominant mainly in modernity), it was a fact of life that individuals not endowed with a sufficient level of literacy and the right school (and later on university) diplomas – did not have much chance of getting along in life.

But things have changed dramatically, and the above justifications have been greatly undermined in the past three postmodern decades. Where once, not so long ago, there were cast-iron religious or modern ideologies (including Scienticism – the total belief in science as leading us to truths), that supported the Western credo about the unspoken link between Knowledge and the Good Life, now one finds only the eroded ruins of these (until the recent past) glorious conceptual structures

(MacIntyre, 1985). In our relativistic postmodern era, we simply no longer have the objectivist epistemologies to support them (Aviram, 1996, 1999a, 1999b).

At the same time the second pillar is crumbling too. The socio-economic circumstances of postmodernity differ radically from those of modernity and render dysfunctional the educational practices that were necessary for the mere existence and development of modern societies (Perelman, 1992; White, 1982; Aviram, 1996). This is the case in a generation which on the one hand is overeducated (or inflated with academicians, many of them unemployed or overqualified for the jobs they manage to find) and, on the other, is characterized by sixteen-year-old hackers lacking academic credentials yet able to start up their own companies and socially and economically successful DJs, caterers, or successful owners of small businesses supplying various kinds of services – lacking diplomas testifying to any formal or disciplinary knowledge on their part (in all these "new occupations" knowledge is extremely important, but it is practical knowledge and knowledge connected with emotional intelligence) (Gary and Herr, 1995; Aviram, 1999b, Chapter 4).

Thus the poor turtle (or the justification that is needed for our educational practices) is perilously perched over a rapidly widening void, whilst we maintain inertia with vacuous slogans echoing recently lost certainties and lacking in substance. And so, in confusion, we retreat to technocratic discussions on means or small-scale reforms, since we lack, and might have lost, the hope of finding or forming "grand visions" or "big aims" to guide us in respect of educational practice.

Perhaps because this is a radically new phenomenon, citizens, educators and experts at large are not yet fully aware of it and are consequently reluctant to deal with it. To some extent we are like cartoon figures that have left one mountain top to head across to the next one, with nothing beneath us but emptiness. We advance, heads high, not daring to look down for fear of becoming aware of, and toppling into, the abyss!

Although in the case at hand it is not yet clear where the next mountaintop may be, it is essential that discourse on the subject is encouraged and developed. I certainly do not want Western public education systems to topple. I believe that, especially in turbulent times like ours, a stable public education system that can help young people navigate in stormy waters is probably more necessary than ever before as long as it is ethically justifiable and effective in the prevailing socio-economic circumstances.

One does not jump over an abyss gradually. It has to be crossed in a single, audacious and preferably meticulously pre-planned leap based on a clear choice of one's goal and a clear and detailed understanding of the circumstances. I would therefore rather believe that becoming aware of the abyss and the confusion lurking in its depths, will enhance our courage to leave the haven of technocratic discourse on means, or reformist discourse on small-scale reforms, in order to develop a meaningful discourse on the utterly new challenges we have to tackle in postmodernity and the grand visions that should coherently guide and support us in facing these challenges. In this way we may be able to contribute to the location, or rather, formation of the next mountain top, thereby helping Western educational systems along their path towards it.

What we need for this purpose is a carefully crafted strategy.

On the need for a strategic approach to educational decision making

When safely advancing along a well-trodden and familiar road one can proceed casually, relying on one's previous experience, intuition or – in the worst-case scenario – trial and error tactics. But when lost in the depths of unknown terrain, it is better to strive for an overall picture of the terrain and its various characteristics (by climbing a high mountain, for example), and then locate oneself in this terrain, set oneself a clear aim (e.g. reaching the town one has seen on the horizon), stick to it, and work out a clear plan for how to get there, based on a combination of the aim on the one hand, and knowledge of the terrain and its conditions on the other. Furthermore, this plan should be based on a detailed set of various milestones, and well elaborated feedback mechanisms that will help one get around once one is off the mountain and loses the grand vision (another indication that we are thrown out into unknown territory by the Digital Revolution is the fact that the metaphor I have just used – one which is as old as our culture – is still meaningful to the present generation of readers; but will entirely lose its meaning in ten or twenty years for a generation who will take satellite-guided navigational systems for granted).

If a clear strategy is not adopted, instead sticking to "more familiar" tactics of relying on experience or intuition or trial and error, it is much more likely that one will walk in circles or just lose one's way in unknown territory.

Given the void rapidly opening up at the foundations of our educational systems, and the fact that this void throws us all of a sudden into wholly new terrain, what is needed is the mindful development of strategic thinking on education in postmodern democratic societies as a basis for systemic educational policies – and first and foremost policies concerning the merger[2] of ICT and education. Otherwise we will keep walking in circles, or just wander randomly and aimlessly (which is what we actually do, as described in one way or another by all the articles in the second part of this volume). Continuing to be prisoners of technocratic discourse (focusing on administrative and technological issues) or small reforms (focusing on small problems or "riddles") that are actually applied to education, we might have the impression of advancing while actually remaining in the same place or going backward.

Strategic thinking on this (as any other) subject should comprise three basic elements, all of which tacitly lie at the heart of the above metaphor. The first of these is a coherent and exhaustive understanding of "the terrain", or in our case of postmodern culture. Readers should note that the term "culture" is used here in its most extensive meaning, including the economic, social and conceptual life-style structures that are influential in a given society at a given moment. The ICT revolution and the cyber-culture it has brought with it are major postmodern driving forces, closely linked with other such forces which are bringing about the rapid erosion of the foundations of our educational systems. The analysis in the previous section of why current educational structures are no longer functional in postmodernity partially stems from an understanding of this fact (for the full

substantiated analysis see Aviram 1999b, Chapters 1-5 and 10). Henceforth I will refer to this element as "the cultural perspective".

The second complementary element basic to strategic thinking is the ethical perspective. This consists of a clear, coherent and operational definition of the desired aims of education as they stem from the world view or ideology of whoever decides on educational policies. Logically speaking, this perspective should be superior to the cultural perspective, since it should act as the foundation for evaluating cultural trends and forces in order to shape an ethically justified and culturally effective educational policy.

The fact that the ICT revolution is unavoidable and that it is a defining revolution, i.e. one that is bound to change all important aspects of our lives (Price, 1999) – and hence our personalities and identities – does not necessarily mean that all its aspects are positive. Educational systems cannot ignore or reject the ICT revolution, but they can try to distinguish between its positive and negative aspects in light of their basic values – stemming from the ethical perspective to which they adhere – and attempt to limit the latter while enhancing the former. Without the ethical perspective, postmodern turbulences and streams will sweep us along in a maelstrom, unable to define specific aims we would like to attain or a shore we would like to land on.

While it is the ethical perspective that defines the desired aims, it is the cultural perspective that allows us to navigate towards them. As has been argued earlier, just as the ethical perspective is analogous to the destination one aspires to reach, so the cultural perspective corresponds to one's knowledge of the terrain and its various geographical and climatic characteristics, while the desired strategy is equivalent to the ability to use one's own knowledge of the givens in order to navigate the stormy waters towards the desired destination (Aviram, 1997b). Continuing with this metaphor it follows that the third element of the desired strategic thinking is based on the combination of the previous two and can be summed up as answering three basic questions:

- What are the desired educational aims?
- How can they be realized within the postmodern reality (or rather, how can various characteristics of postmodernity be optimally used in order to enhance them)?
- What has to be done in order to achieve them, i.e., what should be the characteristics of the educational system that will optimally lead towards their fulfilment?

It is obvious that the ICT revolution, which decisively moulds our era's communication and learning media, will be central to the answers given to these questions.

Policymaking is turtling all the way down

The challenge facing educational systems throughout the post-industrial world ("post-industrial" is used here as a term synonymous with postmodernity, cyber-culture or "knowledge-based society") is therefore the challenge of how to mindfully and critically channel investment in ICT and connected reforms and restructuring processes:

- selectively, in light of the desired values (i.e. the ethical perspective)
- on the basis of an in-depth analysis of postmodernity (i.e. the cultural perspective) leading, among other things, to the understanding that this challenge is not about the introduction of "computers to the classroom", but rather involves the radical reformation of the meaning of "education" and "schooling" in light of the radically new possibilities and requirements of cyber-culture or postmodernity (Aviram 2000).

The requirement that the merger between ICT and education be based on mindful strategic thinking is logically and epistemologically extremely trivial. What is characterized above as "strategic thinking" is no more than the basic structure of planning, as described in Western philosophy at least since Aristotle and as actually implemented by us all in simple matters such as choosing a resort for a vacation or buying a car. When we buy a car, for instance, we define the characteristics of the desired car, or our aims for buying the car; we then study the relevant reality, i.e. the various relevant cars available on the market; and lastly we make our choice in light of criteria stemming from our aims.

What is amazing is that, when we come to crucial issues such as the merger of ICT and education – issues that are bound to have a dramatic impact on the nature of future education and hence society – we find very few traces of strategic thinking or rational planning; and the few that we do find are in the realm of theoretical literature, but not in policy-making.

In an earlier paper I wrote (Aviram, 2001), I analyzed a large number of documents taken from a broad array of sources in order to find out what approaches were suggested for the merger of ICT and education. I found that almost all of them lacked the slightest hint of strategic thinking.[1]

The argument about the total neglect of the most basic strategic thinking in policies relating to the merger of ICT and education is fairly easy to defend. It is much more difficult, however, to explain this grave lacuna, and convince readers used to conceiving the issue as consisting of installing "computers in the classroom" as to the urgent need to embark on it (Aviram, 2000). In the next three sections I shall therefore attempt both to explain this lacuna and refute the false beliefs leading to it, and thus make the case for its necessity. I will move in three steps (each in a separate section), referring to the need for the cultural perspective, the ethical perspective, and a combination of both of these perspectives.

On the need for a cultural perspective

There are four mistaken beliefs shared, usually tacitly, by many educationalists, academics and decision-makers in the field of education that prevent them from adopting the cultural perspective on the issue of ICT and education. I believe that by rendering these beliefs explicit and refuting them, we can advance the case for this perspective. These four mistaken beliefs are:

- The ICT revolution is a consequence of developments that have taken place only in the past twenty years.
- It is mainly about personal computers and (now) the Internet.
- Computers and the Internet are "innocent" or neutral, or "just tools that we can use in any way we want" (as teachers often say).
- The educational system can easily afford to ignore and "overcome" the PC and the Internet as it ignored and "overcame" the telephone, radio and, more importantly, television and video.

All four beliefs are basically wrong.

As regards the first belief, we should remember that the history of the ICT revolution is quite a long one and has been taking place over the past 150 years at least. It can be outlined schematically as a somewhat dialectical story in five phases:

- The first phase began in the nineteenth century. It was a CT (Communications Technology) revolution that started with the development of the telegraph and telex and continued into the early decades of the twentieth century with the development of photography, the cinema, the telephone, the radio and, towards the forties, the television.
- The mid-1950s saw the beginning of the second "latent" phase (to borrow a Freudian term). As the CT revolution marked a pause, the tacit IT (Information Technology) revolution came into being, mainly through the development of mainframe computers which served almost uniquely as "computing" or information-processing devices for corporations, governments and large organizations.
- The third phase began in the early 1980s. It consisted of two parallel lines of development which hardly converged at all at this stage:
  - The IT revolution "surfaced" mainly with the development and rapid spread of personal computers. It was later enhanced by the development and spread of laptops, artificial intelligence, multi-media, hypertext software, virtual reality, three-dimensional environments, speech recognition, on-line translation

software, and so on. It has also been steadily boosted by the exponential growth of computer capacity.
  - At the same time, the CT revolution gathered momentum with the development and widespread use of the fax, satellite and cellular communications, fibre optics and the Internet, at that stage still used by relatively few academic institutions.
- The fourth phase started in the mid-nineties and is still going on with unprecedented energy. It consists of two complementary unifying developments:
  - The spread of the Internet to small businesses and homes which is, in turn, now leading to a unification of the IT and CT revolution into one ICT revolution.
  - The unification of most of the previously mentioned functions into a single holistic ICT environment "located" in the Internet which everybody can access from everywhere through personal computers, laptops, palm pilots or mobile phones.
- It is clear now that we are rapidly approaching the conclusive "wrap-up" stage, or the fifth phase, with the development of what is now called "ubiquitous computing", or computing that:
  - *Is no longer dependent on computers* as separate, recognizable objects as we have known them in the last few decades,
  - *Is maturing*, i.e. becoming really user-friendly and hardly noticed by users any more than electricity and running water,
  - *Is becoming an integral part* of the artefacts that surround us, and allowing for various kinds of interactions between these artefacts, computers and humans.

Therefore to believe that the ICT revolution is a consequence of technological developments that have taken place only in the past twenty years is a completely mistaken supposition. It is a much deeper and more far-reaching cultural revolution, and it is becoming more profound and more extensive every day.

As for the second of the above mistaken beliefs (that ICT means nothing other than PCs and the Internet), I believe that the previous argument also leads to a forthright refutation of this belief. Connection to the Internet at this stage no longer means merely the ability to send or receive e-mails or to download texts as it used to in the early days of the Internet a mere six or seven years ago; today it means the ability to access most of the functions mentioned above – radio, phone, fax, television, video – as well as three-dimensional and virtual reality environments and, through all of these, any kind of material imaginable in any medium imaginable.

As regards the third of the mistaken beliefs referred to above (that we are speaking of "innocent" or neutral tools), it is important to remember that what has been created in the past decade is not just a series of new tools, but a whole new virtual *living environment* encompassing all the technological developments of the IT and CT revolutions of the past 150 years, and that this is rapidly becoming the environment in which we live, communicate, work, consume, do business and spend large parts of our social lives. This new environment is bound to impact greatly on our lives and on who we are.

Each of the technologies referred to above contributed to the transformation of important aspects of human life even when they stood alone **(**McLuhan, 1962**)**. The wrap-up phase we are now witnessing is going to have – is bound to have – a far greater impact than any of its components (Tapscott, 1997) It is also important to understand that while the first and second phases took 130 years to develop, the third stage unfolded over 15 years at most, and the fourth will probably take no more than eight years (i.e. the past five and the next three years), while the fifth stage, which is just now starting to emerge, will probably reach its peak in five or six years.

Furthermore, with the development of ubiquitous computing, the nature of our artefacts will be radically changed. They will gain in capacity for interaction and independent activity. This is the absolute opposite of what human beings have always meant by the concepts of "objects" or "artefacts". I believe that while we have certain clues as to the impact of the fourth Internet-oriented phase (the saturation of the self, the democratization of access to, and formation of, knowledge, the spread of lateral ways of thinking, all to be discussed later in this chapter), we still cannot even begin to imagine the possible impact of living in an environment of independently moving, talking, inter-connecting, and deciding – perhaps even soon "living" – artefacts. And such artefacts are about to surround us in just two to four years.

Until now I have referred to the ICT revolution as being the only revolution that is changing our world. But the truth of the matter is that it is closely connected to several other postmodern revolutions, which include:

1. The Economic Globalization revolution – the erosion of trade and monetary barriers that separated nations until a decade or two ago, the resulting weakening of the nation-state (which to a large extent was the political expression of these barriers), and the restructuring of organizations (Drucker, 1993)
2. The End of Ideology revolution – the transformation of Western culture from reliance on objectivist and all-encompassing modern ideologies (Scientism, Socialism, Nationalism, and Thick Liberalism) to "reliance" on a mixture of sceptical and relativistic views which emphasize individualistic and hedonistic values over collectivist and transcendental ones (Fukuyama, 1993)
3. The Social Pluralism revolution – the transformation of Western societies from societies relying on one "universal" set

> of definitions of basic social roles to pluralistic societies allowing and encouraging a variety of definitions of the roles of "men", "women", "children", "adults", "old people" and of basic social units or "families" (Fukuyama, 1993).

Although analytically it is possible to distinguish between these four revolutions (the ICT revolution and the three other revolutions outlined above), as a matter of fact they have all burst into our lives together, have been interactively enhancing one another since the 1980s, and today it is impossible to imagine any one of them without all the others (Kurtzweil, 1992, 2000).

For example, it is reasonable to claim that without the Globalization and End of Ideology revolutions various uses of the Internet would be curtailed by national, political, ideological and economic borders. On the other hand it is possible to say that in the age of the Internet, such borders make no sense and have no *raison d'être*. On another level, it is possible to say that the End of Ideology and Social Pluralism revolutions have largely enhanced open exchanges on the Internet, but at the same time it is reasonable to assume that the Internet, by diffusing live reflections of different ways of life throughout the world and allowing individual users to virtually play with their identities and constantly change them, has served as a major cause for the End of Ideology and the Social Pluralism revolutions.

The fact of the matter is that all four revolutions are so closely intertwined that it is impossible to tell which is the cause and which the result, and today they are all changing our lives dramatically.

It should now be clear that the fourth belief outlined above is mistaken. To stick to the belief that "schools are going to survive the PC and the Internet as they have survived other technologies" (the fourth of the mistaken claims discussed above) is therefore totally wrong. ICT expresses a revolution that is encompassing us in every single aspect of our lives, changing all of them both negatively and positively. It is also threatening all of the most basic assumptions of schooling, which reflected the very distant "good (bad?) old ways" of a decade or two ago, some of them even 2,500 years old (Gendron, 1997; Moore, 1995; Aviram 1999a, Chapters 1-5, 10):

- It is threatening the linear, authoritarian, disciplinary structure of knowledge, the distinction between valid knowledge and superstitions and the importance of literacy and of the written text, all of which have been basic to the Western liberal curriculum over the past 2,500 years.
- It is rapidly eroding the advantage that adults have over children in "life experience", wisdom and understanding of the world – another basic presupposition of Western education since its earliest origins.
- It is extinguishing the importance of a shared geographical place and time structure for the transmission or production of knowledge – the most basic characteristic of modern education systems over the past century.

- Is there any other assumption basic to modern schooling and education that has been left intact (Ellyard, 1998)?

To conclude: it does not make any sense for educational systems to refer to the ICT revolution in its present form as merely involving a few technological devices that the system can "swallow up" as it did earlier devices, such as the television or the VCR that left no meaningful mark on the educational system.

We must therefore switch from speaking about "integrating computers into the classroom" or "using ICT for teaching math to fourth graders" to radically restructuring the education system, relying on the broader cultural perspective to enhance its adaptation to cyber-culture and postmodernity and thereby save it from marginalization or even extinction (Aviram 2000).

In order to follow this recommendation we must understand what "cyber-culture" and "postmodernity" actually mean, as well as the ways in which they render present-day schools anachronistic. We need to understand further the importance of radically changing the meanings of "education" and "schooling" if we want public education systems to survive. In other words, we have to adopt a cultural perspective in our thinking about education.

On the need for an ethical perspective

Adopting a cultural perspective, although necessary, is by itself not sufficient. The ICT revolution and the emerging cyber-culture connected with it, when judged in light of values that are fairly basic to Western societies, are double-edged phenomena. The same characteristics can impact both positively and negatively on users and society.

Let us look at a few obvious examples of positive and negative aspects of these defining changes. Being hypertextual and multimedia-based, the ICT revolution is changing our ways of thinking and learning, making them more lateral, associative and visual. In so doing it is probably enhancing our imagination and creativity, but it may also be threatening the dominance of the linear, logical and abstract structures which have ruled Western culture over the past 2,500 years and which are vital to any process of reasoning and criticism. Hence it may also be enhancing superficiality and charlatanism (Negraponte, 1995; Hirsch 1987).

ICT is audiovisual and includes constantly improving speech and written text-recognition. We are approaching the point where in many cases reading and writing may become redundant. Hence ICT is likely to diminish the importance of literacy in society (Birkerts, 1994). This in turn might open the door to more equality among individuals endowed with different Intelligences (to use Gardner's term) but might also further encourage the demise of rationality, which has always relied on literacy (Hirsch, 1987; Hough, 2000).

Since the ICT revolution has facilitated immediate connections between individuals throughout the world, it is bound by the same token to extensively facilitate their ability to connect on the basis of similar interests, quests or problems, and thus is having an important empowering effect. In doing so, however, it also

exponentially multiplies the number of an individual's relationships and renders each of them more superficial, fragmentary and temporary, thereby perhaps contributing to increasing emotional "flatness" and to the saturation and disintegration of the self (Gergen, 1992).

Since it allows anyone to form, structure, present and access knowledge anywhere and at any time, the ICT revolution threatens the authoritative structures of knowledge that block the path to many democratization and empowerment processes, but in doing so it also leads to the blurring of the distinction between valid knowledge and superstitions which has largely facilitated scientific advancement in the past two centuries (Gendron, 1997).

Since it is flooding organizations with real-time information, it is compelling them to change into much "flatter", more flexible and more "democratic" structures that can respond and change quickly, imparting more power to the "people in the field" or practitioners. This in turn is contributing to the empowerment of many individuals. But at the same time it changes work patterns in organizations, making them much more hectic, and forces organizations to hire most of their employees on a temporary basis. This in turn is radically changing the structure of the labour market in which, at present, only 40% of the workforce has or can aspire to tenure. This, of course, leaves many more people continuously in the labour market, thereby contributing even further to stressful, hectic life styles (Handy, 1989; Peters, 1994).

Another influence in the same domain is that ICT is leading to accelerated automation and efficiency and hence continually shortening the working week. This in turn (together with the lengthening of life expectancy) is leading to an "End of Work" society, a society in which, for the first time in human history, most individuals will be able to enjoy (or suffer) leisure most of the time. Depending on one's point of view, this may sound either like an almost humanistic utopia of freedom and self-expression, or a capitalistic nightmare of ever-accelerating cycles of consumption and production (White, 1997).

If we take the *loss of literacy*, the *disappearance of the distinction between knowledge and superstition*, the *saturation of the self*, the *inflation in and flattening of human relationships* and other impacts of cyber-culture as given *and* ***desirable***, then there is no reason to stick to schooling or education. Education can only have a *raison d'être* if we adopt a critical stance towards the given and educate young people in light of values that are believed to be "loftier" or more "sublime" than "the given" and "the natural". This, however, calls for commitment to a set of values which we take to be the aims of education and which do not stem from our cultural understanding but, on the contrary, enable us to evaluate our cultural understanding. This is what I call "the ethical perspective".

Today, this perspective is almost universally absent from educational discussions in general, and discussions on ICT in education in particular. On the one hand this is surprising, since one would expect the huge ongoing investments in ICT to be guided by what could be viewed as commitment to the aims of education. On the other hand, given the nature of postmodernity, it is far from surprising.

If we look at the Homeric, Democratic and Hellenistic periods in Athens, the Roman Republic and later the Roman Empire, mediaeval-Christian Europe and the

new modern European nation-states, we see that all relied tacitly or explicitly (usually a mixture of both) on educational views based on aims that enjoyed broad consensual support and were based on what were conceived as basic evident truths about human nature, the nature of society and knowledge, "the good life", the "good of the public" and the desired social and epistemological structures to support these.

This has certainly been the case in Europe and the Western world over most of the past century. Mainstream culture has relied heavily on the four predominant modern or enlightenment ideologies that replaced pre-Enlightenment Christian world views and the educational visions stemming from them. These were: Scientism – the belief in empirical science and the ability of technology to solve all social and humane ills, moral problems and dilemmas included; Socialism (a derivation of Scientism); Thick Liberalism; and Nationalism. Despite meaningful internal variations and contradictions between these ideologies, all are based on a belief in historical progress, i.e. the secular alternative to religious salvation, and are conceived as allowing and enhancing progress. Educational visions in specific Western societies were therefore a reflection of specific mixes of modern ideologies and were based on the assumption that education is a meaningful means (quite often *the* meaningful means) to individual and social progress as defined by the dominant ideological mix.

The problem today stems from the fact that Modernism – the enlightenment world view about historical progress basic to all four modern ideologies – has been shattered over the past two decades by what is now called "postmodernism". Postmodernistic views and philosophies are sceptical and relativistic. They do not leave much room for progress-oriented discourse or for firmly rooted views concerning human nature, the nature of society, of knowledge – as a matter of fact, of anything. Postmodernism as a "view" radically opposes what it calls "Foundationalism", that is, the need to found social practices on, or justify them in light of, ideologies, philosophies or theologies. It therefore also opposes any aspiration for coherence and systematic thinking that stems from Foundationalism (Rorty, 1989).

Thus, our era has also been called the era of "the End of Ideology" (Bell, 1973) or "the End of History" (to use Fukuyama's term, which amounts to the same thing (Fukuyama, 1993)). It reflects the fall of the four modern ideologies that guided Western society and Western education in modernity after the demise of religion, a fall that has created a void at the foundations of the educational process. Where once (only twenty to thirty years ago) there existed clear aims that human beings lived and were educated by, now there is a black hole (Bloom, 1987; Postman, 1996).

The deepening void underlying our educational procedures has led to the "technocratization" of educational discourse and activity. As argued above, the ICT revolution and the cyber-culture connected to it clearly constitute a powerfully defining double-edged revolution. When adapting our educational systems to this revolution it is therefore necessary to try to limit the impact of its negative edge and maximize the impact of the positive edge. This requires educational thinking and restructuring to be clearly based on a coherent ethical perspective unambiguously stating the ultimate aims of education. The prevailing technocratic culture of

educational "discourse" leaves no room for such a perspective. There is no area in which the technocratic attitude is more obvious and alarming than in the introduction of ICT to the educational system.

On the need for the integration of the cultural and ethical perspectives

Three steps together constitute the essence of the necessary, and currently acutely lacking, mindful strategic thinking on the merger of ICT and education.

- Starting from the cultural perspective, we have to analyze our understanding of cyber-culture.
- This should be done in light of a clearly formulated and coherent ethical perspective.
- Only then can we devise a policy for the realization of the desired aims in the best possible way within the circumstances of cyber-culture.

Now as things are, not only the formation of each of the above perspectives is blocked by a series of false beliefs and irrelevant attitudes, but so too is their integration within a framework of strategic thinking. Although the above two perspectives are not logically contradictory, there is, at present, a clear and strong tension between them. This tension is expressed in the prevailing rift in the literature between the "enthusiasts" – who rightly understand the defining nature of the ICT revolution or its potential for radically changing all major aspects of our culture and life structures, but wrongly deduce from it the conception that the ICT revolution is the vehicle of progress and the panacea for social and educational problems (Papert, 1992; Perelman, 1992; Tapscott, 1997) – and the "doomsday predictors" or "heretics" who rightly diagnose some of the negative potential of ICT and its prevailing uses in education but wrongly deduce from this the recommendation to drastically limit the influence of ICT on education (Healy, 1998; Postman, 1992).
For a variety of reasons, some psychologically or sociologically interesting, no thinkers have so far managed to really integrate the two perspectives in a single balanced framework. Apparently this urgently needed balanced attitude represents a real challenge because it requires educationalists and decision makers to both:

- understand the inevitably defining nature of ICT, or the dramatic impact that it has and is going to have on our culture and way of life, and
- at the same time to be able to diagnose both its negative and positive aspects.

For some reason this double cognitive move seems almost impossible for thinkers addressing the issue.

Only on the basis of this double move can we develop the strategies aimed at guiding the merger of ICT and education in such a way that ICT's negative potential will be limited while its positive potential will be enhanced.

THE RECOMMENDED ISRAELI EDUCATIONAL COMPUTERIZATION POLICY

Following this overall defence of the urgent need to switch from technocratic thinking or piecemeal reformist thinking to large-scale strategic thinking on the merger of ICT and education, we can take the second main step in this paper and point to a primary attempt to develop such thinking that was recently undertaken in Israel. For this purpose I will describe in this part what I call the "recommended Israeli computerization policy". This recommended policy is based on the methodology of mindful strategic thinking suggested in the previous section. As such, it is quite unique. Other (suggested or actual) policies seem to be either Technocratic or Reformist. Technocratic policy focuses narrowly on simply introducing ICT equipment into schools and teaching teachers and students how to use it for various needs, or on using ICT within prevailing curricula in existing educational structures. Reformist policies emphasize the need to change school didactics to a more constructivist approach, and to change certain concomitant curricular and organizational structures (Aviram and Talmi, in press; see also information about the national computerization programmes of some of the world's leading nations listed in Note 2: simple analysis of their websites shows that while they rely on attitudes covering the gamut of Technocratic to Reformist, none of them is relying on strategic thinking as defined and justified here.[2])

It must be emphasized that the policy and practices prevailing in Israel right now are also very far from being based on mindful strategy in any sense that even approaches the one proposed above. Like many other national programmes (including the ones just indicated), it can be characterized as lying somewhere between the Technocratic and Reformist poles: relevant declarations tend toward the second, whilst actions point toward the first, as is the case in many Western countries.

Still, Israel's Education Ministry in 2001 set up a committee, which I chaired, to formulate and submit a recommended policy in a position paper. At the time of writing, this policy has not yet been implemented (and unfortunately I do not believe that it will be implemented as recommended in the foreseeable future). Still, one can find some source of promise and hope in the very decision by the Education Ministry to set up both this committee and a previous far larger committee of which it was a consequence (comprising top-level personnel from the Ministry as well as academics and leading educationalists). This move reflects both dissatisfaction with the current state of affairs and the realization that there is a need to rethink policy and practice.

The cultural perspective

The recommended policy – based on mindful strategic thinking – stands upon the two complementary pillars basic to strategic thinking as presented in the previous part. The first consists of perceiving the merger of ICT and education from a *cultural perspective,* i.e. as being a radical cultural and organizational revolution

requiring schools to go through a deep transformation (in contrast to the usual conception of it as the introduction of neutral technology into schools in their present state). The second pillar is the *ethical perspective.* It reflects the view that although this revolution is necessary because of the radically changing circumstances of our cyber-culture or knowledge-based society it should, as far as the education system is concerned, be carefully scrutinized in ethical terms and guided by basic social values (as opposed to the usual conception of it as a predetermined process necessarily leading to progress).

Let us start with the consequences of adopting the cultural perspective. The main practical policy recommendation stemming from the cultural perspective is that schools must, or inevitably will, become much more flexible. Otherwise, we believe that they will not be able to continue their role as a socializing agent in the new postmodern, ICT-based culture (Aviram, 2000).

The quest for higher levels of flexibility should embrace such fundamental elements as time, place, role definitions and content. In terms of time and place, the process implies that the new school will not be committed to "lococentrism". Rather, it will offer students opportunities for distance learning and non-synchronic learning. The change in the definitions of roles implies, among other things, that schools will offer students different kinds of educational support – teachers, mentors and guides. It also means that the role of teaching will be open to new people coming from inside or outside schools, including other students, local citizens, and retired professionals. The Internet may be a source for many new teaching schemas outside of school. The change in content implies reducing compulsory content to a minimum, and leaving it mostly up to students to choose.

The cultural starting point led us also to seriously consider the following questions: Given the long history of failures in educational reforms all over the world (Tyack and Cuban, 1995; Sarason, 1993; see also the second part of this volume), is it reasonable to assume that schools can be transformed into much more flexible institutions serving desired social values? If so, how should such a process be managed?

We are a long way from being certain about the answers to these questions. Nevertheless, we cannot avoid asking them because we believe that if schools do not radically adapt themselves to a world dominated by virtual/knowledge-based/crazy organizations and processes, then they will doom themselves to becoming the option of those who have no other option.

We also believe that radically changing the structure of schools will be a long and arduous process. We are therefore thinking of encouraging schools to move onto the path of flexibility at their own pace and mode. We are considering the possibility of motivating them to undertake painful changes by offering differential support for ICT-oriented projects, depending on the scope of flexibility they are committed to introduce.

Now that we have briefly presented the practical policy recommendations stemming from the first (cultural) starting point, we will move on to focus more extensively on the second (ethical) starting point.

The ethical perspective

The implications stemming from the cultural approach may not seem odd to many readers, since awareness of the need to radically change schools has been emerging in the last two decades and has been expressed also by some of the writers in the Reformist and Humanist "camps" in this book. This is also the reason I did not dwell on them for long. The ethical approach, on the other hand, is rarely to be found in the relevant literature, and certainly not on a systemic strategic level.

The question from which one must start in order to construct the relevant ethical perspective is: What are the basic values that we would like to see become the aims of education? This leads us to a more fundamental question: What are the basic sublime values of our society? By "sublime values" we mean the values suggested by most individuals in society when asked what their ideals are – in spite of the fact that, in daily life, they might not often follow them. Once we asked this question, we did not have much difficulty in answering it: the basic values underlying the ethical perspective of Israeli policy should be the values basic to Humanism, at least from the 18th century onward – the same values that now serve as the foundation of the constitutions of Western liberal democracies (although once again these are often transgressed by actual policies). They are: the enhancement of *liberty, equality* and *fraternity* in society at large.

In our view, the educational derivatives of these general democratic values that seem to be most natural and fundamental to every democratic society are the development of *autonomy, morality* and *belonging* in young people.

I believe that the relationship between the first and the second triads is quite intuitive: it should not be difficult to realize that for each social value in the first triad, its equivalent in the second supplies a derivative/reflection on the psychological level (unfortunately space constraints preclude a more in-depth examination of this issue here).

The educational derivatives of liberty, equality and fraternity are the traits that, if characterizing individuals, will ensure that the above three values are upheld in society. A society in which most members are *autonomous*, *moral* and *belonging* (an expression that we use as a psychological term, as defined just below) would be dominated by the values of *liberty*, *equality* and *fraternity,* and vice versa. In what follows I will briefly present the committee's understanding of these values and their educational implications, as perceived by the committee.

"*Personal autonomy*" infers "*authenticity*" and "*self-direction*". By "authenticity" we mean the individual's ability to be aware of his/her feelings, desires, interests, talents and characteristic styles of performance and learning, and to adapt these to one another. "Self-direction" refers to the individual's ability to rationally form action plans and implement them.

"*Belonging*" is perceived as referring to an individual's conception of himself/herself as being involved with, and committed to, certain social groups within society as well as to society at large. In this context, we refer exclusively to "*dialogical belonging*". This term reflects the view that, while committed to the

larger social group, the individual feels that he/she has a meaningful "voice" within this group and a chance to influence its development.

"*Morality*" is understood by us to be an individual's awareness of the need to avoid hurting others (Aviram and Bar-Lev, 1999; Aviram, 1999b, Chapter 6).

Basic guidelines for the methodology of education in liberal democracies

In terms of an education that will develop these values, we believe that they are best implemented by helping individuals to get involved with experiences of real, voluntarily chosen situations occurring on all essential levels of human life, accompanied by an in-depth process of methodologically guided reflection on these experiences. This process of reflective "experimentations in living" (a term borrowed from J. S. Mill's *On Liberty,* a view on which we have drawn heavily and which is influenced by late 18th and early 19th century German Humanism) should be characterized by four basic principles.

The first three principles – *flexible freedom*, *plurality of experiences* (to borrow another of Mill's terms) and *physical and emotional security* – mainly pertain to the characteristics of an appropriate environment. The fourth – *enhancement of reflectivity* in light of a detailed systematic methodology – is a characteristic of the appropriate didactics. These four principles together comprise the foundation of an educational methodology for developing autonomy, belonging and morality. This methodology, developed at the Ben-Gurion University Centre for Futurism in Education, is called AOE, that is, Autonomy-Oriented Education (Aviram and Bar-Lev, 1999; Aviram 1999b, Chapters 6-9).

Below I briefly define each of these four principles:

- *Flexible freedom* characterizes a situation in which the individual is not only free to choose from predefined options but is also allowed to continually modify his/her choices, change one or more of the prevailing options through his/her participation in it (them) or form new options.
- Plurality of experience refers to the existence of as many different categories of experience as possible in the above free environment and to the emphasis that should be placed on experimenting with different categories of experiences, as opposed to many experiences of the same category (the usual situation in the present-day school).
- Physical and emotional security refers to the lack of threat of physical or emotional harm, the individual's certainty of being accepted by the environment, and its stable, continuous and comprehensible nature.
- Guided reflectivity implies encouraging individuals to identify and respect their own interests, values, capacities, performance styles and emotions (authenticity-oriented reflectivity) on the one hand, and the ability to form rational plans and implement

them on the other (self-direction oriented reflectivity). It is important to emphasize that in order for reflection to be productive or to lead to the enhancement of an individual's autonomy, belonging and morality, it should not be a totally open-ended or diffuse reflectivity such as is now, for instance, encouraged by the Narrative approach. Rather, it should be a methodologically guided reflectivity based on the accompanying tutor's knowledge of the various objects of reflectivity (i.e. knowledge of theories and research about individuals' interests, performance styles, capacities, rationality, etc.) and the mastery of a large repertory of professional responses that might be helpful in guiding the tutee's reflection productively (Aviram and Bar-Lev, 1999; Aviram 1999b, Chapters 6-9).

The evaluation of cyber-culture in light of the ethical perspective and its educational derivatives

Having formulated our basic values and their first-level educational bearings, we can now proceed to evaluate the ICT revolution in light of them. We believe this revolution to be double-edged from this point of view, i.e. as having both potential positive and negative impacts on individuals' chances of developing as autonomous, moral and belonging human beings (Aviram, 2000). I have already discussed the double-edged nature of ICT and the way it can, on the one hand, lead to the empowerment of an individual's autonomy or strengthen various modes of belonging but, on the other, lead to the saturation and disintegration of the self, thereby preventing any possibility for autonomy, and the flattening of human relations, thereby decreasing the chances for meaningful belonging.

Once we have acknowledged ICT's advantages and disadvantages in light of our educational aims, the next question we must consider is the following: Is the ICT revolution deterministic, or can we influence it (at least, to some extent)?

Our view, in response to this question, is basically indeterminist. Our indeterminism is a "soft" one. We assume that the mere fundamentals of the ICT revolution are given, but that we can at least partially *channel* the processes based on them, or – more pessimistically – that it is at least rational to *try* to channel them as long as we have no categorical evidence that such attempts are futile.

As things stand now, we believe that no such evidence exists. On the contrary, the discipline known as Cultural Studies of Technology supplies us with case studies on the channelling (whether in positive or negative directions) of the development and use of ICT in light of social values and interests. Such channelling has quite often been semi-conscious and incoherent (Agalianos et al., 2001). This ex post facto analysis leaves room to hope that fully conscious, intentional long-term systemic and systematic policy could make a difference.

Being soft determinists, we believe that there is a possibility that the ICT revolution and its merger with the educational system (which, as argued above, we

deem to be necessary) can be influenced in directions desirable to humanistic and democratic societies.

The optimization strategy underlying the recommended Israeli policy

In order to restrict to the greatest degree possible the dangers of the Internet from the perspective of basic democratic educational aims and maximize its advantages from the same perspective, we have developed an optimization strategy. This strategy consists of three basic elements:

- Free access to the Internet for all children from anywhere at any time;
- Provision of access in an indirect way so that students have to "pass through" national and local educational intermediate portals;
- Designing the national and local intermediate portals so that they become the main "substratum" or framework of the educational activity, accompanied by an appropriate radical change in the role of schools.

We believe that the first element – if followed by a radical change in the role and nature of schooling on the lines already indicated above – will serve in the best way possible the three first principles of humanistic education: *freedom, plurality of experiences* and some aspects of *security* (among others, the aspects relevant to students' ability to work or learn individually, at their own pace, "unwatched", "uncontrolled" and "uncompared" with others**)**. The second element, *if mindfully planned and managed according to AOE*, will serve the other aspects of *security* (mainly those connected with stability, continuity of institutional frameworks and human relationships), as well as the fourth principle, *reflective tutoring***,** by equipping students "en route" to the Internet with tools that will enable them to mindfully use this potentially empowering and dangerous environment and reflectively "digest" their experiences in it.

Thus the crux of the suggested optimization strategy is a systemic, systematic long-term policy aimed at ensuring that all young people enjoy unlimited access from school, home or any other place to the Internet *as a vehicle to enhance flexible, free, (partially) secure and rich experimentations in living in a variety of situations*. However, in order to make sure that such experimentation will be productive from the perspective of the three humanistic educational aims (our assumption being that because of the Internet's double-edged nature there is, on balance, not much chance that productive development will occur through mere experimentation in and through the Internet), it will be necessary for the intermediate portals to offer an *AOE-based environment providing the tutorship and support necessary to render the Internet-based experimentations productive*.

We suggested in the recommended Israeli policy that this be done by combinations of the following:

- Activities found in the intermediate portals, mainly services provided by human tutors and counsellors, forums and group discussions available to users both on-line and off-line 24 hours a day. The tutors and counsellors trained in the educational methodology relevant to the desired values (AOT: Autonomy Oriented Tutoring) will help users to mindfully prepare or "digest" their Internet-based or other experimentations, reflect on them and make productive psychological use of them.
- Technology basic to these activities – smart agents designed in accordance with, and supporting, the methodology stemming from the desired values.
- Material presented in these portals and the architecture and design of their various environments and interfaces, structured in light of the above methodology in order to explicitly and tacitly transmit the desired values.

We believe that the latter two elements balance each other and together form the best possible strategy for, on the one hand, exposing young people to the infinite range of opportunities and experiences available through free access to the Internet and, on the other hand, guaranteeing their ability to maintain a secure and stable point of reference and to rely on an accompanying and "mentoring" framework which will protect them against the excesses of the Internet and help them to make full use of and productively navigate through it.

I will now give a few examples of some more concrete thoughts we have had concerning the best way to "mobilize" the intermediate portals in order to enhance productive use of the Internet.

As far as interfaces are concerned:

- In order to balance the "noise" and "chaos" of the Internet, the portal interfaces should be simple, clear and "quiet". They should not include advertising and should present their content mostly in a linear "commonsensical" manner.
- In order to enhance users' possibilities of gradually gaining, through their experimentation, self-knowledge of their personal characteristics, the interfaces will be "smart", adapting themselves to users with different preferences, interests, performance styles or capacities. This process of adaptation should not be automatic (certainly not in its default scenario), but should be based on constant interaction with users and on the presentation to them of various options and all relevant knowledge. In this way, users will have to go through the processes of reflection, self-learning and choice that are vital to the reflective experimentation necessary for gaining self-knowledge and hence developing autonomy.

Insofar as the contents included in the intermediate portals are concerned:

- The national intermediate portal will contain a library of knowledge in various disciplines and, what is more important, in complementary meta-disciplines based on the philosophy, history and sociology of science and culture, with hyperlinks connecting the presentation of disciplinary material to meta-disciplinary material. We believe that the creation in users of a meta-disciplinary, critical perspective on knowledge will meaningfully contribute to their autonomy on the one hand and dialogical belonging on the other (by enabling them to gain a better knowledge of the sources of their culture and empowering them to start a hermeneutical dialogue with these sources).
- Both the content and form of the local and national portals will be oriented towards research-based and student-directed learning. While this pedagogical approach is now conceived by many educationalists as fulfilling the desired educational vision, it represents, in fact, only a rather small fragment of it, contributing to the development of rationality and users' ability to adopt an independent stance. This, in turn (if mindfully accompanied by the tutors), can contribute to the development of autonomy and morality.
- Both local and national portals will be rich in forums and interest groups, encouraging virtual communities and belonging. The difference between them will be that the national portal will host forums and groups on the national level, dealing with issues of general interest, while the local portals will host groups dealing mainly with issues of local interest.
- The national and local portals will contain a variety of autonomy- and belonging-oriented authoring tools for all kinds of learners and uses.
- The national and local portals will contain repositories of presentations of knowledge created by all kinds of learners (including those we today call "academics" or "experts" as well as "teachers" and "students") – evaluated not by the age, institutional affiliation or institutional role of their authors, but rather by their level of contribution to the development of the three desired traits in users.

Insofar as technologies included in the intermediate portals are concerned:

- Portals will be based on individual smart agents that will track users, model them (mainly their interests, learning and performance styles, cognitive and rational strategies), reflect the models (only) to the users and dialogue with them in order to enhance their self-knowledge and their capacity for rational

learning and decision-making (as required by our understanding of autonomy).

- Other collective smart agents will match users who have similar interests, problems or aims (as required by our understanding of belonging).
- The individual smart agents will accompany and guide users both on the intermediate portals and, more importantly, on the Internet.
- The intermediate portals will enable users to meet in meeting rooms based on 3D environments, or through conference applications, or both. All these environments will rely on the above smart agents that will encourage the development of participants' awareness and knowledge of dominant patterns of behaviour that characterize them as individuals or groups (and thus contribute to the development of autonomy, belonging and morality).
- They will also include applications for graphic and 3D presentations of individual and collectively formed knowledge in order to assist critical and reflective formation, examination and distribution of knowledge.

Insofar as accompanying services are concerned:

- The first category of accompanying services to be found on the intermediate portals will consist of AOT-based forums supporting users in the main fields of life – i.e. in the search for and the realization of interests, professional development and family/community belonging. These forums will contain information, courses and both on-line and off-line counselling services.
- The second category of accompanying services will consist of AOT-based "counselling corners" for cognitive and emotional issues that have to do with learning and development.
- The third category of accompanying services will be aimed at guaranteeing equal access to the Internet and the intermediate portals by making sure that every young person in the country has the know-how to use them mindfully.

The above characteristics of the intermediate portals were chosen in order to meet the requirements of the four principles of humanistic education stemming from the three basic educational aims and the AOE view and methodology serving them. Free connection to the Internet serves mainly the principles of Flexible Freedom, Plurality of Experiences and (some aspects of the principle of) Physical and Emotional Security. While the characteristics of the intermediate portals do promote other aspects of the third principle (emotional security), they mainly promote the principle of Reflective Tutoring. For example, the smart agents will facilitate the

principle of Reflective Tutoring by reflecting to the users their own interests, preferences, capacities and styles and dialoguing with them on these issues along AOE-based lines. This will also be the goal of the human tutors and consultants who will staff the portals, as well of the moderators of its various forums.

Once a system combining various types of virtual environments is available, schools will have to radically change their nature of operation. They will have to move from being total organizations disconnected from the external world and *supplying* within their walls all the required processes, and instead become open institutions (both internally and externally) relying largely on materials, services and processes available in the virtual and other external environments. They will have to focus on *assuming responsibility for* (sharply distinct from "supplying") the basic educational processes and on supplementing the other available environments from the perspective of the educational process.

This radical transformation is totally compatible with the recommendation concerning the need to encourage schools to become more flexible, as mentioned above within the discussion on the cultural perspective.

This in turn means that schools must assume two roles:

- They will have the *responsibility for the overall education of the individual* and will be in charge of making sure that he/she goes through productive "experimentations in living" processes (henceforth: *Schools as Foci of Responsibility*).
- Following on from the previous point, they will have to switch to supplying young people mainly with:
  - The tutorship that they will not be able to get (solely) through the virtual environment or that cannot be realized (for the greater part) through such environments. Most probably this will be *tutorship based on long-term personal acquaintance, mutual commitment, and all-encompassing mentoring and guidance of the individual* (henceforth: *Schools as Centres for Tutoring*).
  - Access to every kind of resource needed for their developmental process including physical meeting and learning places and, if and when needed, access to virtual environments, help in meeting other people – teachers, counsellors or travelling companions– or in locating specific kinds of knowledge or places vital for the search for and follow-up of their interests (production sites, artistic centres, etc.) (Henceforth: *Schools as Centres for Guidance and Communication*).

The overall vision

We shall now return to a consideration of the broader model of the recommended policy. From the perspective of the cultural starting point, if schools are to merge with the triumphant powers of cyber-culture, they will have to adapt themselves to the institutional structures, operating mechanisms and communicating procedures essential to this culture. This means radically transforming schools into institutions which are much more open (geographically, as well as in terms of curriculum and didactically), with the educational process to a large extent founded on the virtual environment of the Internet and the intermediate portals.

From the perspective of the ethical starting point, schools, as open and flexible institutions, are recommended to orient their activities mainly towards educating students in light of the three basic values of education in democracy (hence shifting the focus of their activity from *teaching* to *educating*). It is further recommended that the educational process rely to a large extent on virtual environments and more especially the intermediate portals.

According to this vision, schools will function mainly as *foci of educational responsibility*, and *centres for tutoring, guidance and communication*. The first role of schools consists mainly in their being responsible for ensuring that the education of young people is carried out along the desired lines (although not themselves supplying all the required material and guidance necessary for the educational process as these will be supplied to a large extent by the virtual environments). The second role is to supply young people with long-term supporting, accompanying, AOE-based tutorship and mentoring. The third is to supply young people with all the facilities, information, knowledge and acquaintances they need for their developmental process.

The third, complementary element of the suggested strategy is an open and supportive virtual education system committed to enhancing the values of autonomy, belonging and morality, based on the AOE methodology and relying largely on the Internet and the intermediate portals.

We are, at the moment, not certain about the means for reaching this desired model. We nevertheless believe that it is necessary to advance in three ways simultaneously:

1. The State needs to act systematically in order to develop the supporting virtual environment (consisting of AOE-based intermediate portals as described above, and the provision of free access to the Internet for every child from everywhere).
2. New schools opened by the State, parents, private associations or organizations should be encouraged by the State (actively through a differential system of state subsidies, for example) in order to immediately make the leap towards the radically different paradigm and be structured in light of education's new mission as described above.
3. Currently operating schools should be encouraged by the State (once again actively through the above-mentioned system of

differential subsidies) to gradually but systematically transform themselves in keeping with their capacities and in light of the recommended policy

For the two latter points, the State must create an extended systemic framework to support the restructuring of schools and the re-education of teachers.

CONCLUSION: TWO SCENARIOS FOR DEMOCRATIC EDUCATION

The question now facing us is not: "Is education going to be radically changed by cyber-culture?" but rather: "How is education going to be radically changed by cyber-culture?"

The power of the cyber-revolution, especially when connected with all of the other postmodern revolutions now swiftly changing our lives, is much too strong for schools to be able to resist. Two basic scenarios for change could be envisaged. The first involves bottom-up change driven basically by "the field", which in postmodern Western democracies means first and foremost the "hidden hand of the market" or economic forces. This would mean the disintegration of the public education system and the development of an open, dynamic and flexible system made up of a mixture of Internet-based home schooling, private schooling and "charter schooling" for the wealthy and middle classes. In this scenario, public education still relying on modern structures (i.e. those pertaining to pre cyber-culture) would be doomed to rapid anachronization and deterioration and would eventually serve only the lower socio-economic classes.

The process of the middle classes leaving the sinking ship for much more flexible and Internet-based alternatives has, as a matter of fact, already begun and is gathering momentum in many Western societies, partly through the rapid rise in home schooling and charter schooling recorded in various societies over the past five years (Hargreaves, 1997; Roland Meighan, 1997).

This is not a desirable scenario for two main reasons. Firstly, it will dramatically increase already existing inequalities in Western societies and secondly, it will be driven mainly by narrow capitalist values emphasizing narrow individualism (or egoism), upward mobility, consumption and hedonism. From both these viewpoints it is clearly anti-democratic.

The second scenario begins with the State developing a long-term policy based on a mindful strategy aimed at understanding *the inevitable* (cyber-culture and postmodernity) and its forces, and harnessing them in order to enhance *desired* humanistic and democratic values. My aim in this chapter has been to urge the realization of this second scenario through the adoption of appropriate mindful policies and strategies. I hope I have succeeded in convincing readers of both the necessity and the feasibility of this second scenario by illustrating its potential operational and concrete meaning.

But even if ethically *necessary* and logically and theoretically *possible*, is it *realistic* to assume that such a scenario will be realized in the foreseeable future?

Although one usually tends to conclude articles like this on an optimistic note, I cannot but express my realistic assessment that, generally speaking (for the vast majority of Western democratic societies, anyway), the first scenario is much more probable and realistic than the second. This is the prevailing default scenario, driven in almost all societies by extremely strong economic interests, political demagogy and the narrow and limited perspectives that educationalists, experts and decision-makers rely on when shaping the future of Western education systems.

If one is worried about the future of Western democracies and their humanistic educational policies (as I am), then the main questions on which one should focus (to borrow Marxian terminology for a moment) are: Who will be the revolutionary class? Or (in non-Marxian terms): Can we identify social powers in prevailing Western societies strong enough to shake the above unholy coalition and encourage processes that could increase the chances of the second scenario being realized? If so, how can we support them?

These questions, and the answers that will be given to them within Western societies, are vital to the future of Western education and Western humanistic democracies (as opposed to market-oriented democracies). But they open up completely new issues. I will leave this discussion, therefore, to another paper that I am planning to write.

NOTES

[1] In this passage I use a term not commonly used in this context to indicate that we have here a dialectical (in the Hegelian sense) process of thesis (the school, book-based system and culture), antithesis (the digital culture) and synthesis which will probably emerge from this "clash of civilizations" (to paraphrase the name of Huntington's well known book in altogether another context).

[2] For websites presenting some of the leading national computerization programmes see the following:

Australia:
http://www.unesco.org/bangkok/education/ict/ict_enabling/files/Australia_ICT_Report.doc
Belgium:
http://www.ond.vlaanderen.be/ict/english.htm
Canada:
http://cfs-ope.ic.gc.ca/default.asp?lang=en&id=6
Denmark:
http://uvm.mondosearch.dk/cgi-bin/MsmGo.exe?grab_id=16494122&EXTRA_ARG=&CFGNAME=MssFindDA%2Ecfg&host_id=5&page_id=10265&query=ICT+and+education&hiword=ICT+EDUCATION+
Finland:
http://www.minedu.fi/julkaisut/information/englishU/2/index.html
Great Britain:
http://www.dfes.gov.uk/ictinschools/
http://www.dfes.gov.uk/ictinschools/pcab.shtml
http://www.number-10.gov.uk/output/page1019.asp
http://www.curriculumonline.gov.uk/Curriculum%20OnLine/default.htm
Ireland:

http://www.education.ie/home/home.jsp?maincat=10866&category=11076&feature=bodies&sectionpage=11888&language=EN&link=link001&page=2&doc=10599
http://www.education.ie/home/home.jsp?maincat=&category=11076&feature=Introduction&sectionpage=12251&language=EN&link=link001&page=1&doc=11266
Scotland:
http://www.ngflscotland.org.uk/aboutngfl.asp

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PEDRO ROBERTO JACOBI

DIGITAL INCLUSION IN BRAZIL

Challenge to implement Information and Communication Technology initiatives to increase access and connectivity in an unequal society[1]

Abstract. Given the central role of information and communication technologies in contemporary societies, social entrepreneurial initiatives such as the one discussed in this paper are playing a crucial role in unleashing the full impact of the digital revolution in Brazil. Digital inclusion is becoming an increasingly important issue and the need to construct a knowledge-creating public-space represents a major challenge if ICT access is to be provided to the excluded sectors of our population. The existing inequality in access to computers in Brazil reflects a form of social apartheid, and private initiatives that strive for technological inclusion are making all the difference in the complex process of creating equity in our society.

EDUCATION AND EQUITY IN LATIN AMERICA

Education is increasingly seen as a fundamental reference for economic development and competitiveness in the present context of globalization. It is generally accepted that education has become a strategic component for sustainable and equitable development and a means of reducing inequalities. The reason underlying this argument is that the expansion of education will create more highly qualified individuals that will have more possibilities to overcome the lack of equity in integrating society.

Major efforts are being made to increase school enrolment in Latin America, a trend that is reflected in the increase in numbers of children attending primary school and, at a slower pace, secondary school, as well as a subsequent decrease in illiteracy However, there are still some very complex problems to be overcome. Governments at the national and regional level are deeply concerned by aspects related to drop-outs, the repeating of grades and, more generally, the quality of education. As an example in regards to drop-out rates, most children begin primary school but, according to national data, fewer than half complete the schooling process. This becomes much worse in secondary school. The repeating of classes is another area of great concern for Latin American educational authorities, as the rate is one of the highest in the developing world. Estimates indicate that while students in Latin America remain in primary school on average for almost seven years, they only manage to complete four years of the primary school programme.

When figures are broken down by social strata, drop-out and class-repeating rates vary significantly, and are indicative of the levels of poverty and the pattern of social inequalities of the region. The trend has been that, although children from

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poor families are able to enter the educational system, their chance of completing their studies is totally dependent on their socio-economic situation. The reality of the situation is that the educational system does not fulfil the expectations of generating upward mobility. But it is also important to mention that the issue of quality of education plays a very important role. Concern about this issue is significantly linked to the lack of correspondence between school learning and the demands of today's technological and informational era, and also the inefficiency of instructional methods used.

The need to overcome these problems underlines the importance of giving high priority to investments in education – in terms of both human and social capital – in order to decrease the levels of social inequity and allow all citizens to attain full citizenship.

EDUCATION AND EQUITY IN BRAZIL

In light of this context, Brazil is in a very challenging situation as it has to continue its drive for universal basic education and simultaneously raise the quality of teaching provided by public schools, which account for 92% of enrolments in primary education and 81% of enrolments at the secondary level. Out of Brazil's total population of 160 million inhabitants, 31 million are enrolled in state-run primary education institutions and 6 million in secondary education institutions. The rate of total illiteracy is 13% and functional illiteracy stands at 29%. Brazil invests 4.6% of its GNP in education, most of the resources being invested in basic education. The average investment per student in primary education is $275, representing approximately one fourth of the investment in OCDE countries. At the secondary level the investment per student is $375, representing one fifth of average investment in OCDE countries.

Despite the increased access to education, Brazil's educational system is pyramidal since only a small proportion of each age cohort manages to complete the basic education courses. An example of this is that only about 30% of 15-17 years old are enrolled in secondary education (MEC, 2000). According to government data (MEC, 2001), the rate of grade repetition is 21.6% at the primary level and 18% at the secondary level. The average number of years of study completed by a Brazilian is, according to the national Census Bureau (IBGE, 1999), 5.7 years.

Only one in four young Brazilians reach secondary education at an age considered as suitable. This gives rise to a very complex problem, which has also to be characterized by the regional differences that aggravate the picture. Efforts to change the educational profile are based on moves to universalize primary education and, to a lesser degree, to increase attendance at the other levels of education. The fact is that primary education is, practically speaking, no longer a problem of democratization of access with certain deficits in specific parts of the country, but basically a challenge to offer an education that meets minimum standards of quality.

Through the implementation of systematic monitoring of the educational system that is carried out annually by means of a School Census and biannually through a National System of Evaluation of Basic Education (SAEB), the government has now

gathered sufficient data on the capacity of the network and the level of quality. The main objective is to promote regular school attendance of students using methods ranging from the improvement of the physical facilities of the school system to the eradication of grade repetition and dropping-out.

The concern of the national government is to identify the causes of repetition and to understand the consequences of age gaps between students, lower performance levels and school failure, which are all factors that have led the educational system to develop programs intended to correct the school flow. Despite efforts to reduce age gaps between students, more than 50% of students in public primary schools are at least one year behind in their schooling. Correcting the school flow by systematically decreasing failure and drop-out rates and increasing pass rates has resulted in an increased number of students completing primary education. The most recent data shows that the failure rate is 12% and the drop-out rate 11%, with significant regional differences between the wealthier Center South and the poorer Northeast and Northern regions of the country[2].

BRAZIL AND THE CHALLENGE TO ENTER A KNOWLEDGE-BASED SOCIETY

Within this context of inequity, social exclusion and poor educational standards, the challenge is to develop abilities, basic skills and knowledge as an essential means of developing a knowledge-based and more equitable society.

Although there is an increasing consensus about the potential contribution to social development that can be made by Information and Communication Technologies (ICT) in Education (UNESCO, 2000), there are structural constraints that significantly reduce the possibilities of implementing ICT in primary and secondary schools in Brazil. The main concerns are with the existing digital divide, and the challenge is to increase the role of the state and NGOs in the development of new policies to democratize access (Afonso, 2000) to the benefits of the knowledge-based society. Insertion in this global process is a determining factor for the labour market and income generation, for education and the challenges of a real digital revolution that implies qualifying a large number of people to engage effectively in the range of activities demanded. Given the structural educational indicators shown above, the possibilities for a large part of Brazilian society to develop culturally, socially and economically are directly related to the levels of information and knowledge that are disseminated within it. Hence, the larger the social exclusion of a society, the more important it is to deal with informational exclusion.

Brazil's situation in terms of Internet use reflects the enormous process of exclusion and social inequality. Of the total 6,000 municipalities, less than 300 (less than 6%) are provided with the minimal infrastructure necessary to install local services with access to Internet. Less than 3% of the Brazilian population has access to Internet, and Brazil is by the far the worst situated in terms of the number of per capita users of personal computers, telephone lines and Internet hosts within the strongest nine economies of the world (Afonso, 2000, pp.3). The country lacks a definition on a national scale to implement effective and broad mechanisms that can democratize access, such as telecenters in regions, cities and neighbourhoods with

less resources, a massive network of interconnected public schools, basic training programs, research on alternatives for connecting at low cost, etc.

The possibility to establish partnerships with civil society organizations and the business community opens a broad range of opportunities to improve digital inclusion and enlarge equity of learning opportunities. Digital inclusion is the contrary to Digital Gap/Digital Divide. It implies a proactive formulation of proposals that aggregate initiatives to include larger sectors of the population that are currently not connected to knowledge-based networks, nor have access to languages, capacities and equipment for ICT integration. The aim is to provide regular access to equipment that enables the existence of these technologies.

The next question is: Digital Inclusion for what purpose? Most of the initiatives and thoughts on this theme are centred on the economic dimension, and to "Include Digitally" implies qualifying professionally or opening more chances in the labour market, or even fostering the development of small businesses. Our point of view is that the most successful experiences of Digital Inclusion are those that generate an impact on the instrumental capacity of the different social groups by reducing differences in communicative capacity and in the processing of information and knowledge, mainly for those that are generally excluded socially and economically.

Implementing initiatives to promote Digital Inclusion – the role of NGOs in dealing with equity and learning opportunities

The notorious social inequalities in Brazil are being confronted by some very challenging initiatives developed by civil society organizations. One of these is the Committee for Democracy in Information Technology (CDI) in Rio de Janeiro. This non-governmental, non-profit organization was created in 1995 and focuses its activities on teaching computer skills and citizenship to the socially excluded sectors of Brazilian society. Its main goal is to promote digital inclusion. To realize this goal, the CDI is pioneering work with low-income communities, sectors of the population excluded from the digital era because of physical and mental disabilities, and socially underprivileged minority communities – adolescents at risk, prisoners, street children, indigenous people and African Brazilians. The main challenge is to promote information technology as a means to social development, making it accessible to sectors of society with hardly any possibility of acquiring it otherwise.

CDI considers technological inclusion as part of a process to provide greater access opportunities to the new digital communication technologies. Its program is articulated with practices to strengthen notions of citizenship and human rights and promote social empowerment within communities, the premise being that through the development of partnerships it may be able to help integrate those excluded from the digital era. Due to the central role that information and communication technologies play in contemporary societies, experiences such as that of CDI are particularly important in opening new perspectives on human relations. The experience of CDI indicates that digital contact can create bridges across social and physical frontiers, at the same time providing a means of confronting technological segregation, increasing solidarity, building new alliances, and gradually constituting

a digital community between the excluded integrating various processes for re-socialization and enlargement of citizenship.

CDI develops educational and vocational programs by creating computer training schools in community-based organizations that are capable of organizing their own educational programs and adhering to the CDI model-concept. The instigator of this initiative is an IT teacher who decided to create conditions to offer slum dwellers access to and use of computers. The idea was first implemented through the collection of used computers and their installation in low-income communities. However, because many of these computers were in bad shape – in fact, technological trash – this generated the need for volunteers to repair these computers. The initiative succeeded well because it mobilized people, but one link was missing: the pedagogical component. Although the communities concerned noted that the donations were having a positive impact, there was a feeling that the project would be much more productive if it were accompanied by pedagogical practices that could promote real changes within the universe of the excluded, and more particularly the digitally excluded. This gave rise to the idea of creating Information Technology and Citizenship Schools (EIC), and in 1995 the first school was created in one of the largest slums of Rio de Janeiro. That same year the Committee was created to provide support for setting up other schools. This was the beginning of the trajectory of CDI, and a noteworthy example of social entrepreneurship based on the premise that investing in this type of school is every bit as important as investing in the capacity of the communities. It creates opportunities for children and youths, many of whom are at social risk, and provides access that their families and community previously did not have.

The project was basically founded on two central points of focus – access to informatics and to citizenship – but it was also important that it refused tutelage and stimulated co-responsibility and empowerment. All schools are self-sustainable and self-administered, and CDI trains community members in computer and Internet skills during intensive three-month courses. Communities wishing to open a school must abide with CDI's rigorous process to ensure that the schools are autonomous once CDI has helped them to implement the program. To develop a CDI partner school, a community must identify the local demand, a coordinating committee and future instructors, as well as a location and security measures for computers. Over the course of 3-6 months, CDI trains the instructors, works with the school to seek an initial hardware donation, and helps the school to install the computers. It also serves as a resource-center to schools for questions in relation to developing and running a self-sufficient training center.

Once a school has been established, CDI serves as a partner-consultant but does not manage the school activities; it does, however, maintain contact with all partner schools and regularly offers technical, pedagogical and administrative assistance, as well as new instructor-training classes. Most schools maintain a fee of $4 for the students, half of this covering administrative costs and the other half paying the instructors. Some schools are maintained by foundations and philanthropic institutions. The EICs, which offer training in basic software packages such as Word and Excel, are designed to maximize opportunities in the job market. Students are in

turn encouraged to support each other as well as underprivileged individuals back in their communities, assisting them to develop their professional profile and opening up a wide variety of new sources of information and social opportunities for the community, thereby accomplishing the socio-educational initiatives of the program. The schools are organized to function six hours daily, five days a week, with a capacity to work with 100 students. Each group of students attends class three hours per week.

The success of this model-concept has stimulated people in other Brazilian states to establish local projects for the democratization of information and technology. This has led to groups of volunteers establishing regional CDIs, each basically comprising four "catalysers" – an experienced person with a sound knowledge of community organizations and/or non-governmental organizations in order to develop partnerships; a software and hardware technician to set-up and install donated computers; a person with a pedagogical background and experience in information technology who can train future EIC instructors; a person to organize equipment donation campaigns and to contact local businesses and institutions. Professional staff trained at CDI's main offices in Rio de Janeiro are responsible for evaluating the groups wishing to set up new regional offices in Brazil, supporting the development of new channels of communication, distributing educational materials, and conducting national fundraising and equipment donation campaigns to benefit the CDI network. The model-concept is thus based on what its main conceiver Rodrigo Baggio[3] calls an "open social franchise" that is already being shared with other countries facing similar social conditions.

The numbers are impressive and reflect the reach CDI has developed in its short existence. There are currently 33 regional CDIs and 285 EICs in 33 Brazilian cities and 17 Brazilian states, and since its inception 86,500 children and young people have been trained in basic computer literacy. CDIs exist in six countries[4] and there are 24 EICs in operation abroad. CDI obtains financial resources for the development of its activities through partnerships with the government, the private sector and philanthropic organizations[5].

Besides the work with low-income communities in poor neighborhoods and squatter settlements, CDI has opened schools in psychiatric institutions and prisons and is working with indigenous groups. The work with psychiatric institutions has enabled the reintegration into society of mentally disabled persons through ICT. The program also provides a source of income for interns who become the instructors of their fellow colleagues. This opens up new opportunities for patients to build self-esteem and regain civil rights by becoming aware of their productive capability and, at least to some extent, surmounting their social condition. In prisons, the computer course has motivated certain inmates to get back to formal education and is thus helping to reduce illiteracy rates[6], at the same time creating greater motivation for inmates to improve their daily lives and raise their expectations.

The learning process – targets and limits

While establishing an alliance between informatics and education, self-sustainability and self-management, the model-concept articulates three factors – differentiated social actors, equipment and pedagogical processes. This is characterized by a working process that stimulates and depends significantly on volunteers, but also searches the means to professionalize the knowledge multipliers in the communities and in the different possibilities that are being opened.

The existing pedagogical proposal was formulated jointly by the Center of Informatics Applied to Education at the State University of Campinas (State of Sao Paulo) and the CDI staff. It is based on a project-type pedagogy focusing on the valorisation of participative action in the teaching-learning process, and making the educators as well as the students responsible for the elaboration and development of each project. This basically signifies that the project should contribute to making learning spaces more meaningful for individuals, enable them to learn in an active, reflexive and participative manner, and increase their motivation to bring about changes in their local social reality. This implies a learning process that effectively engages students in a pedagogical process that stimulates the understanding and redemption of their life experience, the search for answers and a commitment to resolving the problems that are part of their daily reality of social exclusion. The opportunity to make qualitative changes in their life experience is vital to the process, and is associated with the need to articulate their lives with informatics and computational tools.

The underlying objective is that instructors stimulate activities that make communities reflect more deeply on their citizenship through the use of informatics, and the challenge is to break a paradigm that associates access to technological knowledge only with professional occupations. It aims at increasing the value accorded to knowledge by simultaneously working on themes of citizenship and civil and human rights in light of the students' own situations of social exclusion. The choice of local instructors greatly enhances the educational process. Through the use of a project-based pedagogy focusing on research themes relevant to their own experiences, learners become more critical, reflexive and conscious of existing problems. At the same time they learn how to gather information, anticipate and discuss alternatives on issues such as environment, racism, sexuality, health, violence, drugs, poverty, living conditions, etc.

When working within the real-life context of the students, raising problems and proposing solutions that are meaningful to them, real possibilities are opened not just to learn computer tools but also to learn about citizenship, to stimulate collective practices. For instance, during a class on the WORD language, students can be stimulated to produce a local newspaper. This example shows the range of possibilities available to fertilize the process and use tools to formulate contents that can be incorporated into the group activity to open new and different knowledge horizons. The most important moment in the work of the group is defining a project and its dynamics within the group, because when the group decides on the theme to be studied more in depth it uses basic reading material that will standardize knowledge and stimulate activities that strengthen solidarity.

The great challenge is to assure the expansion of this model-concept while maintaining quality and continually striving to improve pedagogical instruments and material, to improve the social franchise through the support of consultants and partners, and to enlarge the connection between schools, thus incrementing networking and links to Internet. One of the main limitations is the reduced access of communities to the web, and this represents a digital divide. Increased access to Internet opens access to a new learning space where participants can exercise a new form of citizenship – a digital citizenship – and where the participation of more individuals can be stimulated, where cultural diversities can play a meaningful role.

CONCLUDING REMARKS

The CDI experience represents a process which, although it cannot overcome the prevailing social inequalities in Brazilian society, does open up new possibilities to multiply social entrepreneurship initiatives that benefit a broad sector of the population and promote through digital contact "new tracks of citizenship".
We understand that as more doors of social and digital inclusion are opened through initiatives such as that of the CDI and other experiences in Brazil, the themes of education for citizenship can be turned into vectors for increasing consciousness of rights and responsibilities, and providing greater access to information and communication for the more excluded groups of society. This in turn implies more possibilities for reducing inequities and reinforcing practices linked to citizenship.

Other existing innovative experiences focus largely on the networking process through the implementation of telecenters[7] articulating a public network of communication and information technology linked to Internet. Several initiatives are being implemented, with the basic premise being to teach the technologically poorest sectors of society to read and write, thereby opening new opportunities of access to education, culture, work and income generation in the aim of enlarging the active participation of citizens through broader access to information. These are part of a broader public policy defined to improve digital inclusion, through activities ranging from the implementation of telecenters to the use of digital inclusion programs to stimulate the cognitive development of children and youth and promote popular participation and democratization of society.

It is important to stress that thinking "digital inclusion" in the scope of formal education represents an enormous challenge, considering the broad variety of actors involved: teachers, students, specialists and communities. Digital inclusion is not only the learning of informatics in school. It basically involves the integration of ICTs in the process of knowledge construction through access, collaboration, communication, representation and authorship, thus enabling the creation of a knowledge-oriented public space within an asymmetric society such as ours in Brazil.

NOTES

[1] This paper is based on the Working Paper written by Pedro Jacobi (June 2001). Committee for Democracy and Information Technology (CDI) – commitment, creativity, audacity and social articulation to confront digital exclusion. São Paulo.

[2] While the failure rate in the Southeast is 7%, in the Northeast it stands at 15.5%, and the drop-outs rates range from 5.9% to 17%. (MEC, 2000).

[3] His social entrepreneurship attitude was strengthened by support from the Ashoka Foundation in 1997 in the form of a grant. This allowed him to focus full-time on building CDI and expanding his model.

[4] Mexico, Japan, Chile, USA, Colombia, Uruguay.

[5] Partners include the Brazilian Social Development Bank, Microsoft Corporation, Ashoka Foundation, Xerox, Exxon, Starmedia Foundation, IBM, Avina Foundation and theKellog Foundation.

[6] The initiative in prisons is very challenging because Brazil's penitentiary system is renown for serious problems of overcrowding and lack of educational and occupational activities. These create tensions that have very often turned into acts of violence.

[7] This is the case of the Project Sampa.Org, coordinated by the NGO of the same name in São Paulo – an open initiative to enlarge active citizenship through the democratization of access to knowledge and information through telecenters. The site Sampa.Org is the main reference, oriented for public participation and dialogue with users.

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WIKTOR KULERSKI & TERRY RYAN

TOWARDS A NEW CANON IN EDUCATION

Abstract. The history of education has been driven by a value system based on the centrality of Man. Education has been the most anthropocentric of all enterprises and its interests – family, school, church, businesses and state – have determined educational goals from the very beginning. It is true that educational means, methods and organization have changed over the years, but the process has always been secondary to the goals derived from our anthropocentric values. It appears that the power of information communication technologies will also operate firmly within our pre-existing values. Yet, should this be the case? This chapter examines these issues so as to include ecological and human rights and responsibilities in a vision of a sustainable future that transcends the purely functional aspects of education.

INTRODUCTION

The civilizations that have dominated the World have all been based on the words written down thousands of years ago in the Old Testament of the Holy Bible: "Be fruitful, and multiply, and replenish the Earth, and subdue it" (Gen. 1,28). In line with this logic the rich countries of the West have used the fruits of the revolution in ICTs[1] to "to create more and more." In many countries policymakers and academics speak of the dawning of a New Economy driven by the power of new technologies.

In a speech delivered in May 2000, then US Treasury Secretary Lawrence Summers reflected on what people are calling the New Economy. "The notion is 'both palpable and amorphous – more often declared than defined," he said. "But if there is one fundamental change at its heart, it must be the move from an economy based on the production of physical goods to an economy based on the production and application of knowledge."

The New Economy, Summers said, seems to behave differently from the agricultural and industrial economies of earlier eras. "Consider the classic Smithian model of wheat: when prices rise, farmers produce more, consumers buy less, and equilibrium is restored at a lower level of demand." This classic model of economics, Summers said, is a "negative-feedback" economy – one that is bounded by near-term constraints of supply and demand. An analogy, he suggested, might be a thermostat, which will shut down the furnace when your house overheats (Rausch, 2001).

"By contrast," Summers observed, "the information economy will increasingly be a positive-feedback economy." In the traditional economy, new technologies and products start out expensive and rare and only gradually become cheap and

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common: think of refrigeration, the automobile, the long-distance call. In the New Economy, additional capacity seems to become available so quickly and inexpensively (think of the microchip) that traditional supply constraints are almost trivial. "*In such a world*," Summers said, "*the avalanche, rather than the thermostat, becomes the more attractive metaphor for economic policy*" (Rausch, 2001).

In this scenario the use of ICTs are central in making it cheaper and more efficient to produce more and more goods and services. In fact, we now live in an avalanche of material goods and services. Nowhere is this avalanche greater than in the production and dissemination of information. Increasingly, it seems the test of a successful education is whether or not a person can actually tell the difference between useful information and white noise which is little more than trash.

In parallel with the logic of the New Economy, within the realm of education in countries across the Western world, investment in ICTs is being made to improve the productivity of the teaching and learning process. For example, "*over the OECD as a whole, approximately $16 billion is invested annually… In the United States, more is now spent on ICT in schools than on books and other printed materials*" (OECD, 2000). Those with access to the new technologies are now in a position to have vast quantities of information from around the world at their fingertips. Yet, information is not the same thing as knowledge, and it is a far cry from wisdom.

The cognitive scientists John Seely Brown and Paul Duguid demonstrate in *The Social Life of Information* that:

> *Information on its own is not enough to produce actionable knowledge… Looking beyond information, as we have tried to do, provides a richer picture of learning. Learning is usually treated as a supply-side matter, thought to follow teaching, training, or information delivery. But learning is much more demand driven. People learn in response to need. When people cannot see the need for what's being taught, they ignore it, reject it, or fail to assimilate it in any meaningful way. Conversely, when they have a need, then, if the resources for learning are available, people learn effectively and quickly.*
>
> (Seely Brown & Duguid, 2000)

Seely Brown and Duguid go on to explain that their years of work with the Xerox Palo Alto Research Center (PARC) has demonstrated that for people to effectively distil information into useful knowledge requires a community of practice. They note that learning is a remarkably social process when they write:

> *Learning needs to be understood in relation to the development of human identity. In learning to be, in becoming a member of a community of practice, an individual is developing a social identity. In turn, the identity they are developing determines what they pay attention to and what they learn. What people learn about, then, is always refracted through who they are and what they are learning to be.*

The social context in which children acquire information is critical to the way in which they construct knowledge and ultimately make sense of their world.

The goals behind education play a large part in the setting of the social context for learning. Traditionally the purpose of education has fluctuated somewhere

between two visions. The first, which dominated educational practice throughout the 20th century, sees education as being about shaping the minds of young people to fit the political needs of the nation-state and the economy. Proponents of this view act as if children's minds are empty vessels waiting to be stuffed with the knowledge and skills society values. The teacher plays the role of specialist whose job it is to fill children up with the academic content they need to function as good citizens and productive workers. In this view, external motivation is central to student learning, and appropriate testing and rewards are of the utmost importance.

Therefore, the curriculum is designed around the testing regime in which it is answerable, and a successful teacher is one who adequately prepares all her students to excel at answering tests on a standardized multiple choice exams. It is a classic input-output model of learning that would resonate with a behaviorist view of learning. For students, being able to recall information is central to the educational process. Rote learning is at the forefront, and this encourages a teacher-centered model of learning. Knowledge is seen as passing smoothly and evenly from the teacher to all learners.

By contrast with the more traditional view of instruction as a process involving the transmission of facts from an active teacher to a passive student, constructivists believe that learning occurs through a process in which the student plays an active role in constructing knowledge and understanding. Constructivist learning is knowledge dependent, with learners using current knowledge to construct new knowledge. We neither see nor hear something in a totally objective form, but rather our receptive processes are colored by all those environmental stimuli that have captured our interest in the past. Inherent to such thinking about the nature of human uniqueness is the acceptance of children being born with differing traits and predispositions.

From this perspective, children's learning is as personal as their fingerprints and this fact calls for teaching that focuses on the individual strengths and weaknesses of each child. With a constructivist form of learning, each child structures his or her own knowledge of the world into a unique pattern, connecting each new fact, experience or understanding in a subjective way that binds the child into rational and meaningful relationships to the wider world. Constructivists believe that an educational approach that simply serves information and expects individuals to memorize and regurgitate it on demand is inconsistent with how the human brain actually works. The idea that the human brain is an active, sense-making entity has influenced how ICTs have been put into practice in some schools around the world, but in far too many places the technology is simply being used to facilitate the traditional classroom practices of teachers and school timetables.

Despite the efforts of innovative educators in various countries, most of what goes on in education is still driven by the belief that learning is the direct result of receiving information, and the purpose of education is to prepare young people for individual success at all costs. This issue of education is what was broached recently in a Polish Catholic weekly when it observed, "Today our vision of the World sees the apex of creation in a mankind that is falling apart, and what's more – everything in this World is subjected to him. Today we see the World as one harmonious entity,

where everything we have is needed and where everything has its place. We are moving away from the view that only the human soul is immortal." The title of the article is insightful: "So Earth Does Not Become a Desert" (Musial, 2001).

As more scientific evidence emerges about the impact human activity is having on the natural environment it seems clear that the goals of education now need to go beyond that of simply talking about "what's in the best interest of man." Until very recently, man was not a threat to nature. Nature seemed vast and man seemed small. Humans were able to focus solely on their existence while nature played a subservient role – it was a resource to be worked with by the farmer, the fisherman, the miner, as well as the poet or the artist.

Through continuous technological progress we have slowly created a global civilization that threatens to devour nature as a parasite devours its host. We are, for the first time in human history, a threat to the survival of the planet. Education has, and in fact always had, a great influence on our relationship to nature. A central principle driving education has been the success of individuals and societies – it did not matter whether this success was material, earthly or everlasting. Any sort of human gain was always considered a success. This, we can now see, is a somewhat shortsighted view. The gains we have made came through the exploitation of skill, knowledge, experience, technology, and nature.

It is potentially to our detriment that, despite our many cultural and technological advances, the human race has never been able to grow beyond its childhood years and achieve full maturity. A maturity that would enable us to derive satisfaction from giving, deferring and service rather than taking, possessing, or ruling. This type of maturity is marked with responsibility and care for our surroundings. This care is greater than the care we have for ourselves.

The desire for material success did (and still does) make us blind to its unintended consequences. This is unfortunate because the damage we cause to the environment will eventually come back to haunt us. Increasingly, it seems we are in the midst of a crisis caused by our inability to see beyond the immediate here and now. The biologist Paul Ehrlich (2000) puts the essence of this crisis into context when he warns, "*The increasing human ability to do things has outstripped the evolution of our ability to understand both what we should be doing and the full implications of what we are now doing*." It appears we humans have trouble seeing beyond ourselves. The cost of environmental degradation – and this has certainly been the case in the most polluted parts of Poland left over by communism – will be paid by future generations.

The overwhelming technological developments of the recent past have enlarged the scale of human possibilities to a degree beyond our imagination and responsibility. Those who control vast oil fields or navigate huge oil tankers operate at the same level of thinking that our ancestors who harvested trees for heat or construction materials did. Similarly, the mentality of modern day terrorists and murderers is no different to the mentality that drove biblical invaders and thieves. The pronouns "I," or at most "we," always come first. The differences are in the tools, their efficiency and the consequences of their application or misapplication.

The social philosopher Neil Postman (1992) makes it clear in his various commentaries on education that technology is a double-edged sword, and that those of us involved in working with children need to wield it wisely. Education, he warns, is far more important than simply giving children the skills they need to be economically successful in a technologically advanced society. Postman captures a deeper meaning for education when he reasons that, "*Perhaps the most important contribution schools can make to the education of our youth is to give them a sense of coherence in their studies, a sense of purpose and interconnectedness in what they learn*." We must ask ourselves what the purpose of education is and, when we have done so, then we can best decide how information and communication technologies should be used to achieve the goals we seek.

The use of information communication technologies by students, and the concept of life-long learning, are ideas that seek to respond to the needs dictated by civilization's advances in the area of technology. Ecology, on the other hand, seems to require something more – attitudes and behaviors that are the result of the internalization of certain values about responsible behavior. And here, early years education is essential. About 80 percent of the impact education has on a person is in their first decade of life. This is when education influence things like core values and mind-sets. And this is something few education systems fully realize or take advantage of. Despite our many technological and cultural advances we all too often see education as little more than imparting the knowledge and skills necessary for children to build a world around their own narrow self-interests. In an increasingly interdependent and fragile world is this going to be enough?

If we accept the premise that the goal of education is to help us go beyond ourselves, then values and educational progress should become our primary focus. Perhaps it is time that we revise and reorient the first principles behind education. We may have to look at ourselves and ask the risky question: "Should we consider the interests of nature and our ecology as equal, or even superior, to those of ourselves?" Is it now time to dethrone man and stop discriminating against nature? Is it now time to seek an equality of rights between man and nature? How numerous the consequences, and possibly dangerous the answers to such questions might be? But what will be the consequences of the status quo?

The United Nations General Assembly accepted the Declaration of Human Rights over half a century ago. Despite the fact that the Declaration was never made available to teachers in communist Poland, some teachers were able get copies of it on their own and they used it as their educational compass. After the Solidarity Revolution in 1989, the first non-communist Parliament in Poland made reference to the Declaration at the very beginning of their efforts to reform the Polish system of education.

Since that time, the Declaration's wisdom has been used to influence official educational policy across Poland, although it is still rarely read by teachers or students. Doesn't the Declaration of Human Rights deserve to have a sister document, namely a Declaration of Human Responsibilities towards Nature and Ecology? Would it not be wise for both of these documents to be the basis of a new

educational canon leading to the development of a new set of values which would, in turn, determine new goals for education?

Thanks to the Declaration of Human Rights a Tribunal was set-up in The Hague over half a century ago to hear cases against humanity. The Declaration provided the moral justification for the West's intervention in the massacre of innocent civilians in the Balkans. This was a first in human history. It is certain that a lot more time is needed before we see these types of interventions, or the Hague Tribunal itself, as a truly universal good. Education could play a larger role in helping children understand the values articulated in the Declaration of Human Rights than it does at the present time.

However, if we seek both justice and the sustainability of our planet then it seems that we must go even further than the Declaration of Human Rights. As humanity has benefited by trying to live under the ideals expressed in the Declaration of Human Rights, so we would benefit by seeking to live under the values of a Declaration of Human Responsibilities to Nature and Ecology. These two documents should become the canon behind education around the World.

An education system based on respect for ecology and human rights would not produce an immediate effect. On the contrary, they require work and efforts that will pay dividends in the future. It is for this reason that such values remain largely outside the focus of not only political and economic decision makers, but also outside the focus of most citizens and educators. If education is to work towards the protection of human rights and the planet, then the international community will have to give impetus to the cause. A dialogue around such issues, which is the first step towards a better future, would enable us to determine, anew, what values should be observed and what goals should be pursued.

A central theme for such an international dialogue could be the relationship of constructivist learning to education for humane self-direction and the rights of nature. These concepts are not in opposition to each other. Rather, they have the potential to work as interlocking concepts. Immanuel Kant, the 18th century philosopher who argued for the rights of man and the supremacy of international law over state power, understood that "thoughts without content are empty, intuitions without concepts are blind." By this Kant meant that to make sense of the world people put new ideas into pre-existing intellectual frameworks.

Kant insisted that "we do not just make lots of particular judgments about the world; we try to integrate all these bits of knowledge into a unified system. We often want to know not merely what is the case but why it is so; we try to explain one fact in terms of others" (Stevenson & Haberman, 1998). For Kant, people relate to new ideas by putting them into the context of earlier understanding and insights. Kant, 200 years before the emergence of cognitive science, captured the essence of constructivism when he noted the centrality of context in learning. Kant sought to use his view that humans learn by making connections to convince his contemporaries that, like ideas, all people should be united under a general theory of law. We are all connected.

By the middle part of the 20th century, philosophers and an increasing number of scientists began to argue that people needed to see themselves as not only connected

to all of humanity but to the planet itself. The German philosopher and Nobel laureate Albert Schweitzer reasoned that people should develop a philosophy based on what he termed "reverence for life," embracing with compassion all forms of life. Schweitzer believed the rights of nature do not have to come at the expense of humans. In fact they are supportive of one another and interconnected. This is a theme that was well described decades before by the Native American Chief Seattle when he stated in the 19th century: This we know. All things are connected like the blood that unites one family…

> *Whatever befalls the earth, befalls the sons and daughters of the earth. Man did not weave the web of life; he is merely a strand in it. Whatever he does to the web, he does to himself.* (quoted in Capra, 1996)

It is towards this larger interconnected sense that we should try to channel the use of information and communication technologies in education. At their very best, ICTs break down barriers to the cross-fertilization of ideas. The most successful use of technology in classrooms, at least among adolescents and older students, facilitates an interdisciplinary approach to learning. In short, these technologies have the power to help young people see new relationships between themselves and the world of which they are a part. Children, through the Web, are increasingly witnesses to the interconnected nature of knowledge. For example, anyone who does a Web search on global warming or environmental change will quickly discover that these issues are defined by a powerful synthesis of scientific evidence from a number of disciplines as diverse as climatology, archeology and epidemiology.

Yet, it is important to point out, children need help in understanding not only the content of different disciplines but how these concepts can come together into a whole. Traditionally, academic thinking has held that any complex set of phenomena or patterns of behavior can be defined or explained by breaking them down into their constituent parts. For example, the activities of nations could be understood in terms of the behavior of individual leaders. However, it is now clear to scholars in a range of fields that this reductionist approach to understanding is far too simplistic to explain most phenomena and behavior. Ultimately, for education to help young people respect both human rights and the rights of nature, it requires schools to help students see how important concepts from different disciplines come together to make a coherent whole. Education needs to move beyond analysis towards synthesis.

At a policy level this would require the setting of an educational agenda that put the interest of the national environment on par with more traditional economic, political and social issues. It is necessary to see these issues as equal in significance and interconnected. Few governments can politically set an agenda that touches on such contentious issues on their own so we advocate following the United Nations effort at issuing the Declaration of Human Rights following the Second World War. This could be achieved, for example, by adding an educational component to the United Nations Framework on Climate Change. At the national and local levels the current expenditures in money and professional expertise being invested on the infusion of technology into the classroom could also be used to get educators,

students and the general public to ask themselves what the ultimate goal of their investment in all this technology really is. In far too many cases governments have simply invested in technology and put it into a classroom for teachers and students to figure out what to do with it on their own, and in a few cases some do a phenomenal job of putting the technology to use.

But the evidence on effective use of ICTs in schools and businesses shows success is usually the result of a plan, solid leadership, and programs for staff development. A key component of such teacher development programs should be an introduction into the relationship of human learning to human rights and to the rights of nature. These programs could be based on the experiences of foundations in East-Central Europe that have worked with teachers and students at the grassroots level across many countries to develop and support the strengthening of civil society. In summary, there needs to be a two-pronged approach to the effort – 1) the setting of the agenda at the international level, and 2) the sharing of the agenda at the grassroots level. All of this could be facilitated by the use of ICTs in classrooms. It is just this sort of model for social change that has been used to build respect for international law and human rights over the past 50 years. It is now appropriate to use this model to strengthen respect for the natural environment as well.

NOTES

[1] By ICTs we mean computers and related pieces of equipment that are networked through the Internet and the World Wide Web. Yet, it should be noted that we recognize the values of books, videos and old-fashioned radio in facilitating student learning.

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PART FOUR

THE HERETIC

Had there been a computer a hundred years ago, it would probably have predicted that by now there would be so many horse-drawn vehicles it would be impossible to clear up all the manure.

K. William Kapp

JIM DATOR

VISIONS, VALUES, TECHNOLOGIES AND SCHOOLS

Abstract. How can visions be used to guide the use of emerging instructional technologies? What we think we know and value depends in large measure on the models and media we use to apprehend the world. Over the course of human history we have moved from entirely oral models and media to those based on hand writing and for the last several hundred years, on the printing press. Most of the institutions and values of modernity are firmly rooted in print. But modern electronic technologies are sweeping them away. This paper questions the ethics of using values based on old models and media to guide our evolution into cultures shaped by visual, olfactory and tactile images. It explores the differences of response to concepts when apprehended in different media, and how new responses become commonplace. Finally, some recommendations are made concerning the application of visions and values for defining strategies to address future needs.

THE FUNCTION OF EDUCATION AND THE ROLE OF THE TEACHER

I always say, and so I will say again, that the function of education and the role of the teacher are always and everywhere the same. The function of education is to help students acquire the attitudes and skills necessary to become effective members of the future society in which they will live. The role of the teacher is to be a living example of such a person – to model the attitudes and skills necessary to be an effective member of the future society in which the students will live. So, the basic and first question for any teacher, administrator, educational policy maker, or parent should always be: *"What might future society be like? What attitudes and skills should students learn now in order to be effective in their futures?"* (Dator, 1998)

No teacher should dare enter a classroom (or a website); no administrator should place a teacher in a classroom (or authorize a website); no educational policymaker should train a teacher or devise a curriculum (or prepare a website); and no parent should send her child to a school or website until each has done her best to survey the futures of the student, and then trained the teachers, prepared the curricula, and established the support systems relevant to the futures of that student.

Every day of every class should start, not with a prayer or a pledge to allegiance to whatever god or nation is in vogue at the time, but with the question, *"How is what I am about to teach, or to learn, relevant to the futures of those who are about to learn it? And how can I be sure?"*

That is to say we must learn to pledge our allegiance, not only to the past or the present, but also and at least in equal measure to the needs and wants of future generations (Kim & Dator, 1999). We should not continue to teach what has been

A. Aviram and J. Richardson (eds.), Upon What Does the Turtle Stand?, 241–250.

taught in the way it has been taught merely because that is the way we learned it and thus that is the way it is easiest to still teach, but because we have some good reason to believe that what we teach is what one needs to know in his/her future. We need to ask similar questions about what we do *not* teach, and be as certain as we can about why we do not explicitly teach it.

What was necessary to be a successful member of society, and what it has meant to be a teacher, has changed over time as societies have changed. For tens of thousands of years, humans lived in small, homogeneous bands and tribes. All information was transferred by watching and imitating, or by speaking and listening. We still learn best that way. We are biologically programmed to learn by doing. As someone said, *"I hear and I forget; I see and I remember; I do and I understand"*.

Even with the advent of writing, most people continued to learn in this way, by direct experience, but some began to gather around the handful of scholars who owned the few handwritten texts available, to study and copy the information from them. The advent of writing was disastrous for oral societies: disastrous for the information that was important to know, for the old teachers and students, and for the way teaching and learning was carried out. I come from a part of the world, the Pacific Islands, where the memories of what happens when oral societies encounter literate societies is still fresh – and bitterly resented (Finnegan,1982; Goody,1977; Ong, 1982).

With the printing press, we entered again something new. The printing press made it possible for many more people to have access to many more texts and ideas, and the human and social consequences of this were even more extreme. For example, the Roman Catholic Church lost its monopoly on truth, Latin lost its status as a universal language, divine monarchies were overthrown and representative governments, based on written constitutions and laws, were invented (McLuhan, 1962; Eisenstein, 1979; Dator Katsh, 1989). Most importantly, industrialism arose, and the modern school system was created to transform peasants into workers and soldiers, or into managers and generals. Scientific research and technological development became a central part of societies in order to create the guns and goods modern capitalism required (Dator, 1999).

And now we are in the throes of another transformation of and by communication technologies which began first innocently with the telegraph, telephone, and camera, then the radio, and black and white and then colour motion picture, and then first broadcast black and white and then cable colour television, first audio and then videotape, then computers, satellites, networks, electronic memory, the Internet, PDAs, soon we'll have biochips, molecular- and nano-technologies, and teleportation, and then…. Well, the transformation is extremely fast and far from settled (Kull & Halal, 1999; Jossey-Bass, 2000).

In the meantime, the formal education struggles unsuccessfully to keep up. Yet all reforms I know of in the US are ultimately shams. As John Goodlad said after his survey of many attempts at educational reforms: *"'Back to Basics' is where we have always been. My grandmother would be quite at home in any classroom anywhere in the US*" (Goodlad, 1984).

Or as David Snyder put it more recently:

> *In more than a decade and a half since the publication in 1983 of A Nation at Risk (National Commission on Excellence in Education: 1983), no major national reforms have been adopted by US public schools, and there has been no significant improvement in overall student achievement. During that same period of time, major business firms in almost every US industry have 'reinvented' themselves, through delayering, reengineering, disaggregating, and realigning. The leaders of educational reform today, by comparison, have no such widely accepted repertoire of successful reforms – or reformers – to turn to at this moment of accelerating innovation. In fact, there is not yet a consensus among educators that truly transformational change is necessary. Currently, for both K-12 students and for graduates of school of education, the dominant reform activity involves mandating stringent tests of student achievement and teacher competency. The 'standards and accountability' movement is the culmination of this twenty-year sequence of largely ineffective initiatives including the 'back to basics' movement of the early 1980s, through dress codes and school uniforms, site-based management, gender separation, reduced class size, [and] the restoration of corporal punishment.* (Snyder,2000)

Matters recently became significantly worse when George W. Bush, against all sensible advice to the contrary, pushed though Congress during his brief honeymoon period legislation requiring standardized testing by all schools in all states of the union (Alvarez, 2001). The results will certainly be disaster (Henriques & Steinberg, 2001; Schemo, 2001; Wilgoren, 2001; Sacks, 1999).

In other words, we are still simply going back to basics over and over, denying or ignoring the massive changes going on around us (Spady, 1999; Scheffel et al., 2000). Of course, some people count this as good, and proclaim that educational standards in the US are on the rise (NCES, 2000). Given what is also being said (I think accurately) about the "millennial" generation just emerging from high schools in the US (and in many other parts of the world) (Howe & Strauss, 2000), it is highly likely that we will have, over the early part of the 21st Century, a highly-disciplined, hardworking, well-trained, orderly, rule-loving and adhering, highly literate, and comparatively numerous age-cohort entering a world that requires exactly the opposite of the skills and mindsets the 'Millennials' have, preferring instead flexibility, adaptability, risk-taking, visual imaging, adaptability, creativity. Everything this emerging age-cohort does not have. A fun time will be had by all, when the 'Millennials hit' the Blur!

Business and the military are eagerly embracing the new educational media. And there is a lot of talk and writing, and some action, about these media going on in educational circles. The hottest educational item of the last year of the Second Millennium was a statement, widely redistributed, by Arthur Levine, president of Columbia University's Teachers College. Levine recounted a meeting he had with Michael Miliken, the once and future junk bond king. Noting the growing obsolescence of formal education at all levels, Miliken's taunt was, *"You guys are in trouble, and we are going to eat your lunch"* (Wyatt, 1999). Miliken has already created a hungry predator: his "Knowledge University" which intends to invade all educational markets from pre-K to PhD.

If Miliken and all of the many new "edupreneurs" at the Virtual High School (Gould & Ross, 1999; Russell & Holkner, 2000), the University of Phoenix (Padilla,1999), or Jones International University, or Unext (http://www.unext.com), or Cenquest (or at Yale, MIT and Stanford for that matter) have their way, and so far nothing the old establishment in the US is doing seems about to stop them, there will be fewer and fewer public school systems within a few decades. Instead, there will be three kinds of learning delivery systems (Manicas, Neubauer, 2000):

1. A few enormously expensive, prestigious and exclusive campus-based schools which serve to socialize the rich and famous;
2. Thousands of "fast-food" learning outlets, offering "just in time", "performance-based" training at all levels and all subjects, on demand and at bargain prices, mostly over the Internet (and its successors) with the rest available wherever there is a room for rent and an instructor for hire (Harkins & Kubik, 2000);
3. And a few niche, private schools and colleges offering old-fashioned scholarship in the old-fashioned way for those still nostalgic, and able to pay, for it.

With most people teleworking from home, rather than gathering in central urban locations, "home schooling" will become the norm (Lines: 2000). Day and/or night childcare facilities will exist for those who must work outside the home, or whenever parents need to travel, but the educational role of these centres will be minimal – certainly nothing like that of public schools today.

Needless to say, the liberal arts, humanities, and most social sciences will be completely marginal in this environment. Tenure and academic freedom will cease to exist (Dator, 1998). Athletic programs (though the heart and soul of the American educational system now) will be taken over entirely by for-profit organizations (a process also already well underway). In the New Economy of "The Long Blur" (Dator, 2001) where everything is commodified, education becomes just one more utility to be bought and sold on the open market according to the wishes of the highest bidder. That for which there is no demand, there will be no supply.

At least that is ONE alternative future emerging from the ashes of the old liberal welfare state.

MODELS, MEDIA AND KNOWING

Many years ago, I came to realize that what we know and how we know it is completely dependent on the models and media we use to apprehend and communicate the world around us (Dator, 1968). That revelation first came to me as I tried to learn how to observe and then to express political behaviour through mathematical formula, rather than merely in words. Like almost all social scientists of my generation, I had been trained to be a wordsmith. Research meant, to me,

reading lots of books, pulling some good bits from the books, thinking about what I read, and then writing something based on what I read and what I thought.
But I became, for a time, part of that smaller cohort who wanted to develop a real political SCIENCE, based on mathematical formulas, computer models, and statistical inference. I discovered that thinking mathematically was very different from thinking linguistically, and resulted in a very different political science from the one I knew before simply because I was now viewing the world through a different model and medium.

That awareness expanded greatly when I went to Japan, and discovered, while trying to teach political science in Japanese for six years in the College of Law and Politics of Rikkyo University in Tokyo, that I was no longer thinking or behaving as I had before. The more I thought and taught in Japanese the more fundamentally different a person I became simply because the world experienced and expressed through Japanese is different from the world in English.

When I moved from Rikkyo University to Virginia Tech, I became influenced by the British architectural group called Archigram, and I began to try to think about politics as architects and artists think – visually, and often in three-dimensional models. I spent several years trying to develop a political science based entirely on direct observation and three-dimensional models – no words at all.

However, when I went to Hawaii, I was asked to transform some of my classroom courses into television shows. In that process, I soon discovered it was not just a matter of taking the classroom content and videotaping it. I had to rethink everything I had previously done and find new ways to do it, or else not do it at all, while thinking and doing in entirely new ways as well.

Similarly with courses I have taught on radio, or entirely via newspaper or, more recently, on the web: using each new medium to teach my old courses requires each time that I completely rethink what I am doing all over again. The medium IS the message. What you know DOES depend on the models and media you use to perceive and communicate that world. Change your medium and you change your world. And not trivially, but essentially – root and branch, heart and mind, body and soul (McLuhan, 1964).

As Neil Postman mournfully put it:

> *Technological change is not additive; it is ecological. A new technology does not merely add something; it changes everything.* (Postman, 1992)

THE ELECTRONIC CAMEL

Like all the rest of the old Modern World, most educators remain captivated by the printed word. We still privilege reading and writing, and treat all other modes of modelling and mediating (except, for some of us perhaps, mathematics) as inferior, if not actually harmful. Even though everyone, including most educators, actually learn about the world primarily from television, movies, radio, and now the Internet, I know of no education system anywhere which takes media literacy as the basis of education, and treats reading and writing as just one form of modelling and

mediating, a form that allows us to do some things well, but that can't do other things as well as other models and media can (Dator, 1977).

We educators can pretend that all we are doing is "tele-computerizing" the old logocentric school system, making it up to date, more efficient, more personalized. That may be all we intend to do. But once the nose of the camel is under the tent, whether reluctantly let in by you or eagerly escorted in by an edupreneur, it will be impossible to keep the rest of the camel out. And the camel is already huge and growing outside the educational tent.

Indeed, as far as I can see there is nothing but camels surrounding all the tents of education, old or new.

As all of the electronic media converge, growing both more wired and more wireless, more global and more local, requiring no literate or typing skills at all but only the ability to talk, touch, feel, smell, and hear (indeed, as they break through these interface limitations and become part of our central nervous system); as biological computers replace silicon computers, only themselves to be replaced by the many hybrid intelligences of the 21st Century; and as the world everywhere becomes more completely artificial than it already is while "nature" retreats to the tokonoma in everyone's cybernetic cottage, the herds of chattering chimeric camels will unwittingly trample the old educational tents, enabling new teachers, new students, and new things to be taught and learned in new ways (Pelton, 1996; Kurzweil, 1999).

GUIDING VALUES AND VISIONS

But wait! Where are values and visions in all this? How have values guided the transformation of communication technologies in the past, and how might values guide the transformation now, into the future? Well, where do you think values themselves come from?

It is my observation that each human's acquisition of values is very much like each human's acquisition of speech. It is not possible to prevent a "normal" infant from learning how to speak as long as she is in the presence of speaking humans. And she will learn to speak whatever it is surrounding humans are speaking. Later, if that child tries to learn another language, then she will always speak it with an accent.

So it is also with values. It is not possible to prevent a child from learning values. She WILL learn them, and she will learn them through the same process and at the same time she learns language – from the behaviour of those around her while she is young. But wait, again: While certain values, or aspects of values, persist over time, other values change. What causes values to persist or to change?

TECHNOLOGY, VALUES AND VISIONS

I believe Marshall McLuhan epitomized it correctly when he said: *"We shape our tools, and thereafter our tools shape us"* (McLuhan & Fiore: 1967). It works like this:

All values, beliefs, institutions, laws and mores are enabled and limited in part by our biology, in part by our culture, in part by our environment, and in part by our technologies. When any of those change, our behaviour changes, and our prior values, beliefs, and institutions are challenged.

Human biology has remained unchanged over tens of thousands of years. Those who argue that "you can't change human nature" may have been correct to the extent such "human nature" is biologically determined. Culture also was once thought to be changeless, but now we all know that cultures change too. We have only recently come to understand that the so-called natural environment changes as well, most recently changing as a consequence of human activity itself, it seems.

But culture and the environment both change slowly on the human scale. Technology changes very rapidly – almost daily. And the pace of technological change has been itself increasing over the past three hundred years or so. However, one of the new technologies which recently burst into our lives and consciousnesses with the controversy over genetically-modified food, on the one hand, and the completion of the Human Genome Project, on the other, is genetic engineering. Soon, as Susantha Goonatilake points out, even biology will be just another technology, subject to human manipulation, and there will no longer be such a thing as unchanging human nature, if there ever was (Goonatilake, 1999).

New technologies allow us to do new things. We can have experiences we could not have had before with the older technologies. As we begin to behave differently, we begin to think differently – our consciousnesses changes. Our sense of self, of our friends and neighbours, of time, distance, place, of right and wrong: they all change as we begin to act in novel ways via the novel technologies.

But of course, the fundamental primacy of our old values lingers as we try out new values. Just as we continue forever to speak new languages with an accent, so also do we enact new values "with the accent" of the old. But not so our children and grandchildren. Just as they learn how to speak our new language as their own, while we stammer along, so also do they view their experiences with the new technologies as given – just as we accepted as given the values which were derived from our old experiences with the old technologies.

Oh, there may be people, even young people, who desire to preserve or restore old values, but they do so through the prism of their experiences with the new technologies. Once the apple is bitten the world is forever changed. And we just keep biting more and more apples of knowledge and power even though many say they are, or should be, forbidden.

CONCLUSION

And so, I have come to the end of my search for answers to the questions posed. And the answer is: No! We should not use current values and visions to guide our use of new technologies. Our present values and visions are overwhelmingly influenced by our experiences and limitations of old technologies. We can scarcely imagine how we will be changed as we interact with and through the new technologies.

So what should we do?

Many people tell us to hold on to the old and reject the new. But while I deeply respect that position, and may bemoan with them some of the behaviours and values that will be lost, using present values to guide our use of new technologies just doesn't make sense to me, if I am correct in my understanding of where our current values and visions come from, and what will cause them to change.

Marshall McLuhan asked us, what if television had been invented before the printing press. It did not happen, and it probably could not have happened. But what if it had?

Can you imagine for a minute that we would have the kinds of government, commerce, and educational systems we have now, based on the primacy of words on paper, if television had been around for hundreds of years and if the printing press were one of our newest inventions? I cannot.

So let go of the words. Let go of the schools. Let go of the old pedagogy and the old academic disciplines and course outlines based on the old technologies and needs of old Modern society. Rather, put yourself in the place of future generations (Kim & Dator, 2000). Imagine that people from the futures are speaking to you now. Will they be pleased with what we have written in this book? Will they thank us for our courage and foresight, or chide us for our failure of imagination and our inability to let go?

It is not for us primarily a question of what from older generations should abide but rather what do future generations need and want us to do for them now so that they can live and flourish as they wish?

There are many possible futures ahead of us, many possible presents for future generations. In some, what we now call computers and high tech may dominate. In others they may be entirely absent. In some, nature might be regained; in others it might be entirely gone. In some, reading and writing will continue to prevail. In others reading will be as quaint and rare and useless as learning Latin is now. The point is, we should think not about what future do WE ourselves want, but "What futures do future generations want us to enable THEM to have?"

That is the question I end by posing on behalf of future generations. What is the world that future generations want? And what should we do now to enable them to live in it?

So maybe that is the vision we have been seeking after all. It is not our vision, but those of future generations. We should use their visions to guide our actions now. But still, what is their vision? Can we ever really know? Probably not, but they might be pleased if they know at least that we tried.

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