FOREWORD

General Aim

Application of information and communication technologies influencing and changing the world and a human being and giving rise to information society, is used as a productive tool for positive transformation in all areas. Introduction of information and communication technologies (ICTs) in education should not follow, but surpass all changes in other fields.

The main mission of the UNESCO Institute for Information Technologies in Education (IITE) is to reinforce national capacities in UNESCO Member States in ICT application in their education systems, to assist them in designing policies for integrating ICTs into education, improving national action plans, elaborating methodological materials, training and re-training of educational personnel on ICT application in education. In this role the Institute is striving to facilitate the exchange of experience and best practice on ICT usage in education among UNESCO Member States.

Information and Communication Technologies in Education

The age of new information and communication technologies has entailed dramatic changes in production and people business activities. They are influencing and changing the world and human life, leading to the appearance of the information society in which not so much material resources but information and scientific knowledge will be objects and results of work of the majority of employed population. Thus, succeeding generations will face the challenges of adjusting to new social environment wherein information and scientific knowledge will replace the matter and energy as its pivotal factors and will define both society's strategic potential and prospects for its development.

New social demands and the new world around us shaped by new information and communication technologies and models of action call for **New Literacy** for information society. It is worth mentioning that the information and communication technologies have brought about dramatic changes in the educational technologies of obtaining knowledge, its transformation in education and education into actions.

Education today is in the process of very fast (on the scale of human generations, not millennia) changes of priorities. Formal knowledge and skills are shadowed; priorities of general development, self-controlled learning, team-work, relevant and motivative project activities are coming to the scene.

Information and communication technologies are playing more and more critical role in this process. But it will be a mistake to think that new information and communication technologies automatically raise quality of education. It is worth keeping in mind that new information technologies are better suited for adapting didactics to the mode of thinking which operates association, rather than direct and consecutive notices. In order to exploit effectively the opportunities of new information and communication technologies, new methodological and pedagogical approaches shall be better explored and employed by the teachers.

The ***role of a teacher*** is changing – s/he becomes the Master of learning, self-development, reacting to the unknown. It seems to be not out of place to remark that there are many teaching and learning situations where pedagogy and technology would be so densely intertwined that it becomes very hard to tell for sure where one ends and the other begins.

Hence, the question arises: How can teachers learn all of this? The book of Anton Knierzinger, Sindre Røsvik, and Erling Schmidt gives us the answer to this question.

The site for teacher learning is the school where s/he works, and schools have advanced in the sense of ICT use in learning. "Trainers", "instructors" are, primarily, other teachers as well as students. Naturally, the process is starting in cooperation with university people intensively involved in the process of work at schools. The specific projects used are relevant to a teacher, his/her work and life. Among them are projects on teacher-student heritage, on the very process of learning in the group of teachers as students.

Coping with Change

The book you are about to read will not give you examples of specific ICT-based activities in the classroom. But it provides you with some very important ***guidelines*** on what is necessary for successful travelling across the immense variety of options brought forth with an advent of ICTs. It is your task to decide which one could suit you best. Don't forget the main point that the authors never fail to remind us of: "Pedagogy not technology should be in the forefront when implementing ICTs into teaching and learning".

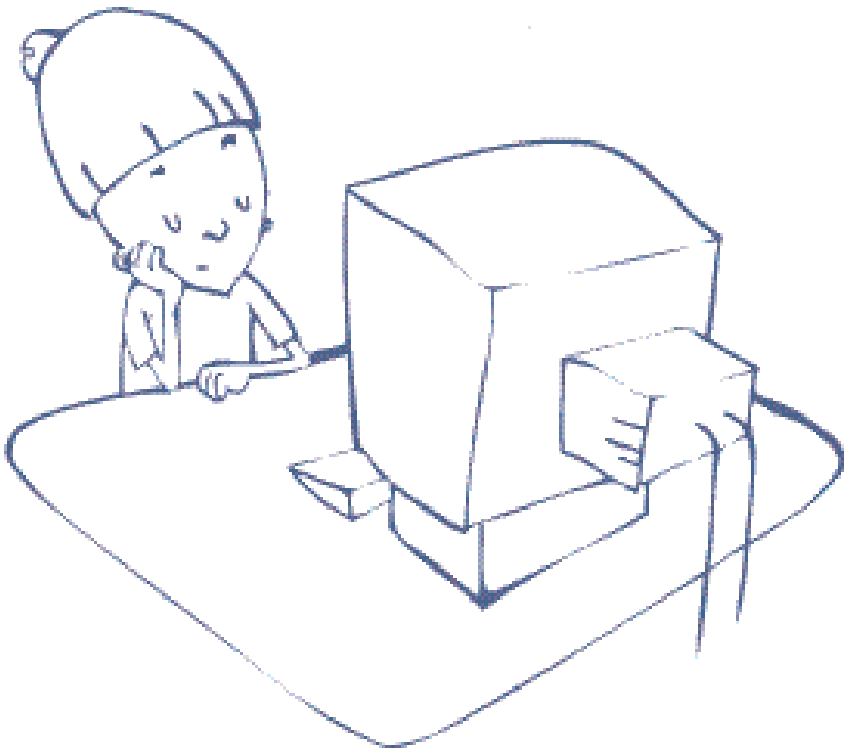
State-of-the-Art Curriculum

This Elementary ICT Curriculum For Teacher Training is a state-of-the-art curriculum. After reading Curriculum you may get a feeling that your wish for driving the computer across the Land of ICTs has increased considerably, but is not yet fully satisfied. Do not be confused – it is quite natural for any honest twenty-first century schoolteacher.

The field of action, as the book definitly testifies, resembles not so much of a highway, or even inner-city curved streets to drive in, but rather high stormy seas where a captain is in charge of managing a ship. Hence, the course in navigation and accompanying maritime arts seems a more adequate working metaphor than a driving licence for anyone willing to really master the craft.

LIST OF CONTENT

1. INTRODUCTION



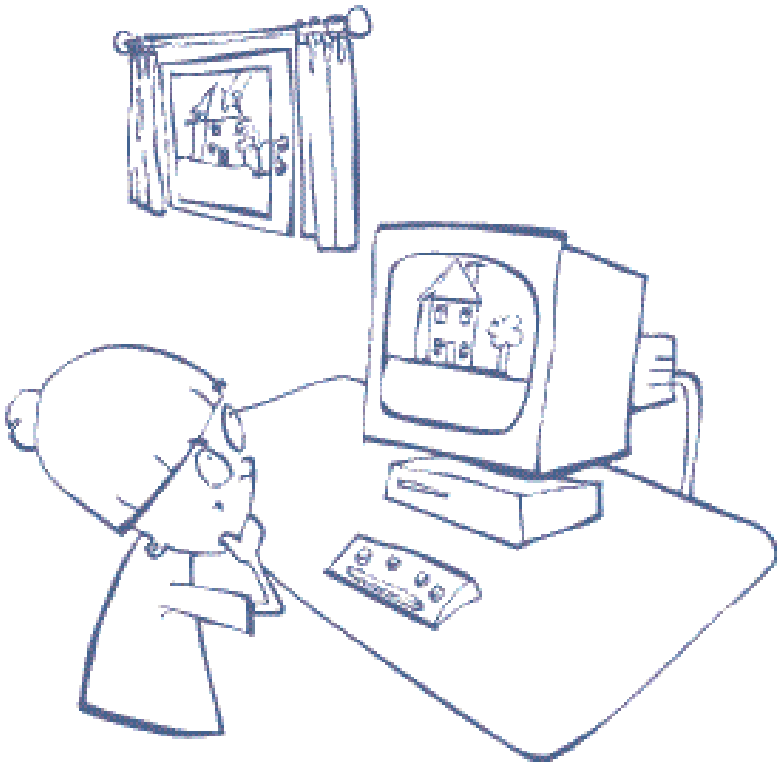
By implementing information and communication technology (ICT), or digital technologies, education is transformed into the digital reality. This means that the technology is not merely an add-on; it transforms education to a digital society with substantial consequences to the school system in organising the learning environment, teaching methods and the content of learning. But the result of this transformation is not solely given by the technology, rather by the choices made by policymakers, educationalists and learners. Keeping in mind that the digital technologies have inherited values, pros and cons, it benefits some but represents new obstacles to others. Hence, those people in charge should be determinedly active to introduce ICT to schools in a critical but constructive way. Teacher education programmes will no doubt be the most critical factor for successful results, with wide-ranging consequences to the development of the prosperity of the future society.

Since schools are already in place, with mostly well-trained but traditional minded teachers, the main challenge will be the development of introductory and retraining programmes for these bearers of the school institution. Teachers are trained for the industrial society, which is organised and working in a different way than the emerging new economies and cultures. It must therefore be strongly emphasised that such a programme of an ICT curriculum for teacher training is not mainly an introduction of hardware and software but rather a reconstruction of schooling and learning. This is not a programme to make teachers familiar to ICT, even if this is the starting point. Introducing digital technologies will be a long-term commitment and a programme of lifelong learning for teachers. It will also be a most challenging programme for the educational leaders who will be in charge of the reconstruction, as they will have to motive their staff to work towards new, open ended, not finaly defined goals.

It is most urgent to give substantial attention to programmes for educational leaders at all levels. This is the only way to prevent enormous loss of organisational energy, and to avoid a situation where there are competing agendas, competing curricula, and competing structures. Hegemonic fights are likely to take place, along with fruitful and value-reflective discussions. Critical aspects and individual stands should be respected and valued. Books, spoken words, traditional content and methods should prosper and be further developed also in a digital school environment.

The needs of teacher training are to be analysed in the perspective of traditions within teacher training colleges and universities, wherever it is located and within the national context. Secondly ICT in teacher training have to reflect the situation of ICT in schools, locally and nationally. Finally local or national initiatives must take a realistic starting point concerning actual resources available in society, schools and teacher training, not any utopian wishes or need for immediate political showcases. It can be noted that most Western countries have learned lessons focusing on how schools and teacher training ought to use ICT, rather then starting from the actual state of art. Shortcuts cannot be done, not considering basic organisational and motivational questions. On the other hand, careful and brave planning focused on realistic actions does make a difference, supporting developments of new learning initiatives including distance-learning technologies.

2. THE ROLE OF ICT IN SCHOOLS



2.1 The Role of Education in Society

The end of the 20th century was dominated by economic crises causing turbulence, conflicts and majors political changes worldwide. These changes, of course, also have ideological and other cultural reasons as well. What is primary or secondary will not be discussed here, but the drama represents an important background in our field of study. A main point is that worldwide changes are experienced, from state to individual level. Information and communication technologies do play a substantial role in this drama, in the financial world, in the cultural world and subsequently the world of politics.

Education policy is commonly considered secondary to other political fields in general, and of economical policy especially. Nevertheless education has been considered important in every society; from fathers and mothers teaching their own children in ancient cultures to our complex education systems of today. In other respects, education is often taken for granted, or seen as less important compared with other issues like economy or military issues. I.e. Marx and Lenin saw education as secondary to political action. Cultural and educational reform must follow political actions. However after the revolution, education became important in building the new socialist state (Fägerlind/Saha, 1989: p. 255).

To quote Coleman: "Considered education (primarily former education) to perform important functions in the political system. These functions included (a) the socialisation of children and youth into the political culture, (b) the selection, recruitment, and training of political elite, and (c) the political integration or national building of groups of people" (Byron G. Massialas: Comparative Education Review, 1977: p. 274). Without going into the conclusions of this article, this statement exemplifies assumptions about the role of schooling in society.

Massialas, in the same article, stated that political systems need support from its citizens to survive and that education often has provided this support through political socialisation. And further: "If the orientations imparted by education or other social agents (e.g. the family, the church, the peer

group) were not supportive of the system, the system either collapsed or changed in order to meet the new demands arising out of new orientations and expectations. "Education may contribute to system change or maintenance, or even to both at the same time being an agent for change and changed by society. By contradiction education may both produce social mobility and reproduce the social order (Fägerlind & Saha, p. 225). In the new, digitalised, information and communication society these aspects are, for certain, changed. These changes do challenge old structures and traditions and need to be handled, or new developments will take place outside traditional structures and plans, finding their own way like a river taking a new route.

According to Hellesnes (1988: p. 39), within western philosophic traditions there is an everlasting search for fixed orientation points, "Archimedes' centers", resulting in rows of succeeding political ideologies. The paradigm shift may expose a need to revise these "fixed points" or given centers of orientation, revealing problems that regimes have not been facing or even hiding. In open information societies like open economies the exposure is immediate. This can lead from one situation-ironical scenery illusion to another. The pre-understanding of new situations like, for example, market economy, and vice versa, may turn out to be different of what it was thought it to be.

Education, in any sense of the word, is considered of great importance to national economical planning and political development. However, strategies are different in different societies, according to the pace of development and need. It is not unlikely that the metaphysical irony (Hellesnes 1988: 56) is represented in educational policy. Consequently it will be experienced that different systems may also lead to trouble and mistakes. Experience opens eyes to the irony of the situation and leads to the metaphysical irony level. But experience may lead to "absolute knowledge" or to confusion, and confusion is often the result. "Absolute knowledge" is apparently not achievable in the field of politics.

The school system is a function of culture and social traditions. Religion is closely related with culture in a dualistic way; it is not always possible to tell how, or to what extent culture influences religion or "choice" of religion, or vice versa. Culture itself influences religion, but is also influenced by religion. It is in this same way that the school system was formed and is thus formed by society. A dialectic model of education and the development dimensions illustrates this (Fägerlind/Saha, 1983: p.197).

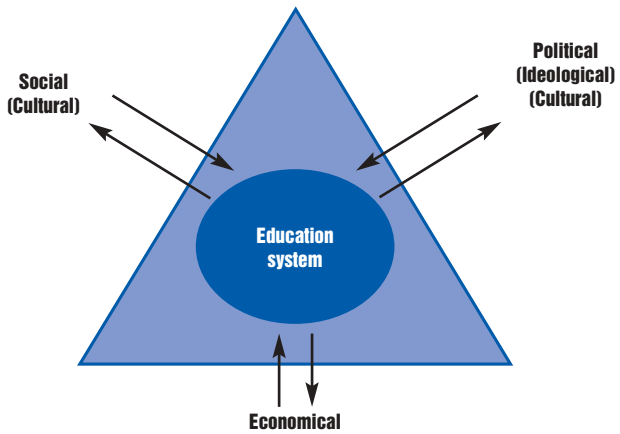


Figure 1: Model for dialectical analysis

In strategic planning it is necessary to keep in mind these dependencies. All kinds of states in different ways "use" the school system in achieving political, ideological and economical goals. Pluralistic societies have to have an open approach in order to meet different views represented in the population. Ideologies press each other and alternate in domination, causing waves and movements of change, progress or regression. Ideologies function as guidelines for institutions, very often in a form of compromises. If compromises are not possible, new institutions, with a dominant ideology, may appear.

To differentiate between national characteristically incidents and a common international trend will always be difficult. No development takes place in a vacuum. This means that events are linked together both at a micro and macro level. International trends are transformed onto the local level and with local characteristics. Changes at the local (or national) level may be caused by genuine local ideas developed out of the economical, social or environmental situation. Genuine ideas always have a local origin, they are "born" somewhere, and it can be exciting to see in what way the crises and demand for change fertilises the educational soil. A rising flow of information will result in a flux of ideas. The real outcome, however, can be growing convergence of cultures and practices globally and divergence of cultures locally. In the digitalised information society flows are rich, and questions of domination and influence are vital.

Political systems have conserving as well as changing forces. Politics can be described as a balance between tradition and change. The changes may have many faces, liberal, conservative, socialistic, etc. Counselling and research bodies supply the system with innovations. Both politicians and administration will use research for their own purposes, and research therefore serves political purposes. These bodies are normally, more or less, closely linked together, professionally and sometimes also formally. This international nature of science causes mutual influence. The context therefore is both national and international.

Economical forces (crises) call for changes politically as well as educationally, and economy is international. An accelerated economical crisis may cause political crisis, starting a chain process (Ginsburg/Darvas 1991: p. 240). In the same way we can observe internationally, not least in Western countries, demands for changes like privatisation, decentralisation and individual freedom; "consumerism". Productivity and competitiveness is expected, even within education. This also calls for individualisation, resource-scrutinizing outcome evaluation and quality control. Ecology-alarms like floods and animal diseases are warning the citizens against other dept-crises that may be caused by the economical race, threatening health and life-quality. Information and communication technologies can to be used to get access to necessary knowledge to follow situations occurring relevant to understand our shrinking world. These changes themselves call for utilisation of ICT for educational reasons as well as organisational and system improvements. During the last decades there has been ongoing reforms.

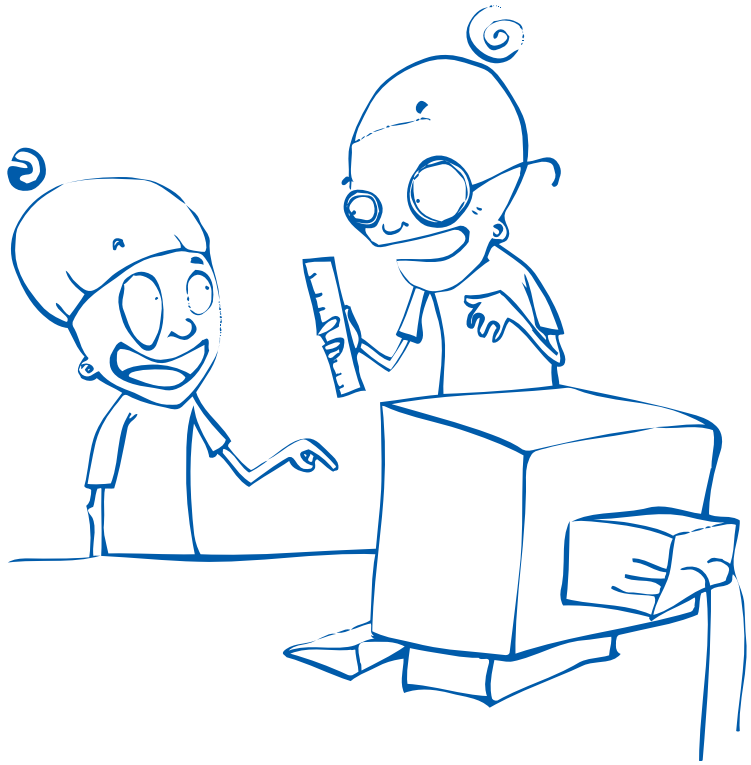
In OECD/CERI note from 1990, SME/ET/90.20, similar considerations were expressed:

"Certainly, great differences remain and the trends that have been mentioned above do not have the same force everywhere, nor do they have the same feature everywhere. But they have enough common to warrant the conclusions that educational policies and educational reforms in the OECD Member countries are increasingly inspired by the same societal forces."

Continuing development should primarily be based on local proposals. Finally it can be noted, referring to OECD/note by secretariat, Denis Kallen SME/ET/90.20 (page 5, paragraph 19):

"The formerly widely practised "R-D-D" (research – experimental or pilot projects, evaluation – political decision, general implementation) makes place for a more flexible strategy. A key role in this process is assigned to a range of innovation projects with rapid and frequent feedback of information and experience both to the system's "clients" (including general public) and to the responsible policy-making and administrative authorities. Thus, gradual improvement and gradual implementation is made possible. The relevant projects are carried out in osmosis with the educational and social environment."

After this statement was written the Internet has changed the rapidity of information flow dramatically, giving educational professionals as well as parents and students access to information about developments globally. The pressure on education system has risen subsequently, exposing both policymakers and practitioners for growing, but often incoherent, demands for development and change.



2.2. Role of ICT in Society and Education

Working with educational policies it is necessary to establish a deeper understanding of long-term implications that digitalisation may have on school development; including changes of content, organisation and structure. The President of the United States of America, Clinton claimed that: "The Information Age is, first and foremost, an education age, in which education must start at birth and continue throughout lifetime" (EFA 2000, p 3). Similarly Prime Minister Blair campaigned with the slogans focusing on three basic areas: "Education, education and education".

A basic assumption is that school is closely related to its' society so that major societal changes will transform schools and schooling. It therefore ought to be worthwhile to present some leading trends in the society of today in order to predict school developments of tomorrow. Such insights are considered to be essential to policymakers, in charge of policies at any level. Digitalisation seems to be one of the most dominant trends in our Western society along with globalisation. Here digitalisation, or information and communication technologies (ICT), will be at the forefront, but the latter not forgotten. Digitalisation and globalisation are closely interrelated.

During the years some different notions and abbreviations have been used concerning this technology, or may be it should be said technologies in plural, since it includes a range of different elements ranging from standard computers, robotics and to the Internet. Another development has been different technologies melting together like TV, video and telephone that all now are integrated into the computer features. From the middle of the nineties communication became more dominant due to the commonness of Internet that enhanced the communication aspect. Lately digital technology has been taken into use, being a more open and including term.

A technological change is not additive or subtractive, but ecological (Postman, 1992). Compare a milieu with and without certain insect. It will not be the same milieu without that insect, but a totally new milieu. The same happens when a new technology is added to a culture. We will not have the same culture plus the new technology, but a new culture (ibid; 24-25). Television provides a technological example. Being more than a piece of furniture, or radio with picture, it altered not only the social life within the homes, but society as a whole. For instance the choir movement was

hit by the emerging television-culture in the 50ies and 60ies and lots of choirs died away. During the last decade the choir culture has experienced a revival, but it is claimed that the meaning of or reason for singing in choir now is different. The choir movement survives by a reconstruction, making short-time projects, and shorttime obligations. Today singing in choir is considered to be a "consumergood". It is a subjective choice, with small obligations and not very ideological based. The post-modern choir is not first and foremost for public entertainment or formed to strengthen mutual values of a society based on solidarity. It is rather a reconstruction of a social phenomenon fitting the individual needs of another society.

Innovations within technology were massive also in the industrial society. This may lead to the conclusion that technology ought to have been included in any society-model as a driving force. Most often this has not been done. Can the reason be that technological inventions in the industrial age were linear, and thus became "invisible" or transparent? It could then be suggested that digital technologies represent a shift, a discontinuity that calls for special attention.

Today information technology is transforming society in such a pervasive way that it must be included in a society model. ICT cause changes of organisations, infrastructures, structures of corporations and challenges national policies (Aronowitz and De Fazio, 1997). Technological change has become a most stabile factor. ICT has intertwined with knowledge, making it dependent upon the technology. Through this alliance abstract knowledge has become the centre of the world's political economy, replacing traditional concrete products (ibid: 194). Similar statements could be made on culture and information technology.

Currently a "new economy" driven by information and communication technology is emerging, creating new industries and recreating traditional industries. Technology also influences the cultural scene very heavily by the existence of satellite communication and Internet. The global village (McLuhan) has reached new levels of development as people across the world communicate instantly in an interactive way eliminating time and space differences. Also schools are using digital technologies within the setting of the global village. The technological implications are included in this model of society, used by Daun (1998).

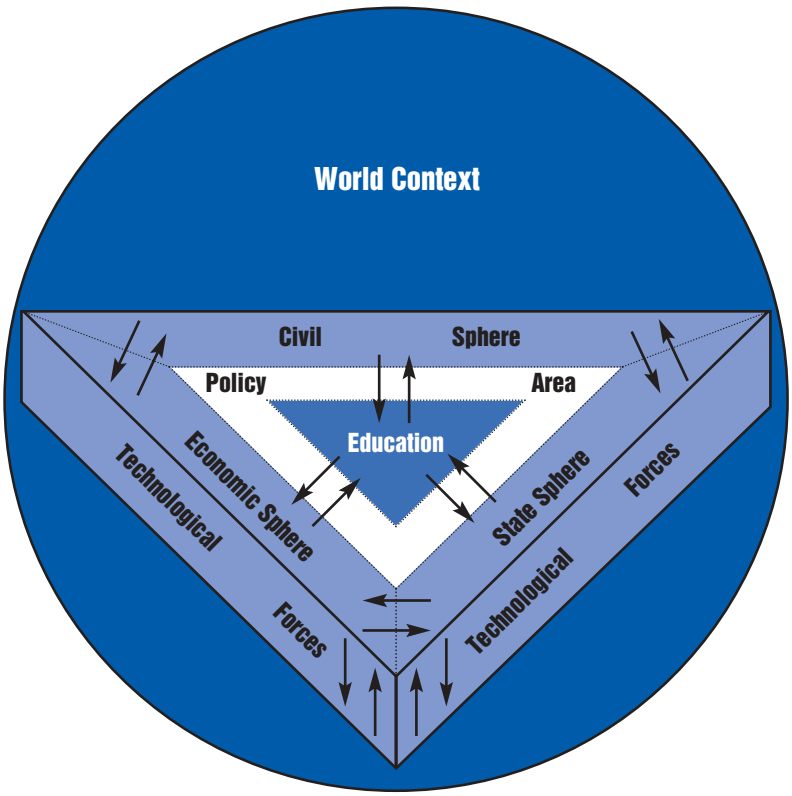


Figure 2: A model of society (Daun, 1998: 30)

He describes society as consisting of three analytical spheres: the state, the civil, and the economic spheres. Most important is though that technology has been introduced in a prominent place, strongly influencing all spheres, and the global, or world context is emphasized by being included in the model. Technology, in this model, is a layer underlying all spheres, constituting the environment where social and economical action takes place. He also quotes Escudero: *"social power is today more related to the possession of knowledge than to the possession of the means of production"* (ibid: 35). Daun furthermore claims that power has become more diffuse and fluid and less based on relations of production than it was before. Production, in this case, may be defined as material productions not including virtual productions. Taking virtual production into consideration, power structures seem even more fluid. Where production is brain-based, companies are moved when the brain people move.

In strategic planning it is necessary to keep in mind these dependencies. All kinds of states in different ways "use" the school system in achieving political, ideological and economical goals. Communist regimes very clearly exerted the influence of Marxist philosophy on all aspects of education. In pluralistic democratic societies, ideologies are of corresponding importance, but have a different appearance. Pluralistic societies have to have a more open approach in order to meet different views represented in the population. These ideologies press each other and alternate in domination, causing waves and movements of change or regression. Ideologies function as guidelines for institutions, very often in the form of compromises. *If compromises are not possible, new institutions, with new dominant ideologies, may appear.*

To differentiate between national characteristically incidents and a common international trend is difficult, as discussed above. No development takes place in a vacuum. This means that events are linked together both at a micro and macro level. International trends are transformed onto the local level and with local characteristics. Changes, local or national, may be imported ideas produced by international trends. On the other hand, it is no doubt that changes are also caused by genuine local ideas developed out of the local economical, social or environmental situation. Genuine ideas always have a local origin, they are "born" somewhere, but today that "somewhere" may be in a virtual environment, consisting of people from different parts of the world. Such "localities" are nowhere. In the digital society it will be exciting to see in what way such environments can contribute to changes, fertilising the educational soil.

Economical forces and crises call for changes politically as well as educationally, and economy is growing more international. Economical crises cause political challenges, starting change processes like decentralisation, privatisation, market-orientation and consumerism. Economy seems to be a part of all of them, causing individualisation, demand for resources, outcome evaluation and quality control. Local and global ecology-alarms are warning the citizens about other crises, also caused by the economical race, threatening health and life-quality.

Understanding Education

Different ways and methods can be used to gain understanding. A straightforward description referring to some given categories and systems is one approach that normally is very clarifying. On the other hand, this method often produces a "closed" understanding by reducing realities to apprehensible notions and objects. "To define is to kill, to suggest is to create" (S. Mallarmé quoted in Levinson 1999, p. 28). A more open approach is use of images or metaphors. A metaphor does not claim to include all aspects of the study object, but invites to see similarities. Gareth Morgan in his book "Images of Organisation" (1997) introduces metaphors as a way of understanding organisational life. But he also points out that metaphors are inherently paradoxical by creating powerful insights and a way of not seeing at the same time (p. 5).

In all realms of life humans are occupied with their perceptions of reality, striving to understand their world. Understanding can be seen as uncovering, decoding, or constructing "reality" creation of images. Understanding thereby involves both objective elements, perceptions, and subjective elements by creating meaning that is personal, and finally a common meaning that is shared with others constituting social relations. Communications of meaning are important to all

understanding of social aspects of living and working together. Communication promotes mutual understanding, deepen and verify mutual perceptions of reality. To understand and describe an object or situation it is common to refer to other objects or situations that seem similar in some way or the other, by comparing them. This can be done by saying that a person is strong as an ox, or perhaps that he or she is a lion, or the head of the family. The comparing highlights similarities, not taking into account the difference.

An fruitful approach can therefore be to aim at understanding schools through the use of metaphors in order to "read" existing, underlying patterns, analysing possible ways of getting ahead coping with new challenges. This point of departure affects the choice of metaphors and their use. Garth Morgan emphasises that uses of different images broaden the view and deepen the insight to see, to think and act in new ways (p. 351). It is also kept in mind that:

"The concept of organisations is a product of the mechanical age. Now that we are living in an electronic age, new organizing principles are necessary. The ideas presented here help us to make the transition and meet the challenges of this new reality."

(Morgan, 1997: p.378)

This is an accurate presentation of the challenge of school today that is addressed and dealt with here. Use of images or metaphors may give strong interpretative direction to the meaning, and can be used intentionally or unintentionally to do so. To understand the organisation is basic in managing it, a how to manage it. The way the organisation is understood constitutes main frames for analysing, planning and the actual day-to-day activities. Use of images does not only support understanding but also creates and changes.

Most organisations are complex and difficult to understand or explain in an intelligible way. Metaphors or images are therefore used to build theories on organisations, explaining what it is all about. Theorising is also modelling, where the making of models often is based on images. Gareth Morgan (1997) has given an overview of commonly used metaphors: Organisation as a machine, organism, brain, culture etc. Whatever metaphor chosen it is important to be aware that it is a description, or an interpretation of the real organisation, not representing all aspects or giving a totality of the reality. Another important aspect to be aware of is that by choosing a certain metaphor to model understanding of an organisation one creates ways of *not* seeing as well (ibid. 5). This presents a true paradox: Understanding becomes a way of *not* understanding.

In the following the images are chosen to describe some main features of school organisations. The different images shall illuminate different perspectives of schools and give some historical background to recent developments, and future challenges. The latter represents the underlying aims of the study. According to Morgan (1997, p.376): insight to see, to think and act in new ways (p. 351). It is also kept in mind that:

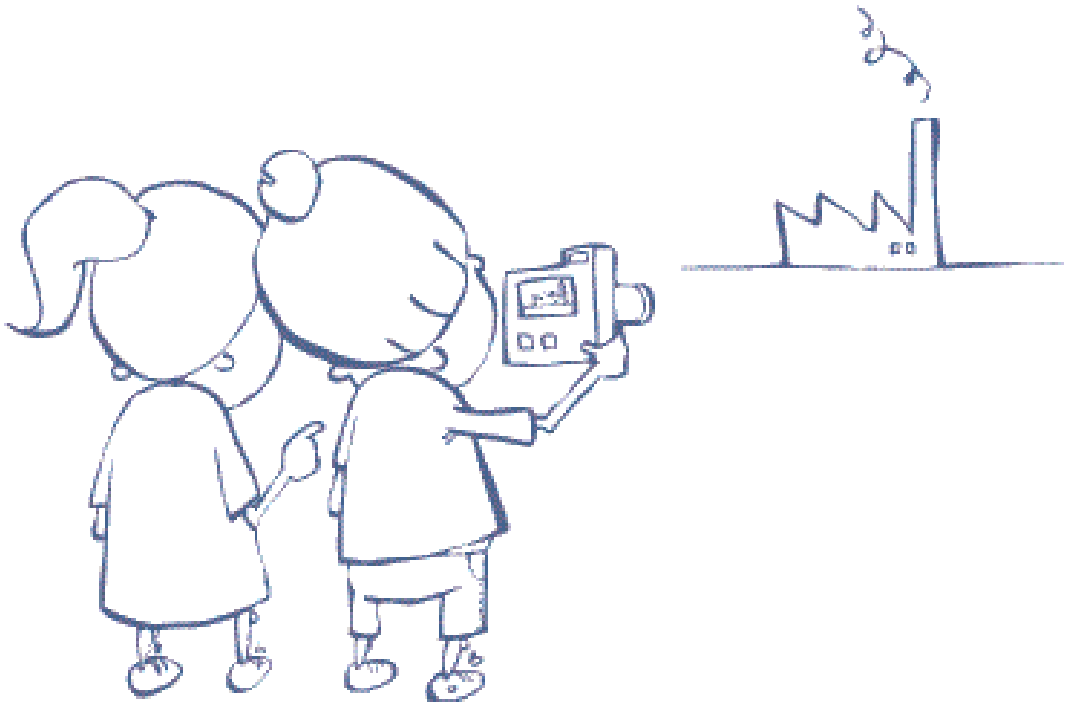
"in times of change it is vital to be in touch with the assumptions and theories that are guiding our practice and be able to shape and reshape them for different ends."

A main background here is therefore looking at schools in the electronic age and a global community. Schools of today are challenged by these trends in several ways ranging from macro to micro level, from the state to the classroom. The overall changes and developments are introducing "The learning society" as an image and ambiguous term, describing the challenge, suggesting its need and potentiality and urging on the need of it (Barnett 1996). An interesting quest may therefore be to find metaphors useful to meet future challenges. Blind spots created by traditional school metaphors should be considered along with obstacles and limitations of new ones, keeping the image of psychic prison in mind. Imaging school as a psychic prison implies a world like the one presented in Plato's "The Republic" where Socrates addresses the relations among appearance, reality and knowledge (Morgan 1997, p. 215). In this shadowy world the inhabitants stick to the shadows as reality rejecting the world outside.

Marshal McLuhan who created several strong images like “The media is the message”, “The discarnate man”, “The global village”, etc. all relevant in this study, also claimed that understanding of society includes looking in “a rearview mirror” (Levinson, 1999). By this he meant that we move into the future with our sight on the past, introducing the telephone as the talking telegraph, the automobile the horseless carriage and the radio the wireless (ibid. 15).

At the initial steps of development of new devices the widening consequences are not understood. The understanding of the school of tomorrow is based on the school yesterday. If the media are the message, we should ask what this means to our understanding of the traditional school, and what it will mean when introducing digital media like Internet. What consequences or impact do these media have on school? Or to ask using McLuhan’s “tetrad”, four laws of media: What does the medium enhance or amplify in the culture? What does it obsolesce or push out of prominence? What does it retrieve from the past, from the realm of the previously obsolesced? And finally, what does the medium reverse or flip into when it reaches the limits of its potential?

We will now present the traditional school imaged as the machine or industrial metaphor. The dominating media in this school is probably the book, and the teacher.



2.3. School of the Industrial Age

All states in the world have an educational organisation called school where defined activities of teaching and learning are practised according to a certain mandate and traditions. The school operates within specific social and cultural context and is constituted by certain structures and processes lead by a leadership (Tjeldvoll 1995). The actors within the school are students, teachers and leaders. Schools belong to a larger educational organisation, often with three different levels: the local, regional and national level. Further, it is organised in categories according to age in pre-primary, primary, secondary and tertiary education (ibid.). The different levels have a corresponding hierarchical management, from the state level to the individual institution. Even if formal education can trace its roots more than thousand years back in history, mass schooling is a relatively modern feature, based on the invention of the printing press, emerging with the industrial age. Educational systems and schools have had a bureaucratic design (Watson, 1994), organised like armies or machines.

Both the army and the machine image give sense when describing classrooms, schools and the educational system in total. In such an image schools are instruments to achieve certain goals, defined from above, and managed by the educational leadership according to given standards, prescribed by clear directives, laws and regulations. Obedience, punctuality, orders, strict detailed rules and regulations accompanied by diverse control mechanisms are central in such organisations. Max Weber pointed out those bureaucracies developed administration processes very similar to the machine routine production in industry. While a group of management theorists forwarded such bureaucratisation in their "classical management theory" and "scientific management", Weber was critical of such developments. F. Taylor, the father of scientific management, stressed rationalisation of time and motion, strict control and standardising of products. "Thinking" was the task of the management that should plan the processes of production split into details. Workers are not supposed to think being no more than hands (Morgan 1997, Chapter 2).

Turning to "industrial" schools: Teachers are responsible of planning every lesson in detail, and do the thinking within her/his sphere, while students are supposed to follow instructions. Classrooms are organised accordingly, oriented towards the conductor, performing in front by the blackboard

or handing out, detailed planned tasks to be solved, normally in ideal silence. In these classrooms students also do the same tasks and exercises simultaneously, sometime forcing fast learners to wait while slow learners must proceed without finishing. Such results can be criticised by those supporting the theory, as bad planning or bad conducted lessons. Learning materials are standardised.

Principals and deputy school leaders follow similar standardisation; planning the school year and the weekly timetables, etc. Tasks of the different school leaders are separated and specialised, and the regulation of responsibility clearly defined between principals and municipal officers. The municipal officer is responsible for the overall budget responsibility, controlling the accountancy work of the principal, clarifying rules through standard letters reminding of details to be executed at school level making sure of properly order concerning schemes and the like for municipal or state statistics.

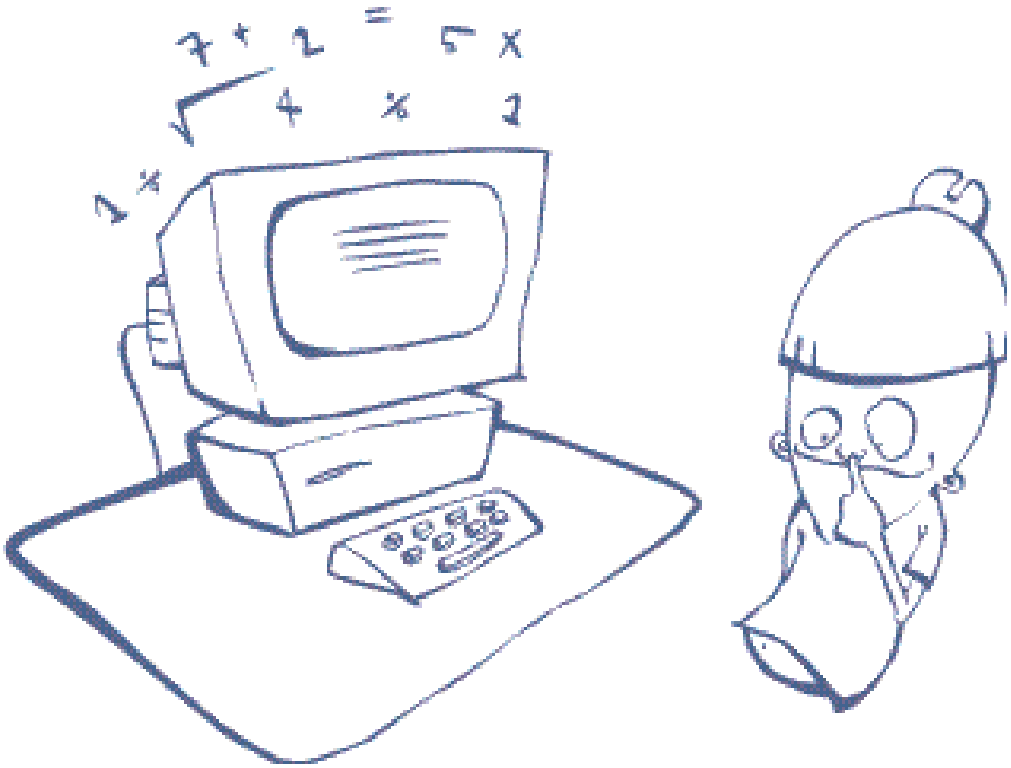
Educational leaders at the regional or state level do their job in a similar way directing the municipal education system as the municipal officers approach principals, making sure of equal standards nationwide by controlling and clarifying rules and regulations when needed. Any request at any level must follow the line to the nearest superior leader. If the superior is not able to answer, the request is passed on to the top level. The political organisation is paralleled to the administrative, with very little power and responsibility at institutional levels, more at the municipal level and the final decisions to be made on law, regulations and goals (curriculum guidelines) at the national level.

Summing up, the machine metaphor organisation: "Set goals and objectives and go for them. Organise rationally, efficiently, and clearly. Specify every detail so that everyone will be sure of the jobs that they have to perform. Plan, organise, and control, control, control" (Morgan 1997, p. 26). This organisation will run effectively when tasks are straightforward, environment stable, exactly the same product is supposed to be delivered over time and humans act as planned. Problems will occur if circumstances change significantly as the organisation in such a situation may have problems in adapting and be slow in acknowledging the need to change, and if acknowledged change of laws and new regulations will be expected, since they are not expected to think. Innovations are not supposed to occur but from the top, the organisation is not designed for individual initiatives and the "walls" will neglect it preventing it to be institutionalised.

The machine metaphor is useful to understand the education system that has been (and still exists), not least some strong underlying structures and processes of schools. Schools close to this image will have strong elements of professionalism especially balancing managerial aspects (Ouchi, in Sturman 1994). Bush (1995) elaborates the same point, where he refers to Hughes notion "leading professional" or "the professional as administrator".

There are other perspectives and understandings of school not duly covered by the mechanical metaphor that are better understood through other images. One is seeing the school as an organism; another relevant image is school as culture. These terms to some degree also present a shift of trends, and changes within the system.

During the seventies and eighties ideas about the education system were clearly influenced by images of organisations like organisms, requesting more openness towards the local community and parents participation. I.e. parts of the Norwegian curriculum guideline from 1987 (M87) were supposed to be developed locally, also giving teachers more professional influence. The image of school as a culture also had an influence, focusing on teambuilding, corporate programmes, ownership and openness towards the environment. There was also a marked shift in attention from teachers and teaching to learning and the learner, that had been on its' way for some time.



2.4. School in a Digital Age

More basic attitudes like learning to learn and lifelong learning are now in the forefront (i.e. "Four Pillars" UNESCO 1999). Looking back the last decade some classrooms have changed substantially, but others are less affected, still being quite traditional. Emphasising project work, electronic learning materials and Internet has gained terrain. Rapid developments of knowledge and easy access to updated information of all kinds are changing content and ways of learning. Some schools produce their own CD-ROM and project presentations are to be found on Internet. In several areas there are quite substantial variations in the learning environment and actual content taught. Variations can be encouraged, not leaving central themes and learning methods neglected. Focus should be on making some substantial changes, creating a new school, answering emerging challenges of the electronic society and needs of children, including social and emotional difficulties.

A main issue should be to provide all the children with the equally high quality of schooling and learning opportunities. Quality issues must always refer to the "environment of use", and in a global and digital world quality of education therefore must be redefined in the context of utilisation. Finding substantial differences in quality should be disturbing and create necessary initiatives to cope with the challenges. This must be a main task of educational leaders and policymakers.

Within administration substantial power has been delegated on operational questions like staffing, personnel matters, budgetary dispositions and other administrative questions. The system being transparent ensures openness to both different levels of administration, teachers, trade unions and the public. Different parties need to be informed about major matters, and have their say in for them essential questions. Crucial or principal questions will normally need political decisions before final enactment. Modern organisations work less hierarchical and more network-based, making them flatter and more flexible, but also less secure for employees. Focus is on teambuilding and culture emphasising ownership of ideas and projects. Ownership and an open supportive culture are considered basic to develop good and effective schools. Innovative projects are stimulated by special resource allocations.

Relevant metaphors to schools described above are the organisation as a brain, and those of organisations as flux and transformation. Content, methods and aims of schooling are questioned.

Through autopoiesis (Morgan, chapter 8) these schools are reflecting and responding to societal developments and changes. Information and communication technologies represent a new "attractor" challenging book-orientation and traditional learning and communication patterns. Management needs to emphasise, follow up and support elements of this new "attractor" to make the systems "flip" to new patterns (ibid. page 263). Such management should rather impose questions, second learning loops, than giving "right" answers and making detailed directives. Small but qualitative substantial important changes are requested, pushing school toward the limit of chaos. The purpose is to cope with challenges emerging in the overall society, fitting the school and making the school fit.

Finally it should be noted that principals' role has changed during the last twenty years, from being what we would call an administrator to become leaders. This means that they are supposed to have a higher personal profile, taking necessary educational initiatives to develop a good school, being accountable of not only economies and administrative routines but the overall pedagogical situation of the school. See the distinction between management and leadership elaborated in the entry of Middlehurst (1993).

Transitional leadership is a term that may fit well (Bush 1995). The school metaphor organisation of such leaders is the one described as learning organisations, or organisations in flux and transformation. Focus on change and development must lead to more regular and scrutinising evaluation and assessment of learning outcome as well as learning methods, and subsequently of school organisations and systems. Additional to internal activities external resources should be included, aiming at processes of double-loop learning. By this also societal changes and alternative moves are included and more natural parts. Also organisations need to come up with new strategies to learn to learn. Administrative routines need to be reduced both in numbers and in focus, looking for new paths. On the other hand, growing external interest and pressure related both on individual rights and quality of schooling also leads to time-consuming documentation work that not always heightens either productivity or quality.

The brain metaphor focusing on learning to learn, or double loop learning, is relevant to schools described above as both purpose and methods of schooling are questioned. In principles of redundancy and minimum specs can relevantly be introduced by creating the new forums for reflections and discussions. Both budgetary and pedagogical debates need to be initiated in a range of forums to obtain holistic perspectives on schooling, linking development plans, organising of schools and learning environments, organising of schooldays and groups (classes) staffing and budgetary routines. Developmental dialogues need to be regular at each school where the education director, headmaster, pedagogical advisors and eventual team-leaders. Similar discussions must be held among the entire staff of teachers, and also organised to include parents to increase focus, motivation, level of participation and quality of co-operation between school and homes. The purpose is to get a reflective and holistic perspective on planning activities and management, learning and life quality in total.

Working with metaphors to enhance understanding of our organisation, it is relevant to consider our ability to meet the challenges of our new, digital society. New technologies and methods should not be introduced into old systems and fixed organisations, without taking advantage of new more flexible opportunities. When examining such important issues using images of organisations it is also relevant to look for psychic prisons, blind spots. One could also look for "dolls and teddy bears", objects that mediate relations to the secure world, making shift to new realities difficult or hindered. Different objects to be suggested could be textbooks, old administrative routines and budgetary systems. Others are traditional, weekly subject-oriented timetables and classroom organisation. Different strategies to be considered can be both small steps, related to such "teddy bears", be it textbooks, blackboards or timetables (etc.), as well as larger leaps making substantial and large changes revolting ways of organising schools and classes, replacing class-structure, textbooks, blackboards with project-groups, information-rich environments including Internet and the entire local and global environment. Other changes to consider are those of tests and exams that no doubt would benefit from being made more relevant

to daily life of schools and society. Such changes require creativity, wisdom and courage, but seem inevitable to correspond to the society of today.

The last decades there has been a considerable growth of schooling expressing an increasing role of education in modern societies. Political forces have stressed education systems all over the world not least in Western countries. Educational changes have been subscribed in US, Britain (David, ibid. 219). Similar changes are found elsewhere. Economic stagnation and decline have been put forward as reasons for need for change. The economical problems have caused closing of factories and mass-unemployment. New technologies, particularly information technology, have contributed to the increasing unemployment as well. On the other hand thousands of new jobs have emerged rapidly all over the world. This new ICT-job market did not exist only a few years ago. In this perspective information technology is of growing importance in modernisation of education, to serve society needs.

All technological change is, according to N. Postman (1996), a Faustian bargain, where to every new advantage a new technology offers there is always a corresponding disadvantage. The questions that need close examinations by educationalists are what these disadvantages are and how to eliminate or reduce them. Or to put it differently: whom the new technologies benefit and who is harmed. Another important observation made by Postman (ibid.) is that technological changes are not additive but ecological, meaning they are causing overall changes, fighting the old technologies. Digital technologies are challenging traditional ways of working and organising schools, and not least the world of books, new papers, etc. Books will survive but their dominance is challenged. The lecturing of teachers is similarly challenged. These are the perspectives that need to be addressed to the teacher education of today along with traditional learning theories based on use of traditional learning material.

In a rapidly changing world overloaded with signs, objects and cultural artefacts constantly transforming and recasting of meaning, a different set of competence is needed. When order is not a structure but a "structure of flows" (Lash and Urry, 1994: 4), new images must be utilised to understand society. Reflexivity, or aesthetic reflexivity, is introduced as a term to explain or illuminate a central feature of humans in the post-modern society. Reflexivity refers the ability of being aware of ones own self and the relation to the self and society. Aesthetic reflexivity includes an ecological awareness, a self that at the same time is a being-in-the-world (ibid: 6), both subject to, and subject of the economy of space, and critical and reflexively aware of that. In this society design has increased value, which is another aspect of aesthetics. Applied reflexive aesthetics also introduces "invented communities", like ecological movements, etc. as well as virtual societies, living their lives within electronic networks.

In societies of the new economy and culture understanding or analysis based on objective, regulated structures may prove too limited and even unfeasible. To approach schooling of today on concepts of the functional paradigm alone may turn out to be confusing and unsuitable. This means that policymakers and others need to reflect upon some different notions and concepts than those rooted in organisation theories and functionalism. To suggest "use of" or "shift to" new paradigms is contradictory to the idea of paradigms. Each paradigm represents defined, basic met-theoretical assumptions constituting a modus operandi for the theorist (Burrell and Morgan, 1989: 23). Basic, taken for granted assumptions are not easily left behind. It is more than changing perspectives. Paradigms represent totally different both values and perspectives. And within each paradigm there are large variations as well. To change perspective within the same paradigm may be more common. Interparadigmatic journeys are rare (Burrell and Morgan 1989: 23), but Marx and Silverman are mentioned to have shifted paradigms. The first changed from radical humanism to radical structuralism and the latter from the functionalist to the interpretive paradigm. The idea is therefore to "lend ear to" different paradigmatic theories and perspectives being introduced.

The perspectives presented above must affect aims and programs for schools, and consequently teacher competencies needed. The way digital technologies intertwine all parts of society and

working-life makes ICT a central part of education, and teacher training. The aims and values of the industrial school (see above) and a paradigm based on functional sociology are outdated. The question is what competences need to be added and what elements are lacking or are underestimated in the functionalist paradigm? Along with globalisation and digitalisation the pace of change and range of mobility has speeded up drastically. Information technologies that in a pervasive way turn our society into digital societies de-stabilise both organisations and states and make change or flux normal. Old patterns and methods of control do not work effectively, and are far from sufficient.

Knowledge has got a predominant place leaving individuals less dependent on single organisations, schools. On the other hand, they will be even more dependent on skills and competencies provided by schools. Giving focus to subjects and change moves the most feasible models of sociological analyses from the functional to the radical humanist paradigm. But, even if such new perspectives may be given consideration and are useful for reflection, it must be underlined that this is a conditional approach relying on some given foci, namely, some specific fields of development that is rapidly changing. The revolutionary changes certainly deconstruct and empty some well-defined structures, concepts and objects. But reconstruction is also a continuing, ongoing process. Organisations that are reorganised after a deconstruction can evolve new stabilising patterns of order and regulation with a new, reconstructed meaning that works within a functional sociology and paradigm. In a rapidly changing society only organisations able to deconstruct and reconstruct can survive, that is learning organisations. Education, and schools, for certain will be able to reconstruct and fill its necessary place within the digital society, but to do so new competences have to find its place in the core of teacher training. And this is what will be explored and discussed below. To give a tool for analysis and discussions of ICT competences needed, a matrix of content, skills at different levels is introduced. This matrix does not claim to define the elementary ICT teacher training programme to be used like a cooking recipe, but rather a tool for exploration and analysis, related to local conditions and current technological developments. Society and children's need as well as pedagogy is to be the frame of reference, rather than technology itself.

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3. ICT IN THE DEVELOPING NATIONS

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3.1 The Global Imperative

At a time when knowledge is surpassing production of goods and services as the main feature of economies, information and communication technologies (ICTs) have become more and more an integrated part of development strategies. The role of ICTs in and for education is expanding in many countries, and its use elsewhere is seen as both a necessity and an opportunity.

Most recently, the Dakar Framework for Action (April 2000) identified the use of new information and communication technologies as one of the main strategies for achieving the EFA (Education for All) goals.

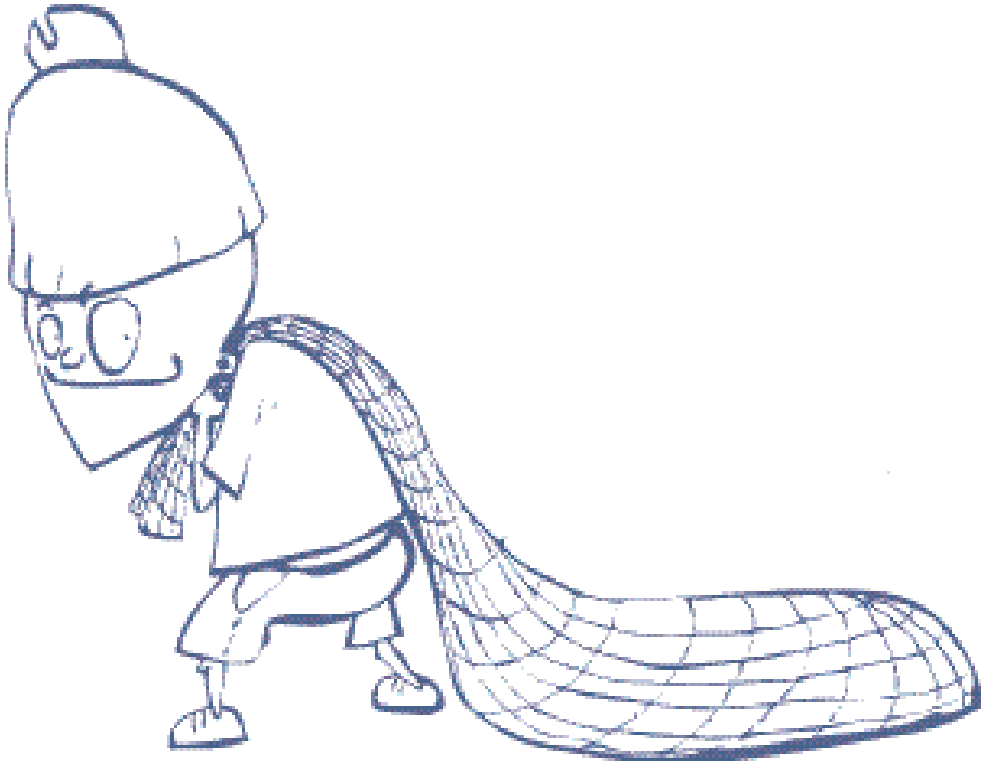
The world community has committed to the goals of Education for All, articulated in Jomtien in 1990 and reiterated in Dakar in 2000. With the proper harnessing of ICTs, the goal of basic education for all, anywhere and anytime, is within everyone's reach. UNESCO, as part of the co-ordination of follow-up to Dakar, is assisting Member States in integrating ICTs in their Education For All national plans and programmes of action.

The UNESCO Institute for Information Technologies in Education has recently been set up in Moscow, with considerable capacity and important functions relating to policy advice, research on new ICT applications in education, training of educational personnel, and continuous monitoring of the use of information technologies in all levels and aspects of education.

Teachers are central to effective learning. They also represent the most critical element and the biggest investment in the educational enterprise. Thus, their preparedness and professional development is not only desirable but also necessary for the success of learners, schools and education systems. It is obvious that teachers cannot be prepared once and for all. One shot of training, no matter how effective and successful, will not suffice. A new paradigm must emerge that replaces training with lifelong professional preparedness and development of teachers that encompasses initial preparation and training, structured opportunities for retraining and upgrading, and continuous on-the job support.

ICTs can contribute significantly to all three components:

- ICTs and properly developed multimedia materials can enhance the initial preparation by providing good training materials, facilitating simulations, capturing and analysing practice-teaching, bringing into the training institution world experience, familiarising trainees with sources of materials and support, and training potential teachers in the use of technologies for teaching and learning.
- ICTs open a whole world of lifelong upgrading and professional development by providing courses at a distance, asynchronous learning, and training on demand. ICTs have the advantage of ease of revisions and introduction of new courses in response to emerging demands.
- ICTs break the professional isolation that many teachers suffer from. With ICT, they can easily connect with administrations, with colleagues and mentors, with universities and centres of expertise and with sources of teaching materials.



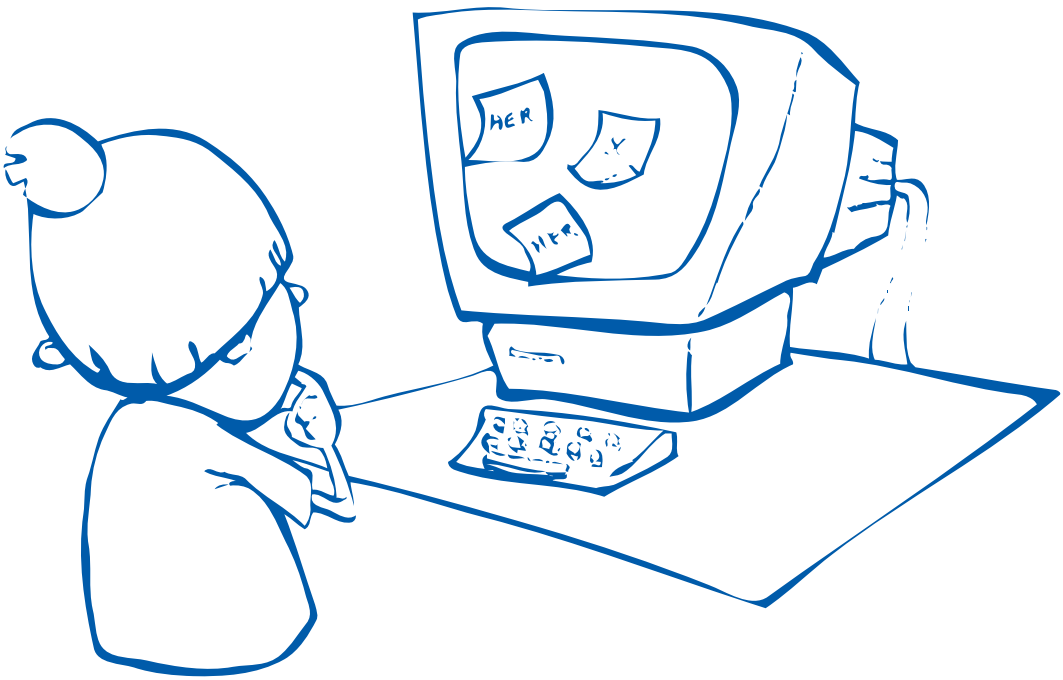
3.2 The Role of the Internet

Most developed countries of the world have extensive programmes of Internet development in the sphere of education. The overwhelming majority of the developing countries, despite many difficulties, problems and fears, is seeking to take part in this formation of a global educational community. In doing so, the order and analysis of positive experiences of Internet usage in education becomes an urgent problem for each country and the global community as a whole, looking to reap the benefits, as well as avoiding the negative aspects and undesirable consequences of its use.

From the international point of view, there is a possibility to decrease the gap in the quality and quantity of information provided for education between developed and developing countries. G. Sadowsky notes that *"Development experiences in one country can be useful in other countries. For recipient countries the trick is to discover similar projects and relevant information that could be useful to them"*. As an example of this, one can use the experience of the MINISIS project (one of the versions of the UNESCO ISIS system), where databases which are critically important for development and education information, accumulated in developed countries, were supplied to developing countries – in this case to the African region.

A significant achievement of global network technologies in the educational field is the decrease in the cost of information delivery to users. We know that most state run schools, not only in developing countries, are limited by budget to acquiring necessary textbooks, authoritative reference material, atlases, etc. Even taking into account the expense of hardware, software and communication channels, it is rapidly becoming evident that tele-publishing has many advantages over traditional publishing.

So the strong message is that the Internet has the potential to provide a bridge across the North-South divide. The danger, of course, is that it could also fuel the 'digital divide' where knowledge is the currency with which to accumulate material wealth.



3.3 Some Issues to be Addressed

Priorities
When a village has neither a well nor electricity and the school takes place in the shade of the local Banyan tree with children sharing one book between the class – can we really suggest that precious resources be used to introduce ICTs? There are no clear answers to this question but maybe we should turn it round and ask what are the consequences of those children not having access to the wealth of accumulated knowledge that is their entitlement? The spread of HIV/Aids throughout Southern Africa, the scourge of curable diseases in many parts of the world, coping with drought and floods – these are all global problems not confined just to the developing countries. Education must be the answer and ICTs can provide the delivery mechanisms.

The future for Intellectual Property Rights
As more and more educational software and entire courses of study become available over the Internet, whether for free download or against payment, the need for a fresh look at quality assurance becomes acute. The Internet is an anarchistic publishing arena where concepts such as 'copyright' and 'intellectual property' are not readily understood by many of its users.

Language of 'instruction' and ICTs
Although a number of educational software packages and tools have been versioned in major written languages, e.g. French, Spanish, etc. very little versioning in regional languages, such as Zulu, Xhosa or Bangla has taken place. The economies of scale have militated against this activity being undertaken by Western publishers but a few developers in Southern Africa, India and South-East Asia have begun to publish in a number of local mother tongues.

A report from a European project that aimed to identify problems connected with the versioning of educational software between countries identified three processes of versioning:

1) Linguistic – concerning spoken and ethnic languages;
2) Technical – moving software from one platform to another;
3) Cultural – revision to fit a different culture, school system, curriculum or way of teaching.

Three models for versioning were proposed:

A. Complete rewriting of the code – but keeping original concept;
B. Using programming tools, partly facilitating technical as well as linguistic versioning;
C. Using integrated systems with a common graphic user interface and facilities for linguistic versioning as well as management of different peripheral equipment.

The final report was optimistic in that it forecast a convergence of technology within Europe and a resulting decrease in the problems associated with versioning. In the short term it proposed the use of standard toolboxes to allow for technical versioning and the creation of more user-friendly interfaces. An interesting appendix describes features of the ideal toolbox for the versioning of educational software. The features included standards for:

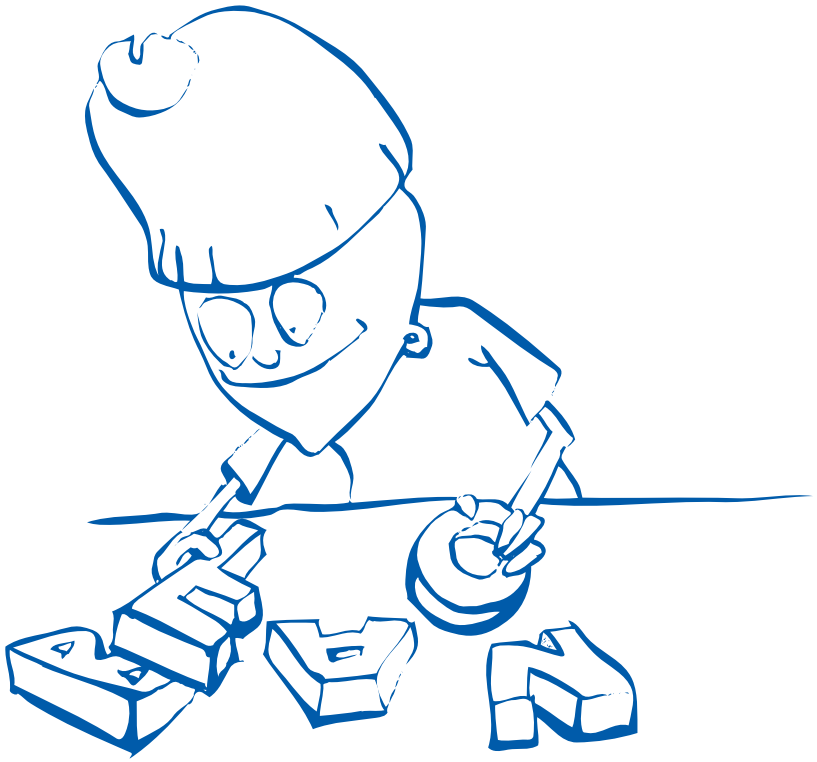
- Sets of characters
- Text formats
- Text and help options
- Basic elements of the user interface (Viewports, menus, primitive and complex fields)
- Graphical primitives (Vector and bitmap)

In many ways, these forecasts have been realised and we are left only with the not insignificant problem of 'cultural' versioning.

The Cultural appropriateness of Educational Software in the Developing Nations

Post-war education in colonial Africa was often characterised by inappropriate teaching and learning, e.g. teachers in West Africa ignoring their own local authors in favour of Shakespeare or pupils in Rwanda learning about Belgium's role in the First World War instead of the establishment of the Tutsi kingdom in the 16th century. Much of what happened in the past was as a result of the textbook resources available coupled with Examination systems imported from Great Britain and the other European colonial powers. In many ways software is not that different from the textbook when portability across national borders is considered. The European Commission initiated a trans-national project in 1987 entitled 'Models for Transfer of Software' and found as one of the outcomes that the cultural factors which most inhibited portability were in order of impact:

- content
- objectives
- methodology
- flexibility
- hardware incompatibility



3.4 Key Elements in Designing an Elementary ICT Curriculum for Teacher Training

National strategies for implementing ICTs in Education are appearing in a number of developing countries. Some are visionary but lack substance; others are substantial but lack the necessary financial resources. The three case studies described later in this chapter illustrate the top-down, i.e. Ministry-led (Republic of Mauritius), the bottom-up, i.e. teacher-led (Pakistan) and the mix of both models (Malaysia). There are no right and wrong ways to proceed – but the secret of success is to have strong leadership emerging from somewhere.

Many of the developing countries are embarking on pilot projects involving a small number of schools, often in an urban environment. The argument is that it has to start somewhere. The most productive examples come about through schools bidding to be involved in an ICT project making clear what they expect to achieve by being involved. For their part, the education administration must properly resource the project both in terms of the human and physical aspects.

The most successful projects build on existing national and regional structures, e.g. new curricula or curriculum change should emerge from existing Curriculum Boards, not from a parallel structure set up to serve ICT as a special case.

There are four key elements in an ICT curriculum development project – Curriculum, Software, Teacher Training and Hardware. Successful projects integrate these four elements so that teachers know what they are doing, what educational outcomes are expected, have the skills to use the appropriate software and have access to hardware and communications resources, if required.

3.5 Some Case Studies of National ICT Programmes

3.5.1 Republic of Mauritius

The Minister of Education and Human Resource Development in a preamble to a major document widely published in the Republic stated *"At the dawn of the Third Millennium, the world society is moving towards an information and knowledge-based global economic and cultural structure. It is becoming increasingly obvious that the learning curve is shortening and employers' preference is for open-minded workers adaptive to workplace culture, with a capacity for team work, displaying good interpersonal communication skills and responsive to demanding and ever-changing performance standards. Personality traits that exhibit a disposition for new knowledge and skills, and ability to use them efficiently and effectively, have pride of place."*

The challenge that faces the Ministry as referred to in its recent White Paper (September 1997), is *"the creation of an environment that will equip our students with the skills and knowledge relevant to life in the 21st century. It is the use of information and communication technologies that will enable our students to become active, productive learners in our global community and empower our work force."*

"The liberalisation of the audio-visual landscape and the availability of global instant information bring in their wake a form of cultural neo-colonialism that may place great stress on our complex social fabric. How successful we are in checkmating the alien effect depends on our Education System."

"Drastic curriculum reforms are needed with focus on languages, critical thinking, information technology, living values, health and physical education, vocational and technical education to make the child first a social and then an economic person. Education should be the bridge between these two concepts. Hence the integrating of education and human resource development to produce an adaptable, trainable and educable work force with the knowledge and skills required to fit in the knowledge society."

"The Directorates will help lift the visions of the schools to become institutions offering after-hours courses for adults and community access to school libraries, information technology, science, arts, sporting and gymnastic facilities, so drawing in wide cross-section of stakeholders who see a practical benefit for their support of the institutions. The Directorates will plan for the development of these services as an integral component of their planning for the educational infrastructure."

"In making these suggestions, we have borne in mind that what we require is a child-centred education rather than a subject-centred one or a teacher-centred one. At this turning point in the development of our nation, it is important to identify clearly our route to the future. Our greatest assets being our people, our way to prosperity no doubt is through a system of education which is capable of producing the economic man as well as the social man of tomorrow."

The White Paper offered a strategy for implementation of a curriculum to prepare students for an information-based society. The strategy is intended to be pragmatic and due regard has been paid to the "art of the possible".

The Ministry of Education and Human Resource Development over the last few years has initiated several projects.

There is only room to describe two of them, namely MaurITprime and MaurITlink

The objectives of MaurITprime were:

1. To identify up to six Primary schools, at least one of which to be located on the island of Rodrigues (some 560 kms east of the main island of Mauritius).
2. To equip each of the selected schools with two desktop PCs and software appropriate to Primary children's needs plus a floor turtle, colour printer and an overlay keyboard.
3. To establish a Mauritian Primary education Information Technology curriculum.

4. To train at least two teachers in each of the six Primary schools to be able to exploit the ICT resources allocated to the school to the fullest extent in terms of children's learning development.

It is intended that MaurITprime expands to include all primary schools and all teachers. By the end of the primary school years, students need to be independent users of technology to communicate and solve problems in all aspects of their learning. The technology competencies are outlined below.

Technology Competencies	Year			
	3	4	5	6
Word Processing	I	U	U	U
Graphics/Design	I	U	U	U
Databases	I	S	U	U
Student/Machine Interface		I	I	I
Spreadsheets		I	S	U
Information Retrieval & Research		S	S	U
Skills Application Software	I	S	U	U

I – **I**ntroduction, S– **S**hared responsibility for use; U-Independent **U**ser
Year 6 is the last year of Primary education.

These ambitious goals give a clear indication of the teacher-training programme over the next few years as the project expands to cover the whole country.

The objectives of MaurITlink were:

1. To identify one institution on the island of Rodrigues, plus two secondary schools (one State and one quasi-private) to receive facilities for utilising the Internet.
2. To train at least two persons (e.g. a teacher + a school librarian) at each Internet location in the management and working of the communications system.

Both Projects were to be evaluated and reviewed on a regular basis and it was agreed that good practice would be disseminated both during and at the end of the Projects.

Method of Implementation

The Ministry announced the two Projects and schools were invited to take part. Aspart of the selection procedure, names of two staff at each school (including school librarians, rectors or head teachers) were submitted.Prospective staff, rectors and head teachers involved in both Projects were interviewed to ensure full commitment.Training courses were activated and hardware, software and communications resources were delivered, some, as part of the courses. Staff at the National Computer and Information Technology Resource Centre (NCITRC) supported and monitored both projects. Evaluation was carried out jointly by officers of NCITRC and an independent ICT in education consultant. Further dissemination was the responsibility of the NCITRC.

The curriculum for Teacher Training in both cases was geared to the expected outcomes of each of the two projects. Where good practice was identified, teachers were invited to take part in in-service training of other teachers and at the secondary phase to contribute to the writing of pupil and teacher ICT workbooks.

To encourage teachers to take part in in-service training, academic credit is available for the training, so that a sequence of training units results in the individual teacher gaining a credit towards a certification offered by the Mauritian Institute of Education (MIE) thus enhancing teacher response.

A School Curriculum Group encourages small-scale action research by staff members, seeking information on educational issues of direct relevance to the school. School boards, in co-operation with the Regional Education Directorate, MIE and the Ministry and in conjunction with the Academy of Education, are instituting a small-scale Research Award Scheme, open to practising teachers and offering recognition of high quality work.

Support and Emerging ISSUES
The key issues that needed to be addressed included:

- One point of contact for calls for help
- Co-ordinated and co-operative decision making involving school-based and technology support personnel
- Additional Support Staff
- Replacement of equipment

The National Computer and Information Technology Resource Centre (NCITRC) was set up in 1993 with the following broad objectives:

- design and implement various training programmes
- offer advisory services to schools
- offer technical services to schools
- carry out hardware and software evaluation with a view to making recommendations to schools
- offer specialist IT courses
- be involved in curriculum development with a view to integrate IT in the school curriculum
- act as documentation centre (IT)
- carry out basic research and development in the emerging fields of IT
- set up link arrangements with international IT development institutions with the objectives of staff development, exchange of staff and technological know-how and keeping abreast of developments in the application of IT in education
- carry out other cognate functions necessary for the success of the ministry's IT programme

So far the National Computer and Information Technology Resource Centre has run training courses for

1. Senior and Principal Education officers
2. Rectors (private and state secondary schools)
3. Deputy Rectors/Principals
4. Ushers
5. Laboratory Attendants
6. Librarians
7. Assistant Librarians
8. Maths teachers
9. IT teachers
10. 18 Primary School Teachers in the MaurITprime pilot project

The current situation in the Republic is that all secondary schools are resourced to offer an ICT curriculum in years 1, 2 and 3 and have a communications link to the Internet via the school library.

Primary schools are to be phased into the programme of ICT development over the next few years following on from the MaurITprime model.

3.5.2 Malaysia

The Ministry of Education in Malaysia (*Kementerian Pendidikan Malaysia*) has embarked on an ambitious programme of development in its schools and the Inspectorate is concerned about the need to evolve tools to gauge quality in terms of the skills and applications associated with Information and Communication Technology (ICT).

Education for a Smart Society
Quoting from a Ministry document: "An exciting development of our education system is the creation of Smart Schools. Smart Schools are being planned in stages nationally, not only to meet the requirements of the Multimedia Super Corridor, but also to create a new generation of Malaysians – Malaysians who are more creative and innovative in their thinking, adept with new technologies, and able to access and manage completely the information explosion". – Dato' Sri Mohd Najib Tun Haji Abdul Razak, the Minister of Education, Malaysia

In many parts of the world where "Smart Schools" exist, the term is generally used to categorise schools that have applied information technology to various aspects of schooling such as teaching and learning, staff training and management.

The Multimedia Super Corridor's Smart School initiative responds to the need for Malaysia to make the critical transition from an industrial economy to a knowledge-based one. This calls for a technologically literate, thinking workforce that is well able to perform in a global environment and use Information-Age tools and technology to improve productivity.

Vision
In Malaysia, Smart Schools are not only categorised by the introduction of technology – which is a critical component – but more importantly, by their ability to deliver education in a better way.

Malaysia's National Philosophy of Education
"Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, to produce individuals who are intellectually, spiritually, emotionally, and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards, and who are responsible and capable of achieving high levels of personal well-being as well as being able to contribute to the harmony and betterment of the family, the society and the nation at large." ("Education in Malaysia", 1993)

The Smart School initiative has five main goals. Two of these goals are targeted at the individual – firstly, to encourage all-round development of the individual covering the intellectual, physical, emotional, and spiritual domains, and secondly, to provide opportunities for the individual to develop his or her own special strengths and abilities.

The third goal relates to the needs of society – to produce a thinking workforce that is also technologically literate. The fourth and fifth goals are targeted at the system of education: to democratise education so that every child has equal access to learning, and to increase the participation of all stakeholders, such as parents, the community and the private sector, in the education process.

Implementation Plan
An integrated set of strategies is being employed to achieve these goals:
- An emphasis on thinking, language, and values across the curriculum.
- The introduction of vertical integration, whereby students progress at their own pace, yet remain with age cohorts.
- Teachers functioning more as "facilitators of learning" rather than "purveyors of knowledge".
- Learning being to a larger extent self-directed.

Information technology will be a prime enabler in implementing all these strategies, supported by the appropriate people, skills, policies, and processes.

There are currently about 7,000 primary and 1,500 secondary schools in Malaysia. The Government envisages that all will be converted to Smart Schools by the year 2010. The first phase of implementation began in January 1999 with 90 schools. These constitute the pilots, a sampling of the array of schools in Malaysia. Broad deployment to the remaining schools started in January 2000 using a phased approach.

Technology is the driving force behind the implementation of Smart Schools in Malaysia. Multimedia technologies will create the enabling infrastructure for new teaching-learning and management processes, the connectivity to the external constituencies, and the educational network to link all Smart Schools.

Pilot Applications
There are three pilot applications for Smart Schools.

Teaching Learning Materials
Comprehensive teaching-learning materials will be prepared for four selected subjects for all grades, i.e. Bahasa Malaysia, English, Science, and Mathematics. These materials will enhance teaching-learning strategies and curricula that are network-based, teacher-based and courseware-based.

Assessment System
The Smart School assessment system will give more accurate and comprehensive feedback of children's progress and achievement. The administration will be more flexible and involve on-line multiple delivery of test items that will take into account students' readiness for assessment.

Management System
The Smart School management system will enable school administrators to efficiently and effectively manage resources and processes required to support the teaching and learning functions within Smart Schools.

Meanwhile, the non-arrival of the official CD-ROM-based courseware has also weighed down the Smart School project. Release dates for the courseware, contracted out to the private sector, have been pushed back repeatedly by the Ministry citing "faulty software".

Another serious concern is how quickly the Government would extend the Smart Schools program to schools using languages other than the national language as its main medium of instruction.

Although the majority of schools currently use *Bahasa Melayu*, other schools still use Mandarin and *Tamil* extensively to teach in multilingual Malaysia. Some members of the Chinese community, which accounts for about a third of the country's 22-million population, voiced their concerns of being left behind in the Smart School race.

To counter the potential gap, the Malaysian Chinese Association (MCA), the largest Chinese-based component party of the ruling National Front coalition, initiated its own Smart School program last August to supply all 1,289 Mandarin-based primary schools with PCs.

But the challenges ahead for the Smart Schools project remain daunting. One favourite point raised by the opposition party is the fact that 1,273 schools in the country still do not have a power supply.

Putting the "Smart" in Smart Schools may also mean going beyond merely placing a PC on every student's table.

A survey carried out in 1999 by the Education Ministry's Curriculum Development Centre of school principals in 75 institutions selected for the Smart Schools project revealed that 97% did not know how to use a computer.

3.5.3 Pakistan

The Pakistan Association for Computer Education in Schools (P.A.C.E.S) has been in existence for nearly twenty years. It grew out of a residential course lasting 6 weeks for around 60 teachers from 30 or so secondary schools held in Karachi and funded by an international bank. P.A.C.E.S. has grown significantly and now has branches in all parts of Pakistan.

Its aims and objectives are:

- to introduce Computer Education at the grass roots level
- to make Pakistani children feel at ease with computer technology
- to keep Pakistani curricula in line with contemporary school education elsewhere
- to create an awareness among schoolteachers of the role computers can play in education
- to ensure that computer education develops in ways that build expertise

Achievements so far:

1. P.A.C.E.S. has introduced computer literacy to more than 50 small and large cities.
2. Teacher training courses are held twice annually at various locations.
3. P.A.C.E.S. supports more than 300 schools.
4. 88 schools have been provided with two computers each.
5. More than 1000 computer teachers have been trained.
6. A Comprehensive National syllabus has been developed for the Matriculation Board.
7. A Textbook has been prepared for the Matriculation Board.
8. Computer Education has been introduced in B.Ed and M.Ed courses.
9. A Syllabus has been prepared for classes VI to VIII.
10. A Detailed study for the implementation of Computer Education for the Regional Government of Sindh has been prepared.

Future Plans

- The continued support for teachers and schools
- The extension of computer education to more schools
- Provision of an Internet facility for all member schools
- To introduce awards for teachers/students
- To provide special computer courses for parents
- To establish P.A.C.E.S. representative offices in main cities
- To develop indigenous quality educational software

3.6 Some Example Case Studies of Distance Education Involving Communication Technologies with Varying Success

Brazil started a massive distance education programme after the Ministry of Education promulgated in 1970 a decree requiring all radio and television stations in the country to set aside five hours each week for free educational broadcasting. The free airtime was put to use by transmitting various non-formal educational and cultural programmes. Known as the Minerva Project it was designed for a national audience in all states in which education secretariats had arranged for the organised or supervised reception of broadcasts.

Côte d'Ivoire had an ambitious programme known as the Ivory Coast Educational Television Project. Its prime objectives were to achieve better distribution and unification of schooling at the primary level, improve school throughput, and establish universal primary education in the country by 1985.

The Project focused on both formal primary education and non-formal education. The secondary objective of the programme was to raise political awareness by familiarising the population with economic, political and administrative structures of the country. One of its drawbacks was that it tended to be too focused on television programming and was unable to enrich and reinforce instruction by using other media technologies.

Dominican Republic

Another example of distance education used to improve the quality of teaching available was the Radio-Assisted Community Basic Education (RADECO) Project. This Project's three-pronged goal was to develop an effective teaching programme at low cost for school-age children, adapt classes for grades one to four for delivery by radio, with formal certification for students successfully completing each year, and finally, train Dominicans in all techniques and skills needed to carry out the programme. The subject matter of the formal distance education programmes mostly followed prescribed traditional curriculum and subject areas.

India
One of the basic objects of the Satellite Instructional Television Experiment (SITE) in India was to undertake instruction in the fields of family planning, agriculture, national integration, and science (e.g. non-formal science series for children). Using existing Satellite technology with television often running from generators in the villages, is considered one of the significant success stories – particularly in the field of education and family planning.

Mexico
Another case study concerned with non-formal education is the Direccion General de Educacion Audio-visual (DGEAV) in Mexico, one of the objectives of which was to promote national literacy by using radio and television.

Nicaragua
The radio Mathematics Project in Nicaragua tried to increase achievement in mathematics offered in public primary schools, to provide for easy and wide utilisation, and to provide an instructional system acceptable to children, teachers, parents and officials.

Generally speaking, in most of the case studies listed above, the pedagogy of distance education did not differ much from that of the conventional education system. Nor did the curriculum and certification process (where teaching for formal education is concerned). In other words, similar courses and materials were taught or covered. Use of printed materials for correspondence seems to be the hallmark of study materials almost across the board. In most programmes, learners were required to submit their written assignments at fixed intervals to be marked and graded by the instructors.

Major Results/Evaluations

- The net unit cost for the three year teachers training using distance learning methods (TTD) was one quarter of the teacher training costs for the same period in a Tanzanian project.
- Major lessons learnt from the study of teacher training at a distance in Kenya include teacher effectiveness, motivation, cost-effectiveness, economies of scale, co-operation, resources, and political support.
- Findings of achievement tests indicate that students learning mathematics by radio scored significantly higher on these tests at each grade level, compared with children who had not been taught by radio in Nicaragua. Also, the teachers involved in radio mathematics project were willing to use the radio lessons (and the post-broadcast lessons) in the classroom and were of the opinion that students learned well from these lessons. Economies of scale served as an important factor responsible for success in mathematics teaching in Nicaragua.
- Taking all evidence into consideration, RADECO students seemed to do as well as conventional school students in the areas of reading, language, and writing, and they did significantly better in mathematics.
- The performance of RADECO students was impressive, especially when one takes into consideration that the RADECO students were in class for less than half of the time that the comparison students were, and that the RADECO study time was at the end of each day when the children were likely to be tired from their day's work in the fields. Trained national staff and the RADECO radio lessons themselves constitute two valuable commodities, whose value has been sustained by virtue of the institutionalisation of the project.
- Telesecundaria schools in Mexico are about 25 per cent less expensive than conventional schools at that level. No significant difference was found in the achievement of third-grade Telesecundaria and traditional students in Spanish and Mathematics.
- In the case of India, about 30 per cent of Indian people who had no previous contact with mass medium were reached by the SITE, and audiences preferred instructional programmes to pure entertainment.

The future use of ICTs to support educational development will need to consider not only technologies based on the latest computers and the Internet, but also on low cost broadcasting, renewable energy sources and the ingenuity of the human resource.

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4. THE MATRIX OF COMPETENCES

4.1 Introduction

Pedagogy not technology should be in the forefront when implementing ICT into teaching and learning. Training programmes should therefore not be separated from the practical educational setting. There are different programmes describing basic ICT competences to be mastered of users in general, also applicable to teachers, i.e. the European Computer Driving Licence (ECDL). The International Society for Technology in Education (ISTE) provides National Educational Standards for Teachers (NETS) based on some essential conditions for implementing such a programme. In Denmark a programme for Educational Computer licence has been developed. Similar programmes are produced within UK and certainly also elsewhere. While the ECDL represents a set standard aiming at certifying, programmes like the Danish are made to develop ICT competencies within an educational setting, and thereby promote and support educational change.

The matrix presented here is a detailed list of competencies that need to be considered in any elementary ICT curriculum for teacher training. It must be underlined though that such a list cannot be considered to be complete or sufficient in a field of such rapid change. Running an ICT training programme without considering pedagogic issues and including practical educational realities will not be effective. At worst it can be a waste of time and money, being more damaging than no training programme at all. At best it provides teachers with some ICT competences whereof some of them are able to utilise their skills and knowledge educationally.

One must be conscious of the need for holistic perspectives and practical approaches to be able to utilise the matrix in an effective and productive way. Holistic perspectives also provide necessary analytical distance preventing to get lost in technical and technological details. If focusing on ICT skills mentioned in the matrix only one may easily get lost in such details, but combining it with pedagogic, practical teaching and learning situations gives relevant perspectives and correctives.

Inapplicable knowledge has no value. Real life is always the best setting for learning, and real learning is to be a part of life.

This basic ICT teacher training curriculum and the matrix are not meant to be what commonly is considered to be a curriculum, but rather a point of departure to formulate study programmes where ICT is integral part. Element of such a programme would include:

- A holistic understanding of different kinds of information and communications technologies, and their use.
- A pedagogic understanding to be able to evaluate proper utilisation of ICT in teaching and learning, when it can be feasible and when it should be left out.
- Develop educational competence to utilise ICT to effectively support student's learning, including student's ICT skills.

The teachers ICT-competencies must include:

- ICT as a subject for teaching
- Utilisation of ICT as tools
- Ability to teach with ICT as tool and learning material

Making teachers to personal ICT users is a necessary but not sufficient precondition for successful ICT implementation in education.

4.2 How to Use the Matrix

The curriculum is described by using a matrix of competences and skills. The following example can show the structure and the functionality of the matrix.

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
1.1	PC equipment	Few PCs in certain places in school building	Computer labs with up to 15 PCs	PCs in every classroom with LAN
1.5	Communication equipment		Slow modem connection to internet	Fast broadband connection
3.21	Use word processor as a personal tool	Produce text using simple layout functions, store and print	Use of advanced text function including tables, graphics	Combing wordprocessor with other professional software tools, using annotations and produce html pages
4.21	Use word processor as a teaching tool	Show the difference between traditional writing and using a word processor	Use word processor as a dynamic tool of documentation	Word processor as a means for supporting creativity and colaborative work

The matrix contains all curriculum items which are necessary for a successful use of ICT in classroom. It can be used in three different ways:

1. The matrix is an instrument to analyse the current status of the development in a country, an area , a school or a teacher training organisation.
   By marking the areas of competence and skill which have been developed up to now you find the existing competence profile and the current status of ICT knowledge.
2. The matrix can also be used as a planning tool. By marking the profile you want to achieve you can easily identify the difference and the areas where you need to develop the competences of the teachers.
3. In its way the matrix can be used as a starting point for the discussion when making national ICT teacher training curriculum or plan.

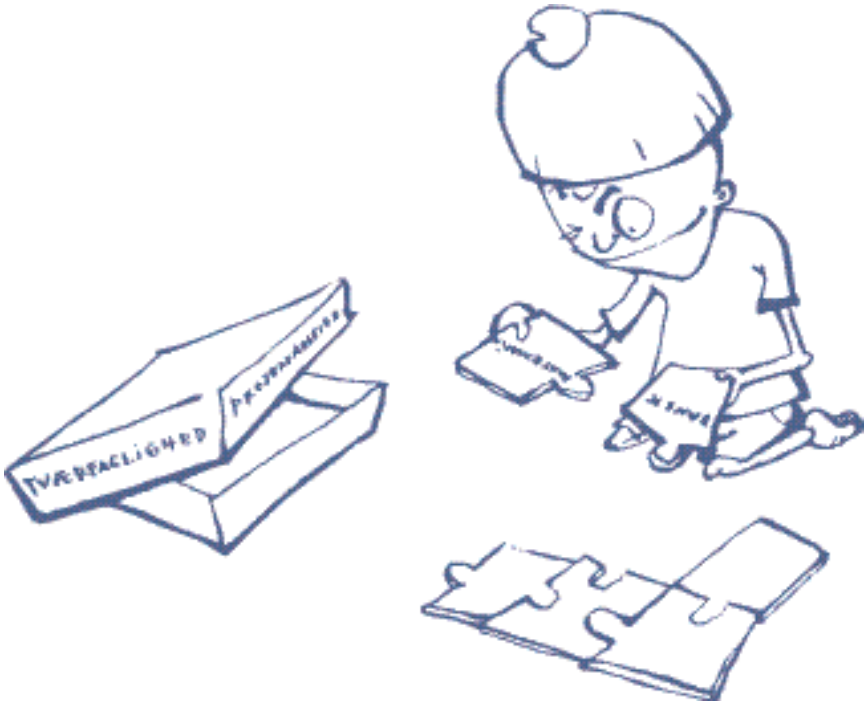
The matrix can also be used for defining the needed skills and competences of teachers and students when planning classroom or school projects as shown in the following example:

Make a newspaper in classroom → 1.1 (2) → 1.5 (1)
Make a newspaper in classroom → 3.21 (3) → 4.21 (2)

(numbers refer to the example)

The matrix shows three levels of competence. Therefore the matrix is an instrument for adapting the curriculum to different situations. National curricula are subject of educational tradition, different levels of technological development, cultural diversity and political systems.

The authors are aware of the problem that a standard ICT curriculum for teacher training never will fit to all situation in all countries of the world. It was their intention to produce an instrument which allows adaption to different need and traditions.



4.3 The Matrix

The matrix of competences is based on similar projects like the syllabus 3.0 of the ECDL (European Computer Driving Licence) and the documents of the National Educational Technology Standards for Teacher Education of the ISTE (International Society of Technology in Education). We have tried to make the UNESCO matrix more open in the sense that it can easier be adapted to different social and economical standards. Nevertheless it is valuable to visit the sites of ECDL (www.ecdl.com) and ISTE (www.iste.org) to see more details and to follow the further development.

All items in this matrix are ment as starting points of discussion and the development of national plans and standards. It is not the intention of the authors to give a full description of the content.

4.3.1 Adequate Technology Competence

Teachers should have a sound understanding of the basic concepts IT is based on. They should be able to identify the main hard- and software components of the IT environment used at school. They must have skills in using common hard- and software in the classroom. All this in order to enable them to design a suitable technological infrastructure and to cope with hard- and software problems in the class. Teachers should be able to follow the rapid changes in the IT world.

The aim is not to be a technology expert, but teachers should reach a level so that they can master the problems and make use of the offers the new technology gives us.

Objectives:
Teachers should be able to:

- Understand the principles and concepts IT is based on.
- Know the basic hardware components of modern computers and peripherals as well as their main functions.
- Master the main function of the operating system mainly used in schools.

- Connect new hardware and technology resources specially designed for educational use.
- Install new software and media products especially those which are produced for educational use.
- Develop trouble shooting strategies to master routine hard- and software problems during the use of IT in classroom
- Evaluate hard- and software concerning their usability in classroom and to make an appropriate choice between different products.
- Use digital media devices and software interfaces for them like CD-ROM, DVD, digital cameras and scanners.
- Design technological parts of a technology enriched classroom environment.

Matrix of Competences for Part I: "Adaquate Technology Competences"

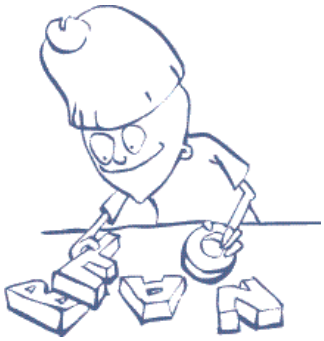
NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
1.1	principles and concepts of IT	• concept of computer as a toolbox • basic functions like storing, processing and transmitting data	• data representation and processing • relation between data and information	• mathematical foundation of IT • representation of Boolean Algebra in electronic circuits • history of informatics and IT
1.2	computer	• main components of a computer system and their functions • memory (storing data) processor (calculating, comparing, moving data) bus system (transferring data between units of the computer) hard disk (know difference between RAM and disk storage) • use of devices like screen, mouse, keyboard	• main parameters indicating the speed of the CPU performance, like – Type of processor – MHz • specification of disk, like – capacity – speed • specification of possibilities of expansion, like – number of slots – video and audio cards – number and types of ports • be able to evaluate IT advertisements and talk to suppliers	• overall knowledge of computers in order to be able to define hardware systems meeting the needs of the school • being able to set up computers including all peripheral devices, LAN and internet connection, knowledge of partitioning of disks and general system optimation
1.3	computer peripherals	• understand peripherals as supplementary equipment – sometimes mounted in the computer chassis sometimes connected via cables • know the main peripheral devices like – printer – CD-ROM – DVD and their functionality	• know other peripheral devices and their functionality, like – plotter – digital boards – projectors – CD-Burner – microphone – MIDI equipment • know that some peripherals demand cards	• be able to connect all kind of peripherals • know to install drivers and cope with port and IRQ numbers

Matrix of Competences for Part I: "Adaquate Technology Competences"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
1.4	digital media components	be able to use basic functions of pre-setup input and output devices connected to school computers, like – scanner – camera – colour printer – CD-ROM burner	• to use more advanced functions of digital equipment and integrate them in multimedia activities	• be able to attach and configure equipment to school computer
1.5	PC in a network	• capability to log into a specific network	• understanding of a network structure and the advantages of using a network • know the difference between local and network disks and can use both • know the function of a server • know the difference between a local and a network printer	• know the different network topologies • can do basic maintenance of a server: – add users – change user rights and passwords – data backup • reinstall computers via network
1.6	internet technology	• basic concept of internet • access technology on basic level • main internet services • functions of different servers in the internet	• functions of standards (protocols) • basic knowledge of – IP number – DNS – Gateway – Router and Modem • installation and configuration of client software including plug-ins and connection to other applications	• setup computers for internet connection • concept of proxy servers • functions of a firewall, like – building intranets – filtering – security
1.7	operating system	• know the importance of the operating system • start and turn-off • know what files and directories are • know the file structure and its terminology • copying files between storages printing	• be able to adjust basic options of the OS via control panels and setup facilities, like screen size, default printer, time, sound controls • connect to other computers in the LAN	• be able to setup advanced functions like IP number network connection virtual memory auto start options • installation of new programmes

Matrix of Competences for Part I: "Adaquate Technology Competences"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
1.8	software	• programmes as tools	• principles of problem solving • data structures • from algorithm to a programme • know common used programming languages	• concept of software development, like structured programming, modules, OOP
1.9	trouble shooting capabilities	• identify "visible" problems, like troubles with power supply, cables, ... • act on error messages and report in proper way	• identify not obvious problems, like data overflow, missing drivers, IRQ conflicts, system overload • try to trace errors systematically	• identify errors which demand reinstallation • reinstall system components • use watch programmes and interpret log files
1.10	system maintenance	• can do basic maintenance work, like: refill paper in printer • know the importance of continuous data backup	• can do more advanced maintenance work, like: remove ink cartridge • use maintenance programmes, like defragmentation of disks • can do data backup of the system	• survey system logs in order to prevent problems • mechanical cleaning and battery renewal • be able to control data security of school and to produce plans and guidelines
1.11	security issues	• know what a virus is and be aware of virus protection • be able to follow general rules to prevent virus attacks • know what to do if a virus attack is reported • raise the awareness of virus protection among students	• be able to update a virus protection shield • be able to take specific action depending on virus report • know where to find information about viruses • be able to start and use a virus cleaning programme	• know the concepts and possibilities of firewalls • define and setup antivirus policies and schemes • know the possibilities of filter programmes and be able to configure it



4.3.2 ICT Productivity Tools

Teachers should be able to use common ICT tools to enhance the productivity of the learning process. They should be able to evaluate existing tools regarding their usability in classroom. Students and teachers should be able to use the modern information tools in order to have access to updated data and information. They should know the possibilities and advantages of having data in a digital form. Teachers should know how to handle new communication tools to be able to collaborate with students and fellow teachers and to share experiences.

Objectives:

- Be able to master useful software products up to a level which is suitable for their work. The most important software applications for classroom activities are:
  - word processor
  - spread sheet calculation
  - simulation
  - graphical applications
  - data handling
- Be able to locate, evaluate, collect and reuse information on the internet and via other IT channels.
- To use IT for all kinds of communication and to handle the hard- and software tools needed to interact with peers, students and parents.
- To identify and use tools for preparing and design publications and to produce material for teaching and learning purposes.
- Use a variety of media formats.
- Use multimedia productivity tools in order to produce multimedia material for the use in classroom.
- Design, manage and facilitate tools for data-handling including features to create reports.
- Use IT to facilitate problem solving, decision making and knowledge construction.
- Have an idea what programming is and know the basic structures and principles of software production.

Matrix of Competences for Part II: " ICT Productivity Tools"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
2.1	word processor	• start word processor • open, create and save documents • insert and delete text in a document • use copy and paste function • change character format • change paragraph format • use bulleted and numbered lists • insert images and graphics to text • print a document including preview	• use help functions • change page format • change display format • change line spacing • use tabs • use standard tables • add headers and footers • use spellchecker functions	• save documents in different formats • modify toolbars • work with templates and styles • advanced table features • merging data and text • use and create macros

Matrix of Competences for Part II: " ICT Productivity Tools"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
2.2	spreadsheet calculation	• start spreadsheet application • open, create and save spreadsheets • enter text and numbers into cells • enter formulas into cells • simple format option for cells, like text format, number styles, including insertion of rows and columns • use auto fill function with relative and absolute referencing • print document including preview	• use help function • advanced format options for cells and tables • cut and paste • use of simple functions like sum and average • add header and footer • change page and tables format • import objects from other applications • produce different types of charts	• save in different formats and interchange of data between spreadsheet and database applications • modify toolbars • use all functions • define protected cells on the table • use and create macros
2.3	database/filing system	use of a database • start database application • be able to perform the main functions with records: – insert – change – delete • sort database on different criteria • create simple queries	set up a database • know concept of relational database structure and the terminology (database, record, field,..) • know the three steps: – record definition – field definition – form definition • create queries with multiple criteria • add and remove filters • create reports from a query	use advanced query functions • create advanced reports by grouping results • programme SQL statements • use and create macros

Matrix of Competences for Part II: " ICT Productivity Tools"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
2.4	presentation and media tools	• start presentation and other media application • open, create and save files • create presentations using masterslides • adding text, graphics and other kinds of objects to presentation • reorder slides in a presentation • change format of text and pictures • basic functions of graphics application • storing voice or music in an audio file	• integrate motion into a presentation • create slideshows with different effects • using a scanner to digitise pictures and upload the picture into the computer • advanced function of graphic application • using a digital photo camera • use a photo • manipulation software manipulating an audio file with a special audio application • using a digital video camera	• saving a presentation in a format designed for publishing on the internet • using OCR software • cutting video material on the computer
2.5	information and communication tools	• starting an internet connection from a network and from a single PC • starting the browser software • open a specific URL • download of files from a web-page • finding and storing bookmarks • starting mail client • sending and receiving mails • using automatic copy • sending and receiving mails including attachments • reply and forward of received mails • using a web-interface for mailing • participation in a discussion forum on the web	• being able to use search engines • copy text and picture in a text document • storing a picture found in the web on disk • download files from the internet • configuration of the start-page of WEB-browser • download and installation of plugins • developing strategies for search in the web • download and transfer of files using ftp • configuration of a mail client • using an address book for mailing • use videoconference system	• advanced configuration of a web-browser including Proxy definition security options cookies helper software • create simple web-pages by using an graphical editor application • transfer web-pages to the server • set up electronic conferences • set up videoconference system

Matrix of Competences for Part II: " ICT Productivity Tools"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
2.6	simulation	• understanding the concept of models as a sub-universe • understanding benefits and the limitations of the model • be aware of the connection between subject matter and simulation • use of simulation provided to student	• create simple mathematical models using standard tools, like spread sheets	• creating models by formulating algorithms in a programming language or by using macros
2.7	graphical applications	• use basic function of graphics software	• use of advanced function of graphics software • using applications for manipulation of pictures	• use of professional graphics tools
2.8	data measuring		• connecting measuring devices specially design for school to PC • use simple control and measurement software	
2.9	robotics	• working with an existing robot • controlling robots by configuring the parameters of control software	• working with an existing robot • controlling the robot by defining algorithms with the help of a control software • using machines for embroider and using CNC lathe	• constructing a robot • creating the control programme using a programming software
2.10	process control systems			• building models and programming the controls
2.11	music			• playing instruments connected to the computer • using programmes for producing a piano score
2.12	programming	• know the principles of software	• algorithmizing of problems • using standard software for problem solving	• using macros or simple programming languages to formulate the algorithm

4.3.3 Teaching and Learning

Teachers should be familiar with the great potential of ICT and new media regarding to improve the teaching and learning process. They should be able to use their technical knowledge to design and change curriculum plans including methods and strategies for an appropriate use of IT in order to enhance the outcome of their work with the kids. They should be able to identify the key factors of the changing role of the teacher in the learning process.

Teachers should be prepared to be facilitators and moderators of the learning process. They should never use ICT unless there is a justification by pedagogical needs.

Objectives:

- Have a sound understanding of the main learning theories and consequences and relation to the use of ICT in classroom.
- Find a positive attitude towards technology and be able to identify the big advantages and benefits of the use in teaching and learning.
- Know the special methodology of using IT in different subjects and find and collect examples of good practice.
- Identify and evaluate information sources available for students.
- Identify and evaluate applications suitable for classroom activities.
- Plan lessons that meet current standards for best practice in using IT for teaching and learning like
  - student-centred learning,
  - collaborative learning,
  - individualized learning,
  - project oriented learning
- Discuss the advantages and problems of distance learning and have their own experience in the use of this method
- Be able to use IT for information of parents and cooperation with them.

Matrix of Competences for Part III: " Teaching and Learning"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
3.1	learning theories and theoretical background	• should be aware that ICT changes conditions in classroom • make personal advantages of ICT in classroom	• has a theoretical pedagogical background on the use of ICT in classroom	• able to write lesson plans to benefit from ICT • have knowledge of the existing research in pedagogy and psychology and be able to exploit it to colleagues
3.2	understanding of teaching tools and methods using ICT in general	• know different kinds of educational software, like tutoring software, drill & pro-active simulation, software tools, and the appropriate way of use	• able to organize pupils in teams and integrate ICT in small scale projects	• know how to integrate ICT in bigger and cross-curriculum projects • know how to set-up guidelines for fellow teachers and act as an adviser

Matrix of Competences for Part III: " Teaching and Learning"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
3.3	understanding of teaching tools and methods using ICT in subjects	• has an overview on existing tools and appropriate methods for a specific subject	has a sound knowledge of existing tools and methods and is able to change traditional activities in order to make best benefits out of ICT tools	• has a global overview on tools and methods in different subjects and can act as an adviser for colleagues • is able to modify tools and adapt them to specific situations
3.4	teaching and learning tools (hardware and software) by using adequate methods	• able to use PC and the basic equipment in the school effectively in classroom • has knowledge on the possible function of more advanced equipment available in classroom	• is able to use all the equipment available in the school in an adequate way • able to evaluate the needs for new tools deriving from educational demands	• set-up and use all kinds of ICT tools even more complex system tools like Video-conferencing systems • able to act as an adviser for colleagues in selecting digital media tools and to combine them
3.5	ICT as a catalyst for student and project centred learning	• is aware that ICT demand/facilitate a change of teaching and learning methods	• has rearranged his way of teaching in some areas • is aware that the role of the teacher is changing • knows different kinds of new methods, like student-centred, individualized, collaborative and holistic learning	• has radically changed his way of teaching • is able to act as a change agent in school
3.6	using ICT based communication	• know the possibilities of ICT communication tools and is able to use them for personal use	• able to use ICT based communication tools for activities in classroom and to guide students in the use of it • able to contribute to discussion groups and electronic conferences	• organize the use of ICT communication tools for the dialogue between colleagues • know to use more complex conference and communication systems, like audio- and videoconference
3.7	using ICT based information systems	• able to browse the net using known URLs and portal sites • knows how to use search engines • is aware of the problems with reliability and quality of information retrieved from the net	• is confident in all kinds of information retrieval on the net • has developed strategies how to find information from different sources • has a personal library of bookmarks	• is able to create web-pages and to transfer them to a web site where the work of his class is presented • is able to act as a webmaster for a class, subject, school website

Matrix of Competences for Part III: " Teaching and Learning"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
3.8	linking reading, writing and talking	• uses reading, writing and talking equally in classroom	• uses software tools which support voice in- and output	• is able to produce multimedia tools supporting audio functions
3.9	music and arts	• is aware of the potential of ICT tools to support creativity in classroom • able to use standard software tools like word processor and graphics tools in creative manner	• using different kinds of software tools (designed for the use in school) in a more systematic approach • able to use ICT for presentation of the outcomes of the creative process	• able to use more advanced (semiprofessional) tools, like MIDI and DVD
3.10	asynchronous and distance education	• is aware of the potential of distance learning methods	• is to able make benefits for himself to use distance learning activities	• is able to participate in distance learning activities as a tutor as co-author
3.11	life long learning	• is aware of the needs for life long learning and the great potential how ICT – demands a permanent update of information and knowledge – can support to keep this knowledge updated		
3.12	ICT supported cooperation between parents and teacher	• can produce textual information using a word-processor	• is able to communicate on email basis • knows how to use communication system of the school	• can use the web as an information means

4.3.4 Assessment and Evaluation

Teachers should be familiar to different assessment and evaluation strategies. They should be able to use IT in the assessment of teaching and learning. IT can be used in collecting and analysing data and to display and communicate the results. They should be able to define criteria for the evaluation of IT tools and products used in the classroom.

Objectives:

- Discuss assessment and evaluation strategies.
- Integrate IT based assessment into plans for use of IT in classroom.
- Be able to decide if methods integrating IT are appropriate.
- Evaluate the information sources used by students (relevance, accuracy,..).
- Find criteria for the evaluation of IT products for the education market.
- Know criteria for the evaluation of courseware products.
- Use IT for reporting of results of the evaluation to students.

Matrix of Competences for Part IV: " Assessment and Evaluation"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
4.1	self-assessment of teachers	• integrate IT based assessment into plans for use of IT in classroom	• is able to decide which methods for integrating IT are appropriate	• is able to help colleagues to evaluate their classroom activities
4.2	self-assessment of students	• encourages students to evaluate	• use tools for evaluation	• set-up systems for self-evaluation in school
4.3	assessment of students by teachers		• use tools for evaluation	• set-up systems for self-evaluation in school
4.4	evaluation of ICT tools	• knows some criteria for evaluation of software tools	• has a list of criteria for evaluation of software tools	• is able to compare different ICT tools • knows sources where to find evaluation reports
4.5	evaluation of courseware products	• knows some criteria for evaluation of courseware products	• has a list of criteria for evaluation of courseware products	• is able to compare different courseware products • knows sources where to find evaluation reports
4.6	evaluation of the quality and reliability of internet resources	• knows the problem of quality of information on the net • able to discuss this with students using different examples • has some criteria how to evaluate	• is able to systematically evaluate the quality of internet sources • is able to produce a list of criteria to do this	• is able to set-up standards for filtering software products • is able to trigger the filtering tools
4.7	be able to choose the right tool for a specific situation	• recognise that the tools are influencing what you are doing	• is able to choose the right tool	• is able to modify tools

4.3.5 Social, Ethical and Human Issues

Teachers should know that the integration of ICT in school as well as in our society raises a lot of legal, social, ethical and human issues. They should be able to communicate these problems to their students. In classroom they should be able to pay attention to the problems of cultural diversity, gender issues and equitable access to ICT. They should take care of a safe and healthy use if ICT.

Objectives:

- Understand and discuss the legal, ethical, cultural and societal issues related to the use of IT in our world..
- Understand and discuss the legal, ethical, cultural and societal issues related to the use of IT in education..
- Be aware that the global village is a multicultural entity and cultural diversity on the internet is a big chance.
- Know the main legal problems related to IT like:
  - copyright
  - privacy
  - security of data
- Know the main societal problems related to IT like:
  - gender issues
  - equitable access towards technology
  - workplace needs
- Discuss ergonomic problems and be able to improve the technological infrastructure of the school from that point of view.

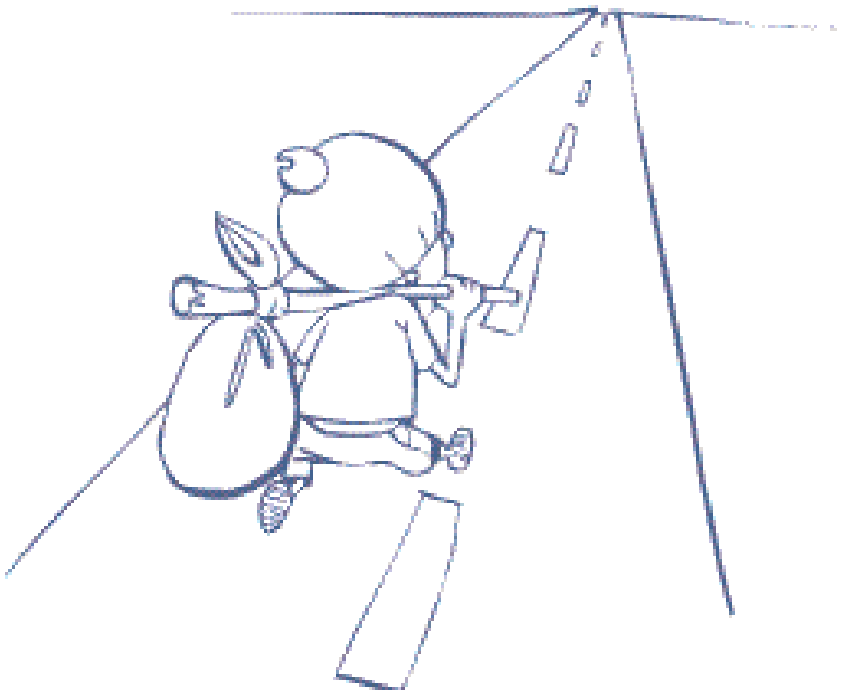
Matrix of Competences for Part V: "Social, Ethical and Human Issues"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
5.1	benefits of a more open of access to information sources	• is aware of the link between democracy and free communication and information access • is able to communicate the benefits to students	• can use this open access to information in order to improve his teaching • show examples on the net to demonstrate this benefits	• is able to set-up projects with students to guide them to be independent learners
5.2	changes of social pattern in society	• is aware of the influence of ICT on social pattern in society		
5.3	changes of power relations in a networked society	• is aware of the influence of ICT on power relations in a networked society		
5.4	problems and benefits of the globalisation of labour market	• is aware of the influence of ICT on globalisation of labour market		

Matrix of Competences for Part V: "Social, Ethical and Human Issues"

NO.	CURRICULUM ITEM	LEVEL 1	LEVEL 2	LEVEL 3
5.5	internet and cultural diversity and identity	• knows that information always is influenced by the cultural background and carries the identity of the sender • is aware that cultural diversity enriches a global network • to be able to adapt information from the net to the own cultural background	• can collect and analyse information gathered from the net in order to support a better understanding between the youth of different nations	• is able to publish on the net and supports the presence of information on the net with a specific culture tradition • is able to set-up project between schools in different countries and cultures
5.6	equitable access to technology	• is aware of the technology gap in a society and between different regions and countries in the world	• is able to cope with different levels of technology in joint projects	
5.7	gender and racial issues	• is treating students of different gender equally	• uses ICT to get information on this problem • is able to analyse information on equity issues	• is able to set-up and execute projects dealing with equity issues
5.8	privacy and security of personal data	• is aware of the problem and has enough knowledge to discuss it	• has enough knowledge to discuss the legal basis of privacy and security of personal data in the own country • is able to use software tools to show the impact of ICT on privacy and security of personal data	• has enough knowledge to give an overview on solutions made in different countries • is able to publish on this topic
5.9	copyright issues	• is aware of the problem and has enough knowledge to discuss it	• has enough knowledge to discuss the legal basis of copyright issues in the own country • is able to use software tools to show the impact of ICT on copyright issues	• has enough knowledge to give an overview on solutions made in different countries • is able to publish on this topic
5.10	ergonomic and health problems	• is aware of the problem and has enough knowledge to discuss it	• has enough knowledge to discuss the legal basis of ergonomic and health problems in the own country • is able to use software tools to show the impact of ICT on ergonomics and health problems	• has enough knowledge to give an overview on solutions made in different countries • is able to publish on this topic

5. NATIONAL REPORTS



National reports produced by members of IFIP TC3 working groups from countries of different cultural background and various political systems should give examples of good practice and show experiences made by the integration of ICT in school.

5.1 Bulgaria

NATIONAL STRATEGY FOR ICT TRAINING IN BULGARIA. LEARNING PLANS AND RESULTS

Boyka Grandinarova

During the last years Bulgaria has encountered serious financial problems connected with the restructuring of the economy. Since 1997 the government budget is suffering from strong restrictions caused by the implemented system of the Currency Board, so the funds assigned for the needs of education and especially for ICT are not enough. But as Bulgaria was one of the leaders among the Central and East European countries in the field of the computer technologies, still in the country there is enough potential for developing of ICT.

On this base the Ministry of Science and Education has worked out a strategy for implementing of ICT in the learning process at primary and secondary schools.

The basic principles of the National strategy approved in 1998 are:

- Up to date ICT to be accessible for every student graduating secondary school
- ICT has not only to support specific educational needs, but also to assist with the rising of the level of education as a whole
- In order to keep and improve their qualification, the teachers will need all life learning for which ICT are of greatest importance.

The aims of ICT training are formulated as:

- Personal-social context – reflecting the opinion that every student is to acquire common knowledge and enough practice on the computer hard- and software as a base for his future progress into the changing informational environment and this way to be prepared for his

future role in the society. In this context are incorporated informational alliteration, cognitive and intellectual improvement, metacognitive skills (critical attitude, evaluation of own activity and its results, analyses of the own learning process and abilities for its improvement), capacity for all life learning, personal improvement.

- Professional context – relates to the necessity the students to be acquainted with the use of computers and ICT in their future profession. As a result of their professional education the students should gain the skills to work with the basic ICT specified for each professional area, to be fitted for work in a group, to be flexible to the quickly changing business conditions in connection with the use of new information technologies. In this aspect special attention is turned to the training of highly qualified hardware and software specialists in the secondary schools.
- Pedagogical context – it is in connection with the use of ICT in the learning process aimed at developing of its organization, implementing of new, more effective educational means, development of the educational system.

The potential of ICT can be used in providing the following:

- Better understanding of the curriculum subjects than by use of the traditional means
- Creation of educational environment for simultaneous teaching of a large number of students, as well as of individual students
- Assistance in the differentiation in learning and the creative activity of the students.

The learning plans and the ICT education

The levels of ICT education in Bulgaria are presented on fig.1

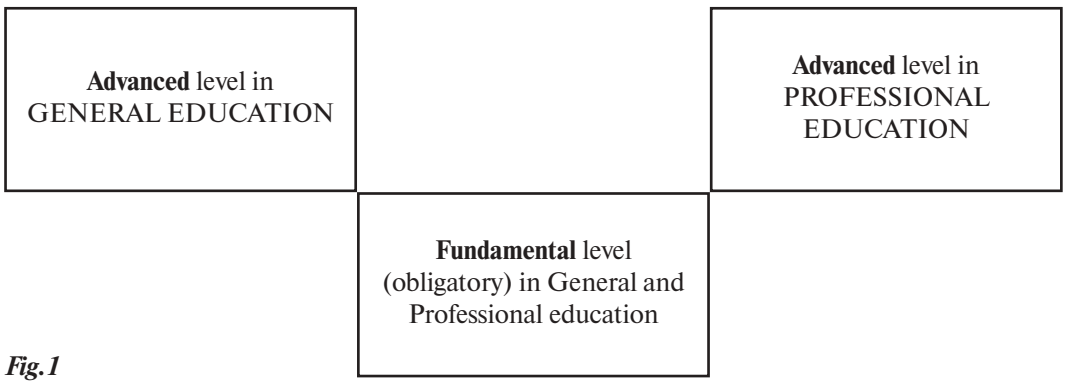


Fig.1

The fundamental level is formed as a part of the general or professional education and is ensuring the obligatory for everyone ICT training, as well as possibility for additional training. It is the minimum knowledge, which everybody graduating secondary school should have. It is effected either as a special ICT discipline or is incorporated into another disciplines

The best solution is fundamental courses on ICT to be included in the learning curriculum prior to the time when the students will choose the secondary school where they will continue their education. It would ensure general training for everybody, allowing the ICT to be applied and studied more profoundly in their further education (in the secondary school). According to the Bulgarian educational system this training is provided in 7^{th} or 8^{th} grade. If the problems with computer equipment in schools and with teachers' qualifications are solved, this training could be provided earlier – in 6^{th} or 7^{th} grade.

The integration of ICT in education begins from the first and continues to last school year. The children are being accustomed to work with computer (didactical games, simple word and drawing processors, etc.) in primary school. This will help them later in their further use of ICT.

The education of the more advanced students in the general education is provided as electives and is based on the learned at the fundamental level. It can be done in systematic or integrated training forms depending on the students' preferences.

The advanced education in the professional education is related mostly to the selected professional field and is based also on the knowledge learned at the fundamental level. The training can be organized in separate modules or to be incorporated into the professional disciplines. For some professions the use of ICT is obligatory and for others is not. This is determined by learning plans for the respective profession or by decision of the particular school.

The obligatory training in ICT (Both fundamental and advanced) is included in the government educational requirements for the curriculum programs.

The position of ICT in the curriculum is presented on fig. 2.

Grade	Gymnasiums, specialized gymnasiums, professional schools
12 11	Advanced level Integrated forms Electives/Obligatory system modules
10 9	Fundamental level Obligatory system modules
8 7 6 5 4 3 2 1	Integrated forms

Fig. 2

Providing the ICT education with technical equipment and software

Recent research is indicating that now the Bulgarian schools have a lack of modern computers and communication equipment. As the government budget is not able to satisfy these needs, some efforts are done in order to solve the problem in non-conventional ways (like funding from donor organizations). The main tasks for the educational system, which require significant financial resources are:

1. The supply of adequate equipment (486 MHz computers, with at least 8 MB of RAM, with color monitor, CD-ROM, network cards) as well as printers and modems.
2. Providing of regular and reliable technical service and supply of consumables.
3. Licensing of the necessary software.

These problems can be solved to some extend with EU funding where EC companies to be invited to bid in a tender for the supply of hardware and servicing of about 10000 second hand computers with the above mentioned characteristics.

In order to solve the problem with licensing of the software it was recommended to negotiate with Microsoft company for obtaining consignments free of charge or on a minimal price of necessary licenses on the base of a large contract for software supply for all the Bulgarian schools (the same was done by Microsoft already for the schools in Hungary and in the Baltic republics).

Providing Internet access

Like in most European countries, the issue about the access to Internet and the new ICT as well as the training for their use in the society is a priority for the Bulgarian educational system. The basic principle is to give equal chances to everyone for access to the new ICT at a reasonable price. In this respect the educational institutions are considered special consumers – on the base of preferences and low prices needed. In order to achieve this aim the following measures are needed:

- Free access to the net
- 70% reduction of the subscription fees
- Free exchange of information in fixed hours monthly
- Discounts when buying computers, modems, software, etc.

It will be helpful if the provider of the National school net is a non-commercial organization (charity or social institution) using in this way preferences either from the government or from the telecommunication company.

Teachers training in ICT

In view of the increased needs connected with the National strategy on ICT in Bulgaria, the number of highly qualified in ICT teachers should be increased. It is necessary the training to be spread to the following groups of specialists:

- Teachers and coordinators in ICT
- Teachers in the other disciplines
- School administration

In accordance with the aims of the integration of ICT in education, the aims of training of the different groups have to be formulated: the theoretical and practical knowledge and skills, the criteria and the quality standards, according to which these knowledge and skills are to be applied.

The training levels are proposed to be:

- Initial training. It is carried out in the high schools (bachelor degree)
- Post-graduate training. This training is aimed to keep and improve teacher's qualifications. It is carried out in two levels: *supporting* (refreshing of the professional knowledge and skills) and *improving of qualification* (gaining of new professional competency, allowing the scope and the character of the activity within the profession to be increased and/or changed – bachelor degree, pedagogical degrees of qualifications).

The system of post-graduate training of teachers presents itself in a variety of educational forms, activities and practice in which the teachers are engaged in order to increase their professional skills and knowledge and to evaluate their professional attitude. The training is effected at the following levels: school, regional, institutional (high schools), non-institutional (conferences, seminars).

Basic principles of the system should be:

- Voluntary participation in the post-graduate training
- Flexibility of the forms and content of the training with preference for these, which do not require absences from the job
- Free elective forms of training and trainers
- Credit system of education (accumulation of credits for each completed module till reaching enough credit for gaining of certain degree)
- Dividing of the training from the certification; different organizations carry out the training, but a specialized authority confers the degree.
- The organizations desiring to carry out specialized training are granted accreditation (concept, training plans etc.) in a competitive way by an expert council.
- The results of the training are related to teacher's status and payment

Content of the training

The content of the training is to be in accordance with the stated aims and to apply to a General State Standard.

Besides the technologically orientated modules, the content of the training should include also modern concepts in preparing of learning plans and lessons using ICT, active learning methods with use of ICT, integrating of IT in various disciplines, etc.

Training forms

It is very important, the training to be arranged in flexible forms, allowing the teacher not to be absent from his work in the school. In this respect there are the following possibilities:

- Integrated courses, including short term intensive modules followed by self-training with ability for consultations.
- 'Sandwich' courses – short term intensive modules followed by individual tasks with possibility for consultations while continuing work, and then followed by a final seminar with presentation of the task done.
- 'Summer term' – carrying out the intensive full time attended modules during the period of school vacations.
- 'Cascade' model – one or two teachers from a school are trained at a central level, then they train their colleagues.

Organization, management and financing of the teachers training

The management of teachers training is performed by Ministry of education and science of Bulgaria. It is necessary to create an Expert Council with the following functions:

- Preparation of standards for training content, adequate learning programs and evaluation criteria
- Working out the credit system of training
- Accreditation of the training sections
- Creation of special training fund and distribution of the finances between the training sections
- Certification of teachers on base of the gained credit

Evaluation of teacher's qualification

Depending on the specific modules, the evaluation is performed by different forms – essay, test, project, interview, 'portfolio' (accumulation of the results of different activities in the process of learning), practical exam etc. After successful completion of a module, the training body issues a certificate, which gives a determined credit. The credit is formed as per approved by the Expert Council rules. For certificate of a certain degree, an application should be submitted to the council, enclosing the certificates for completion of modules and also it is necessary to take appropriate exam/test or to defend a project.

Evaluation of the knowledge, skills and competency of the students in ICT education

The evaluation is carried out both on the bases of the continuous assignment and on the completion of the module. At the end of the curriculum, the advanced students can choose themselves a final exam in ICT including practical and theoretical parts, orientated to the European standards of computer competency (ECDL).

During the work on a project both the final result and the working process are evaluated. Also during the work in a group the skills of effective communication in the group, constructiveness, conduction and contribution of ideas are evaluated.

The student's diploma should contain marking of the exact ICT modules that he has graduated, clarifying this way the level of his individual skills and competency in this discipline. There is a special demand to train qualified computer specialists, keeping the national tradition of 'computer nation', by encouraging the talented students and organizing for them national competitions for applicable software.

Management and financial resources

The management of the activities concerning ICT in the Bulgarian schools is both centralized and decentralized. The schools are free to create their learning plans in accordance with the local economical needs and also with the requirements for profile/professions and the European standard for computer competency (ICDL). On the other hand it allows the regional councils to improve their own policy and to create their own funds for modernizing of the computer facilities. It is necessary the management to be government and public as well. Only a part of the necessary financial resources are provided by the government. Other sources can be:

- sources arranged by International programs such as Socrates, Leonardo, etc.
- sources from the World Bank

- sources from the national and local foundations
- donations from local and foreign organizations or persons
- sources from the regional budget.

Examples of practical implementation
Besides the secondary schools sponsored by EC programs and the private schools (about 10% from all schools), most of the schools in Bulgaria suffer from lack of funds for developing of the ICT training. But due to their inventiveness, some school administrators have achieved very good results in ICT training and providing of appropriate equipment for it. For example, the "St. Kliment" school in Varna has already equipped several computer classrooms thanks to the initiative of the school headmaster. By renting of school conference rooms and with the financial support of the parents of the students, enough funds were accumulated for the supply of modern computers, Internet access and hiring of qualified lecturers. Almost 90% of the students in 6-7 grades have graduated courses for computer competency. The school has created also their own network, enabling the parents to be informed about the level of education of their children.

5.2 China

TEACHER TRAINING STATUS OF ICT IN BEIJING

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We are facing a profound reform. In history, technology has never had fascination like today. It is changing the world so rapidly. Information technology represented by computer and communication seems to shorten the distance of future and realism. In the recent two years, Chinese government began to pay much attention to ICT. The Education Administration in the government established a series of policies and plans to integrate ICT education in China. We tried and gained some experience. In order to strengthen this work, Beijing government has made a goal from 2001 to 2005.

The goal is:
A campus network connected to every primary and middle school will be established and all these networks will be connected with the central network – Beijing Education Network. Computers should go into each classroom in every middle school and primary school. A database of education information resources will be built to meet the demands of students and teachers in primary and middle school. This is very helpful to improve our teaching quality.

To achieve this goal, we realized that teacher training in the effective use of ICT is vitally important. Therefore, Beijing Educational Administration drew a series of plans and policies.

1. The plan and strategy for ICT education in Beijing
(1) Training aim
By the year 2002 around 65% faculty of the primary and middle school in Beijing will supposedly be given a formal training in ICT; and take one of the model schools, for example, teachers under age of 35 are able to make simple teaching-software related to their own work.

By the year 2005, 100% faculty of the primary and middle school in Beijing will supposedly have a general knowledge and basic skill in ICT; approximately 80% will have learned how to surf on line, and how to acquire, communicate, process and take ICT into application.

(2) Training measure
Establish training systems for towns and districts (including counties). The town-level systems are to cover the training of local teaching cadre force; and district-level systems are to cover the

general training for all the local teachers. Local governments in every district will invest to set up ICT training agency on the bases of computer classroom present, and ensure teaching and learning resources can be shared in every area.

Teachers will be given the training courses in their spare time while normal teaching work can be kept well. Selective training and general progress are given the same emphasis. A variety of methods are to be applied in ICT training including face-to-face, on-line training and distance learning. The whole project will get on gradually. Beijing Education Information Network will take net-teaching and training work.

7,500,000 elementary and secondary school teachers in Beijing will have finished their training courses and get certificates by the year 2002. From the beginning of 2002, teachers in middle school who will be promoted and rewarded should get the certificate proving their ability in use of ICT. Administrative departments and schools in different areas should give financial aid for teacher training in ICT, special funds in education sector will use to training works.

(3) Training content

The ICT content in teacher training is composed of two parts. One part is the basic knowledge including: 1.operating system (Win98, Win2000); 2.office series (Word, Excel, etc.); 3.basic Internet knowledge. All the teachers should learn this part of content. The other part is related to help teachers to use ICT in their teaching work. It includes: Powerpoint, Authorware, Director and VB, etc. Some of teachers who have good bases of computer will learn this part of knowledge to assist them make teaching software.

2. Analysis of good examples in practice

(1) Teachers' Training in The High School Affiliated to RENMIN University of China

The High School Affiliated to RENMIN University of China is a model school in Beijing, equipped with epidiascope, projector, cable TV, PC and other teaching devices, along with the relevant cable network, closed and open broadcasting systems and Video systems. The school also have several multimedia classrooms, a visual classroom for distance learning and an e-library with an accommodation of some 200 people.

The training project in the campus has been implemented. To let more teachers know how to use the modern teaching methods, this school has opened some short-term training courses for the teachers on both winter and summer holidays every year. The training contents were upgraded with the latest development of information industry. The participants ranged from school leaders, ordinary teachers, old or new staff – all were working hard on the courses. After the training courses, the level of computer is improved for most of teachers. Some of them can make their teaching software. It became popular on campus for students and teachers in use of ICT in their own teaching and learning works.

Take an example. Ms. Linsheng who teaches Chinese Language and Literature made a multi-media teaching-software on "the Three Gorges of Yangtzs River". While the beautiful scenes were put on shown with captions from the text, questions from the teacher were also a constant plug-in, as learning while travelling in a moving way. At the end of the show, Ms. Lin wrote: "After learning this lesson, we know how to protect the beautiful natural scenes, and try not to spoil the environments." Owing to the implementation of multimedia method, the whole lecture was able to have the students travel freely in places of interests, shuttling from history to reality. Besides learning of the text and edified with literature, a moving environment-protection lecture was given.

Another example – Mr. Pengxiao turned "function's track and natures" (one of chapters in math) into some certain teaching-software which is used on line. It vividly led the students observing the track and natures of a variety of functions, and plenty of quizzes are also one of the advantages in the software, which has the function of self-correcting, thus let the students practicing while learning. There was even a BBS for further discussions so that communications between teachers

and students are much easier. The interactive functions of on-line teaching-software are mostly praise as strong and useful, which evidently changed the traditional teaching methods and largely liberated the students from endless note-keeping. The Do-it-Yourself let the students do their own researching work, and the ability of creativity and practice was thus formed. And, what's more, the students will now be able to customize their time-table, location, and speed of study with the help of on-line teaching-software.

(2) Example II – one math class in use of ICT

Another example in math course – 'Teaching of the equations of Curves' polar coordinates. A teacher made a math software with the aid of "math tool" to introduce polar coordinates equation. This software includes explaining concept, analyzing examples and giving a series of quizzes, visual mathematics circumstances for students' further research have also been included in this software.

Firstly, dynamic demonstration is shown on the screen. And secondly, the students were led step by step into the forming of the curve equation of polar coordinates, and then teacher described the equation with the rosy curves and the next thing we do is, put the beautiful curves on the screen..., now you see, beautiful roses blossoming! A sentence poped on the screen: "Do you know – what has the flower got to do with the "n" in your equation?"

Ok! Now, math circumstances were provided. Students can choose different values of "n" to enter, then different flower appeared! The students were so excited, because they have never seen in traditional class. In this lesson, everybody can describe the effect of "n" (the parameter in polar equation) on the numbers of flower petals. But, when 0.1 or 0.2 input, there is fantasy on the screen that even the teacher himself never saw!! With the miracle in eyes, students can't help asking: "why this?" How mathematics gives us such an impressive fantasy and a visual space for free thinking!

The above example expresses how computer will be able to create a new "mathematical studio" which was out of imagination. With mathematics circumstances introduced, a brand-new teaching mode in math class is created – this mode will probably change the traditional way and minimize the burden of students in learning mathematics.

The practice in the use of ICT for learning and teaching works showed:

(a) Multimedia teaching through network plays an important role in primary and middle school.
(b) The class is vivid with the help of ICT and the initiative of students in learning process is promoted.
(c) Teaching in use of ICT benefits cultivating students' ability in observation, memory, imagination and thinking.
(d) Different subjects have different characters in use of ICT: Creating situation is available in the subject of Chinese language and foreign language. Demonstration is usually used to the subject of physics, math and natural knowledge, etc. Competition based on network is available to inspire the studying interest of the students and train their skill ability.

(3) Examples of teacher training through distance learning

We made many large or small experiments in long distance education from 1999 in Beijing. One of the examples is the distance education in Labagoumen. Labagoumen village in Huairou county near Beijing, is located in mountainous area and its' economy drops far behind the city zone. It is the remotest village from Beijing. Because of the traffic and communication, schools here are in some way isolated from outside. It would take teachers two or three days to gain an hour of training in the center of the city. Governments invested and connected this school network with the Beijing education network. The long distance education came into use. The famous teachers in Beijing gave a lecture and introduced their experiences to the teachers in Labagoumen through network. They exchanged their views and discussed questions in Internet. Half a year later, there was an obvious changing with the help of long distance teaching. The quality of teaching in Labagoumen school improved. At present, it is popular to learn and use ICT among students and teachers in this school.

In the following year, we started long distance education courses in some other remote schools in Huairou and all the pivot schools in remote areas. We also started cyber courses between the schools of China and U.S.A. It proved to be very effective.

Besides long distance training, Beijing governments also plan to develop a website especially for teacher training program and we hope to enrich the training courses. Teachers in the connected schools can surf on the internet-study and get training courses in their spare time. All these training plans have been brought into the whole continuing education program for all the teaching faculty in Beijing.

3. Summary

(1) Teachers play a real important role in combining ICT into teaching. Teachers should be sufficiently involved in ICT application in class.

(2) ICT is progressing very rapidly now. In China, till now even many students have grasped ICT skills, while most teachers don't use it in class. It's even worse in remote areas. Therefore, the government must draw a relevant program such as investment, organizing basic ICT training. This is extraordinarily necessary in early using of ICT.

(3) Grasping some basic ICT skills is not enough. That doesn't imply the solution to the problem of using ICT in class. Teachers need to be trained to learn how to combine ICT into their teaching process.

(4) The level of using ICT in teaching can't be judged only by technology or only by equipment. ICT must be tightly combined with education reform. We should choose appropriate technology and equipment to meet the demand of education reform high efficiently. This is the only way to measure the level.

(5) Also we can use ICT technology in teacher training as much as we can, such as mutual video frequency conference system together with website technology. This can achieve the goal of training teachers in a mountainous area in a real time way or unreal time way. Through this kind of training, teachers obtain not only the knowledge of ICT but also the relevant skills, and they will put the skill into their own teaching.

(6) It is very necessary to construct abundant teaching resource on the web. To choose a good net education pattern is also important. This is the premise to improve the efficiency and level of teaching.

5.3 Denmark

INFORMATION TECHNOLOGY AND TEACHERS
A strategy for information technology in the training
of teachers and their in-service
and further training
Danish Ministry of Education 1997

Foreword

Information technology has long been at the top of the agenda for action in the Danish educational system. Developments in the service and information society require that young people be so equipped that all of them can take part on an equal footing in the society of the future. In this process, an initiative in the field of education as a whole, and in the basic school especially, is quite central.

We already have many positive experiences in involving information technology in the basic school. This is not least true of the use of information technology as an auxiliary aid in the planning and execution of teaching based on the needs and requirements of the individual pupil.

An important prerequisite for the maintenance and further development of these experiences is to ensure that through their training and further training, teachers receive a fundamental qualification in the inclusion of IT-related topics in their professional, pedagogic and didactic considerations.

Through "Information Technology and Teachers. A strategy for information technology in the training of teachers and their in-service and further training" I wish to strengthen efforts in this area and actively involve student teachers, college of education teachers, basic school teachers and heads of institutions in future developments.

Ole Vig Jensen

Background

With its plan of action for IT policy in 1995, the Danish government focused on the development of IT in the educational sector, including the importance of a special effort in the basic school. The background for a special effort in the educational sector in general and in the basic school in particular is the growing importance of the role played by information and communication technology in almost all areas of society.

Against the background of the knowledge and experience they gain in the basic school, the youth of the future must have the chance to function and thrive in many different contexts in which information and communication technologies play their part.

Information and communication technology has provided an important instrument for breaking down those barriers which distance has previously placed in the way of cooperation between educational institutions, both nationally and internationally.

Experience in the use of information and communication technology in teaching shows that this technology can provide important help when, as required by law, teaching is to be planned and prepared to provide challenges to all pupils, whilst taking account of the background, ability and interests of the individual.

The Ministry of Education has taken several initiatives as a follow-up to the government's policy statement of goals for IT in education. An important element in this is that a number of follow-up activities will be started that can help with the realisation of the goals of IT policy and educational policy.

The area of teacher training is an important one for us to tackle, since it is the colleges of education which supply the basic schools with teachers who will have to carry out the intentions of the law on the integration of IT in teaching.

The legislation includes requirements as to the qualifications of teachers in relation to information and communication technology in the sections of the law which state:

- The aims of teaching in the Folkeskole (municipal primary and lower secondary school), including the aims of the individual subjects
- The aims of teaching at colleges of education

Even today, the aims of teaching in the Folkeskole make a number of extensive demands and expectations to teacher qualifications with respect to knowledge on, and experience in, the use of IT in teaching.

Developments in society also mean that the requirements and expectations regarding teachers' knowledge and experience in IT will increase.

What is knowledge and what forms of representation can it have? How is education to be regarded? What will happen to the teaching process when information becomes easily available through information and communication technology? What skills will be necessary and how can they be learnt?

These are important questions for the individual teacher to relate to and questions to which initiatives taken in the area should help to provide answers.

Strategic goals
A strategy for IT in the training of teachers and their in-service and further training must take into account the fact that there are several target groups – student teachers, teachers at colleges of education and in the basic school and, not least, the heads of institutions whose commitment will be necessary, if lasting results are to be obtained through follow-up activities.

Based on human resources, an IT development strategy must focus on the possibilities that lie in a change of thought, action and organisation.

It is important that student teachers, teachers at colleges of education and basic school teachers be enabled to achieve the following IT qualifications through teacher training or in-service and further training:

- Teachers must have a basic qualification in including IT-related topics and points of view into their professional, pedagogic and didactic considerations in connection with the planning of their ordinary teaching. They must be able to communicate knowledge on the social importance of information and communication technology.

If this goal is to be achieved, it will require that teachers have the following qualifications:

- A general knowledge of how IT helps to shape the conditions of education and work in society
- Knowledge of methods and concepts in IT-based and technology-supported learning, teaching and education
- Basic knowledge on, and skills in, the use of information and communication technology as an instrument in the daily preparation and teaching activities
- Insight in, and experience in, various methods for evaluating the quality and utility of IT-based information, teaching materials and teaching environments
- Insight in, and experience in, the development of methods to evaluate IT-based and technology-supported learning, teaching and education

The development and improvement of IT policy
The implementation of an IT policy for the training of teachers and their in-service and further training is a process that must ensure a constant development and improvement of the stated policy for the area. If this goal is to be achieved, it will be necessary that:

- there be a thorough evaluation of the initiatives taken in the area. For this to happen, it is necessary that, before a specific initiative is taken, there be clarity about the scientific, professional or pedagogic results expected;
- there be a systematic recording of the knowledge gained;
- knowledge gained be made available to the whole sector;
- previous experience be taken as a basis for further developments;
- initiatives taken should lead to new educational activities being fully integrated, both professionally and financially, into the general activities of the institution.

The area of effort and target groups
If the professional qualifications of teachers in the area of IT are to be improved, it is necessary to look at what relevant areas of effort and target groups there are.

In this strategy statement we have chosen to present the following areas of effort:

I. New teaching environments and forms of study and education
II. New forms of evaluation
III. Flexible further training and teaching practice
IV. Cooperation and the development of organisation

The bases for these areas of effort are:

I. New teaching environments and forms of study and education

This area of effort has been chosen in order to promote initiatives by which teaching in, about and through IT can be integrated into courses based on learning carried out both on a class and on an individual basis. Emphasis is laid on initiatives that create new interactive learning environments and changed conditions for education, with a view to promoting process- and participant-orientated learning, variation in the forms of teaching, the development of new forms of teaching, the development of new methods of evaluation and of teaching materials. Special interest will be given to initiatives that involve the basic conditions for learning, organisation and evaluation. Initiatives are thus expected to contribute new experience in the development of a common foundation of knowledge about the integration of IT and the development of technology-supported learning.

II. New forms of evaluation

This area of effort is noted as a separate area. But it must also be emphasized that evaluation is an integral part of area I. This area is expected to promote initiatives having the purpose of examining the potential of technology-supported learning in relation to the development of new forms of current and final evaluations, including, e.g. examinations, tests and other forms of evaluation. Special interest will attach to initiatives that include process-orientated forms of evaluation, based on the participants' own goals for learning. It will be especially interesting to examine and develop the new potential for storage, interaction and documentation that are part of technology-supported learning. The area will be decisive for the general development of technology-supported learning, since new forms of evaluation must be made to interact with the development of new forms of study and teaching.

III. Flexible further training and teaching practice

The integration of IT and the development of technology-supported learning can contribute to the further development of the relationship between theory and practice in teacher training. New forms of dialogue based on telecommunications can create increased interaction between the theoretical reflections which are part of the teaching and learning at colleges of education and the learning in practice which takes place during teaching practice. Correspondingly, the development of technology-supported learning can contribute to the creation of new opportunities for flexible further training for teachers at colleges of education and teachers in the basic schools to take place in the institutions where they are employed and where they feel at home. The relationship between theoretical reflection and learning through practice can thereby be changed, such that an increasing part is played by actual educational needs, cooperating teams and participant-orientated working methods. It will be especially interesting to study and develop the possibilities of creating interaction between several target groups. Experimental initiatives that seek to create a synergy effect in the development of technology-supported learning can contribute important experience to the development of a common basis of knowledge.

IV. Cooperation and the development of organisation

The final area of effort has been chosen to promote the development of new lines of action and working methods in relation to the integration of IT and the development of technology-supported learning. Existing experiences with the development of technology supported learning are unanimous in indicating that organisational changes are a vital prerequisite if the development is to be successful. Organisational circumstances can develop into decisive barriers if re-adjustments and organisational changes are not included as a vital requirement. Leadership commitment is an especially necessary requirement for success. Special interest will be directed at initiatives that examine and develop new forms of leadership and cooperation as a part of the organisational development. It will therefore be important to examine and develop methods for the strategic development and formation of plans of action for technology-supported learning at colleges of education and basic schools. The primary target groups for the initiatives are student teachers, teachers at colleges of education and teachers at basic schools, as well as the heads of these institutions. The following table shows the possible combinations (sections) of areas of effort and target groups. When the present strategy is to be evaluated, the table should include an assessment of each section.

Areas of effort	Target groups			
	Student teachers	College of education teachers	Teachers at basic schools	Instit. heads
I. New forms of study and teaching and learning environments				
II. New forms of evaluation				
III. Teaching practice and flexible futher training				
IV. Cooperation and development of organisation				

Initiatives
As far as possible, specific initiatives should be formed such that as many as possible of the target groups – preferably all of them – are reached through the specific action taken.

The creation of real cooperation across institutional boundaries has a high priority.The same applies to initiatives which may lead to the production of useful experiences that will benefit the area as a whole.

It is important that specific initiatives actively include teachers and students and that there is an interest in including the contributions that student teachers are able to make.

Initiatives can be classified as being general or special in character. General initiatives are of such a nature and are so generally formulated that they are directed at all four target groups. Special initiatives are those in which the contents and formulation mean that they are aimed at one of the target groups.

Below there is a description of a number of general and special initiatives which it is relevant to take. The description is not be regarded as a complete and final list of all relevant initiatives that should be taken in the area.

General initiatives
Initiatives with the purpose of making possible new learning environments and new forms of study and education.

- Participation in, and the evaluation of, teaching environments aimed at giving participants general knowledge about the social role of information and communication technology and the ability to impart this knowledge
- Participation in, and evaluation of, learning environments aimed at making the participants efficient personal users of information and communication technology
- Participation in, and evaluation of, new learning environments and new forms of study and education aimed at giving participants an insight into, and experience of, teaching under new circumstances, including network-based dialogue as well as the use and evaluation of digital sources and interactive texts
- Participation in, and evaluation of, learning environments that include the didactics of technology-supported learning as an element in didactics
- Participation in, and evaluation of, learning environments designed to enable participants to develop and make quality judgments about learning environments that integrate IT in teaching
- Participation in, and evaluation of, learning environments designed to enable participants to include IT-relevant points of view in their professional, pedagogic and didactic considerations when planning teaching

Initiatives with the purpose of making possible new forms of evaluation

- The formulation of fundamental views on how information and communication technology can or ought to influence the conditions for, and contents of, examinations and other forms of evaluation
- Participation in, and evaluation of, learning environments aimed at making participants able to include IT-relevant points of view in professional, pedagogic and didactic considerations, when planning examinations and other forms of evaluation

Initiatives in the area of flexible further training and teaching practice

- The development of activities that make use of information and communication technology with a view to increasing choice and flexibility in the area of further training, e.g. by means of electronic conferences
- The development of activities which make use of information and communication technology with a view to increasing the returns to the student teacher of teaching practice and the solving of project tasks. This refers to the increased possibilities provided by information and communication technology for cooperation between the college of education and the school where the student teacher is in teaching practice

Initiatives with the aim of enabling the development of new forms of cooperation and changes in the form of organisation

- The development of teamwork and experience in methods of supervision, as a basis for continuing further training and improvement of qualifications
- The development of team-based preparation of evaluation processes and the development of evaluation methods which are suitable for assessing learning environments in technology-supported learning
- The development of knowledge of methods and procedures for the improvement of organisations and the shaping of IT strategies and plans of action, as a prerequisite for participation in making changes in organisational forms
- The analysis of the advantages and consequences of the establishment of technical and organisational cooperation in the IT area, between institutions and other relevant organisations

Special initiatives aimed at the student teacher

- Cooperation between colleges of education on the professional and technical level with a view to increasing the student teacher's study possibilities
- An introduction to the use of information and communication technology with a view to increasing the student teacher's possibility of communicating with other students and teachers both within and outside his/her own institution
- An introduction to teaching materials for use in technology-supported learning with a view to increasing the students teacher's opportunity for independent study
- The participation in, and evaluation of, forms of studying and teaching in which elements from traditional teaching based on the physical presence of the student are combined with technology-supported teaching, such that an attempt is made to make optimum combined use of qualities taken from both forms

Special initiatives aimed at college of education teachers

- The use of distant teaching to increase the range of courses available to college of education teachers, both in terms of the use of IT in teaching by college of education teachers and in terms of the subject content of teacher training
- The development of new forms of studying and teaching in which the elements from traditional teaching based on the physical presence of the student are combined with technology-supported teaching, such that an attempt is made to make optimum combined use of qualities taken from both forms
- The development of models for in-service training and further training in terms of the use of IT by teachers at colleges of education
- The analysis and description of the need for network services having specific relevance for college of education teachers

- The exchange of experience in, and ideas for, the use of network services in teacher training
- The development and evaluation of models for communication and the exchange of experience between colleges of education across national frontiers
- Quality assessment and development of teaching materials which integrate IT in the training of teachers

Special initiatives aimed at teachers in the basic school

- The use of distant teaching to increase the number of courses available to teachers in the basic school, both in terms of the use of IT in teaching by such teachers and in terms of the subject content of teacher training
- Participation in, and evaluation of, supplementary educational activities in which elements from traditional teaching based on the physical presence of the student are combined with technology-supported teaching, such that an attempt is made to make optimum combined use of qualities taken from both forms
- The development of models for in-service and further training activities in terms of the use of IT by teachers
- The analysis and description of the need for network services having specific relevance for teachers at the basic school
- The exchange of experience in, and ideas for, the use of network services in education
- The development and evaluation of models for communication and exchange of experience between schools across national frontiers
- Quality assessment and development of teaching materials which integrate IT in teaching

Special initiatives aimed at the heads of institutions

An elucidation of the new challenges facing leaders of institutions in connection with the use of IT in teaching and education. A consideration of the following questions is relevant:

- The delegation of competence – for example to the IT committee of the institution
- Cooperation with other educational institutions
- The possibility of encouraging involvement and a common understanding in the total staff of teachers
- The communication of experiences in the IT area at the institution

Terms of reference for "The Working Party on Information Technology in the Training, In-service and Further Training of Teachers at Colleges of Education and the Basic School"

Background

The setting up of the working party is to be seen as part of the linking of initiatives concerning IT activities at colleges of education closely to the execution of the Danish government's educational policy goals for the Folkeskole.

This can be done through technology-supported learning activities in the training and in-service and further training of teachers at colleges of education and at the Folkeskole, including ensuring that teachers are given necessary and adequate qualifications in the integration and use of IT in teaching.

Purpose

The purpose of the working party is to:

- ensure close cooperation between the relevant parties and the Ministry of Education on the shaping of a new strategy for the integration of IT and the development of technology-supported learning
- ensure that the aims of the government's IT educational policy in the Folkeskole is supported by activities in the area of the training, in-service and further training of teachers in the basic school
- contribute to the development of models for the integration of IT and technology-supported learning in connection with the current work on the revision of the law governing teacher training

- ensure that the funds for IT development allocated to colleges of education are spent as effectively as possible for the benefit of all colleges of education
- ensure that proposals be prepared for an organisational model which will support an effective and speedy communication of experiences gained from IT development projects, including the coordination of initiatives and funds

5.4 Brasil

REPORT ON ICT POLICIES AND IMPLEMENTATIONS IN BRAZIL

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Some Information about Brazil and its Educational System

Brazil is a huge country, with approximately 8,5 million square kilometers, that is, approximately the size of the United States, and with a population of about 170 million. In 1970 this population was about 70 million. This means that Brazil has a great and increasing number of young people who need to have access to education.

The education system has been reformulated recently and includes three main levels:

a) Basic school (*ensino fundamental*): it comprises eight years of study and usually begins with 6 to 7-years-old children. This level is supposed to be followed by all citizens but this is not always the case.
b) High School (*ensino médio*): it consists of three years of study and corresponds roughly to the high school concept.
c) University (*ensino superior*): university studies (graduation), usually takes four to five years. Masters course is 1,5 to 2 years after graduation and the Doctor Degree can be obtained in about four to seven years after the Masters degree.

Nowadays, Brazilian public schools are free of payment, while private schools usually are too expensive to the average Brazilian worker. The minimum wage in Brazil is about US$75.00 by month (half of the workers in Brazil receive this "salary"), while a course in a private university may charge from US$150.00 to US$500.00 on average.

As a consequence, many people in Brazil still depend uniquely on public education in order to become citizens and have a minimum quality of life. Unfortunately, the quality of public schools is much lower than that of private schools. Only in the case of universities we can observe that public schools are much better than the average private ones, because private schools with graduation courses are not yet very interested in developing research activities, which are done almost exclusively in public universities.

Today, Brazil has about 65.000 public basic and high schools. Some already use ICT regularly in education, and some do not have even electricity or telephone. Any public project for the dissemination of the use of ICT in Brazilian schools has to consider this enormous number of schools and students and their great differences.

A Short History on ICT in Education in Brazil

The experiences on using ICT in education in Brazil have at least 20 years. In 1981 the University of Brasilia and the Ministry of Education organized the first seminar on Computers in Education in Brasilia. The first important document on national policies for ICT in education was published also in 1981. In 1983 the Ministry of Education and the Secretary of Informatics created the EDUCOM Project, the first national project to introduce ICT in schools in Brazil. The project implemented a number of research centers in different states of the federation in order to develop qualified people to deal with ICT in Education, and to subside with information and experiences the creation a national policy on ICT in education.

The first initiatives of the government on ICT in Education were centered in the Universities, where the know-how was supposed to be produced. Today, with many established research groups in Computers in Education in the Brazilian Universities, the government is concentrating in providing schools with infrastructure and training.

In 1988 and 1989 some initiatives were taken in order to start a process of decentralized production of educational software in Portuguese, and adapted to the Brazilian context. Seventeen CIEDs (Center for Computers in Education) were created. Those centers had the responsibility to produce human resources, and they should also be used to create and distribute technology to the schools.

In October 1989, the Ministry of Education created the National Program on Computers in Education (PRONINFE). In 1997, the Ministry of Education created a new National Program on Computers in Education aiming initially to distribute 300.000 computers to the public schools. As the necessity of teachers training and infrastructure was detected, the program decided to achieve only 100.000 computers and spending the rest of the budget on training and infrastructure.

The first Symposium on Computers in Education sponsored by the Brazilian Computer Society happened only in 1991. Since then it is an annual. This event and the Workshop on Computers in Schools, also sponsored by the Brazilian Computer Society are the main forums for academic discussion on ICT in Education in Brazil. In 1997, the Brazilian Journal on Computers in Education was created to consolidate the increasing academic production in this area. This journal is published in Portuguese because it is intended to serve as an interface between the academy and the appliers of ICT in schools (very few people in Brazil actually speak other languages than Portuguese).

The Proinfo Project

The main objectives of the Proinfo Project were:

1. To commit the schools to the use of technology;
2. To install appropriated infrastructure (computers and network facilities);
3. Training teachers;
4. To produce high quality educational software in Portuguese;
5. To interconnect schools;
6. To support financially those activities.

The Proinfo project is currently in implementation. It was planned to have two moments: In the first stage it aims to introduce students and teachers to ICT technology. Then, the computer should be incorporated in the teaching/learning process, and the scholar administration has also to be improved with technology.

One of the hard decisions was choosing which schools should receive those resources. Only 7500 schools qualified to receive the resources (nevertheless, this means more than 5 million students). Schools were chosen based on their size (greater schools were considered to have more possibility of success) and existing infrastructure (security, phone lines, buildings, etc.). As a result, we can see that the policy of the Brazilian government now is not to use the technology to attenuate the differences between poor and rich schools, but a choice of success: selecting the best to make them improve further.

Other Projects on ICT in Education being developed in Brazil

Many other initiatives in ICT in Education in Brazil may be related. Some of them are:

a) Thematic Group in Distance Education of the Brazilian Internet Management Committee (http://www.cg.org.br/ead).
b) Kidlink, that uses the international experience with the Brazilian community (http://venus.rdc.puc-rio.br/kids/Kidlink).
c) Inter-Agir (Inter-Act), that focuses on the implantation of networks in schools (http://www.cg.org.br/ead/inter-agir/).
d) Educadi (Distance Learning in Science and Technology), that approaches the area of teaching sciences, an area where important deficiencies were detected (http://www.psico.ufrgs.br/lec/ead/cnpq)

e) Educational Information Repository (http://lite.fae.unicamp.br/repeduc).
f) Ibirité Project (http://newton.coltec.ufmg.br/cecimig/ibirite/IBIRITE.htm).
g) Programa Rede Escola (Network School Program), life long learning (http://www.sectec.rj.gov.br/redeescola/).

Brazilian Schools that already use ICT in Education

A recent study conducted by Campus (1999) revealed some interesting information on more than 400 Brazilian schools that already use ICT in education. This study selected schools that already have sites on the Internet. The study revealed that 80% of the schools that already use ICT in education and have a site on the Internet are private. 82% of the schools also use computers in the administrative tasks.

In about 60% of those schools the computer where used less than 2 hours a week on average.

The main activities identified were:

a) Learning reinforcement (92,16%);
b) Browsing the Internet (78,43%);
c) Use of tools like text editor, spreadsheets, etc. (74,51%);
d) Educational software to stimulate reasoning (68,63%);
e) Learning curricular subjects (68,63%);
f) Participation in educational projects (60,78%).

The teachers indicated the following uses for computers in the school:

a) Tools to prepare didactic materials (78,43%);
b) Programming languages teaching (15,69%);
c) Basic Computing Courses: Windows, Office, Internet (50,98%);
d) Student Evaluation (37,25%);
e) Activities complementary to the curriculum (45,10%);
f) Browsing the Internet (80,39%);
g) Sending messages (43,14%);
h) Participation in discussion lists (25,49%);
i) Participation in projects (43,14%).

The following difficulties were identified:

a) Administration not interested (9,80%);
b) Obsolete or inadequate hardware (11,76%);
c) Software in English (23,53%);
d) Few stations to access the Internet in the school (25,49%);
e) Charges of the access servers (11,76%);
f) Problems with telecommunication services (41,18%);
g) Lack of technical support (7,84%);
h) Lack of time on the school schedule (37,25%);
i) Teachers not interested (31,37%);
j) Students not interested (3,92%);
k) Financial resources not allowed (29,41%).

Discussion

As it can be seen, despite the governmental effort to improve the use of ICT in public schools, the private schools are the ones that have dominated the implementation of such programs. That is reasonable, because those schools depend on the high quality of their teaching, especially for marketing reasons, while public schools, that are free, do not depend on that.

It can also be seen that despite the researchers and governmental policies on education have been proposing more flexible curricula and the extensive use of ICT in regular education, very few schools use the computer extensively in curricular activities. This reveals that still many teachers and principals are afraid of changes in their current activities. Even in some training courses given

in the context of the Proinfo Project, the computer is used mainly as a curricular complement or as a tool. Very few see ICT technology as a way to change the process of teaching and learning. Examples of new curricular practices may be seen in few sites. Project Educadi is one that relates some new and interesting experiences.

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5.5 Japan

TEACHER TRAINING FOR INFORMATION AND COMMUNICATION TECHNOLOGY IN JAPAN

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Summary

In Japan, Information and Communication Technology (ICT) is regarded as a useful tool that requires no training or education. Because of this view, no systematic training of ICT has been done for teachers. However, new compulsory subject called "Informatics" is to be introduced in the year 2003 for high school and the situation is changing. Some problems associated with teacher training for this new subject are discussed.

Introduction

Why Informatics is not appreciated in Japanese education

In Japan, teacher training for ICT is not systematic and until recently, its contents is usually how to a send e-mail or to use a browser. This is because Japanese people in general think that the computer should be a useful tool and should not be more than that. They believe that it must be so simple that no training or education is to be needed for using it. Although the new subject "Informatics" is to be introduced in high schools as from 2003, it is not properly understood as a scientific discipline by Japanese teachers in general.

Vocational Training

Although Information and Communication Technology (ICT) is widely used in Japan, it is not popular in education because of the above reason. Teachers in general are very conservative and prefer to use a chalk and blackboard. This is because it is generally believed that the contents of ICT should be developed and maintained by professionals and ordinary people are not required to learn it. Therefore, until now in Japanese high schools, systematic ICT education has only been done as a vocational training and has not been done for nonvocational students.

Influence of university entrance examination

In Japan, most influential thing to high school education is entrance examination. Almost half of the students go to some kind of higher education and until recently, entrance examination to universities were highly competitive. University professors are negative on ICT related education and nothing on ICT was required for entering universities. This discourages the high school teachers to carry out ICT related education. This attitude goes down to junior high school and elementary schools.

ICT as a Useful Tool
The common usage of ICT in schools is word processing. This is because the word processor is a useful tool for document preparation by teachers. Spread sheets may also be used for school records management. Generally speaking, teachers have found no further usage than those in ICT even now when internet becomes popular.

Age profile of teachers
When personal computers are introduced in schools mainly by governmental budgets, internet becomes available. However, Japanese schools usually equipped with only three telephone lines and enthusiastic teachers alone use internet by establishing some way of connection by their own way. Besides, because of the complicated procedures for using computer, elderly teachers, who are dominant in Japanese teachers' age profile, find difficulty in using ICT. With the decline of young population, employment of young teachers shrinks and such profile has been formed.

This report
In this report, new subject "Informatics" is explained and how to raise teacher and the associated problems are shown. The report is hoped to suggest future of the Japanese "Informatics" education and teacher training, because what happened to high school would gradually be transferred to junior high schools and elementary schools.

Informatics for High School
Informatics as a vocational education
In Japan, ICT has been regarded as a vocational subject and has been taught in industrial or commercial high schools. This comes from the general view of ICT as a matter of professionals and not of ordinary people. For ordinary people, ICT should be a useful tool that requires ideally no training and education. This attitude towards ICT has great influence on ICT education and leads to two distinct directions. One is very technical for professionals and the other is for ordinary people just to learn how to use it.

Because of the recent proliferation of ICT, new vocational subject called Informatics has been established. The contents of this vocational Informatics include software engineering and multi-media applications. These are the areas of ICT that are not covered by the existing industrial and commercial areas of vocational schools.

Informatics for ordinary students
When ICT is taught for non-vocational purposes, one common way is to use ICT just as a tool and to show how it can be used by the students for some objectives, such as solving a mathematical problem or showing the sight of dangerous experiments.

Another important aspect of Informatics education is to raise ability to find, formulate and solve the problem using (or not using) ICT. However, with the computer usage becoming complicated, learning how to use some application program does not work as it is expected and understanding of the essentials of ICT has become needed.

Non-vocational ICT education has three axes
Non-vocational compulsory subject "Informatics" is divided into three components, namely, "Informatics A", "Informatics B", and "Informatics C". Each of these requires seventy hours of class work and a student must take one of these. Each of these three components has the following three axes, although emphasis of each component on these axes is different.

- Practical aspect of ICT
- Scientific understanding of ICT
- Attitudes towards information society

The aim of the subject is explained as follows by the ministry of education. With the proliferation of ICT, students must be able to select necessary information from the vast amount of relevant information and be able to utilize ICT properly for their daily and professional activities. They are

asked to select, process and output information independently. The term "independently" means in self-governed way and emphasizes not passive but active use of ICT. Students are asked to understand influence of ICT to the society, to obtain sound attitudes towards information society, and to contribute to the development of sound society.

The subject must be a good continuation of the materials relevant to ICT taught in the junior high school subject "technology and homemaking". The content of this is almost as same as the "Informatics A" shown below, although their levels are different.

ICT education has three components
There are three components called "Informatics A", "Informatics B", "Informatics C" in non-vocational subjects. After year 2003, students are asked to take at least one of them.

The component "Informatics A" mainly comprises training of essential ICT skills to select, process, and output information and students are expected to use these skills independently. This includes effectiveness of ICT, utilization of ICT in collecting, outputting, and processing information, and understanding of the change of life caused by the introduction of ICT on our society.

The component "Informatics B" emphasizes scientific understanding of the computer and its function and organization, and of the method of using the computer. It includes usage of computer for solving the problems, modeling of the problem in terms of information processing and data administration, and ICT for realizing information society.

The component "Informatics C" emphasizes the role and influence of information network in the society and tries to promote the sound attitudes towards information society. It includes digital representation of information, information network and communication, responsibility for collecting and broadcasting information, and development of ICT and its influence on the society.

Teacher Training
License for "Informatics" education
Single license for Informatics is given both for non-vocational and vocational subject as well. This means that although majority of education is for non-vocational purposes, teachers must be qualified for vocational purpose as well. This decision seems to be sound because otherwise those teachers of mere user of the computer may become teachers of "Informatics".

We believe that comprehensive knowledge including software engineering is necessary for teaching problem solving in general, because its central part, that is, requirement analysis, design, implementation and evaluation of the software to complete would be the most experienced and effective methodology for solving the problem. Another important field of vocational informatics is multi-media information processing and this, too, would be useful for developing the students' capability for representing their ideas on information technology.

The way to give a license
The compulsory subject "Informatics" starts in 2003 in Japanese high schools, but no licensed teacher existed until the conversion training started in the year 2000. This training is done for the current qualified teachers of mathematics, science, commerce and industrial subject.

Although the "Informatics" education must mainly be carried out by those converted teachers from other subjects, there are two other ways to raise qualified teachers, namely, by qualifying examination that examines the knowledge of qualified teachers in other subjects and by university education on "Informatics" in teacher training courses. However, the former is very competitive and the latter takes time. Therefore, those two ways of raising qualified teachers would not be dominant in terms of active teachers in schools, because majority of teachers will be supplied by conversion training.

Conversion from other subjects
Three thousands new teachers were trained for fifteen days during the summer of 2000. The trainers for this were trained during the same spring for five days. The training includes both non-vocational and vocational materials and therefore becomes very superficial.

Although the same materials were used all over the country, the actual training differs among the training site. This process of teacher training is to be done for the years 2001 and 2002, and a total of nine thousands teachers of "Informatics" are hoped to come out.

One of the complaints on this process is that those teachers who are very active in using computer for their classes are not qualified to take the training if they are teachers of other subjects than those described above. They have to take the very competitive examination for getting the license or to attend the teacher training courses offered by the qualified universities.

One of the serious effects of this conversion is that for the subjects such as mathematics and sciences that supplies "Infomatics" teachers. Converted teachers are often very enthusiastic in education and were the key persons of the subject for the school they belong. Establishing "Informatics" education may cause some defects in other subjects.

Some issues on teacher education
Teacher training education is very important in long term, although currently how to start Informatics education is more serious. Because of this, although qualified teachers are to come out from universities some years later, positions will be filled with converted teachers and newly qualified teachers who graduate from teacher training courses would find difficulty in getting their position.

Among the issue of teacher training education, the most serious is how to establish the methodology of Informatics education. One of important problems of Informatics education is the definition of "information". It can be defined in the way Shannon established for communication engineering, but it is not appropriate from the viewpoint that the meaning "information" implies in daily life, because the content of information is more important than the quantity of "information" that carries the meaning. In this regard, not only carriers point of "information" that is covered by the traditional theory of communication engineering or computing science but also cognitive and social aspect of "information" must be taken into account. We believe that such comprehensive view on "information" must be studied from the viewpoint of "Informatics" education.

Conclusion
In Japan, high school education of "Informatics" is to start in 2003, and it will be done by nine thousands converted teachers from mathematics, sciences, commercial and industrial subject through the summer training of fifteen days. There will be no other way to start but it could put serious effects on the future of "Informatics" education.

"Informatics" education does not mean teaching computing science alone but we do not have clear view what should be taught as secondary education on "Informatics."

IFIP – INTERNATIONAL FEDERATION FOR INFORMATION PROCESSING

IFIP is a non-government, non-profit umbrella organization for national societies working in the field of information processing. It was established in 1960 under the auspices of UNESCO as an aftermath of the first World Computer Congress held in Paris in 1959. Today, IFIP has several types of members and maintains friendly connections to specialized agencies of the UN system and non-governmental organizations. Technical work, which is the heart of IFIP's activity, is managed by a series of Technical Committees. Each of these committees has two major types of activities – Events and Publications.

IFIP TC3

TC3 is IFIP's Technical Committee on Education. It has following aims:

1. To provide an international forum for educators to discuss research and practice in:
   a) teaching informatics
   b) educational uses of information and communication technologies (ICT).

2. To establish models for informatics curricula, training programmes and teaching methodologies.

3. To consider the relationship of informatics in other curriculum areas.

4. To promote the ongoing education of ICT professionals and those in the workforce whose employment involves the use of information and communication technologies.

5. To examine the impact of information and communication technologies on the whole educational environment:
   a) teaching and learning
   b) administration and management of the educational enterprise
   c) local, national and regional policy making and collaboration.

Contact:

http://www.ifip.or.at
http://wwwedu.ge.ch/cptic/prospective/projets/ifip