THE IMPACT OF ICT ON EDUCATION: THE THREE OPPOSED PARADIGMS , THE LACKING DISCOURSE

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Introduction

Our motivation in writing this paper stems from the realization that inspite of the booming literature on ICT and education, there is almost no discourse on the subject. In other words, despite the large and often contradictory variety of approachs and attitudes in the field and in the literature, there is almost no systematic discussion amongs their upholders. Since the subject refers to the most influential change process in our educaional systems in the last and coming decades - a change process that is not only going to determine the form of the educaional system but also the nature of education and hence the nature of the coming generations - such lack of discourse can be profoundly detrimental to the very foundations of our societies .

The lack of discourse may stem from the lack of appropriate recognition of the various and often opposed views on the subject that coexist, mostly without their adherents being aware of them not being identical or compatible, both in the 'field" and in the academic professional literature. The prevalence of such recognition is certainly a necessary condition for the mere acknowledgement of the need for discourse. Thus the main aim of this paper is to "map the ground" and distinguish between the various and opposed views on ICT and education stemming from different approaches and attitudes to the subject.

For this sake, we present a new methodological tool for analyzing theoretical and practical views towards the "merger" between ICT and Education (section 1), use it for the analysis of several recent representative texts dealing with ICT and education (section 2) and distinguish in its light between three general clusters of views (henceforth we will call these clusters "paradigms") in this field (section 3). We conclude by claiming that a rational discussion on the issue, up until now lacking, can begin once one is aware of:

a. The differences between these views and their many contradictions
b. The possibility to compare these views despite their differences and their opposed tacit suppositions,

1. A matrix for the mapping out of views on the computerization of education

Views of ICT and education can be characterized in light of two parameters which together form a matrix. The first parameter – the horizontal axis in the resulting matrix - concerns mainly *approaches* one adopts regarding the aims and/or the nature of the computerization of education. The second parameter - the vertical axis in the resulting matrix - refers to *attitudes* one adopts regarding the nature and extent of the changes in prevailing schools conceived as necessitated by the introduction of ICT to education.

We will deal with the approaches first, and will then move on to describe the attitues. Within this first parameter it is possible to distinguish between seven approaches: the administrative, the curricular, the didactic, the organizational, the systemic, the cultural and the ideological.

The administrative approach consists mainly of the desire to achieve a certain ratio of computers (or other kinds of equipment) to students. It sees the sheer existence of technology as progress and as an important aim, and focuses on the quantity and quality of equipment. It does not refer to any other possible aim. This is the approach that usually characterizes administrators, bureaucrats and politicians; hence its name.

The curricular approach stems from the conception of technology as serving some specific curricular aim in the given school curriculum and structure. There are two forms of integrating ICT in the school curriculum:

(a) The disciplinary form: ICT as a discipline in itself. The underlying idea in this form of ICT introduction is that ICT is an important tool in our times, a separate subject matter required like foreign language or Math. Usually, there is no attempt to connect ICT learning to other activities of the school, and it is usually taught in computer labs. Quite naturally is characterizes many computing teachers at schools.

(b) The integrative form: ICT as integral part of the prevailing curriculum. An attempt is made to take advantage of ICT for the teaching/learning of the current curricular

subjects. It is usually typical of teachers of specific disciplines, certainly in the context of math and natural sciences in higher grades.

These two forms of introduction of ICT to the school activity often appear in reports and texts together (for quite understandable reasons), and therefore were combined to a single approach here. However, each time we refer to the curricular approach, we will indicate which of the sub-approaches is involved.

The didactic approach stems from the conception that the introduction of technology can lead to, or necessitates, the introduction of new didactic or teaching/learning methods. Active, research-oriented, or constructivist methods of teaching/learning are almost always mentioned in this context. As such it make another conceptual step beyond the curricular approach since while the first still conceives of ICT as a neutral tool in the service of the new ICT subject or of the prevailing subject matters (which it takes to be unchanged), the didactic conception claims to the impossibility or undesirability of such situation. It points to the inevitable or desirable change ICT is bound to, or should, bring about in the teaching/learning of the subject matters. It almost always still presupposes the prevailing disciplinary curriculum (with frequent allusions to problem-based interdisciplinary orientation). This approach characterizes the conception of ICT and education held by most academics and many experts and teachers.[1]

The organizational approach, when it appears, is quite often connected with the previous one and is based on the understanding that the introduction of ICT to schools – leading to research oriented and hence necessarily more flexible teaching/learning -should involve organizational changes in school, consisting of more flexible attitudes to time, place, authority, roles and curriculum. It characterizes the more consistent and radical among the adherents to the previous approach[2].

[1] There is not much point in giving examples for these approachs – many thousands of papers and books have been written in their light in the last few yeas. Just going through the proceedings of any recent conference on ICT and education will provide the reader with a large number of examples. See, *e.g*., Information Society Directorate General of the European Commission & Finnish National Technology Agency, 1999, *Summary Proceedings: Information Society Technologies, Conference and Exhibition,* Helsinki, November 22nd-24th; ; EUN, 2000. *Proceedings of the EUN Conference: Learning in the New Millennium,* Brussels, March, 20-21 ; The Open University of Israel and the European Commission, 1999, "Technology in learning Environments : The Learning citizen", Tel-Aviv, October. See also EDEN (European Distance Education Network) website for other proceedings: http://www.eden.bme.hu

[2] Papert in his two well known books is the obvious example for this view (Papert 1980, 1992). See also Dillenbourg, 2000.

Although each of these approaches is deeper and more encompassing than the previous one, they all still allow one to limit one's considerations within quite narrow perspective to a specific school or groups of school and/or to some aspects of the prevailing educational paradigm. The other three approaches, on the other hand, require both a more macro vision encompassing the whole system and all or most important aspects of the educational process.

The systemic approach maintains that didactic and organizational changes in school will not be possible without systemic changes, and that the merging of ICT and education requires organizational changes on the level of the whole system – in the direction of allowing more distance-learning or even virtual schooling, thus changing the attitude towards time, place, curriculum and other connected attributes of the system on a systemic level (Hargreaves, 1997; Meighan, 1997).

While all the previous approaches start from current school and educational structures, the cultural approach stems from an altogether another starting point: the recognition that the ICT revolution is a deep cultural revolution changing all modes and patterns of our lives and hence bound to lead to dramatic changes in education.

It is characterized by its recognition of two basic facts:

- ICT has a powerful defining impact on all important aspects of our lives and hence our culture (in terms used often in this context: it is a "defining technology");
- The ICT revolution is a part of a group of intertwined revolutions that in the past twenty years have been transforming Western culture from a modern into a postmodern culture.

The cultural approach is quite rare in discussions on ICT and education, and those who rely on it are mainly academics, intellectuals, or futurists – unknown to many teachers and even to academics in the field. The adherents of the cultural approach maintain that educationalists should be aware of these two facts, and strive to adapt the education system to the new culture. The adaptation could take diverse routes: it is possible to judge the rising postmodern culture favorably and recommend radical changes in the school structure in order to render it adequate to the new "human situation" (the radical attitude bellow), It is also possible to judge it unfavorably and

opt for preserving and strengthening the existing structure of education (the conservative attitude below) [3].

The ideological approach starts from those basic values that are considered (by the upholders of the different variations of this view) as setting the most basic social and educational aims, judges the social cultural and educational situation in their light and strives to fulfill them in the best possible way through (in our case) the educational process. The ideological approach characterizes those individuals oriented towards philosophical or critical social thinking - those who believe that whatever the change that takes place, it should be guided in light of the values that are taken to be the aims of education.

Again here we face another totally new stance towards the issue: while all the previous approaches kept to descriptive language (at least on the surface) and refrained from an explicit systematic judgment of the postmodern situation or the prevailing or expected systems- this is exactly the starting point of the ideological approach.

From the perspective of their scope it is possible to say that each of these approaches encompass the scope of the previous one (with the exception maybe of the curricular-disciplinary sub-approach) one cannot adopt a systemic approach without relating to organizational issues, nor can one adopt a didactic approach without referring to the curriculum.

The second, vertical parameter, reflects the attitude one adopts regarding the kind and the level of change that the mergence of ICT with education will, or should, lead to. Within this parameter it is possible to distinguish between five attitudes: the agnostic, the conservative, the moderate, the radical, and the extreme radical (or the deschoolers' attitude).

The agnostic is the attitude of those who don't have a clear opinion as to the impact of ICT on education. One is classified as agnostic when one does not think or care

[3] See, *e.g.,* Bloom, 1987; Hargreaves, 1993; Hirsch, 1987; Perelman, 1992; and Postman 1992. These writers focus on different aspects of the postmodern cultural changes, accord different weight in their thinking to education, pass different judgments on these developments, and reach different conclusions concerning the directions the educational system should take. But they all recognize the deep all-encompassing changes we are now going thorough; they all diagnose ICT as being at least one of the major causes for these changes; and they all believe education should respond to these changes (although in very different and sometimes opposed ways).

about the possible changes in the school resulting from the introduction of ICT, or when one simply does not know what would or should these changes be.

The conservative is the attitude of those who believe that schools will, and/or should survive, ICT with minimal change, as they have survived other technologies (television- is the most often mentioned in this context) and that PCs and the Internet are just additional tools beside the book and the chalk (which will/should stay dominant) for the teachers to use.

The moderate is the attitude of those who believe that for the sake of the integration of ICT, schools are about to (or should) go through an extensive change in their didactics. Usually more active problem based, authentic or research-oriented learning and teaching methods and the connected organizational changes are mentioned in this context. At the same time upholders of this attitude still believe schools need to cling to all other characteristics of the prevailing schools that are being criticized by the next two views.

The radical is the attitude of those who believe that schools are going to radically change in all their parameters (i.e. the focus on theoretical teaching and leaning, the institutionalized division between adults and children, teachers and students, the reliance of schools to large extent on the 'unity of time and place" principle, etc), or have to go through such changes if they are to survive the ICT revolution. To put it differently, the radicals believe that there is no chance for the potential of ICT to be expressed and for active learning methods to be implemented without such radical changes.

The extreme radical (or deschooling) attitude is the attitude of those who believe that ICT is a Trojan horse inside the base of the prevailing educational system, and that the latter will not (and quite often also: should not) survive it (Aviram, 1999e).

It is important to bear in mind that there are some overlaps between approaches and attitudes. Some approaches lead more naturally to some attitudes than to others, while there are some intersections that are logically impossible. Thus, for example, the administrative approach can lead by definition only to the agnostic attitude. The curricular approach is only compatible with the agnostic and conservative attitudes, while the didactic approach can be compatible with the agnostic, conservative and

the moderate approaches. The Organizational, Systemic, Cultural, and Ideological approaches seem to be incompatible with the Agnostic attitude. The possible combinations are presented in the matrix presented in table 1- the impossible intersections are blackened

Approaches Attitudes	Administrative	curricular	Didactic	Organizational	Systemic	Cultural	Ideological
Agnostic							
Conservative							
Moderate							
Radical							
Extreme Radical							

TABLE 1

2. Text analysis: different views of ICT and education.

In what follows we will analyze in light of the above matrix the views on ICT and education as found in six repesetativative texts. The text were chosen in light of three basic parameters, so that together they cover all or most of the possibliteis including in these parameters:

- The levels of the educational system they refer to: early childhood, elementary ed., high-school, all or some of the above
- The literary genre they belong to: proceedings of an international conference on the subject, a book or a paper. Concerning the last two cases, a further distinction should be made between a descriptive overview of experience or research and normative argument supporting a certain view or combination of both.
- The cultural context they refer to: either European or North American

Although any choice within the practically infinite literature on ICT and education is to large extent arbitrary, we did our best to choose those texts that best cover all the possibilities in the above parameters. They will thus include:

1. A proceeding of a recent European Conference on ICT and distance education - covering all age groups and level of formal education. The conference chosen was the *EDEN Fourth Open Classroom Conference* that took place in Barcelona in November 19-21, 2000 (Kastis, 2000).

2. A proceeding of a recent American Conference, *the Association for Educational Communication and Technology 2000 Long Beach Conference* that took place in February 16-20, 2000 covering all age groups and levels of formal education (Sparks & Simonson, 2000).
3. An extensive survey of the needs of practitioners in education vis-à-vis the introduction of ICT to education, concentrating mainly on North America, published in 1999 (Roberts and associates, 1999).
4. A paper delineating a similar survey on early childhood education in Canada, published in 1998 (Wood, Willoughby & Sprecht, 1998).
5. A report on the *Second Information Technology in Education Study* (*SITES*) *project*, published in 1999, surveying ICT in education worldwide (Pelgrum & Anderson, 1999).
6. Neil Postman's *The end of education* (1995), making a normative argument on the effects of ICT on human life and education (mainly from a North American point of view).

While analyzing these six basic texts we will refer to others as well, to further clarify some points or substantiate them

2.1 Fourth Open Classroom Conference

The proceedings of the *EDEN fourth Open Classroom* Conference which took place in Barcelona, Spain, in November 2000 (Kastis, 2000) presents us with a variety of texts regarding ICT and education. The texts in the proceedings refer to all levels of education, and belong to very diverse literary genres: from descriptions of a specific case of ICT introduction in a certain school or a specific DE course using some new software or hardware, through national surveys on various aspects of ICT in education , to national plans for the introduction of ICT to a country's education system.

A detailed analysis of 40 (out of 55[4]) texts in the proceedings reveals that the agnostic attitude is the most common one (17 papers), distributed between the administrative (4 papers: IzsÓ & Hercegfi, 2000; Lytras & Doukidis, 2000; Tsolakidis, 2000; Yatchou, Tangha, & Gouradères, 2000), the curricular (10 papers: Bessagnet & Nodenot, 2000; Chojnacki & Fleszar, 2000; Eskenazi & Assenova, 2000; Karroulis & Pombortsis, 2000; Love & Banks, 2000; Müller & Hubweiser, 2000; Patrineli &

[4] texts not analyzed include a. texts dealing only with higher (tertiary) education with no referral to primary or secondary education b. irrelevant texts c. texts where the attitude or approach were not clear

Fitsiou, 2000; Reynolds, Vanbuel & Marks, 2000; Midoro, 2000; Zijlstra & Taconis, 2000) and the didactic (6 papers: Bocconi & Pozzi, 2000; Breuer, 2000; Dochev, Yoshinov & Pavlov, 2000; Galbraith, 2000; Marks & Dobbeni, 2000; Rubio & Carreras, 2000) approaches.

The largest group of papers represented the didactic-moderate combination (11 papers: Anastasiou et al., 2000; Athanasopoulos et al., 2000; BrØgger & GjØrling, 2000; Forcheri, Molfino & Quarati, 2000; Guerin, 2000; Inelmen, 2000; Jiménez, 2000; Johnston & O'Brien, 2000; Lea, 2000; Löwenhielm, Männikkö-Barbutiu, & Sjögrund, 2000; Sterner, 2000). Another somewhat common combinations was the organizational-moderate combination (4 papers, 3 of them resembling the didactic-moderate papers, but taking a little step further along the road with some preliminary suggestions for organizational change: Koivisto, 2000; Kylämä M. & Silande, 2000; Sidiropoulou, 2000; Søby, 2000). One paper reflected the curricular-conservative combination (Figueiras & Fortuny, 2000). There were 4 papers promoting a radical attitude (systemic: McGarr, & O'Brien, 2000; cultural: Kristmundson, Jeppesen, Micheliadou, Guttorn & Hansen, 2000; and ideological: Hermant-de Callatay, 2000). Aviram & Comay's (2000) article represents the only ideological- radical combination in the entire proceedings.

Let's take a look at some specific examples, beginning with the agnostic attitudes. Tsolakidis (2000) provide an example of the *administrative-agnostic* combination in primary education. He described a program aimed "to provide the necessary equipment and know-how to the primary schools of the small Aegean islands so that they will have the chance to enjoy the benefits of IT" (p. 197). The program includes installation of equipment, connection to the Internet and to other schools, technical support, teachers training in IT and its use in education, and some distance education features. Importantly, there is no consideration of the contents and learning methods or educational aims ICT can promote, and definitely no broader perspective on ICT introduction to education.

An example of the *curricular-agnostic* combination is Eskenazi & Assenova's paper describing the Bulgarian plan for the introduction of ICT in education. The plan as described by the authors is meant to enable students acquire skills which can help them in their future careers. The main part of the paper discusses the disciplinary form of the curricular approach- the introduction of "ICT curriculum", I.e ICT as a curricular subject in itself (some of the topics mentioned in this context are data

processing, typing, Internet use and programming). In addition, the authors point to the integration of ICT in other subjects as a plan for the future (the integrative form of the curricular approach).

An example for the *didactic-agnostic* combination is Rubio & Carreras' (2000) paper which, like the previous papers, does not consider the impact of ICT on education. The paper describes a website dealing with the history of childhood, which is built with the participation of children from different European countries. The paper describes the site's emphasis on meaningful, constructive, interdisciplinary, "multicultural-local" learning of history – that is, it does considers to the ways ICT promotes these desired didactic approach – but its scope is limited to this website alone, avoiding its possible implication to schools or even to history learning in general.

Distant learning of specific subjects is also the topic of Figueiras & Fortuny's paper, describing the use of Internet in math tutoring of secondary school students who are unable to reach schools (e.g. because of illness). For that purpose a web page was designed to "cover the same curriculum which is considered at the correspondent school" (p. 90). The approach of this paper is obviously *curricular* (integrative form). Its attitude is *conservative*, as the school itself is expected to remain unchanged by the novel possibilities offered by distance learning (!) The benefits the student acquires through the use of distant education (e.g. virtual personal tutoring) are not considered in this paper, as the target is ensuring the "students' rejoining to the school setting and the adaptation to the way of assessment of his or her current teacher at the school" (p. 92). Thus there is no discussion of the possibility of extending this technology to other students.

To take another example of this combination which also emphasizes the integrative form of the curricular use of ICT, Jimenez (2000) states that "Technology applied to education can show all of its potential as a means to facilitate key and qualitative change in the teaching-learning process… the constructivist model seems to be promising and suits well the use of ICT. (p. 9)" According to the author, it is important to be computer-literate, but "textbooks and blackboards would still be the main teaching aid … Ideally this computer based material should be adapted to the school curriculum… so that we could teach the characteristics of the Nile in a new manner" (p. 8).

Anastasiou et al's (2000) paper can serve as a good example for the *didactic-moderate* combination, although the changes proposed are minimal and cautious. The paper describes the design and the implementation of pedagogical technology (web-based electronic tools) in Greek schools. The target is to use the novel technology to promote constructionist didactics, emphasizing interdisciplinary, collaborative learning closely linked to real life experiences. According to the writers, ICT-use would create important beneficial changes in the didactics and the curriculum, but its role is clearly restricted: "The new ICT based educational tools must not be imposed as a substitute to the conventional teaching but rather as an *add-on* that has to justify its introduction through the qualitative *upgrade* it offers to *every day school practice*" (p. 43, italics mine). For instance, though the novel tools enable and require some connection with students from other countries, the relations are limited to the course procedures and subject matter. The authors' explicitly stated vision is to open the school to the world - not to make the world a school (!)

Søby's (2000) description of the "Norwegian network for IT-research and competence in education" is an example of the *organizational-moderate* combination, where the organizational attitude incorporates the didactic approach. This can be seen in the project's goals, which are "pedagogically… the direction of a constructivist classroom and collaborative learning… this also implies a reorganization…"(p. 4) According to the author, "the school is seen as an organization, and as such, the changes that ICT implementation has created [are treated] within the organizational framework" (p. 5). The writer claims that ICT contributes to create a more flexible school and a "decentralized and varied educational system".

One example for the *cultural-radical* view is found in Kristmundson, Jeppesen, Micheliadou, Guttorn & Hansen (2000). Their *cultural* approach is reflected in their recognition that "we find ourselves in a transitional phase between and industrial society and an information society, where both society and the individual pupil make new and modified demands on the educational system" (p. 152). This situation calls for change: "Against this background there is a need for pedagogical restructuring…" (p.152) "Today it must be considered as a requirement and necessity that the vision and practical enterprise of school constitute a reorganization… (p.153)"

Aviram's *cultural-ideological- radical* view (Aviram & Comay, 2000; see also Aviram, 2000) is based on one hand on the claim that the prevailing educational system is modern through and through and therefore it does not stand a chance in postmodernity It is hence currently facing a tremendous change - whether we will like it or not. We further claim that if this change would be ethically guided, there is a chance that it could be very beneficial to the individuals and the society alike.

More specifically, we take a soft indeterminist viewpoint and claim that it is reasonable to suppose that the relationship of ICT and culture are reciprocal, not a one-sided causal relationship in which technology is headed on its own course and society's role is reduced to adaptation. It follows that we have a chance to influence the development of dissemination and use of technology, at least, to some extent. Society should not stand aside, but act on the basis of this supposition, and channel ICT to enhance the desired values of education which are in democratic societies: the enhancement of autonomy, dialogical belonging and morality (terms which we operationally define). Thus the double challenge educational systems are facing to day is how to radically adapt themselves to the new postmodern situation or to cyberculture, while channeling as much as possible of the basic elements and processes of this culture to support and enhance autonomy, dialogical belonging and morality.
will be discussed extensively in the third section.

2.2 The National Convention of the Association for Educational Communications and Technology (AECT)

The *proceedings of the National Convention of the Association for Educational Communications and Technology*, which took place in Long Beach, California in February 2000, would serve as one example of the many American conferences dealing with computers and education. 13 of the 35 texts are analyzed here. Of the texts not analyzed, 11 dealt with higher education or the workplace, and 11 were too technologically oriented to be discussed here – describing a specific technological innovation or a specific way to improve a certain technology with no referral to its implementation in education. Of these 13 papers, 6 demonstrated the curricular-agnostic combination (Ganesh & Middleton, 2000; Koszalka, Prichavudhi & Grabowski, 2000; Koszalka, Grabowski & McCarthy, 2000; Leh, 2000; McCrary, Miltiadou, M. & Savenye, 2000) and 3 demonstrated the didactic-agnostic combination (Adams, 2000; Lim & Yu, 2000; Wu, 2000). Thus, 9 of the 13 papers reflect the agnostic attitude. Other papers with a didactic approach include 2 with a

moderate attitude (Dornisch & Land, 2000; Maushak & Chen, 2000) and one with a radical attitude. One paper represented the ideological-moderate combination (Cifuentes & Murphy, 2000).

Koszalka, Prichavudhi & Grabowski's (2000) represents the *curricular-agnostic* combination. Their study dealt with measuring teacher's attitudes toward the use of web resources in the classroom, most probably in the integrative form (integrating ICT with prevailing subjects). The questionnaire was completed by teachers from the United States and from Thailand, and required that respondents report their degree of agreement with statements that reflected the 3 different constructs of attitude (cognitive, emotional and behavior), e. g. "Using web resources in the classroom is efficient" "Effectively incorporating web resources into lessons can help present subject matter in realistic situations" "I will use the web resources (such as informational web sites, search engines or e-mail) in my lessons" (p.160). The authors refer to using ICT as a part of the traditional lesson, and do not mention other possibilities.

The *didactic-agnostic* combination is clear in Lim and Yu's (2000) paper, which discusses learning via web design. A few quotes would illustrate this nicely: "The technologies help to create reflective learner who can apply knowledge and skills to novel and real-world situations…Using hypermedia and the Internet, learners become engaged in meaningful learning instead of rote memory of the discrete concepts… [Hypermedia] requires students' active participation and engages them in authentic problem investigations." (p. 197) Like the previous example, no further changes in school are discussed.

Dornisch & Land present a *didactic-moderate* combination. The authors are concerned with developing collaborative learning environments to enhance the construction of multiple perspectives. They claim schools and the traditional learning environment usually stress "cognition in solo" and individual learning, but admit that traditional class discussions do support the social construction of meaning. ICT is therefore not the only means for collaboration, but can surely assist this goal: "The information-rich and communicative aspects of the Internet might offer a much needed avenue for collaboration among people with alternate perspectives by providing environments devoted to supplying learners with information and activities

that could cross ethnic, cultural, and socio-economic boundaries and by providing spaces for negotiation" (p. 77).

According to the authors, even if ICT is only one way to reach collaboration, since ICT-tools become more common in education "instructors and designers must provide students with the tools necessary to develop… a shared perspective" (p.78). Thus, the purpose of the paper is "to provide a general framework of such processes that could be used to support the development of collaborative learning environments, particularly those that are mediated electronically." (p. 78) We classify the authors' attitude as moderate because they clearly believe that learning in school would change and improve if ICT-learning tools are incorporated: "Web-based communication tools provide students with opportunities to cross cultural, ethnic, and socio-economic boundaries, barriers seldom crossed in traditional classroom experiences… evaluations of CSILE [computer-supported intentional learning environments] indicate that students surpass those in traditional classrooms on measures of depth of learning and reflection…" (p. 84).

Wilhauk's (2000) paper represents a rare combination – the *didactic-radical*. His treatment of the novel technology he discusses (virtual reality) includes the scopes of the administrative and the curricular approaches. The didactic approach is usually accompanied by less extreme attitudes, as changes in didactics, curriculum and equipment are usually not supposed to cause a fundamental change in the school. However, the author states clearly that "Inasmuch as VR represents a more extreme break from traditional media, the effective use of virtual reality in education will doubtlessly require a significant reevaluation of many firmly entrenched practices and deeply held concepts of curriculum and instruction" (p. 263). Curriculum-wise, virtual reality "offers the opportunity to create educational simulations of unprecedented complexity, engagement and realism" where students "simulated the experience of being a ball in order to better understand Newtonian mechanics" (p. 266). Moreover, "An inherently non-linear and interactive medium, [virtual reality] will require the development of radically new narrative forms"(p. 266).

Referring to didactics, the author claims that the new technology could rise above all previously imagined possibilities: "constructionist applications of virtual reality could offer learners the opportunity to take part in the creation of entire worlds" (p. 267). Despite the radical changes he envisions in these domains, the authors does not perceive the novel technology as a part of a larger-scale cultural change, and does

not predict or support any organizational or systemic adaptation on the part of the educational system (thus presenting what might be called “cautious Radicalism”- although it does sound as an oxymoron)

The last paper of these proceedings WE will discuss here is Cifuentes & Murphy’s (2000), which presents us another rare combination – the *ideological-conservative.* That the point of view is ideological is obvious from the beginning – the first line demonstrates an explicit commitment to a defined set of values that should guide education. In this case, these are inspired by Postman’s “End of Education” (see below, section 1.2.6): “We propose that distance technologies can be used to achieve the desirable multicultural "End(s) of Education" that Postman (1995) describes” (p. 71). These values, which they summarized as “multicultural understanding and world citizenship” should provide the basis for the desired curriculum.

The role of ICT, according to the writers, is to promote these values: the authors agree with “Tiessen and Ward (1998) claim that ‘computer-mediated communication technologies can … directly support educationally valuable activities that would be difficult through traditional media’ (p. 71). However, this is supposed to happen within the existing structure of the school (- hence the conservative attitude of this view) The paper describes one such ICT-supported project, a collaborative distance learning community which brought together students from the United States and Mexico who learned about each other’s culture. According to the authors, the project succeeded in developing multicultural understanding and empowering positive self-concept among the participants.

2.3 “Professional Development and Learning technologies”

Our next text is a Canadian project report – “Professional development and learning technologies: Needs, issues, trends and activities” initiated by several Canadian educational organizations (report prepared by Roberts & Associates, 1999). The goal of the project was to study the professional development needs of information technology practitioners and planners in the field of education and training, and to analyze central issues and trends in this domain. In order to reach this goal, a comprehensive analysis of the literature since 1990 was conducted, emphasizing North American texts (from Canada and the United States) and including other major countries. The findings from the literature review were greatly enhanced by telephone interviews with 46 (mostly Canadian) front-line practitioners (professors, instructors,

teachers, trainers), planners (teachers, school board and professional association executive members and staff members, as well as school planners) and policy-makers from schools, colleges, universities, career colleges, the community and the private sector. The interviewees were also asked about existing professional development activities, and findings from including conferences, workshops and seminars are also included in the report.

In the following we concentrate on the findings regarding school-level education. The findings are summarized in tables 2-4. The first row in tables 2 and 3 describes the needs of the practitioners and planners, as reflected in the literature review the authors have conducted. The second row of these tables describes the “issues” the practitioners and the planners have raised in the telephone interviews conducted by the authors. As no texts were found to describe needs of policy makers, table 5 includes only the issues they raised in the phone interviews.

The general trend is obvious: The *didactic* approach is dominant in the needs and issues brought up by practitioners, planners and policy makers. As the didactic approach includes the scopes of the administrative and the curricular approaches, these scopes are discussed as well (albeit from the perspective of the didactic approach). For example, administrative points are: improving equipment and access, providing funding and time, and training the teachers to use the technology; (integrative) curricular points include the requirement for a more effective integration of ICT in the class curriculum and a better, readily applicable teacher training for that purpose.

The main need, as emphasized throughout the review, is didactic – ICT promotes a change in the teachers’ role, and this possibility should be analyzed and evaluated and the teachers trained to deal with it. The attitude reflected in both the literature review and the interviews is *moderate*. Clearly, all parties concerned believe ICT would cause schools to change meaningfully in everything concerned with the changes in didactics and connected organizational and curricular changes, and hold some opinions on the best way to guide this change.

In addition, there is evidently a budding recognition that the novel learning technologies might cause some kind of transformation to the future school and to the future teacher and learner. It seems that the interviewees are quite perplexed by ICT, unable to express a clear opinion about what this change might be or what they want

it to be. There are some implicit hesitance and confusion on their regard: they perceive something radical might happen, but can only talk about preliminary changes in didactics. Thus it is possible to say that although the dominant view on the surface is certainly the didactic-moderate one, underneath there is a hesitant emergence of cultural-radical view.

TABLE 2: PRACTITIONERS

Needs (Literature review)	▪ "Time to learn…how to use the technology, experiment with it and integrate it into the curriculum"; ▪ "Proof that technology integration makes a difference in teaching and learning and that it can be justified in terms of improved student learning"; ▪ "Practical 'how to' knowledge and the … skills needed to use and operate technologies to support teaching and learning"; ▪ "An organized program of professional development activities designed to reach all teachers…" ▪ "Time and opportunity to consider the role of learning technologies as tools for learning and teaching and how they change the teacher's role" ▪ "In-depth knowledge of learning and instructional theories – constructivism…" ▪ "Opportunities to use learning technologies during in-service programs".
Issues (phone interviews)	▪ Learning how to use learning technology effectively in the classroom both as "just another tool" and as a tool of change ("paradigm shift") in how teachers work and the role of the teacher; ▪ "Access to the technology, hardware, software and connectivity" ▪ "Lack of time for professional development, and for developing and integrating learning technologies in the classroom" ▪ Lack of funding ▪ Need for strong leadership and support of parents

TABLE 3: PLANNERS

N e e	**Planners**

	Goals: ▪ Technology should be used with greater emphasis on learner-centered pedagogical strategies ▪ Technology must be integrated into the fabric of the school program Principals should supply- ▪ Vision – linking all technology-related activities to broader educational goals and other change initiatives ▪ Administrative support ▪ Teachers' involvement, teacher's training, linked to Sufficient time ▪ Promotion of learning transfer, Focus on real classroom applications A technology coordinator, equipment, access
Issues (phone interviews)	▪ Access and availability of equipment and services ▪ Funding and time ▪ Research on the actual effectiveness of technology to promote implementation ▪ Discussions of the changes technology would cause in the education system: possible outcomes, appropriate role etc. ▪ Better teacher training, more suited to their different needs, e.g. focus on applying learning technology into the curriculum ▪ Informing and educating the outside community (e.g. parents)

TABLE 4: POLICY MAKERS (*no articles were found in the literature)

Issues	**Policy makers**

	▪ Time for professional development ▪ Funding ▪ Access, equity of access ▪ Expanding the "debate over the role of technologies in the classroom, specifically – its effectiveness in learning ▪ Better teacher training (e.g. distance training, "Model the behavior you are trying to teach")

2.4 Survey on ICT in Early Childhood Education Centers

The *didactic* approach is also manifested in early childhood education in Canada, according to a recent survey (Wood, Willoughby & Sprecht, 1998). The survey included a wide variety of early childhood education centers (day care, preschool, etc.) and presumably reflects, in general lines, the situation in North America. For this age group, researchers indicate that ICT has the potential to provide exposure to developmentally appropriate social and cognitive information using a play environment. The respondents expressed a high interest in introducing ICT. The most popular reasons were "preparing children for later school experiences, facilitating learning and enhancing physical coordination" (p.242).

As the "curriculum" in this age is not easily distinguished from didactics the approach expressed in this survey is best classified as didactic. However, in contrast to the moderate attitude of school-level educators, the attitude of both the respondents and the researchers is *agnostic*: ICT is not thought of as a potential agent of change to early childhood education or to later echelons in the educational ladder.

2.5 The Second Information Technology in Education Study (SITES)

While most of the papers included in the previous texts presented us with scope that might be claimed to be limited – geographically or from the perspective of focusing mainly on the micro-level, , Pelgrum & Anderson (1999) provide us with a birds-eye macro view on large scale Governmental policies concerning the introduction of ICT into the educational systems of countries worldwide. *The Second Information Technology in Education Study (SITES)* project aimed "to assess and analyze, by means of international comparative statistical surveys, the status of ICT in schools for instructional activities by teachers and/or students…"(p.5). While it was possible to claim concerning the previously analyzed texts that the views included in them are

somewhat accidental- a book portraying the macro pictures of 27 countries from all over the world is bound to be much more reflective- both due to its large scope and to its content having to do with state-wide macro policies that are bound to reflect and affect most of what is taking place in the participating countries.

Generally, the reason the editors points to as justifying the introduction of ICT to education (in the first introductory chapter) is the better preparation of students for the Information Society. According to the editors, education systems today are confronted with pressures to adopt educational programs that reflect new ways of learning aimed at preparing citizens for the Information society. The editors juxtapose the "emerging paradigm" (e.g. a tighter integration of schools in society, a change of the teacher's role to a tutor who guides the student's independent learning, a more active, collaborative learning etc.) with the "traditionally important paradigm" that relied on the assumptions that school is isolated from society, the teacher is the initiator of instruction of the whole class, and the students study singly to answer the teacher's questions in a mostly passive, low-in-interest manner.

The underlying idea in ICT-introduction, according to the editors, is that it can help achieve objectives that are considered important cornerstones of education in the Information Society and play a "facilitating role in managing the increased flow of information associated with more autonomous learning environment" (p. 5). In particular, the editors emphasize the ability of ICT based education to help students achieve competitiveness in the new global economy and support life-long, flexible learning. It seems thus that the editors' view can be characterized as *didactic-moderate*.

The second chapter of the report provides summarized descriptions of ICT-related policies in 27 countries (for the full version see Plomp, Anderson, Law and Quale, in press). An analysis of the policies described in this review shows that the large majority of them (16) fall under the rubric of curricular-agnostic (This is a good characterization of the policies of Bulgaria, Canada, Chinese-Taipei, the Czech Republic, France, Hungary, Iceland, Italy, Japan, Latvia, Lithuania, New Zealand, Norway, Slovenia, Thailand and the United States of America- as presented in this text). Other policies characterized by an agnostic attitude include 1 with an administrative approach (Belgium - French) and 1 with a didactic approach (the Netherlands). A second group of policies reflect the didactic-moderate combination (5 papers, reflecting the policies of: Cyprus, Finland, Israel, Singapore, and

Luxemburg), which as claimed above is reflected also in the editors' introductory and summary chapters. Other policies with moderate attitude include 2 with an organizational approach (China- Hong Kong and Denmark) and 1 with a curricular approach (South Africa, where the change ICT is supposed to assist is mainly targeted to improving equity in education).

Let us look a little more closely at some examples. The paper presenting the policy in French-belgium (Wallonia) reflects the *curricular-agnostic* view in a characteristic way. The paper states the following "principles": "Belgium is intent on boosting its economy; The development of telecommunication is a major objective of this policy; The effective implementation of this policy requires young people to be trained in the use of ICT; The use of ICT by students, within different schools, is a new resource for learning and a necessary condition for a policy of equity"(p.22). The rest of the paper describes equipment acquisition and installation, technical support, networking solutions, teacher training etc. There are implicit indications that ICT would be introduced both as a separate discipline in the form of "computer science" (-disciplinary sub-approach) and as a part of other curricular subjects (-integrative sub-approach). Nothing is said on the need or lack of need to lead to any change in schools following the integration of ICT in it- neither on the organizational level nor on the didactic level- hence the characterization of this view as "agnostic".

As claimed above, the view based on the *curricular-agnostic* combination is the most popular in this report. In most policies presented in this category, ICT is introduced both as a separate subject-mater (the disciplinary form of the curricular approach) and as integrated with other subject-matters (integrative form), but nothing is said about possible impacts this may have on the existing curricular subjects, the learning methods, or the school in general. Thus for example, in the Russian federation "The use of ICT now focuses on one subject only – informatics"(p. 76) and constructivist learning is "provided without any connection to ICT and it use" (p. 76). This is true also for Lithuania, where ICT forms a separate compulsory course, which consists of information, algorithms, computers and information technologies. The authors state that integration of ICT in other subjects is optional, and that "although schools take a constructivist approach to learning, they are presently unlikely to use ICT in this regard because of a lack of hardware and software, a lack of qualifications and experience among teachers and so on"(p. 63). In Norway the general goal is that students and teachers "…become personal users of ICT" (p. 73) and ICT is integrated in the curriculum for this purpose.

The National Computerization Program in Israel reflects the *didactic-moderate* combination, stressing that ICT can generally help enhancing desirable modes of teaching (needless to say these are exclusively active constructivist modes). It emphasized "Assimilating IT in the school as leverage for pedagogic changes and as a tool for improving teaching in various domains" (p.52). This didactic emphasis in ICT use is reflected in Singapore's education system as well, where one of the main goals is to "Generate innovative processes in education: Development of new teaching and learning strategies will open new possibilities for curricula and assessment"(p. 77).

The policy in China-Hong Kong can be classified as *organizational-moderate*. In the section dealing with "policy goals, vision and targets" the author states that "If the vision of promoting IT in education is to be realized, then it will be necessary to induce fundamental changes in the role and functions of schools, teachers, and students. Technology is seen as an important catalyst for… turning schools into dynamic and innovative institutions…"(p. 31). One specific component in this vein is "Fostering the development of a community-wide culture of collaboration amongst all stakeholders within and outside the school sectors… heads of schools, teachers, students, parents, tertiary institutions, the business community and community bodies" (p. 32). The paper cover as well the scope of administrative, curricular and didactic approaches .

In Denmark the *organizational-moderate* combination (including also the scope of the previous curricular and didactic approaches) has a different focus: "to determine the likely consequences that ICT integration will have for the organization of teaching and for the composition of subjects at different place in the education system…. Whether subject as presently prescribed will continue to exist or whether they will be incorporated into or replaced by new 'groups of knowledge'…" (p.40)

2.6 The End of Education

Let us now turn to Neil Postman's "End of Education" (1995). Unlike the texts reviewed until now, this text is not descriptive but normative, and reflects the author's opinion on the educational system in the United States. Postman distinguishes between the "end" of education – a conception of the Desired Graduate or the Good Life – and the means to reach this end (how, when and where the learning should take place). Postman rebukes educational systems for forgetting the ends and

concentrating on the means, and argues that if schools would fail to find a meaningful reason for their existence, the end (in a second sense of the term) of schooling would come about.

According to Postman, schools need narratives to provide them with reasons for learning. Good narratives should provide moral guidance, a feeling of continuity, explanations about the past, clarifications of the present, and hope for the future. Our times are times of "narrative crisis". He further claims that the narratives schools use are mostly shallow, limited and instrumental, and thus do not provide meaningful reason for learning.

Postman argues that one such shallow narrative is the narrative of technology[5] (Potman, 1995, pp. 37-50). He claims this narrative is essentially religious: it promises prosperity to its believers; it commands that "information" and the "Information society" be worshiped; and devotion is expressed by acquiring technological equipment and skills. He claims that there are three kinds of directions this narrative takes:

- First, some see it as their task to prepare children for life in the information society; in our terms , these correspond to the upholders of the administrative, disciplinay and curricular approaches (when combined with agnostic, conservative or moderate attitures).
- Others wish to use technology to enable the flexible learning necessitated by the Information Society – these are the upholders of the didactic approach (probably – as combined mainly with the moderate attitude) according to our classification.
- Then there are those who believe technology would render schools obsolete, as the modes for the transfer and processing of information are radically changing nowadays and as hence- children do not need schools to acquire information anymore, and are usually better off alone in front of the computer. Postman mentions Perelman (1992) and Ravitch (1985) in this context. These are the cultural-extreme radical views according to our classifictiaon above.

Against the upholders of the first version on the narrtive about ICT as Saviour postman claims that the majority of the popolation would know how to use computers

[5] In "Technopoly" Postman treated technology in a broader context as a social phenomenon (Postman, 1992

10 years from now even if the schools would do nothing abou it, in the same way people learned to drive without learning it in school. He further claims that computers may indeed be practical in the teaching of curricular subjects, but they undermine the learning of social values (such as patience to slower learners). Thus, in introducing computers to the classroom educators must be more careful and less ecstatic than they cuurently are.

Against the upholders of the second version he claims that there is no solid foundation for the belief that flexible, constructivist or collaborative learning do requires computers, and that it can be very well implemented with books. Against the upholders of third version Postman claims that schools are not meant to be disseminators of information. The task schools face, he maintains, is educating people in the light of the desired educational values, which should be the backbone of meaningful narratives .

In this book Postman does not list the desired educaitonal values, but it is possible to extract them from his discussion of narratives. He believes education should guide students in the light of modern-rationalistic, democratic values (critical thinking, the importance of the serach for Truth; democracy, freedom, social responsibility, morality, cultural pluralism), with a touch of postmodern communitarianism and echologism.

As aforesaid, Postman claims the dominant narrative views technology in a shallow, limited fashion. Therefore, it fails in its task to provide an “end” for education. It worships technology from a determinist viewpoint, but avoids the serious question of what technology does to our lives and hence also avoid ctirisizing it in light of our basic values. According to Postman, this is a very important question, one that should be a major topic for discussion in our societies and in our schools (Postman, 1995, pp. 139-142, 189-193).

Postman is indeterminist in his view of technology. He acknowledges that technology might very well change our lives and our emotional conduct for the better and for the worse. However, schools ’ role should not be to “adapt” to technology, but to control this process and shape it so that it will enhance the desired social values and goals and not harms them.

Postman's approach can be easily classified as *cultural-ideological.* It is cultural sicne he places an important emphasis upon the cultural influences of technology and emphasizes the fact that it changes basic patterns of knowledge transference, and processing and hence the attitude towards knowledge and learning and all major aspects of human life based on them. It is ideological since he does not take these dramatic changes as given but distinuishes between the "is" and the "ought" and systematically criticise ICT and its impact in light of basic rationalistic and humanistic values.

As far as his attitude is concened it ranges somewhere between the cosnervative and the moderate. He maintains that schools in their current format are vital, as children need a non-virtual teacher to help them deal with their difficulties, need frontal teaching in a classroom to learn how to behave in a group, etc. From this prespective he is basically a conservative. However, the main part of the book deals with changes he belives should be made in the educational system in America. He describes large-scale changes in the naratives, that would most propbably necessitate a variety of changes in the school curriculum, didactics and organizations. Hence it is also possible to ascribe to him some moderate tendencies.

At this point, we would like to briefly criticize Postman for not considering the possibility that ICT and postmodernity might offer novel means instead of the old ones to reach the "ends" he so ardently advocates. Thus, it is not improbable that children can acquire a feeling of belonging to virtual communities, or be emotionally supported in the learning process by a virtual tutor (see, for example, Aviram (1999), Figueiras & Fortuny's (2000) proposal for tutoring hospitalized students).

3. The Three Emerging Paradigms on ICT and Education

The logical matrix in the first section offers a wide variety of possible combinations between approaches and attitudes. However, as already claimed, not all combinations are equally probable or prevailing. A general look at the distribution of approaches and attitudes encountered in the above literature review clearly shows that:

- There are several views which are much more frequent than the others
- The various views can be grouped into three clusters of views which as a matter of fact comprise three basic paradigms on the subject.

As for the first point, it is clear that in the three collections of papers (the European and the American proceedings and the SITES report), the curricular and the didactic approaches were the most popular. There was some representation of the administrative and the organizational approaches, but very little representation of the more extreme approaches (systemic, cultural, and ideological). The agnostic attitude, especially when combined with the curricular approach, was common, as well as the moderate attitude combined with the didactic approach. The conservative and radical attitudes were by far less common, and the extreme radical attitude was not represented at all.

The two surveys reviewed **(**the Professional Development and Learning Technologies report and the survey of early childhood education) similarly reflected a curricular-didactic approach combined with a moderate (report) or an agnostic attitude (early childhood). A theoretical framework for thinking about this distribution of approaches and attitudes would be taken up in the next section.

The choice of texts was, as aforesaid, to large extent arbitrary. Thus, the distribution of approaches and attitudes found does not necessarily represent the actual trends in the literature. However, we believed these texts were representative enough to give us good reasons to suppose that they do present dominant trends, ones that both researchers and practitioners in the field of ICT and Education usually adhere to. This will be our working supposition in what follows

The choice of the last text (Postman's "End of Education") was in a way much less arbitrary. We did not know what the dominant views in the previous texts were before their analysis. These were chosen because of their broad, comprehensive nature, representing large conferences on the subject of discussion (proceedings) or thorough surveys of the field. Postman's book was chosen because the view expressed in it, the cultural-ideological approach, is much less frequently represented.

As for the second of the above points, it is possible to group most of the papers analyzed in the second section to three clusters of views. These clusters are far from arbitrary – they reflect three very different starting points and perspectives for viewing the "merger" of ICT and education (to be delineated in the following paragraphs). Thus they can be characterized as representing three paradigms. We chose to call

these paradigms (not totally hiding our biases) the Technocrat, the Reformist, and the Holistic.

The Technocrat paradigm characterizes those who avoid any discussion about school change. This group includes all the papers classified as having agnostic attitude, and also almost all papers reflecting administrative, curricular or didactic approaches combined with a conservative attitude. The latter are included as long as their conservatism stems from the authors' choice not to consider the possibilities, opportunities and risks inherent to ICT. In other words, they are included as long as there conservatism is unconscious or naive (as distinguished from Postman's conservatism which is conscious and intentional).

The Reformist Paradigm characterize those who see ICT as a tool that can assist in promoting the "right" didactics. The most fashionable buzzwords that are mentioned in this context are: "interdisciplinary", "constructivist", "collaborative learning". The papers reflecting this view are the ones classified as didactic-moderate and organizational-moderate.

The Holistic pardigm characterize those that unlike the writers belonging to the previous two paradigms usually present an explicit set of assertions regarding the socio-cultural situation and the impact ICT has on it (cultural approach). They also have an opinion as to the desired values that should guide educational decision making (ideological approach). Not only do they aspire to have comprehensive theories and clear recommendations for the education system, they do not evade discussing the theories of their rivals (unlike the two previous groups). Included in this group are those who start from the cultural - ideological approaches. Their attitude is either conservative (e.g. Postman, 1995) or radical and extreme radical (e.g. Aviram & Comay, 2000; Kristmundson et al., 2000).

We called these three clusters of perspectives, mind-frames and following (suggested or implemented) policies towards ICT and education "paradigms" because they differ on the mot basic ways of approaching ICT merger with education (although as can be seen form the above short discussion of the holistic paradigm- they may be divided into many subparadigms). To better understand the opposed views basic to them let us take a look below the surface, to the suppositions each of these groups make about two worlds – the world of education and the world

of ICT. As we will see, their suppositions about these worlds are different and to large extent contradictory.

3.1. Suppositions underlying the three paradigms

These three different paradigms make opposed suppositions about the two worlds they try to bring nearer. The world of education will be discussed first, and the world of ICT next. The suppositions will be presented as answers to the fundamental questions that arise in these two worlds.

First, concerning the world of education, they give (mostly tacitly) opposed answers to the questions:

- Is the educational system as we have known it in the last century going to last in the foreseeable future in its present shape?
- Should it?

Obviously, the Technocratic group does not state an opinion on the matter. Some probably think nothing will change, and do not bother to make this assumption explicit; others do not think it their job to go beyond the narrow task of implementation they took upon themselves; the rest may simply not know. Whatever their actual opinion is, since they are investing time and money in introducing ICT to the current system, their working hypothesis must be a positive answer to both questions.

The case of the Reformists group is simpler. They believe the educational system would last, but that in order to fit the new conditions in society some aspects of it must (moderately) change - the didactic and some of the organizational. We thus assume their answer to the first question is positive. Since most of the Reformist authors do not make the distinction between the “is” and the “ought” concerning the future of the education system, their positive response to the first question implies their positive answer to the second

The Holists do provide answers to these questions. Regarding the first question, their answer is that the educational system faces now and would continue to face formidable challenges as a result of the ICT revolution. Their cultural point of view permits them to perceive how deeply ICT affects the concepts most basic of education (concepts like “knowledge”, “learning”, “work”, “communication”, “group”,

"belonging", "identity"). They agree that without some action by the parties concerned the educational system would decline and even collapse. However, they (at least those among them discussed here) disagree on the answer to the second question. The conservatives (Postman, 1995) do not want the educational system to change and suggest ways to helps it regain its ground, while the radicals (Aviram & Comay, 2000; Kristmundson et al., 2000) want to transform it to a postmodern organization.

Concerning the world of ICT, the upholders of the three above paradigms give (mostly tacit) opposed answers to the four following questions concerning the defining nature of the ICT revolution, its predetermine nature, and its ethical value:

- Is the ICT revolution neutral from the perspective on its influence on our life or is it a defining revolution?
- Is ICT revolution predetermined or can we influence it?
- Can the ICT revolution be judged ethically?
- If so - is it good or bad?

Obviously, the point of view one adopts regarding ICT and education (referred to by the previous set of questions) must be influenced by one's conceptions of the relationship between technology and culture. The first two questions refer to this issue from its two oppsoed and complementopry perspectives, i.e. from the pespective of the possible influences of ICT on culture and the perspective of the possible influences of culture on ICT.

The first question reflects the first perspective: the possible influence of ICT on culture (in the most exentened use of this word, relferrign to humanly formed structures on all level of human existnece). Facing this question one has to decide between holding to the view that ICT is neurtal - i.e. "just a tool" to be used by huam beings accoridng to their aims and desires, or "defining", i.e. changing or redfining *by its mere use- regrdless of the contnets and aims of this use-* (Preiss, 1999) the circumstances and culture it which it is being used. For lack of better terms we will call these two views henceforth: "Neutalism" and "Non-Neutralism".[6]

The second question reflects the second, complementory, perspecitve: the possible influence of culture (in the above exteded sense) on ICT. Facing it one has to decide

[6] It seems that various combinations of these two views are possible as well, although we are not aware that they were proposed; according to such possible combinations, ICT can be said to be neural from some perspctives or in some cultural ciurmusntnces and defining in others.

between the the deterministic view which understands technology as an independent driving force, often (if conceived also as definign force) demanding dramtic adaptive changes from all cultural institutions and processes, and the non-determinstic view understanding it as non- predermined force, i.e as a force shaped and pushed forward by human and cultural views and interests. Therefore, it could be reshaped by different kinds of views, intersts and cultural circumstnaces (Ellul, 1965, 1998; Staudenmaier, 1985).[7]

As far as their logical nature is concerened, these first two questons are descriptive, i.e. they refer directly to the nature of events in the empirical world. The third question is also descriptive, but on a higher level. The answer to it does not stem from one way of understanding of events in the world or another, but from one's way of understadning the range of reference of ethical questions. If one conceives ethical questions as referring only to human activities – in the narow and immeditate sense of the term - then one would probably answer the third question negatively (will conceive ICT as not being a possible object for ethical judgement). But if one concieves ethics as relating also to sociocultural circumstances that might be influenced by human acitivies, then one would tend to answer this question positively and think that ICT and the cultural cirumustnces created by it (if one holds to the definign understadning of ICT) are possible object to ethical judgement.

It should be noted here that this question is the easiest to answer: most of us will tend, upon thinking, to belong to the second category. This is the case since most of us will not be dettered from judging some very large socio-cultual citucmstances (the Natzi or Soviet labour and death camps,or even the all of Natzi or Soviet society) as evil and other (for example an enlighted Humanisitic democratic welfare society) as good.

Thus it seems that negiatve answer to this question (i.e. one's hestation to pass judgement on ICT and the culturle enhanced by it) will reflect either lack of mindfulness or ardent determinism, or ardent Neutralism vs ICT. If ICT is judged to have no impact whatsoever on its users or the cultural circumstances in which it is being used ("Neutraslism") - than there is no reason (and it is logically impossible) to pass ethical judgement upon it. Similarly, if its development is totally independent of human intenstions and views, then although it may be logically possible to judge it

[7] Here again combninations of these two views are logically possible although at present we are not aware of views reflecting such combinations

ethically (we might tend to judge ethically also cirumstnace that we know are given and that we cannot change – like a pramture death for example) it does not make much sense.

While the first three questions are descrtiptive ones, the fourth is clearly normative. The answer to it will stem from the comparison of various chacteisitcs of ICT or the social, cultural, psychological circumstandes created by it (if one adheres to the definign understaning of ICT) with some nomative model of the Good human Life, or charcater or good or desired soiecty . Obiously, ICT will be jusged to be good to the extent that it will be found to enhance what will be taken to be good (human character, society etc.) and bad to the extent the it will be found to enhance what is taken to be bad.

Logically speaking, one can point to many combiantions of the answers given to the four above answers. But as a matter of fact, the literature on technology in general and on ICT inparticular distinguishes between two main camps. The adherenats of the first are Determinists, and Non-neutralist. They believe that the relationship between technology and society is essentialy a one-way causal relaitonship: technology moves on “one and only one grand avenue of advance”, that is, a fixed and necessary sequence; society must always "catch up" and adapt (Staudenmaier, 1985). The adherants of this camp actually separate technological change from any other cultural process or norm, judge it only according to its efficiency, and thus always perceive it as “advancement” and as “good” no matter what the actual effect on society is (Staudenmaier, 1985). In other words, they adopt an ethic of efficiency, within its framework they judge technology to be “good”.

Regarding education, this cluster of beliefs is critically described by Postman (1995) as follows: “The Technology is already here or will be; we must use it because it is there; we will become the kind of people the technology requires us to be; and, whether we like it or not, we will remakel our institutions to accommodate the technology. All of this must happen because it is good for us, but in any case, we have no choice.” (Postman, 1995, 39-40). Postman’s description grasps the essence of this viewpoint in its extreme.

The adherents to the second camp are Indeterminists and Non-neutralists. They perceive the technology-culture relationship as a much more complex, interdependent phenomena. The relationship is intrinsically mutual, as only the value-

laden (explicit or tacit) choices of some culture are capable of shaping new technical designs, generating momentum for them and maintaining them, while these designs affect the culture and so on (Staudenmaier, 1985). Moreover, They maintain that it is not an imperative that technology be judged according to efficiency norms only, but should be evaluated in response to a culturally defined set of values or goals (See Ellul's discussion of technology, 1965, 1998). Only as long as the technology serves these goals will it be judged "good".

What are the views of the three emerging paradigms regarding the four above questions? The Technocratic paradimg is implicitly neutralist. Basically, they do not treat sersiously (what other will take to be) the definging influences of the ICT revolution, and don't take ICT to have far reaching impact on who we are . Moreover, this paradigm is also implicitly determinist: its members perceive ICT as a "necessary force" the educational system should adapt to, and the sooner the better. They They neither imagine that society could, if it so chooses, mold ICT according to its needs and values, nor believe that the education system could channel the influences ICT holds in store. To put it simplistically, they buy computers for schools because there are computers to be bought - without further questions or thoughts

It is reasoanble to assume that its members give an implicit negaitve answer to the third question (concerning our ability to ethically judgethe ICT revolution), and that their answer stems both from their Determinisn and Neutralism concernig ICT and their lack of intersest in questions of values and basic educational goals. Thus, Riffel and Levin (1997) conclude from their field study that "technological imperatives (to have the latest, most powerful computers available) overtake unclear educational objectives…the overall educational focus of ['the schools'] efforts remains unclear."

The Refromists paradigm is based on an undestanding of some aspect of the definging naure of ICT, and it is therefore Non-neutralist. It is also determinist: its adherents don't think they (or somebody else) can or should have a say concerning the general development of thechnology. If there is notion of indetermisnim in this view it does not lie in its adhernets' understadnign of technology relationship to culutrue but rather in the educational use that can be made with it. Many of them seem to believe that since technology is there, schools must learn to do *interesting* and *desirable* things with it. They do ask themselves what educational purpose ICT might and should serve; their answer is that ICT can be used to promote the desired (constructivist) didactics.

From the above it follows that they do presuppose positive answers both to the third and fourth questions. Basically, they too percieve novel technologies to be "advancements", and therefore place an ethical judgement on ICT. Moreover, they find that ICT exerts a positive influence, since it encourages constructivists tendencies, or may potentially do so. This viewpoint is underlying the question posed by the editors of the SITES project report in the concluding chapter - "Is our education measuring up with regard to its innovative potential?" (p. 217) "

The third paradigm, the Holists, is actually defined according to its Non-Neutrality, as its upholders treat ICT as a major defining force of culture. Its view is basically indeterminist, although different holists might hold different kinds of indeterminism. Postman (1995) believes it is impossible to preserve the good parts of "American cultural institutions and heritage" while allowing uncontrolled technological development, and advocates a serious discussion regarding the advantages and disadvantages of technology and the way it changes our perception of the world. Aviram & Comay (2000) strive to form "*strategies for the channeling* of the inevitable [ICT] revolution to socially and humanely beneficial directions" (italics in original). One can say that these are two different kinds of indeterminism: strong indeterminism in Postman's case – since his appeal for social discussion on the fundamentals of the ICT revolution is implicitly based on the supposition that society could change those fundamentals; and soft indeterminism in Aviram and Comay's case – since here it is assumed that the mere fundamentals are given, but it is possible to channel the processes based on them.

Obviously, authors in this group do not evade the discussion of what the desired values of education are. They then judge the ICT revolution in regard to these values -answering the third question positively. As to their judgment, they vary from neutral to negative and positive. Thus, Hermant de Callatay (2000) states that "Technology will have to serve the educational purpose. It should not be the other way around"(- a rather neural judgment). Postman believes ICT is harmful due to its influence on culture at large (Postman, 1992) and on education (see section 2.1.5 above); While we believe it to have both positive and negative potentials and its impact on society and on education depends very much on the way we channel its introduction to education (Aviram, 2000).

The differences between the three groups stand out in table 5, which summarizes their presuppositions and the relationships amongst them

TABLE 5: Suppositions

Holists	*Reformists*	*Technocrats*	
No	Yes, with some modification of the didactical aspects	No opinion (positive answer implied)	*Will the educational system last in its present shape?*
Yes / No	Yes, with some modifications	No opinion (positive answer implied)	*Should the educational system last?*
Defining	Defining	Neutral	*Is the ICT revolution neutral or defining?*
Indeterminist	Determinist	Determinist	*Is the ICT revolution predetermined?*
Yes	Yes	No opinion	*Can the ICT revolution be judged ethically?*
Yes / No	Yes	No opinion (positive answer implied)	*Is ICT revolution good?*

Conclusion: the need for rational discourse

We have described the three general paradigms in the field of ICT and education, and showed that there are substantial differences between the suppositions these paradigms make about the worlds of education and the world of ICT.

The most basic concepts of rationality and science entail that when there are three competing theories in a scientific field, a discussion between their upholders is to be expected. The field of ICT and education is a blatant anomaly when viewed in this light. Essentially, there is no rational discourse between the different views about ICT's introduction to education. Each of the upholders of the three above paradigms takes a stance (explicitly or implicitly), but doesn't seem to be aware and/or to care about the existence of competing theories. Most authors (especially the Technocrats and Reformists, but to some extent the Holists as well) do not have a meta-level perspective on the place of their view in the discourse, which is a cornerstone of rationalistic-scientific conduct (see Aviram & Talmi, unpublished).

The question of the field's development is not only theoretical, but obviously a very practical one as well. The lack of rational discussion is true not only in regard to the theoretical debate; it is even more correct concerning practice (and how could it be different if practicians don't have systematic theoretical debate to rely on?). Schools, districts, regions and countries develop and implement ICT products and models of ICT based education, but due to the basic lack of culture of rational discouse and rational development, in too many cases there are no clear threads of ongoing improvement on existing models. As it is, everybody is reinventing the wheel time and time again.

The different implementation policies stemming from the different views have an enormous impact on the future of the educational system and the society at large. Given the history of very ambivalent results (to say the least) in the productive introduction of ICT to education in the last twenty years and the huge investments involved, we cannot afford to continue treating this process in the shallow unmindful manner currently prevalent (we elaborate on this issue in Aviram & Talmi, unpublished). It is vital that we look below the surface of the process of ICT introduction to education, expose the fundaments of the different views that have guided this process until now, and encourage an on-going rational and critical discussion among them. In order to make well-founded implementation decisions in the field, we must initiate a rational discourse between the different theories, and form a model for ICT-introduction that would reflect the state-of-the-art in the field.

The mapping out of the ground and the distinction between the three paradigms, that we have taken upon ourselves in this paper, is a necessary but not a sufficient condition for the enhancement of the desired discourse. In order to promote this aim further we have to substantiate positive answers to the following questions:

Is the rational discourse we have appealed for in the previous sections at all possible on logical and on practical grounds?
Is it possible on sociological grounds?

We believe the answers to both questions are positive. We have substantiated this belief elsewhere (Aviram & Talmi, unpublished).

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