Towards a theory of digital literacy: three scenarios for the next steps.

Abstract

This paper focuses on the discussion of the digital literacy skills for effective and mindful learning in the emerging digital environment. The importance of this subject has been practice-oriented, and lacks a sound integrative framework and theoretical foundation. This grave lacuna in the current discourse on learning in general, and on learning in the digital culture in particular, calls for a clear view of the basic literacies required for effective learning in digital environments.
this paper reviews an integrative framework for digital literacy recently suggested by Eshet-Alkalai (2004; 2005) as a starting point for the much-needed theorization. Two basic strategies – the conservative and the skeptical – are considered for this purpose. The strategy relies on the basic assumption of the current discourse that "digital nothing but skills. The second strategy, based on doubts concerning this assumption, leads to two different skeptical hypotheses. The first contends that the be reduced to the older discourses on learning styles and multiple intelligences; the second attempts to reduce it to the much more fundamental discourses modern book-based and the post modern digital cultures.

Introduction

The rapid development of digital technologies in the digital era presents the emerging information society with situations that require them to employ a growing assortment of cognitive skills in order to perform and solve problems in digital environments. These skills are often referred to as "digital literacy" (Gilster, 1995; Pool, 1997), which is presented as a special kind of mindset that enables users to perform intuitively in digital environments, and to easily and effectively access the knowledge embedded in these environments (Gilster, 1997; Tapscott, 1998; 2004; 2005).

Digital literacy is usually conceived of as a combination of technical-procedural, emotional-social skills. For instance, using a computer program procedural skills (e.g., handling files and editing visuals), as well as to intuitively decipher or "read" visual messages embedded in graphic user interfaces. In the same way, data retrieval on the Internet is conceived of as a combination of technical-procedural skills (working with search engines) and of cognitive skills (evaluating biased data, and distinguishing between relevant and irrelevant communication in chat rooms is conceived of as requiring the utilization of certain social and emotional skills. With the increasing exposure to digital working environments, digital literacy has been conceived as a "survival skill," a key that digital tasks effectively.

The above description is a summary of the numerous current and past uses of the term "digital literacy." Like any other popular catchword, recent uses of the term vary widely, ranging from the purely technical or procedural realm (e.g., Bruce & Peyton, 1999), to cognitive, as well as psychological and sociological perspectives (Swan et al., 2002). This creates ambiguity and leads to misunderstanding, misconception, and miscommunication among those who design and produce digital technologies.
In recent years, extensive efforts have been made to describe and conceptualize skills that users employ in digital environments (e.g., Burnett & McKinley, 2002a, 2002b; Wang et al., 2000; Zins, 2000). Unfortunately, most of these efforts have been locally focused, often limited to information-seeking (e.g., Marchionini, 1989; Zins, 2000); therefore, they do not provide an exhaustive coverage of digital literacy.

In order to improve our understanding of "digital literacy" and provide professionals, designers of digital environments, and educators working with ICT with better guidelines for design and education, there is a need for a refined framework for the concept that is as exhaustive, coherent, and parsimonious as possible. Eshet-Alkalai (2004; 2005) developed a conceptual framework for digital literacy, which attempts to meet these requirements, at least to the extent possible in light of the given practice-oriented literature. This framework comprises five types of literacy skills: (a) photo-visual literacy; (b) reproduction literacy; (c) information literacy; (d) branching literacy; and (e) socio-emotional literacy.

This list is conceived as a practical framework, derived from years of experience and design of digital environments for youth and adults, as well as an analysis of recent literature on the subject, and based on a pilot study of the performance of scholars in different types of digital tasks (Eshet-Alkalai, 2004; Eshet-Alkalai & Amichai-Hamburger, 2005). Although certainly not the only list of digital skills, (see Gilster, 1997; Tapscott, 1998), we believe that this framework covers the most meaningful types that users employ while effectively and mindfully working in digital environments.

The practice-oriented literature about digital literacy stems from the experience and educators working with students on ICT, and still lacks a theoretical foundation. In the works of Eshet-Alkalai (2004) and Eshet-Alkalai & Amichai-Hamburger, steps are taken in the necessary direction: the integration of different digital skills into a coherent framework, and their testing in empirical studies. The present paper is an attempt to develop a theoretical framework for the discussion of digital literacy, by considering and analyzing the major topics, questions, and research directions that should be rigorously studied in order to produce a better-developed scientific and educational foundation.

Two main strategies, derived from the current literature on digital literacy, are presented in this endeavor. The first, referred to as the "naïve" or conservative strategy, takes the view presented in recent literature at face value. It accepts the basic assumption that what we are dealing with is a number of separate skills. Consequently, this approach leads to an outline of the tasks that users employ while effectively and mindfully working in digital environments.
the steps to be taken beyond the primary development of a prima facie coherent T hese include among other things, a thorough analysis of the s interrelationships, and the resulting implications for educational developments.

The second strategy, in contrast, is skeptical. It stems from do underlying the conservative strategy, and from a hypothesis th skills lies something much deeper. In the present paper we pres skepticism. The first holds that the different sets of digital lit different learning styles (in terms of Dunn & Dunn, 1993), intelli; Gardner (1993a), or personality types (Briggs & Myers, 1987; Ca even more skeptical view, contends that there are actually two which are logically and empirically incompatible and, in fact, re is related to the work of writers such as T apscott (1998) and digital culture, on the one hand, and book-based culture, on the epistemologies and values.

According to the first, moderate skeptical view, the literature o part and parcel of the body of work on learning styles, multiple i types. According to the second, it is the tip of the iceberg of lite civilizations," which describes the transition of western soci individualistic culture to the digital, audio-visual, culture charac disintegration of the self.

It could be said that while the first naïve or conservative appro adherence to the basic supposition of the current discourse, th actually attempts at deconstruction of this discourse and its r assumptions.

The present paper does not presume to indicate which of the t approaches is correct, or even more probable. Exploring each of i requires a research project that would extend much beyond the present these strategies and approaches as possible starting discourse on digital literacy, which until now has been merely pra rich theoretical and empirical research. We leave it to the reader the issue to decide which path should be followed.

We begin our discussion with a review of Eshet-Alkalai’s (2004; literacy into five main groups and the pilot research (Eshet-Alka
2004) on these literacies. We believe this to be a good, coherent, certainly not the only possible) presentation of the dominant view on the moment (cf. Gilster, 1997; Ba et al., 2002; Hargittai, 2002a; 2002b). In the second section, we present and discuss the first "naive" or conservative strategy and in the third, the two approaches as derived from the skeptical one.

Digital Literacy - An Integrated Model of Skills

This section reviews the conceptual framework of Eshet-Alkalai (2004), reports on trends found by Eshet-Alkalai & Amichai-Hamburger (2000) of the performance of users from different age groups of tasks within the five types of digital literacy.

In 2004, Eshet-Alkalai published a 5-skill holistic conceptual model for digital literacy (Eshet-Alkalai, 2004), arguing that it covers most of the cognitive skills users and scholars employ in digital environments, and therefore provides scholars with a powerful framework and design guidelines. Today, this model is considered one of the most complete and coherent models for digital literacy (Akers, 2005) among the pivotal models for digital learning in the Encyclopedia of Distance Learning (Alkalai, 2005). The five cognitive digital literacy skills that comprise the model

Photo-Visual Literacy - Learning to Read from Visuals

According to Eshet-Alkalai (2004), the evolution of digital environments from text-based, syntactic environments to graphic-based semantic ones (Nielsen, 1993) makes it necessary for modern scholars to employ cognitive skills (Mullet & Sano, 1995; Shneiderman, 1998; Tufte, 1990) in order to communicate with the environment (Margono & Shneiderman, 2002). A unique form of digital literacy – photo-visual literacy – helps users "read" and understand instructions and messages that are displayed in a visual-graphical form. Prime examples of utilizing photo-visual skills in digital environments can be found in the deciphering of graphic user interfaces (Opperman, 2002) and in modern computer games, in which all instructions are provided by means of graphical representations. Successful photo-visual scholars usually have good visual memory and strong intuitive-associative thinking, which is useful in understanding visual messages.

Reproduction Literacy: The Art of Creative Duplication

The modern digital technologies provide scholars with new possibilities for academic work by reproducing and editing texts, visuals, and audio pieces (Gilster, 1997). Besides the ethical and philosophical questions related to reproduction and editing, there are practical and technical challenges that need to be addressed. The reproduction literacy model (Eshet-Alkalai, 2004) provides scholars with a powerful framework and design guidelines for digital literacy that covers most of the cognitive skills scholars and researchers employ in digital environments.
for legitimate genuine use of digital reproduction, the digital reproduction literacy requires modern scholars to master a special kind of digital literacy, which is essential in two major fields (Mason, 2002): writing, where pre-existing sentences can be reorganized and rearranged to create new meanings; and in art, where pre-existing audio or visual pieces can be edited and manipulated in order to create new works of art (as in the pop art or of the Internet artist, Darko Maver, 1998). Labbo et al. (2013) contend that digitally reproduction-literate scholars have good multidimensional thinking that helps them discover new combinations for arranging information in new, meaningful ways.

**Branching literacy: Hypermedia and thinking or multiple domains.**

The non-linear nature of modern hypermedia technology has introduced new dimensions of thinking, which are necessary in order to make educated decisions and by the fact that users were used to books, and expected to work with digital environments in much the same way as they read books. The modern hypermedia environments, such as the Internet, multimedia environments, and digital databases, provide users with a high degree of freedom in navigating through knowledge domains. At the same time, however, they present users with problems that involve the need to utilize non-linear information-seeking strategies and to construct knowledge from independent information that were accessed in a non-orderly and non-linear way (Jansen & Pooch, 2001; Schank, 1984; Zins, 2000). Spiro et al. (1996) cognitive flexibility theory describes the importance of branching literacy in constructing meaningful understanding of complex phenomena. Eshet-Alkalai (2004; 2005), this thesis led to the evolution of a new kind of digital literacy skill, termed "branching literacy," or "hypermedia literacy skill." Branching-literate scholars are characterized by good multidimensional spatial orientation - they avoid getting lost in hyperspace while navigating through complex knowledge domains. They also have good metaphoric thinking and the ability to create concept maps, and other forms of abstract representation of the web's structure, which help branching-literate scholars overcome problems of disorientation.
Information Literacy: The Art of Always Questioning Information

Today, with the exponential growth in available information, the ability to sort out subjective, biased, or even false information by sorting out subjective, biased, or even false information has become a key issue in training people to become smart information consumers (Kerka, 1999). Information assessment is made in almost every work we do in our daily lives, from data queries or navigational decisions in the web. It is the users' awareness of their decisions that determines the actual quality of the conclusions that they construct from the information. According to Eshet-Alkalai, information consumers to make educated, smart, informed decisions are characterized by a special kind of literacy skill, which he calls information literacy. Unfortunately, most studies on information literacy skills focus on the information-seeking strategies and habits of users (e.g., Dresang, 1999; Morahan-Martin & Anderson, 2000; Zins, 2000). Information literacy skills also focus on the cognitive and pedagogical aspects that are relevant to this skill (Minkel, 2000; O'Sullivan, 2000; Salomon, 2000). Information literacy false, irrelevant, or biased information, and avoids its penetration into the learner's cognition. Information-literate consumers are critical thinkers – people who always question information, and never take it for granted (Mardis, 2002). It is true that information literacy is not unique to the digital era; it has always been a crucial trait of successful scholars, even before the information revolution. However, in the digital era, with the unlimited exposure of humans to digital information, it has become a survival skill that enables learners to make informed use of information.

Socio-Emotional Literacy

The expansion of the Internet and other platforms of digital communication has led to new dimensions and opportunities for learning through knowledge-sharing, collaboration in knowledge communities, chat rooms, and many other forms of collaborative learning (Scardamalia & Bereiter, 1996). However, in order to take advantage of these new opportunities, users need sociological and emotional skills that enable them to "understand the rules of the game" and survive the hurdles awaiting them in the mass communication of cyberspace (Wallace, 1999). According to Eshet-Alkalai, these new kinds of digital literacy skills include the ability not only to share formal knowledge, but also to identify pretentious people, Internet traps, such as hoaxes and malicious Internet viruses. He introduces a new kind of digital literacy, which he calls socio-emotional literacy, as it primarily involves emotional and social aspects of working in cyberspace. Among a...
described here, Eshet-Alkalai (2004; 2005) describes socio-emotionally literate users as the highest-level and most complex one. It requires users to be highly critical and analytical, very mature, and have a good command of information, branching, and photo-visual literacy skills.

A wide range of studies focus on efforts to portray a sociologically literate cyberspace user (e.g. Amichai-Hamburger, 2000; Amichai, 2003; Mundrof & Laird, 2002). On the basis of their results, Eshet-Alkalai describes socio-emotionally literate users as being willing to share their knowledge with others, and possessing the capabilities for evaluating and designing knowledge in collaboration with others.

The conceptual model of Eshet-Alkalai (2004; 2005) was reinforced by two separate empirical task-based studies (Eshet-Alkalai & Amichai-Hamburger, 2004) that investigated the performance of learners from different age-groups in authentic tasks that required the utilization of the different digital literacy skills of the model. Each of the two studies had 120 participants: Forty 11th grade high school students, forty 3-year college students, forty 30–40 year old adults who are college graduates.

Similar tasks were assigned in each study. These tasks were:

- For photo-visual literacy: Decipher the graphic user interface and use a painting program to construct a theatre stage.
- For reproduction literacy: Manipulate a given digital text in order to change its meaning to it.
- For Branching literacy: Design a tour to an unknown country and make sure that it follows a non-linear way.
- For Information literacy: Write a critical comparison of the same piece of information published in seven different Internet news sources.
- For socio-emotional literacy: Content analysis of inputs of participants.

Results from the two studies clearly indicate that digital literacy is not age-related, and that the commonly used notion that the younger generation is more digitally literate than the older one (Tapscott, 1998) should be examined with care. The findings emphasize the importance of the refined conceptual framework of digital literacy discussed in the present paper as a powerful tool for improving our understanding of how different users perform tasks that require the utilization of different digital literacy skills.

Despite the fact that the two studies were conducted on different times, results showed similar trends as follows: (1) In both studies,
were found to be superior over the older ones in tasks that investigated photo-visual and branching literacy skills. (2). In both studies, the older participants were found to be superior to younger ones in tasks that investigated reproduction and information literacy skills. There was no clear pattern in the results for socio-emotional literacy task.

Similar findings were reported in other studies that were conducted independently, times and places, on children (Ba et al., 2002) and adults (Hargittai, 2002a). These findings support the trends described by Eshet-Alkalai & Amichai-Hamburger (2005); they suggest that Eshet-Alkalai's literacy skills might have a universal significance, and therefore the discussion on clash of cultures in this paper.

**Rethinking Digital Literacy: The conservative Strategy**

The recent research that has identified the main digital skills, integrated and parsimonious framework of digital literacy and tested the validity of this framework (Eshet-Alkalai, 2004, 2005; Eshet-Alkalai & Amichai-Hamburger, 2004) is a first step towards the formation of an integrated conceptual theory. We believe this to be a fair, up-to-date representation of the state of the art, and integrating the various skills mentioned in a coherent framework is only the first step on the long road from rules of thumb to the formation of a conceptually and empirically sound theory of digital literacy.

Given the utmost importance of (what is now taken to be) digital functioning, learning, and teaching in digital environments, the direction is vital to our ability to deal rationally with the challenges. The following is an effort to outline the next steps required for a set of questions to be asked regarding the list of digital skills suggested and hypotheses in response to these questions.

As discussed earlier, the sets of questions may stem from the state of the art and the subsequent list of types of literacy. The conservative strategy, is based on the widely accepted assumption that represents a set of skills. Accordingly, after the first step of developing a typology of skills, research should proceed with examination of their interrelationships, operational definitions, and implications for educational and technological design. The second strategy, above as "skeptical," is derived from skepticism towards the above-mentioned assumption and based on the hypothesis that there is something much deeper beyond these emerging
In this section, we delineate the main questions that constitute the core strategy; in the second, we present the skeptical strategy and from it.

In light of the basic supposition that digital literacy does consist of emotional skills, a few questions naturally arise (as in any other empirical field). Most of them have not yet been seriously discussed or researched. They can be divided into several groups.

**The Theoretical Questions**

There are four general theoretical questions:

1. **Is the suggested list of skills in the proposed digital literacy framework complete?**

In other words, do the skills included in it exhaust the relevant area? Are skills – cognitive, perceptive, or emotional skills – that are also essential for the effective and mindful use of the new digital media? Although some efforts have been made recently to portray the literacy profiles of digital users (e.g. Amichai-Hamburger, 2002; McKinley, 1998; Cothey, 2002; Dresang, 1999; Hargittai, 2002a; 2000), the definition of digital literacy is still incomplete, and more research on the performance of effective users of digital media is required.

2. **Are the skills independent of each other?**

The above skills have been discussed and presented in literature, independent, but are they? Aren't some of them conceptually, or at least empirically, connected? Can a user score high on socio-emotional skills and low on branching skill or on information literacy? Similarly, might some people score high on reproduction literacy skill but not on photo-visual skill?

3. **Are the skills compatible?**

While our discussion has focused on "positive relations" between representing them, obviously there is also a possibility of "negative relations," that is, empirical or logical contradictions between different skills or their definitions. Actually the research (Eshet-Alkalai, 2004; 2005; Eshet-Alkalai & Amichai-Hamburger, 2004) that while children score higher than adults on photo-visual and branching skills, adults score higher on information and reproduction literacy. Furthermore...
consistent and gradual, that is, high-school students score higher in photo-visual or branching literacy, but elementary-school children score higher than both around: adults score higher than high-school students in information literacy, but the latter score higher than elementary school children on this literacy.

Despite the fact that these findings were obtained by various studies, we believe that they are insufficient as a conclusive evidence of groups of skills. However, they do indicate that there is good reason to suppose that this is indeed the case. Further, large-scale research is needed in order to corroborate, this will lead to three salient questions: (a) a theoretical question, concerning explanation of the observed contradictions; (b) a value-oriented question, decision of which set – "adult skills" (reproduction and information literacy) or "children's skills" (all the other) – or a combination of the two is educationally preferable; (c) a didactic question, concerning how to best implement the answer to the value-oriented question may be.[1]

Serious discussion of these question leads, in fact, to the second strategy of digital literacy variables.

Thus we return to these questions later, in the next section.

4. What is the explanatory power of digital literacy variables?

Assuming that the above framework of digital skills is found to be independent and not contradictory, we still face the serious answer the questions: To which extent can these skills explain the extensive range of the differences between effective and mind learners? Only if rigorous valid and reliable statistical methods show that they explain a large extent of such differences will it be worthwhile to invest in their operational and didactic development.

Most research (including Eshet-Alkalai, 2004; 2005) refers to some of these questions, but only partially – for certain types of groups, users functions, or specific skills. We still lack a comprehensive analysis of a reasonable level of confidence that all relevant digital literacies are included in the literacies included in it are indeed independent, and that the learners to a meaningful extent.

Various earlier studies (e.g. Jonassen, 2000; Mayer, 2001) used terms such as "explain," "extensive range of differences," "effective learning," and "mindful learning" in completely different ways. In order to examine the explanatory definition of digital literacy, we need a large-scale, systematic
meanings of the terms basic to the research. We are also very far from an empirically sustained explanation, compatible with the conservative strategy, for the difference found between adult and children's literacies. The most probable explanation seems to lead to the second skeptical hypothesis, discussed later, which is essentially incompatible with the conservative strategy.

The Operation-Oriented Questions

The digital skills reviewed above have been defined in very general and abstract descriptions of their end results. For example, branching literacy is described as the capacity to mindfully create complex and intricate paths of navigation in non-linear, chaotic digital environments. But what does this mean in concrete operational terms? This question can be subdivided into three:

1. The behavioral question: How do individuals that are recognized actually behave; given a specific goal what is the flowchart of the chaos?

2. The psychological-neurological question: What cognitive, emotional are involved in performing tasks that require each kind of digital literacy?

3. The psychological-profile question: What personality characteristics group of individuals?

Only after we have a robust body of research on these three questions will we understand the operational meaning of each of the discussed skills.

The Didactic Questions

We have identified three basic didactic questions, in the following logical order:

1. In Plato's dialogues, the discussants are often troubled by the Greek) learned or innate? The same question must be asked concerning desired skills be developed in individuals, or are they innate? Or, put in more obviously, to the extent that they can be developed, how should this be achieved?

Now, we suppose – in contradistinction to some of the discussants to some extent, these skills can be developed by learning or training, even if some innate tendencies may facilitate such learning or render it more difficult. Actually, this supposition derives directly and inevitably from the conservative strategy. The contrasting, skeptical
strategy, in its two versions, is based on the opposite view, that the (alleged) literacies nothing but innate personality characteristics (first version) or different cultures (second version). Both versions are incompatible they can be learned.

2. Even if we adhere to the supposition concerning the learned nature still tackle the cost-effectiveness aspect of the didactic question: development) through extensive investment of educational resources? Is this investment educationally and economically worthwhile?

The answer to this question, in turn, depends upon the answer: including the previous one about the explanatory power of specific digital literacies, we must search for the best, most effective ways to develop skills.

Needless to say, dealing rationally with these questions require we have today, and hence, much more research is required.

3. One issue that might already be raised at this stage, which has discussions before, is: who will be in charge of the development of these skills? should the teachers be? This question arises in light of the fact the literacy skills, children seem to be prima facie much more developed than Alkalai, 2004; Eshet-Alkalai & Amichai-Hamburger, in 2005). If further research supports this finding, it may be, at least for some of these literacies, that it is the adults.

The Development and Design Questions

Two complementary design questions emerge from the above ICT-based environments:

1. Usually, when relating to any desired skill or other personality the digital environment, the obvious question raised is: How can we develop this characteristic in students? Before discussing this question, we would like to focus on a much less-discussed – although no less important – issue: How can we help individuals who are not necessary navigating skills to get around the ICT-based environment a possible?

The rationale behind this question is quite simple: assuming t
shown to significantly explain differences between effective and ineffective ICT-based learning, the subsequent line of thinking should not be restricted to how to develop these skills in those who lack or are weak in them, but also how – if possible – to help users who haven’t acquired them yet, or cannot acquire them (because their dominant learning is in conflict with these skills, they are too old to effectively acquire so compensate for the lack of these skills?)

2. The second question concerning design is more conventional: are not sufficiently endowed with the necessary skills to develop them? sub-questions: (a) how to enhance direct development of these skills and their indirect (or tacit) development. It is possible to help students directly, by developing courses in the relevant skills, or indirectly, by designing the learning environment or the curriculum in such a way that the necessary skills are acquired while acting and learning in the environment for other purposes education call in other contexts: the "hidden curriculum," as opposed (Dreeben, 1968). Obviously, some combination of both approaches is possible.

It is generally accepted that the hidden curriculum (or indirect learning) endorses the explicit one. However, this is a very rough generalization. Consequently, further research should guide the decision of whether, and to what extent this is the case for digital literacies. On this basis, the optimal combination of direct and indirect (environment-based or hidden) curricula for the development of digital literacies should be developed.

Rethinking Digital Literacy: The skeptical strategy

The questions discussed above derive from the conservative strategy assumption concerning the necessity of a certain set of skills for effective ICT-based learning. The skeptical strategy, in comparison, involves deeper, more critical questions. They stem from the suspicion that there is no such "thing" as digital literacy or digital skills, or more precisely, that what we consider "literacies" or "skills" are conveniently disguised by their denotation as "skills." In our analysis of the subject we have come across two different skeptical hypotheses. According to the first, the so-called digital literacies are just the tip of the iceberg of sets of personality traits known as "intelligences," "capacities," or "personality types". According to the second, the digital literacies are just the tip of the iceberg of much deeper cultural literacy. According to this hypothesis, the list suggested above reflects a deeper "clash of civilizations" (to paraphrase Huntington), that is, contemporary post-industrial, digital culture and the previous one...
In the following section, we will elaborate on these hypotheses. Before we emphasize what we already clearly stated at the outset (p. 4): we do not claim these hypotheses to be well substantiated or even substantiated. It is much too early to make a claim. We are still at the early stage, which is called the "context distinguished from the "context of justification" or substantiation in Philosophy of Science. The first context allows for, and even requires open-ended creative thinking, which is needed for the formation of hypotheses necessary for the explanation of some known facts. Only after the hypotheses have been formed, the second stage that refers to the context of justification can begin.

The trigger for our thinking process in the context of discovery were the basic facts:

- The common use of the term "digital literacy" in education
- The fact that it serves for the design of curricula, didactics
- The fact that it emerged from practice without any clear theoretical foundations.
- Our conviction that in order to be used productively and mindfully, this found on sound empirical research and a rational and theoretical discourse.
- Empirical research needs (at least) "thin" theory or hypothesis the interpretation of the findings stemming from the research, in its turn, "thickens" the theory and creates the rational scientific discourse

Given this state of affairs, we wish to point to three such "thin" hypotheses, the first of which is suggested by practice, and some evoking, though primary, findings we had.

We are fully aware of the fact that this is only the first step, and that we will examine these hypothesis in larger-scale researches, and that where now there is only practical discourse, productive and mindful rational one will emerge (to paraphrase Freud's expression of his desire to replace as much irrational id with the conscious and rational ego).

**The First Skeptical Hypothesis: the Concept of "Digital Literacies"**

The first hypothesis is based on some clear similarities between various pluralistic conceptions of learning (if we unite for the sake of different theories on learning and learners to be mentioned immediately, ignore the meaningful...
differences among them and relate to all of them under the term "pluralistic views of learning"), such as learning styles, multiple intelligences, or different theories on the one hand, and aspects of the concept of "literacies" (2004; 2005) on the other hand.

For example, the tension between the photo-visual and symbolic literacy as is strikingly similar to the tension between audio-visual and the more analytical or conceptual learning styles as described by various learning styles theories (the distinction among different kinds of intelligences in multiple intelligences theory (1993a, 1993b, 2000). Other examples are the possible parallel between branching and linear literacies as depicted in digital literacies views and the difference between inductive and deductive learning styles as conceived of in Griggs, 1988), or the distinction between analytical- logical in multiple intelligences theory (Gardner, 1993a, 1993b).

These are few examples, but they suffice to lead to the (still primary and hypothesis that different literacies reflect different learning styles or intelligences or personality types. If this would indeed be found (upon much further research and analysis) to be a probable hypothesis, then the theory outlined above and in 2004; 2005, and its implications for helping individuals function in the modern computerized environment must be adjusted.

First, the integrated set of skills that is presented, by the conservative something anyone can acquire, may be revealed as reflecting personality are perhaps innate, not easily acquired by everybody, and certain.

Then, if this emerges to be the case, the didactic recommendation literature on digital literacy, namely, that everybody should acquire somewhat problematic. In fact, the parallel pluralistic approach to learning leads to a very different conclusion: first and foremost, individuals should be encouraged to follow their personal strengths (described differently in terms of "learning styles", "personality types") and invest in acquiring or improving other strengths only insofar as such an investment seems personally worthwhile. Advocates of the pluralistic views of learning might even say that it is not individuals that have to adapt to computers, but computers that have to adapt to individuals. Such recommendation can draw support from the extensive discourse on the adaptability of ICT environments, individualized personal learning (Lazzaro, 1993).

This skeptical hypothesis gives rise to four questions, on three
Two ontological-psychological questions

- Are "digital skills" really independent characteristics in their own right, or are they derivates of deeper personality characteristics?
- If the latter is true, are these deriveives of learning styles, different intelligences, different types, or of some combination of the above?

The educational question

If "digital skills" are simply derivatives of personality traits, what are the educational implications? Should we still follow the recommendation of digital literacy literature concerning the need for universal acquisition of these literacies, or the pluralistic recommendation based on the other theories mentioned?

The design question

If we adopt the pluralistic recommendation, that is, that individuals have different inclinations and strengths, what is the task of the designers – to adapt the digital literacies, to help individuals who are not endowed with such skills function in digital environments without them (by adapting the environment to their profile), or both?

Naturally, we have to start by tackling the ontological-psychological questions. Without an answer to these questions, we are also unable to respond to the other questions.

The Second Skeptical Hypothesis: The List of Digital Literacies Reflects a "Clash of Civilizations"

The second skeptical hypothesis is more radical than the first one. It emerges from the prima facie contradiction among the empirical findings on digital literacy presented by Eshet-Alkalai (2004). As noted, these results indicate that while young children perform much better than adults in the three first literacies, adults perform much better than the fourth.

This suggests that the list of five skills, which are presumed to reflect a "clash of civilizations" (to use the name of Huntington's well known book in altogether different context from the one to which it refers), or the differences between the "old" modern, rationalistic, linear, conceptual, book-based culture of Western societies in the last few centuries (since Gutenberg), and the post modern, branching, multimedia-based, reproduction-oriented culture of Western societies in the last few centuries (since Gutenberg), or the differences between the "old" modern, rationalistic, linear, conceptual, book-based culture of Western societies in the last few centuries (since Gutenberg) and the post modern, branching, multimedia-based, reproduction-oriented culture of Western societies in the last few centuries (since Gutenberg), or the differences between two contrasting cultures. Specifically, these are the "old" modern, rationalistic, linear, conceptual, book-based culture of Western societies in the last few centuries (since Gutenberg), and the post modern, branching, multimedia-based, reproduction-oriented culture of Western societies in the last few centuries (since Gutenberg), developing in the last twenty years, largely (albeit not exclusively
different electronic media and recently, the Internet.

This radical skeptical strategy relies on three types of analysis: conceptual, empirical.

The conceptual analysis

A quick conceptual analysis of the list of five skills discussed in the paper's easily reveals that the first four belong to two different "families" (at least three, in my opinion), but we need to understand the last one well enough to know which "family" it belongs to. While the first three belong to the "information literacy" family (photo-visual skill, reproduction skill and branching skill), the latter – requiring critical treatment of the material being processed through ICT – contradicts the new multimedia tendencies and help individuals adapt to them, especially in the context of the treatment of the material being processed through ICT – contradiction.

Being critical requires, among other things, being rational, which is linearly (since rationalism is based on logic, which is linear through and through) (Perkins, 1993)[2]. Thus it is reasonable to assume that emphasizing the critical attitude is contradictory to emphasizing the importance of branching thinking and the other literacies that are connected to it (photo-visual and reproduction literacies).

The theoretical analysis

Once one has reached the conceptual analysis described above – that contradiction between these two groups of skills – one should naturally look for discourse or literature that can support or substantiate this hypothesis. The hypothesis is supported by a very extensive body of theoretical literature that can support or substantiate this hypothesis. This already extensive and steadily growing corpus, incorporating numerous leads us in various ways to same conclusion: in the last few decades, Western culture has gone through a revolutionary change from a modern, second-wave, industrial, book-based ("Gutenbergian," in McLuhan's terms) society to a post modern, third-wave, post-industrial, digital society. These two societies are opposed to each other in all basic aspects of human existence.

For one thing, while the first society was based on linear modes (stemming from book reading) and hence was totally linear in all
organizational structures to conceptions of human life as expressed in different developmental theories), the second is based on lateral modes hence it is branching in all its other aspects (including organizational structures and developmental conceptions) (Peters, 1994; Tofler, 1981, 1990).

Furthermore, the first society was based on the conception of an independent, enduring entity and hence of conceptions of independent "ownership" and "authorship." The second, on the other hand, is based on the "death of the individual," as by postmodernists such as Derrida, (1998); Gergen (1992); and Foucault (see also: 1994), and hence, on the "death of the author" and legitimization.

This large and complex corpus of theoretical literature provides opposition between the first three and the fourth digital skills, clashing cultures: one modern, book–based, linear, individualistic, and the other postmodern, multimedia-based, branching and much less individual-oriented.

The empirical analysis

We began with a conceptual analysis, which revealed the probability of a clash between the two above groups of skills. We then moved to the theoretical level, hypothesizing to reflect not just a trivial clash but, in fact, the dramatic clash between the modern Gutenbergian culture and the postmodern digital culture. Having defined the two opposed tendencies in terms of cultural clash, we can then further support it on the empirical level, which actually led us to this intellectual journey in the first place.

The empirical evidence stemming from Eshet-Alkalai (2004), as reported in the previous section, corroborates the above hypothesis, and acquires a new meaning in light of it. As reported, it has been found that while young children fare much better than teenagers and teenagers do better than adults in the three first literacies, adults fare much better than teenagers and children do in the fourth. This is exactly what we, on the basis of this hypothesis, would have expected. Now, this is not the only empirical evidence for our hypothesis; other research also indicates a similar direction (Oppenheimer, 1997, 1998). When we first formed this hypothesis – in a leap of imagination – we had very slim empirical evidence to support it. The recent empirical studies of Eshet-Alkalai & Amichai-Hamburger (2004) and Eshet-Alkalai & Chaiut (described above in detail), which were supported by other equivalent studies (described above in detail), all clearly illustrated the differences in digital literacy between age groups and suggested the merit of Eshet's list of literacy skills as a reliable holistic framework for digital literacy.
Thus, although we are still in the context of discovery, the radical skeptical leap of imagination looks now as a serious candidate for leaving this initial context, and for being subjected to further and more extensive, hopefully inter-cultural, sharper examination/refutation in the context of justification.

If this hypothesis is further substantiated, it might mean that we would not continue speaking of enhancing "digital skills" and refer to all the first four literacies (as noted, we ignore the fifth here) as if they were part of the "same pack direction. We must choose. The choice, in this case, is not just between two categories or literacies; it is rather a choice between two cultures, (a) one favoring rationality, continuity, criticism, abstract thinking, individuality, authenticity, systematic planning, and thinking; and (b) the other favoring fragmentation, spontaneity, concrete visual processing of knowledge, connectedness, reproduction, and branching associative thinking.

In light of the possible need to make this crucial choice, we will need to consider "neural" skills or "literacies," we have quickly been drawn into a discussion of the central aims and values of Western education. If such a scenario come true, we will need to tackle the most fundamental questions:

- Should education strive to achieve the enhancement of post modern values, preservation (as much as possible) of modern values?
- Should the aim, instead, be some combination of the two?
- If so, what combination (Aviram, 2005; Dator, 1993; Postman, 1991)?

A discussion of prima facie neutral skills can turn, if this scenario is realized substantiation of the radical skeptical hypothesis, into a basic cultural educational values. The resolution of this dilemma should not necessarily be an "either-or" one; we should be able to strive for an optimal balance. First, however, we will need to recognize the dilemma for what it is, and then consciously make the decisions, necessarily have impact on the most fundamental educational policies.

Examination of the second skeptical hypothesis, and certainly of the dilemma inevitably emerge if it is found to be true, is beyond the scope of this paper (hopefully) to future discussions.

**Conclusion**

This paper relies on previous work, in which the fragmented literacies are integrated into a taxonomical framework of five basic digital literacies. This was a first necessary step in transforming an important emerging discourse.
and intuition-oriented, into a more productive, integrated, theoretical discourse, it is far from being adequate.

We dedicated the paper to making the first few steps necessary for the enlargement, deepening, and theorization of this extremely important discourse, which should guide us in the most basic policy decisions concerning education.

We have done so by pointing to two possible basic strategies for discussion about digital literacy. The first, rather conservative, assumes basic to the prevailing discourse at face value; we assumed that what are generally called digital literacy "skills" are indeed nothing but skills or literacies, and raised questions that arise from this conservative starting point.

The second, a skeptical strategy, is based on an essential questioning of this assumption. It stems from the hypothesis that the "skills and deeper layers in individual personalities than just the rather narrow and technical cognitive layer implied by talk of "skills" or "literacy". In this context, we raised two different hypotheses, one relatively moderate, and the other, quite radical:

1. According to the first hypothesis, the prevailing practical literature "skills" are actually reducible to certain learning styles, intelligences, or personality types. This hypothesis, if true, might lead to much more pluralistic educational and design recommendations relative to the "monistic" ones now suggested by the digital literacy literature (that every student must acquire the same digital literacies).

2. According to the second hypothesis, "literacies" and "skills" are incompatible sets of skills, and more importantly, these two expressing two cultures and sets of values that are now clashing in the West, in general, and in the foundations of Western education, more specifically. If this hypothesis is true, the allegedly neutral and "naive" discourse about skills is transformed into a thoroughly ideological discussion about the basic values that should guide education.

We have neither expressed nor defended a view concerning which possibilities (the conservative one or one of the two more radical from the digital literacy discourse is the correct one. We simply did not even present a concrete research design, which might enable us to decide among them (or their various combinations). It is too early to be able to do even that.

Still, the digital era is not going to disappear, and the need for an growing digital tide is rapidly increasing. The educational response to digital culture may vary from full adaptation to compromising with it or opposing it. It is
coined by William James) – a decision we cannot avoid. “Avoiding” the above possibilities means actually deciding to passively and fully adapt to the new is indeed the probable default scenario. If that is so, and if the radical hypothesis about the civilization clash is true, it is likely that photo-visual skill, branching skill and reproduction skill will be powerfully enhanced, while the ability for criticism, or indeed, rational thinking of may deteriorate. Some might take it to be a desired scenario, but it is a decision, rather than being dragged towards it blindly.

[1] This question becomes especially problematic if we opt – in some combination of the two kinds of skills. Given the prima facie contradiction between these two sets of skills, it is reasonable to suppose that an educational process leading to the enhancement of one set might suppress the other. If we want any of the two, we must carefully design didactic ways that will prevent a “zero-sum” process from taking place.

[2] It is true that the formation of hypothesis may, at the “discovery stage,” include branching thinking. However, while one can certainly be rational without for branching thinking (that is, rational without being creative), one cannot be rational without being capable of linear logical thinking. In other words, logical-linear thinking is a necessary and maybe also sufficient condition for rationality, while branching thinking is only a “helpful condition.”

References


http://www.kapelica.org/maver/main.htm


