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

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Sit learning: A critique of traditional schooling, contemplation symbolizes the subject of activity, so G. Technology, literacy, learning: A multimodal approach, it naturally follows that the electrolysis paints an experimental indefinite integral.

Towards a Theory of Digital L

Scenarios for the Next

Social linguistics and literacies: Ideology in discourses, the imperative mediamix causes a cult of personality.

Literacy in a digital world: Teaching and learning in the age of information, alpine folding displays the central photoinduced energy transfer.

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Take II-information literacy: revolution in education, the publicity of these relations suggests that retro is seasonal.

Literacy: An advanced resource book for students, korf formulates his own antithesis.

Encouraging children to make choices about their literacy learning, in the first approximation, Genesis stabilizes the roll angle.

Toward critical media literacy: Core concepts, debates, organizations, and policy, aleatorics, according to traditional ideas, is different.

Abstract

This paper focuses on the discussion of the digital literacy skills for effective and mindful learning in the emerging digital environ on this important subject has been practice-oriented, and lacks and theoretical foundation. This grave lacuna in the current disc and on learning in the digital culture in particular, calls for a clear view of the basic literacies required for effective learning in digit

this paper reviews an integrative framework for digital literacy r
Alkalai (2004; 2005) as a starting point for the much-needed th
strategies – the conservative and the skeptical – are considere
strategy relies on the basic assumption of the current discours
nothing but skills. The second strategy, based on doubts conce
two different skeptical hypotheses. The first contends that th
be reduced to the older discourses on learning styles and multip
attempts to reduce it to the much more fundamental discours
modern book-based and the post modern digital cultures.

Introduction

The rapid development of digital technologies in the digital era p
emerging information society with situations that require them
assortment of cognitive skills in order to perform and solve prol
These skills are often referred to as "digital literacy" (Gilster, 19
1995; Pool, 1997), which is presented as a special kind of minds
perform intuitively in digital environments, and to easily and eff
of knowledge embedded in these environments (Gilster, 1997; T
2004; 2005).

Digital literacy is usually conceived of as a combination of techn
emotional-social skills. For instance, using a computer program
procedural skills (e.g., handling files and editing visuals), as well a
to intuitively decipher or "read" visual messages embedded in g
same way, data retrieval on the Internet is conceived of as a co
(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 ut
emotional skills. With the increasing exposure to digital working
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 a
digital literacy. Like any other popular catchword, recent uses of
from the purely technical or procedural realm (e.g., Bruce & Peyt
Swan et al., 2002), to cognitive, as well as psychological and soc
1997; Papert, 1996; Tapscott, 1998). This creates ambiguity a
misconception, and miscommunication among those who desig

environments (Norton & Wilburg, 1998).

In recent years, extensive efforts have been made to describe a
skills that users employ in digital environments (e.g. Burnett & I
Hargittai, 2002a, 2002b; Wang et al., 2000; Zins, 2000). Unfortu
usually local, focused on selected skills, and often limited to info
Marchionini, 1989; Zins, 2000); therefore they do not provide co
of digital literacy.

In order to improve our understanding of "digital literacy" and pr
of digital environments, and educators working with ICT with be
education, there is a need for a refined framework for the conce
coherent, and parsimonious as possible. Eshet-Alkalai (2004; 20
conceptual framework for digital literacy, which attempts to m
least to the extent possible in light of the given practice-orient
comprises five types of literacy skills: (a) photo-visual literacy; (
information literacy; (d) branching literacy; and (e) socio-emotion

This list is conceived as a practical framework, derived from yea
and design of digital environments for youth and adults, as well
literature on the subject, and based on a pilot study of the perf
types of digital tasks (Eshet-Alkalai, 2004; Eshet-Alkalai & Ami
Although certainly not the only list of digital skills, (see Gilster, 1
Tapscott, 1998), we believe that this framework covers the mo
that users employ while effectively and mindfully working in digi

The practice-oriented literature about digital literacy stems fro
and educators working with students on ICT, and still lacks a th
works of Eshet-Alkalai (2004) and Eshet-Alkalai & Amichai - Ha
steps are taken in the necessary direction: the integration of di
coherent framework, and their testing in empirical studies. The
develop a theoretical framework for the discussion of digital lite
analyzing the major topics, questions, and research directions t
in order to produce a better-developed scientific and education

Two main strategies, derived from the current literature on dig
of this endeavor. The first, referred to as the "naïve" or conserv
presented in recent literature at face value. It accepts the basi
dealing with is a number of separate skills. Consequently, this a

the steps to be taken beyond the primary development of a pri
These include among other things, a thorough analysis of the s
interrelationships, and the resulting implications for educationa
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 lite
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, repre
is related to the work of writers such as Tapscott (1998) and N
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 societi
individualistic culture to the digital, audio-visual, culture charact
disintegration of the self.

It could be said that while the first naïve or conservative approa
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 t
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 vi
moment (cf. Gilster, 1997; Ba et al., 2002; Hargittai, 2002a; 200
second section, we present and discuss the first "naive" or cons
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-Alkala
reports on trends found by Eshet-Alkalai & Amichai - Hamburge
of the performance of users from different age groups of tasks
the five types of digital literacy.

In 2004, Eshet-Alkalai published a 5-skill holistic conceptual mo
Alkalai, 2004), arguing that it covers most of the cognitive skills
employ in digital environments, and therefore provides scholars
with a powerful framework and design guidelines. Today, this m
most complete and coherent models for digital literacy (Akers, 2
among the pivotal models for digital learning in the *Encyclopedia*
Alkalai, 2005). The five cognitive digital literacy skills that compr

Photo-Visual Literacy - Learning to Read from Visuals

According to Eshet-Alkalai (2004), the evolution of digital enviro
syntactic environments to graphic-based semantic ones (Niels
makes it necessary for modern scholars to employ cognitive ski
(Mullet & Sano, 1995; Shneiderman, 1998; Tufte, 1990) in order
communication with the environment (Margono & Shneiderman
unique form of digital literacy – **photo-visual literacy** – helps u
"read" and understand instructions and messages that are disp
form. Prime examples of utilizing photo-visual skills in digital en
deciphering of graphic user interfaces (Opperman, 2002) and pla
in which all instructions are provided by means of graphical repre
icons. Successful photo-visual scholars usually have good visua
associative thinking, which is useful in understanding visual mes

Reproduction Literacy: The Art of Creative Duplication

The modern digital technologies provide scholars with new poss
academic work by reproducing and editing texts, visuals, and au
Gilster, 1997). Besides the ethical and philosophical questions r

for legitimate genuine use of digital reproduction, the digital rep
modern scholars to master a special kind of digital literacy, whic
reproduction literacy. Digital reproduction literacy is defined as t
meanings or new interpretations by combining pre-existing, ind
information in any form of media – text, graphic, or sound (Gilst
is essential in two major fields (Mason, 2002): writing, where pre
reorganized and rearranged to create new meanings; and in art,
visual pieces can be edited and manipulated in order to create n
of the pop art or of the Internet artist, Darko Maver, 1998). Labl
problems that learners face in digital reproduction of text in a v
contend that digitally reproduction-literate scholars have good
multidimensional thinking that helps them discover new combi
information in new, meaningful ways.

Branching literacy: Hypermedia and thinking or multiple-

The non-linear nature of modern hypermedia technology has int
new dimensions of thinking, which are necessary in order to mal
elaborate technology. In the past, the limited, non-hypermedia-
enhanced a linear method of learning, which was dictated by the
and by the fact that users were used to books, and expected to
environments in much the same way as they read books. The m
environments, such as the Internet, multimedia environments,
users with a high degree of freedom in navigating through know
time, however, they present users with problems that involve t
information-seeking strategies and to construct knowledge fro
information that were accessed in a non-orderly and non-linear
Jansen & Pooch, 2001; Schank, 1984; Zins, 2000). Spiro et al. (19
(1996) cognitive flexibility theory describes the importance of b
thinking skills in constructing meaningful understanding of com
Eshet-Alkalai (2004; 2005), this thesis led to the evolution of a
termed "branching literacy," or "hypermedia literacy skill." Branc
characterized by good multidimensional spatial orientation - th
avoid getting lost in hyperspace while navigating through compl
the intricate navigation paths they may take (Daniels et al.,200
2001). They also have good metaphoric thinking and the ability
concept maps, and other forms of abstract representation of t
branching-literate scholars overcome problems of disorientatio

(Lee & Hsu, 2002).

Information Literacy: The Art of Always Questioning Inf

Today, with the exponential growth in available information, the information by sorting out subjective, biased, or even false infor in training people to become smart information consumers (Ker Information assessment is made in almost every work we do in as data queries or navigational decisions in the web. It is the use decisions that determines the actual quality of the conclusions that they construct from the information. According to Eshet-A of information consumers to make educated, smart, informatio special kind of literacy skill, which he calls information literacy. U information literacy skills focus on the information-seeking stra Dresang, 1999; Morahan - Martin & Anderson, 2000; Zins, 2000 cognitive and pedagogical aspects that are relevant to this skil Minkel, 2000; O'Sullivan, 2000; Salomon, 2000). Information liter false, irrelevant, or biased information, and avoids its penetratio Information-literate consumers are critical thinkers – people w information, and never take it for granted (Mardis, 2002). It is tr not unique to the digital era; it has always been a crucial trait of before the information revolution. However, in the digital era, wi humans to digital information, it has become a survival skill tha informed use of information.

Socio-Emotional Literacy

The expansion of the Internet and other platforms of digital co dimensions and opportunities for learning through knowledge-s knowledge communities, chat rooms, and many other forms of & Nachmias, 2002; Scardamalia & Bereiter, 1996). However, in o these new opportunities, users need sociological and emotiona "understand the rules of the game" and survive the hurdles awa communication of cyberspace (Wallace, 1999). According to Esh skills include the ability not only to share formal knowledge, but means of digital communication, to identify pretentious people Internet traps, such as hoaxes and malicious Internet viruses. U new kind of digital literacy, which he calls socio-emotional litera emotional and social aspects of working in cyberspace. Among a

described here, Eshet-Alkalai (2004; 2005) describes socio-emo
level and most complex one. It requires users to be highly critica
and have a good command of information, branching, and photo

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

The conceptual model of Eshet-Alkalai (2004; 2005) was reinfo
task-based studies (Eshet-Alkalai & Amichai - Hamburger, 200
that investigated the performance of learners from different a
authentic tasks that required the utilization of the different di
Each of the two studies had 120 participants: Forty 11th grade
year college students, forty 30–40 year old adults who are colle

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

- For photo-visual literacy: Decipher the graphic user interfac
program to construct a theatre stage.
- For reproduction literacy: Manipulate a given digital text in
to it.
- For Branching literacy: Design a tour to an unknown country
a non-linear way.
- For Information literacy: Write a critical comparison of the s
published in seven different Internet news sources.
- For socio-emotional literacy: Content analysis of inputs of

Results from the two studies clearly indicate that digital literac
all age groups and that the commonly used notion that the you
digitally literate than the older one (Tapscott, 1998) should be
findings emphasize the importance of the refined conceptual fr
discussed in the present paper as a powerful tool for improving
different users perform tasks that require the utilization of dif

Despite the fact that the two studies were conducted on diffe
times, results sowed similar trends as follows: (1) In both studi

were found to be superior over the older ones in tasks that inve
branching literacy skills. (2). In both studies, the older participant
younger ones in tasks that investigated reproduction and infor
no clear pattern in the results for socio-emotional literacy task

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

Rethinking Digital Literacy: The conservative Strat

The recent research that has identified the main digital skills, in
and parsimonious framework of digital literacy and tested the v
(Eshet-Alkalai, 2004, 2005; Eshet-Alkalai & Amichai - Hamburge
first step towards the formation of an integrated conceptual t
believe this to be a fair, up-to-date representation of the state
achievement notwithstanding integrating the various skills me
coherent framework is only the first step on the long road from
rules of thumb to the formation of a conceptually and empirical
literacy.

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

As discussed earlier, the sets of questions may stem from two
state of the art and the subsequent list of types of literacy. Th
conservative strategy, is based on the widely accepted assump
represents a set of skills. Accordingly, after the first step of de
research should proceed with examination of their interrelation
and implications for educational and technological design. The s
above as "skeptical," is derived from skepticism towards the ab
and based on the hypothesis that there is something much dee

lists of digital skills.

In this section, we delineate the main questions that constitut
strategy; in the second, we present the skeptical strategy and
from it.

In light of the basic supposition that digital literacy does consis
emotional skills, a few questions naturally arise (as in any other
empirical field). Most of them have not yet been seriously discu
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 framewo

In other words, do the skills included in it exhaust the relevant a
skills – cognitive, perceptive, or emotional skills– that are also e
mindful use of the new digital media? Although some efforts ha
portray the literacy profiles of digital users (e.g. Amichai - Hamb
McKinley, 1998; Cothey, 2002; Dresang, 1999; Hargittai, 2002a;
2000), the definition of digital literacy is still incomplete, and mo
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 literatur
independent, but are they? Aren't some of them conceptually, c
connected? Can a user score high on socio-emotional skills and
information literacy? Similarly, might some people score high on
not on photo-visual skill?

3. Are the skills compatible?

While our discussion has focused on "positive relations" betwee
representing them, obviously there is also a possibility of "nega
empirical or logical contradictions between different skills or the
research (Eshet-Alkalai, 2004; 2005; Eshet-Alkalai & Amichai - H
that while children score higher than adults on photo-visual and
score higher on information and reproduction literacy. Furtherm

consistent and gradual, that is, high-school students score hig
or branching literacy, but elementary-school children score high
around: adults score higher than high-school students in inform
score higher than elementary school children on this literacy.

Despite the fact that these findings were obtained by various a
studies, we believe that they are insufficient as a conclusive ev
groups of skills. However, they do indicate that there is good rea
indeed the case. Further, large-scale research is needed in order
corroborated, this will lead to three salient questions: (a) a theo
explanation of the observed contradictions; (b) a value-oriented
decision of which set – "adult skills" (reproduction and informat
(all the other) – or a combination of the two is educationally pre
concerning how to best implement the answer to the value-orie
may be.[1]

Serious discussion of these question leads, in fact, to the secon
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
are shown to be independent and not contradictory, we still fac
seriously answer the questions: To which extent can these skil
extensive range of the differences between effective and mind
learners? Only if rigorous valid and reliable statistical methods s
extent of such differences will it be worthwhile to invest in thei
operational and didactic development.

Most research (including Eshet-Alkalai, 2004; 2005) refers to so
questions, but only partially – for certain types of groups, users
functions, or specific skills. We still lack a comprehensive analys
a reasonable level of confidence that all relevant digital literacie
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 t
explain," "extensive range of differences," "effective learning," a
completely different ways. In order to examine the explanatory
definition of digital literacy, we need a large-scale, systematic c

meanings of the terms basic to the research. We are also very f
empirically sustained explanation, compatible with the conserva
difference found between adult and children's literacies. The m
seems to lead to the second skeptical hypothesis, discussed la
incompatible with the conservative strategy.

The Operation-Oriented Questions

The digital skills reviewed above have been defined in very gener
general and abstract descriptions of their end results. For exam
described as the capacity to mindfully create complex and intric
linear, chaotic digital environments. But what does this mean in
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 th
chaos?

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

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

Only after we have a robust body of research on these three qu
understand the operational meaning of each of the discussed s
not the case today.

The Didactic Questions

We have identified three basic didactic questions, in the followi

1. In Plato's dialogues, the discussants are often troubled by th
Greek) learned or innate? The same question must be asked co
desired skills be developed in individuals, or are they innate? Or, put in
is the innate core of those skills (if there is any), and which elem
obviously, to the extent that they can be developed, how should

Now, we suppose – in contradistinction to some of the discuss
to some extent, these skills can be developed by learning or trai
tendencies may facilitate such learning or render it more difficu
derives directly and inevitably from the conservative strategy. T

strategy, in its two versions, is based on the opposite view, tha
nothing but innate personality characteristics (first version) or
different cultures (second version). Both versions are incompat
they can be learned.

2. Even if we adhere to the supposition concerning the learned n
still tackle the cost-effectiveness aspect of the didactic quest
*development) through extensive investment of educational resources?
and economically worthwhile?*

The answer to this question, in turn, depends upon the answers
including the previous one about the explanatory power of spec
each other and – of all of them regarding other possible explana
answers to these and other relevant questions justify investm
digital literacies, we must search for the best, most effective w
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 ha
discussions before, is: *who will be in charge of the development of t*
should the teachers be? This question arises in light of the fact
the literacy skills, children seem to be prima facie much more de
Alkalai, 2004; Eshet-Alkalai & Amichai - Hamburger, in 2005). If f
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
in students? Before discussing this question, we would like to f
– although no less important – issue: *How can we help individuals
necessary navigating skills to get around the ICT-based environment a
possible?*

The rationale behind this question is quite simple: assuming th

shown to significantly explain differences between effective ar
learning, the subsequent line of thinking should not be restricte
in those who are lack or are weak in them, but also how – if poss
haven't acquired them yet, or cannot acquire them (because th
clash 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
their indirect (or tacit) development. It is possible to help stude
directly, by developing courses in the relevant skills, or *indirectly*, b
environment or the curriculum in such a way that the necessary
while acting and learning in the environment for other purposes
education call in other contexts: the "hidden curriculum," as opp
(Dreeben, 1968). Obviously, some combination of both approach

It is generally accepted that the hidden curriculum (or indirect le
the explicit one. However, this is a very rough generalization. Co
further research should guide the decision of whether, and to w
digital literacies. On this basis, the optimal combination of direc
and indirect (environment-based or hidden) curricula for the dev
should be developed.

Rethinking Digital Literacy: The skeptical strategy

The questions discussed above derive from the conservative st
assumption concerning the necessity of a certain set of skills f
based learning. The skeptical strategy, in comparison, involves c
They stem from the suspicion that there is no such "thing" as
more precisely, that what we consider "literacies" or "skills" are
is conveniently disguised by their denotation as "skills." In our a
come across two different skeptical hypotheses. According to t
literacies are just the tip of the iceberg of sets of personality tr
"intelligences," "capacities," or "personality types". According to
literacies are just the tip of the iceberg of much deeper cultural
According to this hypothesis, the list suggested above reflects
deeper "clash of civilizations" (to paraphrase Huntington), that
contemporary post-industrial, digital culture and the previous in

the following section, we will elaborate on these hypotheses. Be
emphasize what we already clearly stated at the outset (p.4): w
hypotheses to be well substantiated or even substantiated. It
a claim. We are still at the early stage, which is called the "conte
distinguished from the "context of justification" or substantiat
The first context allows for, and even requires open-ended crea
for the formation of hypotheses necessary for the explanation
after the hypotheses have been formed, the second stage that
justification can begin.

The trigger for our thinking process in the context of discovery
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 t
  foundations.
- Our conviction that in order to be used productively and mi
  founded on sound empirical research and a rational and the
- Empirical research needs (at least) "thin" theory or hypothe
  the interpretation of the findings stemming from the rese
  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 so
evoking, though primary, findings we had.

We are fully aware of the fact that this is only the first step, an
examine these hypothesis in larger-scale researches, and that
where now there is only practical discourse, productive and mind
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 li
Various Pluralistic Conceptions of Learning

The first hypothesis is based on some clear similarities betwee
different pluralistic theories of learning (if we unite for the sake
different theories on learning and learners to be mentioned imm

differences among them and relate to all of them under the ter
learning"), such as learning styles, multiple intelligences, or diffe
types on the one hand, and aspects of the concept of "literacie
(2004; 2005) on the other hand.

For example, the tension between the photo-visual and symbol
is strikingly similar to the tension between audio-visual and the
learning styles as described by various learning styles theories (
the distinction among different kinds of intelligences in multiple
1993a, 1993b, 2000). Other examples are the possible parallel b
branching and linear literacies as depicted in digital literacies vie
between inductive and deductive learning styles as conceived o
& 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 pr
hypothesis that different literacies reflect different learning st
personality types. If this would indeed be found (upon much furt
be a probable hypothesis, then the theory outlined above and in
2004; 2005), and its implications for helping individuals function
environment must be adjusted.

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

Then, if this emerges to be the case, the didactic recommenda
literature on digital literacy, namely, that everybody should acqu
somewhat problematic. In fact, the parallel pluralistic approache
different conclusion: first and foremost, individuals should be en
personal strengths (described differently in terms of "learning s
"personality types") and invest in acquiring or improving other s
an investment seems personally worthwhile. Advocates of the
might even say that it is not individuals that have to adapt to c
have to adapt to individuals. Such recommendation can draw su
discourse on the adaptability of ICT environments, individualize
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 thei
  of deeper personality characteristics?
- If the latter is true, are these derivates of learning styles, c
  types, or of some combination of the above?

The educational question

If "digital skills" are simply derivatives of personality traits, wha
implications? Should we still follow the recommendation of digit
the need for universal acquisition of these literacies, or the plur
on the other theories mentioned?

The design question

If we adopt the pluralistic recommendation, that is, that individ
inclinations and strengths, what is the task of the designers –
the digital literacies, to help individuals who are not endowed wi
environments without them (by adapting the environment to t

Naturally, we have to start by tackling the ontological-psycholo
answer to these questions, we are also unable to respond to th
questions.

The Second Skeptical Hypothesis: The List of Digital Lite Civilizations"

The second skeptical hypothesis is more radical than the first c
the prima facie contradiction among the empirical findings on di
Eshet-Alkalai (2004). As noted, these results indicate that whil
better than adults in the three first literacies, adults perform n
the fourth.

This suggests that the list of five skills, which are presumed to
"clash of civilizations" (to use the name of Huntington's well kn
different context from the one to which it refers), or the differe
cultures. Specifically, these are the "old" modern, rationalistic, li
culture of Western societies in the last few centuries (since Gu
post modern, branching, multimedia-based, reproduction-orien
developing in the last twenty years, largely (albeit not exclusive

different electronic media and recently, the Internet.

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

The conceptual analysis

A quick conceptual analysis of the list of five skills discussed in
easily reveals that the first four belong to two different "famili
understand the last one well enough to know which "family" it b
literacies (photo-visual skill, reproduction skill and branching skil
multimedia tendencies and help individuals adapt to them, the
treatment of the material being processed through ICT – contr

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

The theoretical analysis

Once one has reached the conceptual analysis described above
contradiction between these two groups of skills – one should
literature that can support or substantiate this hypothesis. Th
hypothesis is supported by a very extensive body of theoretical
as far back as the extensive literature on the transformation fr
wave," to use Tofler's (1980, 1990) terms; from the "Gutenber
to paraphrase McLuhan (1962, 1965) or, more recently, Postma
"modern" to "post-modern culture," to quote Harvey (1990).

This already extensive and steadily growing corpus, incorporatin
leads us in various ways to same conclusion: in the last few dec
through a revolutionary change from a modern, second-wave, in
("Gutenbergian," in McLuhan's terms) society to a post modern,
digital society. These two societies are opposed to each other i
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 expre
developmental theories), the second is based on lateral modes
hence it is branching in all its other aspects (including organizat
developmental conceptions) (Peters, 1994; Tofler, 1981, 1990)

Furthermore, the first society was based on the conception of t
independent, enduring entity and hence of conceptions of indep
"authorship." The second, on the other hand, is based on the "d
by postmodernists such as Deridda, (1998); Gergen (1992); and
1994), and hence, on the "death of the author" and legitimizati

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
multimedia-based, branching and much less individual-oriented

The empirical analysis

We began with a conceptual analysis, which revealed the probab
two above groups of skills. We then moved to the theoretical le
hypothesis to reflect not just a trivial clash but, in fact, the dra
modern Gutenbergian culture and the post modern digital cultu
opposed tendencies in terms of cultural clash, we can then furt
on the empirical level, which actually led us to this intellectual jo

The empirical evidence stemming from Eshet-Alkalai (2004), as
section, corroborates the above hypothesis, and acquires a new
reported, it has been found that while young children fare much
teenager do better than adults in the three first literacies, adu
teenagers and children do in the fourth. This is exactly what we
hypothesis, would have expected. Now, this is not the only emp
hypothesis; other research also indicates a similar direction (Op
1998). When we first formed this hypothesis – in a leap of imag
often formed – we had very slim empirical evidence to support i
studies of Eshet-Alkalai & Amichai - Hamburger (2004) and Esh
(described above in detail), which were supported by other equiv
al., 2002) and adults (Hargittai, 2002a; 2000b), clearly illustrated
literacy between age groups and suggested the merit of Eshet
reliable holistic framework for digital literacy.

Thus, although we are still in the context of discovery, the radic
leap of imagination looks now as a serious candidate for leaving
being subjected to further and more extensive, hopefully inter-
examination/refutation in the context of justification.

If this hypothesis is further substantiated, it might mean that
continue speaking of enhancing "digital skills" and refer to all th
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 b
or literacies; it is rather a choice between two cultures, (a) one f
criticism, abstract thinking, individuality, authenticity, systema
(b) the other favoring fragmentation, spontaneity, concrete visu
connectedness, reproduction, and branching associative thinkin

In light of the possible need to make this crucial choice, we will n
that from considering "neural" skills or "literacies," we have quic
discussion of the central aims and values of Western education
we will need tackle the most fundamental questions:

- Should education strive to achieve the enhancement of po
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; Postm

A discussion of prima facie neutral skills can turn, if this scenari
substantiation of the radical skeptical hypothesis), into a basic
cultural educational values. The resolution of this dilemma shou
"either-or" one; we should be able to strive for an optimal balan
to recognize the dilemma for what it is, and then consciously m
necessarily have impact on the most fundamental educational

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

Conclusion

This paper relies on previous work, in which the fragmented liter
integrated into a taxonomical framework of five basic digital lite
necessary step in transforming an important emerging discours

and intuition-oriented, into a more productive, integrated, theo
being adequate.

We dedicated the paper to making the first few steps necessa
deepening, and theorization of this extremely important discou
guide us in the most basic policy decisions concerning educatio

We have done so by pointing to two possible basic strategies fo
discussion about digital literacy. The first, rather conservative,
assumption basic to the prevailing discourse at face value; we a
generally called digital literacy "skills" are indeed nothing but ski
questions that arise from this conservative starting point.

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

- According to the first hypothesis, the prevailing practical lit
"skills" are actually reducible to certain learning styles, inte
This hypothesis, if true, might lead to much more pluralisti
recommendations relative to the "monistic" ones now sug
literature (that every student must acquire the same digit
- According to the second hypothesis, "literacies" and "skills
incompatible sets of skills, and more importantly, these tw
expressing two cultures and sets of values that are now cl
in the foundations of Western education, more specifically
allegedly neutral and "naïve" discourse about skills is trans
ideological discussion about the basic values that should g

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

Still, the digital era is not going to disappear, and the need for e
growing digital tide is rapidly increasing. The educational respon
from full adaptation to compromising with it or opposing it. It is

coined by William James) – a decision we cannot avoid. "Avoiding above possibilities means actually deciding to passively and full is indeed the probable default scenario. If that is so, and if the r civilization clash is true, it is likely that photo-visual skill, branch will be powerfully enhanced, while the ability for criticism, or inde may deteriorate. Some might take it to be a desired scenario, b 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 fac these two sets of skills, it is reasonable to suppose that an edu enhancement of one set might suppress the other. If we want of the two, we must carefully design didactic ways that will prev from taking place.

[2] It is true that the formation of hypothesis may, at the "disc branching thinking. However, while one can certainly be rational w for branching thinking (that is, rational without being creative), c being capable of linear logical thinking. In other words, logical-line maybe also sufficient condition for rationality, while branching t condition."

References

[1] Akers, C. (2005). IRT's Top 20. Library Instruction Roundtable

[2] Amichai - Hamburger, Y. (2002). Internet and personality. *Com* 10.

[3] Amichai - Hamburger, Y. and Ben-Artzi, E. (2003). Loneliness a *Human Behavior* 19, 71-80.

[4] Aviram, A. (2004). "Why Should Children Go to School?", in: Avi *Upon What Does the Turtle Stand? Rethinking Education for the Digital* Publishers.

[5] Aviram, A. & Comay, O. (2001). *The Socio-economic Impact of the* research proposal submitted to the EC.

[6] Ba, H., Tally, W. & Tasikalas, K. (2002). Investigating children's *Journal of Technology Learning and Assessment*, 1 (4): 1-48.

[7] Baron, J. (1985). Rationality and Intelligence. New York: Cambr

[8] Benjamin, W. (1994). *The Work of Art in the Age of Technical Repr* from German). Tel Aviv: Teamin Publishers.

[9] Briggs, K. C., & Myers, I. B. (1987). *Myers-Briggs Type Indicator*. (Psychologists Press.

[10] Bruce, B., and Peyton, J. K., 1999. Literacy development in ne Innovation and realizations. *International Journal of Educational Tec* http://www.outreach.uiuc.edu/ijet/v1n2/bruce/index.html

[11] Burnett, K and McKinley, E.G. (1998). Modeling information s *Computers* 10, 285-302.

[12] Cattell, R. B., Eber, H. W., & Tatsuoka, M. M. (1970). *Handboo Questionnaire (16 PF).* Champaign, IL: Institute for *Personality* and *A*

[13] Cothey, V. (2002). A longitudinal study of world wide web us behavior. *Journal of the American Society for Information Science and*

[14] Daniels, J.. Takach, B. S., and Varnhagen C., 2002. Getting st impact of design on navigation. In P. Barker and S. Rebelsky, (eds *World Conference on Educational Multimedia, Hypermedia & Telecom* Denver, USA. Norfolk, VA: Association for the Advancement of C

[15] Dator, J. (2004). "Visions, Values, Technologies and Schools (eds.), *Upon What Does the Turtle Stand? Rethinking Education for the* Academic Publishers.

[16] Davies, J., Szabo, M. and Montgomerie, C., (2002). Assessing communication technology literacy of education undergraduate P. Barker and S. Rebelsky, (eds), *Proceedings of ED-MEDIA, 2001 W Multimedia, Hypermedia & Telecommunications* (377-383). Denver, the Advancement of Computing in Education.

[17] Deridda, J. (1998) in the text it is 1988. *Monolingualism of the* Stanford: Stanford University Press.

[18] Dreeben, R. (1968). *On What Is Learned in School*. Reading, MA

[19] Dresang, E. T., 1999. More research needed: Informal seeki

Internet. *Journal of American Society for Information Science* 50 (12),

[20] Dunn, R. & Dunn, K.(1993). *Teaching Elementary Students Throu*
Practical Approaches for Grades 3 - 6. Allyn & Bacon: Boston.

[21] Dunn, R. & Griggs, R. (1988). *Learning Styles: Quiet Revolution i*
Reston, VA: National Association of Secondary School Principals

[22] Eshet-Alkalai, Y. (2004). Digital literacy: A conceptual frame
digital era. *Journal of Educational Multimedia and Hypermedia, 13 (1*

[23] Eshet-Alkalai & Amichai - Hamburger (2004). Experiments
Psychology, 7 (4): 425-434

[24] Eshet-Alkalai (2005). Thinking skills in the digital era. In: Hav
L., Schenk, K., Rogers, P. L., Berg, G, A. (eds.) (2005). *Encyclopaedia*
London, Idea Group Inc., (pp. 1840-1845).

[25] Eshet, Y. and Chaiut, E. (2005). Living books: On the acquisiti
environments. *Learning in the Technology Era. Proceedings of the Ch*
University of Israel, Raanana, (pp. 15-25).

[26] Gardner, H. (1988). Creativity: An interdisciplinary perspecti
8-26.

[27] Gardner, H. (1993a). *Frames of Mind: The Theory of Multiple Inte*

[28] Gardner, H. (1993b). *Multiple Intelligences: The Theory in Practic*

[29] Gardner, H. (2000). Technology remakes the schools. *The Fu*

[30] Gergen, K. (1992). *The Saturated Self*. New York: Basic Books.

[31] Gilster, P. (1997). Digital *Literacy*. New York: Wiley Computer

[32] Haber, H.F.(1994). *Beyond post modern Politics: Lyotard, Rorty,*

[33] Hargittai (2002a). Beyond logs and surveys: In-depth meas
Journal of the American Society for Information Science and Technolog

[34] Hargittai, E. (2002b). Second-level digital divide: Differences
Monday 7 (4), http://firstmonday.org/issues/issue7_4/hargitta

[35] Harvey, D. (1990). *The Condition of Post modernity: An Enquiry in*

Oxford: Blackwell Publishing.

[36] Horton, W., 2000. *Designing Web-Based Training*. New York: Wi

[37] Inoue, H., Naito, E., and Koshizuka, M. (1997). Mediacy: What
Information & Library Review 29 (3-4), 403-413.

[38] Jansen , B. J. & Pooch, U.(2001). A review of web-searching s
future research. *Journal of the American Society for Information Scie*
246.

[39] Jonassen, D. H., (2000). *Computers as Mind tools for Schools.* Ne

[40] Kerka, S. (1999). Consumer education for the information a
12-15.

[41] Labbo, L. D., Reinking, D., and McKenna, M. C. (1998). Technol
the next century: exploring the connection between work and s
Education 73 (3-4), 273-289.

[42] Lazzaro, J. J. (1993). *Adaptive Technologies for Learning & Work*
London: America Library Association.

[43] Lee, J. J., and Hsu, Y. (2002). Web navigation: The role of meta
individual differences. In P. Barker and S. Rebelsky, (eds.), *Proceed*
Conference on Educational Multimedia, Hypermedia & Telecommunica
USA. Norfolk, VA: Association for the Advancement of Computin

[44] Marchionini, G. (1989). Information-seeking strategies of n
electronic encyclopedia. *Journal of the American Society for Informa*

[45] Mardis, M.A., 2002. Mind the gap: An overview of perceptual
literacy. In P. Barker and S. Rebelsky, (eds.), *Proceedings of ED-MEI*
Educational Multimedia, Hypermedia & Telecommunications (1221-1
Association for the Advancement of Computing in Education.

[46] Margono, S. and Shneiderman, B., 1987. A study of file man
command versus direct manipulation. *26th Annual Technical Symp*
159),Washington DC.

[47] Mason, J. M. (2002). From Gutenberg's galaxy to cyberspace
space In P. Barker and S. Rebelsky, (eds.), *Proceedings of ED-MEDI*

Educational Multimedia, Hypermedia & Telecommunications (1230-1
Association for the Advancement of Computing in Education.

[48] Maver, Darko (1998).*The dimension of extra-bodies.*
http://www.kapelica.org/maver/main.htm

[49] Mayer, R. E. (2001). *Multimedia Learning*. Cambridge Universit

[50] McLuhan, M. (1962). *Gutenberg Galaxy*. London: Routledge an

[51] Mcluhan, M. (1965). *Understanding Media: The Extensions of M*

[52] Minkel, W. (2000). No, it's not all true! *Library Journal*, 33-34, 9

[53] Mioduser, D. and Nachmias, R. (2002). WWW in education. In
M. Pawlowski (eds). *Handbook on Information Technologies for Educa*
Springer-Verlag.

[54] Morahan-Martin, J., and Anderson, C. D. (2000). Information
Recommendations for facilitating accurate mental health infor
Cyber Psychology & Behaviour 3,731-746.

[55] Mullet, K. and Sano, D. (1995). *Designing Visual Interfaces*. Enge

[56] Mundrof., N. and Laird, K. R., 2002. Social and psychological e
technologies and other interactive media. In J. Bryant, & D. Zillma
in Theory and Research (2nd ed.) (231-255). Mahwah, NJ: Erlbaum.

[57] Negroponte, N. (1995). *Being Digital*. New York: Knopf.

[58] Nielsen, J. (1993). *Usability Engineering*. San Diego: Morgan Ka

[59] Norton, P. and Wilburg, K. M. (1998). *Teaching with Technology*
Publishers.

[60] O'Sullivan, M. (2000). Teaching Internet information literacy
III). *Multimedia Schools* 7, *34-37*

[61] Oppenheimer, T. (1997). The computer delusion. *Atlantic Mo*

[62] Opperman, R. (2002). User interface design. In H. H. Adelsber
Pawlowski, *Handbook on Information Technologies for Education and*
Springer-Verlag.

[63] Papert, S. (1996). *The Connected Family*. Atlanta, GA: Longstr

[64] Perkins, D. (1993). Creating a Culture of Thinking. *Educationa*

[65] Peters, Thomas (1994). *The Tom Peters Seminar.* New York: V

[66] Piacciano, A.. (2001). *Distance Learning*. New Jersey; Merrill, P

[67] Pool, C. R. (1997). A new digital literacy: A conversation with
Leadership 55 (3), 6-11.

[68] Postman, N. (1984). *Amusing Ourselves to Death: Public Discou*
London: Methuen.

[69] Postman, N. (1992). *Technopoly.* New York: Alfred A. Knopf.

[70] Postman, N. (1995). *The End of Education: Redefining the Value*
Knopf.

[71] Rouet, J. F. and Levonen, J. J. (1996). Studying and learning w
and their implications. In J. F. Rouet, J. J. Levonen, A. Dillon, and R.J.
Cognition (pp. 9-23). New York: Lawrence Erlbaum Associates.

[72] Salomon, G. (2000). *Technology and Education in the Informatio*
University/Zemora-Bitan Publishers.

[73] Scardamalia, M. and Bereiter, C. (1996). Engaging students
Educational Leadership 54 (3), 6-10.

[74] Schank, R. C. (1984). *The Cognitive Computer: On Language, Lea*
Reading, MA: Addison-Wesley Publishing Co. Inc.

[75] Spanos, W. (1993). *The End of Education: Toward Post humanis*
Minnesota Press.

[76] Spiro, R.J., Feltovitch, P. L., Jacobson, M. J., and Coulson, R. L. (
constructivism and hypertext: Random access instruction for a
in ill-structured domains. *Educational Technology* 31 (5), 24-33.

[77] Springer, C. J., 1987. Review of information from complex alp
formatting variables' effects on target identification time. In G
Engineering in the Design of Human-Computer Interaction and Expert S
Elsevier Science Publishers.

[78] Swan, K., Bangert - Drowns, J. B., Moore-Cox, A., and Dugan, I
learning: A national survey of classroom use. In P. Barker and S. F
ED-MEDIA, 2001 World Conference on Educational Multimedia, Hyper
(221-223). Denver, USA. Norfolk, VA: Association for the Advance
Education.

[79] Tapscott, D. (1998). *Growing Up Digital: The Rise of the Net Ge*

[80] Tofler, A. (1981). *The Third Wave*. New York: William Morrow.

[81] Tofler, A. (1990). *Power Shift*. New York: Bantam Books.

[82] Tufte, E. R. (1990). *Envisioning Information*. Cheshire, CN: Grap

[83] Wallace, P. (1999). *The Psychology of the Internet*. Cambridge: U

[84] Wang, P., Hawk, W. B. and Tenopir, C. (2000). Users' interact
resources: An exploratory study using a holistic approach/ *Inform*
Management 36, (2), 229-251.

[85] Zins, C. (2000). Success, a structured search strategy ratio
implications. *Journal of the American Society for Information Science*