Digital Literacy and the Position of the End-User

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INTRODUCTION

As an educational setting, the traditional classroom fails to meet the learner's need for suitable skills to learn with educational software. The development of digital learning skills in school curricula challenges designers of educational software. A useful starting point of research in this domain is the study of literacy, both in its traditional and new forms (Tyner, 1998). It is a powerful background for research on the interaction of learners with educational software platforms. A "platfom" is a particular software package, designed for educational use.

BACKGROUND

Both in school and society, the skill to comprehend and handle printed course materials is essential. Literacy has since long been a vital skill for functioning adequately in an industrial society (see e.g. Marvin, 1984).

An Emerging Plural Notion of Literacy

The International Adult Literacy Survey (IALS) describes literacy as a broad range of information processing skills in relation to written or printed language. Traditional literacy is defined as follows (OECD, 1997, p. 2):

"Using printed and written information to function in society, to achieve one's goal and to develop one's knowledge and potential."

However, traditional literacy is increasingly evolving into a new, plural literacy that refers to making sense of meaningful content in more complex and technological environments (Erstad, 1998). The growing importance of images and of communication technologies has a cultural backlash that even transforms the nature of literacy. Gee (1990) opened up so-called "New Literacy Studies" (NLS). He defends a socio-cultural approach of literacy (p. 153):

"Literacy is the mastery of, or fluent control over, secondary discourse."

While primary discourse pertains to infant face-to-face interaction of children with trusted figures (parents, family, and others), secondary discourse develops through contact with public life and its social and cultural conventions. Secondary literacy is in itself a plural concept: a multitude of social institutions and commitments to public life invade an adult's life and are as many "literacies" to master. As Walter (1999, p. 34) points out:

"The existence of multiple literacies, none more valid than the next, but each specific to a culturally-defined community."

According to this plural notion of literacy, literacy can be neither neutral nor universal, since all literacy includes social and cultural conventions that shape a particular type of "literacy". Visual literacy, for instance, complements traditional literacy and claims a unique position in today's school curriculum. Debes (1969) first mentioned "visual literacy". According to visual literacy, a specific "image" language supports communication. In traditional language, words support verbal communication. Visual literacy may not only be a means of communication, but also a way of thinking (Hortin, 1983). Thinking visually, then, means the ability to think and learn in terms of images. And children's acquisition of skills to work effectively and efficiently with educational software has to underpin this recent position of a new and full interpretation of literacy.

Undoubtedly, it is of prime importance to analyse the nature of skills necessary to take full advantage of today's learning opportunities. In a visual oriented culture the acquisition of new reading and writing skills is indispensable, e.g. the analysis and composition of images. Indeed, literacy supposes an active intervention in a social and cultural context. Avgernou and Ericson (1997) define visual literacy as a group of skills that make it possible for an individual to understand and use visuals for intentional communication with others. This concerns different target groups, for instance primary school pupils or even impaired children.

During the last decade, a wide array of "literacies" relating to information and communication technologies (ICT) surfaced: media literacy (Hobbs, 1998; Potter, 1998), electronic literacy (Maylath, 1993), multimedia literacy (Kellner, 1998), computer literacy (Guthrie & Richardson, 1995; Peha, 1995), and digital literacy (Gilster, 1997). This evolution accompanies the expansion of IT to ICT. Indeed, communication is now a central feature of technological environments, clearly depending on both "traditional" and "new" literacies (Plowman & Stephen, 2003):

"(…) the flexible and sustainable mastery of a repertoire of practices with the texts of traditional and new communication technologies via spoken language, print and multimedia."

The overarching notion "information literacy" denotes the ability to access, retrieve, manage, and use information relevant to an identified need for information (Kuhltau, cit. in Campbell, 1994). Originally, information literacy was limited in scope to computer information. The progress of computer sciences and, more generally, the use of ICT in a wide array of domains broadened its meaning into library skills, computer skills, thinking skills, and critical reading skills.

Media literacy pertains to communication through and critical analysis of a diversity of media; it is the end user's ability to navigate both effectively and efficiently and to keep track of position in electronic media, while "criss-crossing the landscape" (Spiro, R. J., Feltovich, R. L., Jacobson, M. J., & Coulson, R. L., 1991). Gilster (1997, p. 1) defines digital literacy as follows:

"(…) the ability to understand and use information in multiple format from a wide range of sources when it is presented via computers."

Computer literacy is the ability to integrate information and build a personal knowledge base. Both electronic literacy (e-mail reading skills) and multimedia literacy (technical multimedia skills) are building blocks of more general "computer" literacy. Electronic and multimedia literacy explain, for instance, the comprehension of hypertext.

When comparing different "literacies", two observations are important. First, critical analysis, interpretation, and processing of information are attributed to media literacy and digital literacy. The processing and integration of information (computer literacy) and technical skills (electronic and multimedia literacy) have to be critically evaluated by computer users. Secondly, without the notion of traditional and visual literacy, none of the newer forms of literacy can be understood. Indeed, media and digital literacy acquire meaning for users through similar basic mechanisms as traditional and visual literacy. Literacy education elucidates implicit messages, ideological content or even idiosyncratic

intentions designers may embed in software packages. On the other hand, the study of ICT related literacies informs software designers of problems encountered by learners with educational software platforms. Traditional issues are accessibility of information and user interface design.

Current Research Questions

The "literacies" debate is a theoretical starting point. Empirically, the detection of specific skills that explain interaction with educational software -digital literacy- is a first research path. These skills have to be integrated in the school curriculum and are treated as abilities underlying new "literacies". Before any application of theoretical insights, a primary research question has to pertain to the relationship between "operational skills" (searching, clicking, and/or dragging screen and user interface objects) and content comprehension in educational software. Is retrieval of information influenced by the mastery of operational skills?

Moreover, information can be represented through text, visualization, or talk. Does the integration of these different symbol systems in educational software alter the typical linear end-user interaction with the computer screen interface? The most common pattern of software use is sequencing interface screen after interface screen in a so-called linear fashion. Clicking hotspots and exploring additional in-depth layers of screens, providing e.g. background information, are seldom spontaneous actions. This type of research question addresses conditions that facilitate "switching content" in -for instance- an educational software package fitted out with hotspots and hyperlinks. The content of an educational platform can for example be organized in an adventure game with hyperlinks, combined with an illustrated encyclopaedia supporting the game with textual and verbal background information. A related question points to the relationship between switching content and retrieving or remembering information afterwards. Is switching detrimental to retrieval of information or does it on the contrary support memory?

Research with 3rd and 4th graders using a multimedia comic strip about World War II (see Utsi & Lowyck, 2002) revealed end-users to anticipate crucial events: they look for objects in the interface screens that most probably will play a crucial role in the next few screens. Mere reactions to audio-visual events in interface screens steadily fade, while searching, clicking, and/or dragging objects become increasingly well-considered throughout the user-interface interaction. Throughout the process, visual literacy gradually changes from superficial use of visual cues to deeper comprehension of educational content. Thus, visual literacy is an essential condition for meeting the educational goals. Multimedia literacy skills are effortlessly acquired on the spot: clicking and dragging objects pose no problem. When first confronted with a new educational software platform, visual literacy seems narrowed to multimedia skills, like

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