

# Bridging the Cognitive Divide in ICT-Mediated Learning

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## Abstract

*The digital divide means more than having access to ICTs. It also means that a person has the necessary ICT literacy skills needed to learn and succeed in an ICT-mediated learning environment. ICT literacy includes the ability to access, manage, integrate, evaluate, and create information. These skills are regulated by the appropriate cognitive styles, which allows an individual to acquire, process, store, retrieve and use information efficiently and effectively. Many adults lack these essential skills. This paper describes a model developed for bridging this cognitive divide based on brain plasticity research and cognitive augmentation and transfer training methodologies.*

## Introduction

Much efforts and resources are being devoted to provide equal education and training opportunities for all, using ICT to bridge the “digital divide”. However, equal educational opportunities also means that a person has the repertoire of cognitive skills needed to learn and succeed in this learning environment. Wright (1993) suggested that ICT-mediated learning materials with complex structures could disorient some learners and debilitate their ability to learn. Cognitive-based research has demonstrated that one of the most important factors contributing to achievement differences is the cognitive style that a student brings to academic tasks (Letteri, 1992).

## Cognitive Styles

Manouselis and Sampson (2002) defined cognitive style as “an individual’s characteristic and consistent approach to organizing and processing information”. Research findings indicate that instructional task can be style-biased and that there are two fundamental ways to address this problem. The first is by applying the deficit model where the environment is adapted to meet the learners’ needs. The ethic of adapting instruction to meet short-term objectives has been raised. Slabbert (2002) disagrees with this approach and noted that since the potential for improvement is situated inside of the learner s/he is the only one who can maximize it and that external assistance should only be devoted to facilitate the process.

## Cognitive Modifiability

For several years researchers believed that the human brain was fixed and could not be modified. As a result, the manipulation of external conditions was the only way to help learners with cognitive skills deficit. Feuerstein’s Theory of Structural Cognitive Modifiability (SCM) has demonstrated the transformative nature of the individual’s cognitive structures (memory, perception, intelligence) and mental level (cognitive process). Letteri (1992) has developed and validated a Cognitive Profile Assessment Instrument (CPAI) consisting of seven bipolar measures of basic cognitive skills. Following is a brief description of each:

**Analytical** : Recognizing the various component parts of a given problem as distinct and unique pieces of the whole.

**Focus** : Maintaining attention to the specific and important part in the problem and disregarding all irrelevant data.

**Reflective** : Taking sufficient amount of time to make a complete and accurate comparison between the given problem and prior problems for correct identification.

**Narrow** : Selecting from alternative solution strategies the one which most accurately satisfies the problem task.

**Complex** : Defining the problem accurately by specific category for the purpose of selecting appropriate solutions.

**Sharpener** : Comparing a problem with all other problems in a similar category and applying solution procedures, which have been successful in the past.

**Tolerant** : Has the ability and willingness to (a) deal with information that may not be consistent with what they know; and (b) to explore novel areas of learning.

These cognitive skill dimensions have been found to determine and predict with high accuracy students' level of success in academic learning (Chinien, Boutin and Letteri, 1997).

## Cognitive Literacy for ICT-mediated Learning

In 2001, Educational Testing Service convened an International ICT Literacy Panel to examine the need for a measure of ICT literacy and to develop a workable Framework for ICT Literacy. The Panel indicated that technology skills “without corresponding cognitive skills and general literacy, will not decrease the gaps defined by a

digital divide". (p. 6). The Panel provided a working definition for ICT literacy: "ICT literacy is using digital technology, communication tools, and/or networks to access, manage, integrate, evaluate, and create information in order to function in a knowledge society" (p. 2). The five critical components of ITC literacy "represent a set of skills and knowledge presented in a sequence that suggests increasing cognitive complexity" (p. 3). They are defined as:

**Access:** knowing about & how to retrieve information.

**Manage:** applying an existing organizational scheme.

**Integrate:** interpreting and representing information, summarizing, comparing and contrasting information.

**Evaluate:** judging the quality, relevance, usefulness, or efficiency of information.

**Create:** adapting, applying, designing, inventing, or authoring information (p.3).

A comparative analysis of these components against Letteri's seven cognitive style dimensions is presented in Table 1. Results indicated that all of the seven cognitive styles have direct implication for the effective performance of the five skill sets involved in ICT literacy. It is interesting to note that ICT literacy skills such as "create" and "evaluate" draw on the information processing capabilities related to all seven cognitive styles. Additionally, the cognitive dimensions "Focus", "Narrow" and "Complex" are required cognitive skills in all five ITC literacy components.

Table 1

Comparative analysis of Cognitive Styles and ICT Literacy

	Analytical	Focus	Reflective	Narrow	Complex	Sharpener	Tolerant
Access		x		x	x		
Manage		x		x	x		
Integrate	x	x		x	x	x	
Evaluate	x	x	x	x	x	x	x
Create	x	x	x	x	x	x	x

This analysis showed that individuals who possess a complete repertoire of these seven cognitive styles would have the requisite literacy skills to succeed in an ICT-mediated learning environment.

Chinien, Paul and Bannantyne (2002) design and develop the cognitive augmentation and transfer training modules for each of the seven cognitive style dimension for adult learners: Project LEARN (Learning Enhancement for Adult Retraining Needs) is available electronically in CD-ROM format and also on the web for free download.

## Conclusion

Information and communication technologies (ICT) provide the flexibility to meet diverse learners' needs anytime, anywhere and any place. In the context of ICT-mediated instruction the emphasis is placed on self-directed learning rather than teaching. Consequently, ITC-mediated learning can be debilitating for people with limited cognitive skills thus creating a cognitive divide.

ICT literacy, defined as the ability to access, manage, integrate, evaluate and create information, is therefore a critical element for successful learning. The present analysis showed that individuals who possess a complete repertoire of cognitive skills have the requisite literacy skills to succeed in an ICT-mediated learning environment.

Brain research has demonstrated that contrary to established belief, the brain has plasticity and is modifiable. This finding has paved the way to research focused on cognitive augmentation. Instead of modifying a learning environment to accommodate the information capacity of learners, it is more ethical to empower learners by assisting them to overcome their cognitive skill deficits. The cognitive empowerment of learners provides them with the requisite literacy skills needed to succeed in an ICT-mediated learning environment, thus bridging the cognitive divide.

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