Chapter 7
Distributed Cognition:
Teachers' Perceptions and Implications for Learning Outcomes and Instructional Technology

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ABSTRACT

This work uses the framework of distributed cognition for understanding the way that educators perceive cognition in classroom application. The focus is on the elements of technological tools and peers as extensions of students' cognitive capacity. A qualitative study was conducted with teachers at a combined middle and secondary school in an urban area. Data from interviews in this exploratory case study revealed that teachers had minimal awareness of distributed cognition especially in terms of developing and assessing student learning outcomes. Teachers particularly struggled with ways to label, quantify and apply this construct. One unexpected finding was the concern about a lack of student expertise in utilizing tools. Suggestions call for systemic changes in curriculum, instruction and assessment. A focus on instructional technology as a mediator for critical thinking and problem solving is advocated. Additional reform measures include a renewed look at educators' epistemology through transformative professional learning.

INTRODUCTION

Most students in settings outside the school walls are digital natives (Prensky, 2001) navigating the use of cell phones, video games and other digital tools with ease. According to the Pew Research Center in 2013, teens are particularly connected with 78 percent having a cell phone and 93 per-

cent of teens having a computer or access to one. Young people have come to accept these tools as common everyday devices to communicate and access information. The tools have become a part of their accepted knowledge base and they rely on them as memory devices to store and retrieve basic information such as phone numbers, addresses and answers to questions. When not sure of how to do a task or explain a notion, the phrases, "Google it" or "Ask Siri" would apply.

These tools are also part of young people's collective communication structure so that social media becomes a dominant means of interacting and sharing information and ideas. Without knowing the term, "distributed cognition," part of their intelligence is "propagated from mind to mind; mind to tool, and tool to mind" (Schwartz, 2008, p. 390).

In contrast, students are not as highly connected to technology in the school setting. In a study conducted by the U.S. Department of Education in 2010, teachers reported that they or their students use computers in the classroom during instructional time often (40 percent) or sometimes (29 percent). When technology is typically employed in school settings, it may be for teacher presentation, or low-level knowledge tasks such as practice for test preparation.

The mission of this chapter is to entertain the notion that technological tools and peers need to be embraced and used by teachers and students as a means to extend and redefine learning outcomes through an awareness and application of distributed cognition. Data from a qualitative research study of educators revealed the need for more awareness of the power of technology as cognitive tools for learners and particular roadblocks in realizing this understanding.

Analysis of teacher perceptions indicates some ways that this awareness of educators can be operationalized in terms of shifting beliefs and assumptions about the benefits of technological devices in terms of modes of thinking as well as knowledge acquisition and use. Specific examples

are presented to showcase the ways that this needed change could take student learning to higher levels of interactive critical thinking and application; thus building the kind of thinkers and innovators needed for the future.

This chapter is framed around two theoretical paradigms; distributed cognition in student learning and transformative learning in educators. Student learning is analyzed from the theoretical perspective of distributed cognition where cognition is distributed among the individual, other persons and tools. When technology becomes the "tool" it can come to represents a type of "second brain" for the learner. As data in this study reveals, this tool enhanced learning presents new challenges for teachers when trying to align student outcomes and assessments to this conceptual framework.

Through the lens of Mezirow's (1981) transformative learning theory, there is the questioning of educators' assumptions and examining their points of view about the role and value of tools as knowledge storage devices. In teacher interviews, it was found that based on their varied opinions and stages of awareness; there was the need for more mentoring, support and information regarding the role of technology in producing student outcomes. Through carefully planned professional learning and modeled teaching behaviors, educators can be supported in changing their existing worldviews about the role of technology as tools to access, store, critically analyze and collaboratively use information.

THEORETICAL/CONCEPTUAL FRAMEWORK

Defining and Comparing Distributed Cognition as a Theory

Learning theories have been viewed as a series of evolutions from the behaviorist view that learning was most simplistically a series of stimuli and re-

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