Chapter 11
Sustained Learning in 4\textsuperscript{th} and 5\textsuperscript{th} Graders but not 7\textsuperscript{th} Graders: Two Experiments with a Talking Pedagogical Agent

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ABSTRACT

In this chapter, agent movement and temporal speech cueing were designated for empirical study. In Experiment 1 an agent presented students in grades 4 and 5 (n = 133) with instruction, practice, and feedback on the proper usage of the apostrophe to show singular and plural ownership. Analyses of the data in Experiment 1 showed that modality effects favoured speech cueing over text cueing but agent animation had no effect. In Experiment 2, a different agent presented students in grade 7 (n = 91) with examples and practice questions on multiplying and dividing fractions. Experiment 2 data showed no effects for modality or agent animation. The data reflects previous findings of inconsistent effects in modality research.

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INTRODUCTION

Pedagogical agents are computer-generated characters that can be programmed to move around the screen and provide advice to students in speech or text bubble. These animated characters can be expected to focus student attention on critical information in a computer program (Dehn & van Mulken, 2000) or even provide individualized scaffolding on an educational website (Lester, Towns, Callaway, Voerman, & FitzGerald, 2000; Moreno, Mayer, & Lester, 2000), though the optimal role for an agent in educational multimedia is unclear (Kim & Baylor, 2006).

LITERATURE REVIEW

In the absence of a comprehensive theory of learning from pedagogical agents, researchers must rely on relevant research in human psychology and education. Theory development in educational psychology has added insight to our understanding of learning from educational media including, though not limited to: that students comprehend oral and written discourse differently (Hildyard & Olson, 1982), fuzzy trace theory (Brainerd & Reyna, 1990), the interactive-compensatory hypothesis (Stanovitch, 1980), dual coding theory (Paivio, 1986), the separate streams hypothesis (Penney, 1989), the split-attention theory of multimedia learning (Chandler & Sweller, 1991), the model of working attention (Baddaley, 1992), the structured sound function model of instructional design (Mann, 1992, 1995, 1997a), the dual processing theory of working memory (Mayer & Moreno 1998), the cognitive theory of multimedia learning (Mayer, 1997, 2001), and the attentional control theory of multimedia learning (Mann, 2006, 2008a, 2009).

LISTENING AND READING IN ADULTS

From these advances and others, we know that when adults listen and look at educational multimedia, they integrate spatial and verbal sensations in their working memory for a short time as they generate meaningful relationships between the spatial store and the verbal (language) stores. Most adults can systematically and completely integrate information from listening and reading (Pressley & McCormick, 1995), by self-initiating an executive control of these different mental processes (listening and reading), as suggested in the literature (Halliday, 1987; Higginbotham-Wheat, 1991; Penney, 1989). During listening, adults acquire the gist or meaning from the auditory sensations (Hildyard & Olson, 1982; Penney, 1989; Reyna, 1992; Brainerd, 1993), and from reading text, acquire the details or surface features (Tannen, 1985), sometimes known as verbatim information learning (Martin & Briggs 1986; Penney, 1989). However when our attention is overloaded or distracted, features can be combined inappropriately. We know that students learn better when the instructional material does not require them to split their attention between multiple sources of mutually referring information (Chandler & Sweller, 1992; Mayer & Moreno, 1998; Mousavi, Low, & Sweller, 1995). Meaningful learning occurs when adults select relevant information in each store, organizes the information in each store into a coherent representation, and makes connections between corresponding representations in each store (Mayer, 1997).

AUTOMATIC AND CONTROLLED PROCESSING

The integration of information from listening and reading easy or familiar content, adults use automatic processing (Schneider & Shiffrin, 1977) also known as pre-attentive processing (Treis-
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