

# Chapter 90

## E-Learning in Elementary Education

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### ABSTRACT

*E-learning (EL) is defined as communication and learning activities through computers and networks. EL in elementary education is mainly blended with having a teacher present who is steering, at least in a broad sense, what goes on. After defining key terms and introducing pioneers, the main advantages and disadvantages of EL are discussed. Two ground-breaking projects on EL in elementary school are then detailed. The section on EL effects begins with a discussion on drills, which are among the most widely used and effective EL types in elementary education. Meta-analyses show that tutorials (which usually include drills) have consistently been found to be effective, especially in the domains of mathematics and science. Three future research directions on e-learning in elementary school are discussed, including the interactive whiteboard, simulation-based learning environments, and instructions for digital literacy development of students.*

### INTRODUCTION

Computers and network technology are taking on an increasingly important role in all facets of life, and education is no exception. Various educational uses of technology in school are nowadays subsumed under the name of E-learning (EL). A widely accepted definition is that EL encompasses

communication and learning activities through computers and networks (Tsai, & Machado, 2002; Wong, 2007).

EL in elementary school differs from EL in other settings by its blended form. There is often a mixture of technology use and regular teacher-led or teacher-supported classroom activities. This blended use affects both the design and functionality of EL.

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Pioneers in the area of EL in elementary school are John Bransford, Marlene Scardamalia, Carl Bereiter, and Seymour Papert. Bransford and colleagues (Barron et al., 1998; Cognition and Technology Group at Vanderbilt, 1992, 1997) developed the Jasper Woodbury Series, an instructional approach that revolves around a video that presents a meaningful problem for students to solve. Their research presented an early form of problem-based instruction, with EL serving informational and instructive purposes. Scardamalia and Bereiter (1993, 1996) have enriched the educational field with their Computer Supported Intentional Learning Environment, later called Knowledge Forum, which presented a significant advance compared with other approaches to computer mediated communication. The primary goal of this form of EL is to share knowledge building among students. Papert (1980) introduced Logo-programming as vehicle for stimulating elementary school children's problem solving skills. His famous studies on children learning to steer a Logo-turtle (robot) with commands (e.g., "Right 90" for having the turtle make a right-hand turn of ninety degrees) received widespread attention from the educational community for quite some time. Interest in this type of EL in elementary education has waned in the last decade.

Brown (1992) and Collins (1992) have contributed indirectly to EL with their ground-breaking publications on design-based research. Design-based research seeks to combine an engineering approach with a scientific approach, to obtain meaningful and effective outcomes together with theory development and testing. The approach is eminently suited for research and development in EL because it sets out to produce "new theories, artifacts and practices that account for and potentially impact learning and teaching in natural settings" (Barab, & Squire, 2004, p. 2). Because its contribution to EL is indirect this approach is not further detailed in this chapter.

## OVERVIEW

The development of EL has often been characterized by technological changes. Taylor (2001) summarized these changes as an evolution in which print technology was followed by multimedia technology to which telecommunications were then added, after which online delivery via the Internet emerged.

In line with these technological changes one also finds an abundance of EL-related terms. To name but a few from a long list, there are: computer assisted instruction, computer based training, distance education, distance learning, distributed learning, flexible learning, information and communication technology, online education, online learning, tele-learning, and virtual learning. Some of these terms are simply different names for the same type of technological approach to education or instruction. Learning and education tend to be used interchangeably, for example. Some terms truly reflect differences in definitions of EL, expressing divergent views of its components, or its necessary and sufficient conditions (e.g., Cavanaugh, Barbour, & Clark, 2009; Meredith, & Newton, 2004).

In elementary education EL largely takes place within the physical boundaries of the school and under the direction or guidance of the teacher. EL is mainly blended with having a teacher present who is steering, at least in a broad sense, what goes on. Word processors, spreadsheets, Internet and dedicated programs are widely used tools in elementary education. The use of these tools has been found to vary considerably due to factors such as: (a) the presence of an adequate infrastructure and technical support, (b) different views about learning (i.e., behaviorism, cognitivism, and constructivism) and (c) different designs of tutorials, drill and practice programs, computer-assisted instructions, simulations, instructional videos and the like (e.g., Cox, 2008; Cox, & Marshall, 2007; Kulik, 2003; Niederhauser, & Stoddart, 2001; Tondeur, Van Braak, & Valcke, 2007a, 2007b).

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