

## Chapter 8.7

# Enhanced Speech-Enabled Tools for Intelligent and Mobile E-Learning Applications

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### ABSTRACT

*Web-based learning is rapidly becoming the preferred way to quickly, efficiently, and economically create and deliver training or educational content through various communication media. This chapter presents systems that use speech technology to emulate the one-on-one interaction a student can get from a virtual instructor. A Web-based learning tool, the Learn IN Context (LINC+) system, designed and used in a real mixed-mode learning context for a computer (C++ language) programming course taught at the Université de Moncton (Canada) is described here. It integrates an Internet Voice Searching and Navigating (IVSN) system that helps learners to search and navigate both the web and their desktop environment through voice commands and dictation. LINC+ also incorporates an Automatic User Profile Building and Training (AUPB&T) module that allows users to increase speech recognition performance without having to go through the long and fastidious manual training process. New Automated Service Agents based on the Artificial Intelligence Markup Language (AIML) are used to provide naturalness to the dialogs between users and machines. The portability of the e-learning system across a mobile platform is also investigated. The findings show that when the learning material is delivered in the form of a collaborative and voice-enabled presentation, the majority of learners seem to be satisfied with this new media, and confirm that it does not negatively affect their cognitive load.*

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## INTRODUCTION

In the context of rapidly growing network applications, an abiding vision consists of providing computer-based media support where no sophisticated training is required. Among these applications, e-learning systems are rapidly gaining in popularity. In fact, easier-to-use development tools, lower costs, availability of broadband channels and potentially higher returns, in the form of better learner productivity, have made e-learning technology attractive to a wider variety of institutional and individual users. Numerous studies, including those of Najjar (1996) and Alty (2002), confirm that the type of computer-based media incorporated in e-learning materials can have a significant impact on the amount of information retained, understood, and recalled by learners. Recently mobile learning (m-learning) has emerged as a promising means to reach more prospective learners. M-learning refers to the use of mobile and handheld IT devices, such as cellular telephones, Personal Digital Assistants (PDAs), and laptops, in teaching and learning. As computers and the internet become essential educational tools, the portability of e-learning content across technologies and platforms becomes a critical issue. This portability has to be investigated in terms of benefits or disadvantages for the learning process. Jones et al. (2006) gave six reasons why mobile learning might be motivating: control over goals, ownership, learning-in-context, continuity between contexts, fun and communication.

Several web-based techniques are used to develop online Collaborative Learning (CL) systems. These systems may integrate a form of chat window or forum through a public or private communication channel. To some extent, these features switch the system to an interactive and communication system, which may be separated from the underlying learning context. This justifies the development of the proposed “in context” system described below. Moreover, to design an effective e-Learning tool for CL, we must avoid

some common issues arising from applying or developing them. For example: (1) teachers fear to apply them in the classroom because of the apparent loss of control in the classroom; (2) students resist collaborating because of the lack of familiarity with CL techniques and class management; (3) students are accustomed to working competitively, not cooperatively (Bosworth, 1994). These issues motivated us to develop a Web-based learning tool called Learn IN Context (LINC).

The ideal user environment has not yet been found, but individual interface technologies are sufficiently advanced to allow the design of systems capable of making a positive impact on the e-learning experience. Central to such systems is a conversational interaction using speech recognition and text-to-speech synthesis. Deng (2004) states that, in recent years, Automatic Speech Recognition (ASR) and Text-To-Speech (TTS) have become sufficiently mature technologies. Therefore, this allows their inclusion as effective modalities in both telephony and other multimodal interfaces and platforms. New protocols, such as Media Resource Control Protocol (MRCP) (IETF, 2006), are providing a key enabling technology that facilitates the integration of speech technologies into network equipment and alleviates their adoption in many distributed and mobile applications. MRCP leverages IP telephony and Web technologies to provide an open standard and a versatile interface to speech engines that could open new horizons for e-learning applications.

In this chapter, we propose to include such technologies in a virtual laboratory dedicated to the mixed-mode learning of C++ language programming. This mode combines face-to-face and distance approaches to education. In this context, an instructor meets with students in the classroom, and a resource base of content material is made available to students through the web.

This chapter is further organized as follows. Section 2 is concerned with both TTS and ASR background. An overview on the relevance of including multimedia files into an e-learning

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