

## Chapter 3.3

# An Intelligent Web-Based Human-Computer Interaction System with Natural Language CSIEC and its Integration into English Instruction

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### **ABSTRACT**

Computer Simulation in Educational Communication (CSIEC), is not only an intelligent Web-based human-computer dialogue system with natural language for English instruction, but also a learning assessment system for learners and teachers. Its multiple functions including grammar gap filling exercises, talk show, and free chatting or chatting on a given topic can satisfy the various needs from the students. This chapter will present the CSIEC system and its integration into English instruction with pilot case studies. At first the computer assisted language learning (CALL) development and research are surveyed to address the need for a virtual interactive chatting partner.

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Then the underlying theory and architecture of CSIEC are elucidated. This chapter mainly introduces the pedagogical functions in details and explains how to integrate the CSIEC into English class with two pilot studies in middle school, and analyzes the application and evaluation results. At last the lessons learned from the case studies and the further development direction are discussed.

### **INTRODUCTION**

English, as an international language, is regarded as a key tool for the development and cultivation of the cross-cultural communicational ability, which is becoming more and more crucial in the developing countries like China. In China, English has been listed as one obligatory course in

school and higher education. As stressed by situated learning (Brown, Collins, & Duguid, 1989; Barab & Duffy 2000) and constructivist learning theory (Jonassen, 1994; Von Glasersfeld, 1996), one of the best ways to learn a foreign language is frequent communication with a native speaker. But it is not a practical method in the classroom due to the one-to-one student/teacher ratio it implies. In the social environment the students have no much exposure to the target language. A number of factors ranging from the lack of time to shyness or limited opportunity for quality feedback hamper using the target language (Fryer & Carpenter, 2006).

In the age of information and communication technology (ICT) the computer and Internet have been extensively applied in language instruction so that computer assisted language learning (CALL), an interdisciplinary research field, has emerged among linguistics, computer scientists, and other related researchers. A lot of literatures report the CALL can improve the student's four abilities (listening, speaking, reading and writing) significantly.

However, the biggest inherent problem of the current online courses is the lack of interaction between teachers and students (Hampel & Hauck, 2004; Strambi & Bouvet, 2003). The online courses for language instruction are no exception. As a result, instructors tend to rely on students' self-motivation and responsibility (Gilbert, 2001).

A potential solution to expand the chance of interaction and communication in English is to apply computer spoken dialogue systems to role play a conversational partner. If we could design an interactive web-based system which could chat with the English learners anytime anywhere, their great demand for learning partners could be somewhat fulfilled. This is the original motivation of the project CSIEC. This chapter is to explain the CSIEC project and its integration into English instruction in middle schools.

## **BACKGROUND**

The recent literatures demonstrate that current human language technology, especially chatbot technology, can supply a virtual chatting partner; and moreover, the application of such systems in education can facilitate the learning and teaching process.

Brennan (2006) defined a chatbot as "an artificial construct that is designed to converse with human beings using natural language as input and output". A chatbot architecture integrates a language model and computational algorithms to emulate communication between a human user and a computer using natural language (Abu Shawar and Atwell, 2007).

ELIZA (Weizenbaum, 1966) was the first chatbot. It used key words to analyze input sentence and created its response based on reassembly rules associated with a decomposition of the input. But it held no memory of the conversation, and so could not achieve targeted collaboration or negotiation. However, the syntactic way of natural language processing (NLP) exemplified by ELIZA has been developed significantly from 1960s to date, leading to the advents of various chatbots, including ALICEBOT (<http://www.alicebot.org>), one popular open-source chatbot system. Since 1990s with the improvement of NLP, chatbots have become more practical, and have also been applied in education.

Graesser, Chipman, Haynes, & Olney (2005) used "AutoTutor", an intelligent tutoring system with mixed-initiative dialogue which can simulate a human tutor by holding a conversation with the learner in natural language, to enhance the learner's engagement and the depth of the learning. Grounded in constructivist learning theories and tutoring research, AutoTutor achieved big learning gains.

Kerfoot, Baker, Jackson et al. (2006) described an experimental use of chatbots as a teaching adjuvant in training medical students. The experi-

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