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Intelligent Language Tutoring System:
Integrating Intelligent Computer-Assisted Language Learning Into Language Education

Dara Tafazoli, University of Cordoba, Cordoba, Spain
https://orcid.org/0000-0001-7082-2286
María and Elena Gómez Parra, University of Cordoba, Cordoba, Spain
Cristina A. Huertas Abril, University of Cordoba, Cordoba, Spain
https://orcid.org/0000-0002-9057-5224

ABSTRACT

Intelligent computer-assisted language learning (ICALL) is a multidisciplinary area of research that combines natural language processing (NLP), intelligent tutoring system (ITS), second language acquisition (SLA), and foreign language teaching and learning (FLTL). Intelligent tutoring systems (ITS) are able to provide a personalized approach to learning by assuming the role of a real teacher/expert who adapts and steers the learning process according to the specific needs of each learner. This article reviews and discusses the issues surrounding the development and use of ITSs for language learning and teaching. First, the authors look at ICALL history: its evolution from CALL. Second, issues in ICALL research and integration will be discussed. Third, they will explain how artificial intelligence (AI) techniques are being implemented in language education as ITS and intelligent language tutoring systems (ITLS). Finally, the successful integration and development of ITLS will be explained in detail.

KEYWORDS

Computer-Assisted Instruction (CAI), Intelligent Computer-Assisted Language Learning (ICALL), Intelligent Tutoring System (ITS), Language Education, Second/Foreign Language Acquisition (S/FLA)

1. INTRODUCTION

Computer-Assisted Language Learning (CALL) has been implemented in the classrooms since technologies allow learners to apply them in their learning process free from time and space boundaries. There are different phases for the development of CALL, including the terms Behavioristic/Structural CALL, Communicative CALL and Integrative CALL popularized by Warschauer (1996; 2000). With the aid of Integrative CALL, language learning becomes an ongoing process rather than isolated steps in the computer lab. Learning is continuous when technologies are used freely. Based on Bax's (2003) description of an 'integrated' approach to CALL "physical location of the computer is in every classroom, on every desk, in every bag" (p. 21).

The main goal of the development of computer systems for intelligent tutoring is to provide students with the same educational advantages as a human tutor can offer (Anderson, Boyle, & Reiser, 1985; Brown & Greeno, 1984; Lesh & Kelly, 1996; Sleeman & Brown, 1982; Vidal-Abarca, Gilabert,

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Ferrer et al., 2014). From the early emergence of computer science, computers have been seen as capable devices with potential to improve the quality of education. In computer-assisted instruction (CAI), there are now over 1,000,000 pieces of educational software available which are in contrast with Intelligent Computer-Assisted Instruction (ICAI). ICAI programs are those which "simulate understanding of the domain they teach and that can respond specifically to the student's problem-solving strategies" (Anderson, Boyle, & Reiser, 1985, p. 456). The low quality of CAI software and the displeasure of teachers with using such educational devices led to the integration of artificial intelligence (AI) techniques into the development of ICAI.

From 1950s to 1980s, different reasons were behind the failure of integrating AI into educational devices: a) high cost of ICAL devices, b) the large amount of time necessary to create ICAL devices, and c) lack of established paradigm for enabling students acquire knowledge [although these obstacles are now being overcome] (Anderson, Boyle, & Reiser, 1985).

History of intelligent systems was largely misunderstood and over-estimated and the achievement of intelligent systems was very unrealistic (Duquette & Barrière, 2001), and more realistic purposes, subdivision and reconsideration were taken into account in this field after failing of previous expectations. Natural Language Processing (NLP) and Intelligent Tutoring Systems (ITS) have emerged as two major fields. Parsing of natural language input, either written or spoken, and error correction, machine translation, and chat bots (programs that you can converse with) are added to NLP. In Farsi (Tafazoli, 2011), Thai (Danuswan, Nishina, Akahori, & Shimizu, 2001), Japanese (Nagata, 2002), and English (Tokuda & Chen, 2004), some studies were conducted on error correction, often as a part of a tutoring system. ITS acts like a human tutor with the ability to match to the individual students' learning needs (Moundridou & Virvou, 2003). ITS save information that a teacher would have on the content to be taught, the student, and the pedagogical strategies (Curilema, Barbosab, & de Azevedo, 2007). ITS has four components (Kang & Maciejewski, 2000): 1) Expert Knowledge Module, which provides the information to be taught; 2) Student Model Module, which is a dynamic representation of the student's competence; 3) Tutoring Module, which designs and regulates instructional interactions with the learner; and 4) User Interface Module, which controls the interactions between the system and the learner.

This paper reviews and discusses the issues surrounding the development and use of ITS for language learning and teaching. Firstly, we look at ICALL history: its evolution from CALL. Then, issues in ICALL research and integration will be discussed, and we will explain how Artificial Intelligence (AI) techniques, such as ITS and Intelligent Language Tutoring Systems (ITLS), are being implemented in language education. Finally, the successful integration and development of ITLS will be explained in detail.

2. SHIFTING FROM CALL TO ICALL

In the last two decades, the development of CALL tutors has been the center of attention in the field (Heift & Shulze, 2003). A CALL tutor evaluates students' responses and gives feedback. This computer system checks simple "right" or "wrong" responses in the student input, so fill-in-the-blanks and multiple-choice tasks are frequently used. In this simplest version of CALL, learners' responses are compared to pre-stored answers, letter by letter, to see if learners' answers are right or wrong. When accurate responses are predictable, learners do not make any grammatical mistakes, or imagined errors correspond directly to intended feedback, the simple pattern matching can work well to detect errors (although some linguistic errors, such as embedded non-defining relative clauses happen, may not work for diagnosis). Nevertheless, activities that cannot be listed are problematic in this system. Limitations of this system can create problems in performing some activities frequently used in language education.

Providing personalized feedback to individual learners on language forms and rules is another motivation for the development of tutors. Performing error diagnosis, error correction, and generating