ASIAN JOURNAL OF INFORMATION TECHNOLOGY

MEDWELL PUBLICATIONS

Technology-Based Review on Computer-Assisted Language Learning: Chronological Perspective

[1]Dara Tafazoli, [2]M. Elena Gomez Parra and [2]Cristina A. Huertas Abril
[1]*University of Cordoba, Cordoba, Spain*
[2]*Department of English and German Philologies, University of Cordoba, Cordoba, Spain*

Key words: Computer-Assisted Language Learning (CALL), mainframe, microcomputers, internet, emerging technologies

Corresponding Author:
Dara Tafazoli
University of Cordoba, Cordoba, Spain

Page No.: 186-192
Volume: 19, Issue 9, 2020
ISSN: 1682-3915
Asian Journal of Information Technology

Abstract: This main focus of this review paper is on the advancement of technologies in Computer-Assisted Language Learning (CALL) from historical perspective. The review started by defining CALL and its related terminology, then highlighting the first CALL attempts in 1950 and 1966's, then moving to other decades of mainframes and microcomputers. At the final step, emerging technologies in 21st century will be reviewed.

INTRODUCTION

Computer-Assisted Language Learning (CALL) was first used by Davies and Steel[1] in a conference paper. This term was widespread in the UK in 1982. At the same year, Ealing College of Higher Education published the CALL-related newsletter titled "CALLBOARD". Furthermore, in 1983, TESOL started up CALL Special Interest Group[2, 3] which was a big move in the field.

At the first stage of this comprehensive review, we have to define Computer-Assisted Language Learning. Beatty[4] defined CALL as "any progress in which a learner uses a computer and as a result, improves his or her language". Changing from simple CD-ROMs to virtual reality in computer science shows the evolving nature of computers and technology which made Beatty[4] to consider CALL as a vague and unstructured discipline. Moreover, emergence of new literacies like electronic literacy, multimedia literacy, etc., warn teachers and learners to equip themselves with new technologies and literacies to meet the requirements of 21st century citizenship.

Although, the exact date of the appearance of CALL term is not clear[5], different terms are appeared in the literature of applications of technology in pedagogy. Computer-Aided Instruction (CAI) refers to learning at the computer in which there's no necessity in language education, also, the word 'instruction' refers to a teacher-centered approach. Computer-Assisted Learning (CAL) is similar to CAI but the focus in on learners. Computer-Assisted Language Instruction (CALI) was incorporated into the name of the professional association Computer-Assisted Language Instructed Consortium (CALICO). In contrast to CAI and CALI, the emphasize of Computer-Assisted Language Learning (CALL) is on learning rather than instruction, therefore, its reflecting a student-centered approach rather than a teacher-centered one. Computer-Assisted Language Teaching (CALT) is another term which in contrast to CAL emphasizes the

teachers. Computer-Assisted Teaching (CAT) is learning any subject at the computer. Computer-Based Training (CBT) refers to a program used for teaching of some discrete language learning skills. Computer-Mediated Communication (CMC) is a computer-based discussion environment in which learners need to communicate with native speakers of the target language. Computer-Mediated Instruction (CMI) is the application of some form of computer software or hardware in instruction in which learning takes place when a learner communicate with a distant tutor. Like CAI instruction in this term shows a teacher-centered approach. Intelligent Computer-Assisted Language Learning (ICALL) is a software-based program which provides learners with customized feedback based on their performances. Technology-Enhanced Language (TELL) as an alternative term to CALL appeared in 1980's is any applications of technology in the classroom. Finally, Web-Enhanced Language Learning (WELL) refers to CALL in which WWW is the medium for instruction.

Several scholars in the field, tried to review the history of CALL from different perspectives[6-8]. Warschauer[9], Warschauer and Healey[10], Bax[11] and Rahimpour[12] reviewed CALL and classified them based on underlying pedagogical and methodological approaches. Fotos and Browne[13] in their intoductory chapter of their edited book reviewed the rise of CALL and its application by considering the historical context of computers and their changing role in second language. Davies *et al*.[5] considered both approaches and technology-based devices and programs in CALL. A chapter of Beatty's[4] book provide a brief history of CALL from a comparative perspective of behaviourist and constructivist design features. The focus of this review is on the advancement of technologies in the field of CALL from a chronological perspective.

HISTORY OF CALL

Early CALL and mainframes; 1950's and 1960's: The United State was the pioneer country in early days of CALL. In 1950's, the prominence of teaching language for military purposes in competent and scientific ways, led to the application of huge and high-priced mainframes, as the first application of computers in language learning, being available at universities. In competition with USSR in Cold War (1945-1991), the first CALL programs were developed at Stanford University, Dartmouth University and the University of Essexin order to teach Russian as a foreign language[14]. Among the early mainframe-based programs which were served as tutor and drill master, the PLATO[15] and the TICCIT projects[16, 17] were the highest profile ones[5].

Programmed Logic/Learning for Automated Teaching Operations (PLATO) system, developed in 1959 by the University of Illinois was one of the first and most important CALL system in teaching Russian using a grammar translation approach. The main and early focus of the PLATO was on translating Russian texts; then in the early of 1970's, Curtin and his colleagues added "grammar explanations, vocabulary drills and other drills and translation tests over a course of 16 lessons requiring 70 h to complete"[4]. Davies and his colleagues counted different features for the last PLATO system, PLATO IV such as "the plasma graphics terminals, multimedia capability using a computer-controlledaudio device, the touch-screen input option, centralized storage and delivery of largeamounts of instructional material and an online community space". As the PLATO presented some up-to-dated features like feedback, spelling and grammar-checkers, it could be called 'intelligent CALL' (ICALL).

Microcomputers; 1970's and 1980's: Throughout the 1970's and 1980's, high-end mainframe computers were still available for CALL research. In 1972, the University ofTexas and Brigham Young University (BYU) in cooperation with Mitre Corporation started to develop instructional materials for remedial English and mathematics. To meed the end, they launched 'Time-shared Interactive Computer Controlled Information Television' (TICCIT) which was the mixture of computer and television technologies[5]. The innovative aspect of this project was the fact that TICCIT didn't prescribe the learner's pathway, e.g., learner could move freely through the courseware. Moreover, Boyle *et al*.[18] developed a computer-based diagnostic test for French language on a mainframe computer[19].

Still, the US was the dominant country for CALL activities. Olsen[20]'s report on CAI in foreign languages, showed that 62 language departments from 52 institutions in 24 states using computers for language education. However, little activity in CALL was reported by Rex Last in the late 1970's at the University of Hull in UK.

In that decade, one of the main focus of CALL research was on videodisc technology. Videodisc technology abled computers to go beyond textual exercise. The CALL research stream moved to a smaller and more convenient format called Compact Disk Read-Only Memory (CD-ROM) and then forwarded to DVD-the larger volume media DVD[4]. Bush and Crotty[21] counted advantages of videodisc in compare to traditional instruction: more meaningful, an understandable contextwith many extralinguistic clues and empower student's problem-solving skill. 'Macario', 'Montevidisco' and 'Interactive Dígame' were three early examples of videodisc technology. For a review of Macario, Montevidisco and Interactive Digame[22].

The 1980's was the shining period of CALL in which many great publications released[14,23-28]. Furthermore, two professional association were founded: CALICO in the US and EUROCALL in Europe. The emergence of microcomputers influenced the position of CALL in that decade. The CALL programs moved from some specific universities and institutes to into primary and secondary schools.The 'Apfeldeutsch' was the first complete CALL packages for microcomputers[29].

In 1983, Massachusetts Institute of Technology (MIT) funded a 5 year project in contribution with Digital Equipment Corporation (DEC) and International Business Machines (IBM) called 'The Athena Language-Learning Project (ALLP)' in order to investigate the role of the computer in education[30]. ALLP benefited from Universal Interactive eXecutive (UNIX) (or UNiversal Inter-eXchange or University eXchange) workstations, which were "connectedto each other and to textual and visual databases through a Local Area Network (LAN)"[4]. Murray *et al*.[31] indicated three advantages of the ALLP system: The encyclopedic information usually associated with print that can be recalled with the speed of the computer, the extensive models of the language provided by multiple speakers usually associated with television or film materials and the engagement of interactivity usually associated with more primitive drill-and-practice routines[30, 4].

Other successful CALL programs in that decade were two videodisc-based simulation projects: 'No Recuerdo's (I Don't Remember) and 'A la rencontre de Phillippe' (Recognizing Phillippe). For a review of 'No Recuerdo's and 'A la rencontre de Phillippe',[4].

In 1984, Apple Computer developed a materials authoring program called 'HyperCard'. This program was one of the innovations in the'Macintosh' environment. HyperCard was among the first programs which rooted theoretically in hypertext and hypermedia capabilities, in which, text, images, audio, animations and video can be added to a set of virtual index cards[4].

In the mid of 1980's, ICALL started to show off in CLEF and TUCO II programs. These programs provided learners with "extensive tutorial sequences, discrete error analysis and feedback"[5]. Applying Artificial Intelligence (AI), semantic and syntactic parsers, Natural Language Processing (NLP) in combination with microcomputers and shifting from drill-and-practice to communicative competence led to the development of Spanish game 'Juegos Comunicativos'[32] and the German spy game 'Spion'. The production of text-only simulations such as a Granville: The Prize Holiday Package and London Adventure is another development in CALL software. The advent of Information and Communication Technology (ICT) in education arouse the use of concordancers in the language classrooms-Data-Driven Learning (DDL). This discovery-oriented approach was a great assist in learning and teaching grammar and vocabulary[33].

Davies *et al*.[5] believed that the major shortcoming of that time was that "microcomputers did not have the capability of recording and playing back sound". To solve the problem, around 1988 and by the advent of sound cards, a new development happened by adapting 'truly interactive digital sound-enhanced CALL Software'.

Multimedia PCs and the internet; 1990's: CALL development in the 1990's began with the advent of multimedia PCs. This advancement in ICT and computer science, changed the face of drill-and-practice programs to more communicative ones. 'Talking Book's CD-ROMs became popular by launching the first program 'Just Grandma and Me' in 1992 which was the combination of text and sound in three languages. Simulations on CD-ROM such as 'Nuevos Destino's[34] and 'Who is Oscar Lake? in 1995 became dominant CALL programs. CD-ROMs-based programs like 'Encounter Series'in 1997, 'Triple Play' (later renamed Smart Start), 'Talk to Me'and 'Tell meMore'series provided different learning opportunities for students by engaging them in listening and responding activities[5].

Davies *et al*.[5] believed that the "appearance of World Wide Web is probably the most significant development in ICT during the last 30 years". Natured in drill-and-practice activities, 'Hot Potatoes'is an example of web-based interactive authoring tools includes different activities like multiple choice, gap-filling, crosswords, etc.[35].

New terms, tools and CALL-related developments like 'e-learning', 'online learning' and Virtual Learning Environments (VLEs) provided different teaching and learning opportunities both for language teacher and learners which also, facilitate teacher-learner and peer-to-peer communications. In the late 1990's, the UK Open University delivered wide range of courses via 'Moodle'-an open-source VLE. By the development of the Internet and its speed, new applications emerged for language learning and teaching. Among them, Multi-User Domains (MUDs) and Multi-user-domains Object Oriented (MOOs) were two of the popular ones. To get better understanding of what the MUDs are "MUDs were originally designed as text-based, role-playing adventure games to be engaged in across computer networks but they also offered opportunities for collaboration and education including language learning"[5]. Concerning MOOs, language learners (players) log into a MOO and communicate with other learners either synchronously or asynchronously. For a review on how to use MOOs in language learning, see Von der Emde *et al*.[36] and Shield[37]. Virtual worlds or Multi-User Virtual

Environment (MUVEs) are virtual environments in which language learners act in 3D environments. For a review on how to use virtual worlds in language learning[38, 39].

EMERGING TECHNOLOGIES: THE 21ST CENTURY

Integration of technology in our 21st-century daily lives has changed the form of CALL programs. Different commercial entities, governmental and non-governmental universities and institutes began to offer complete language courses on the Internet, as a software, mobile application, etc. Drawback of e-learning led to the coinage of a new term called 'blended learning' which was a combination of both online and face-to-face interactions. Web 2.0 technologies, gained popularity from 2004, provided different learning opportunities for language learners through socializing with native speakers of target language via social networking sites and applications like 'MySpace' and 'Facebook'. Web 2.0 is a "social platform for collaboration, knowledge sharing and networking"[5]. Different web-based communities such as discussion lists, blogs[40], wikis[41], podcasts[42], vodcast[43], Social Networking Sites (SNS) and social media tools[44, 45], etc. are the consequence of web 2.0 technology.

Recently, the advent of mobile and portable devices like smartphones and laptops and the widespread availability of them has led to the coinage of a new term called 'Mobile-Assisted Language Learning (MALL). Although some scholars believed that MALL differs from CALL[46] the authors of this paper put MALL as a subcategory of CALL. A good number of studies showed the usefulness and effectiveness of portable devices in language learning and teaching: mobile phones[47], tablet PCs[48] and MP3 Players[49] and etc.. Moreover, different applications of mobile phones functions and capabilities are also reported by different scholars: video recording[50] using GPS[51], QR (Quick Response) codes[52], Short Message System (SMS) tool[53],etc. In spite of the affordances of MALL[54], some challenges and limitations are also reported[55].

Finally, emerging technologies like new gaming platforms, e.g., Massively Multiplayer Online Role Playing Games (MMORPGs)[56], virtual realities[57], second life[58, 59], Robot-Assisted Language Learning (RALL)[60-62] are another new dimensions of CALL faces.

CONCLUSION

There is no doubt that Information and Communication Technologies (ICTs) are now having a vitaleffect on theway foreign languages are being taught and learned. It can now be argued that Computer-Assisted Language Learning is a middle-aged multidisciplinary field with a lot of experiences from different parts of the world[63]. In view of the advancement, it can be said that CALL has reached the stage of stability in language education; moreover, using language education software and applications have become a common social phenomenon. However, in order to plan and implement technology successfully in language education classes, teachers and learners should clarify their goals. In addition, all the complexities and difficulties, e.g., cultural, structural and infra structural of integration of education into syllabus should be considered[64]. Finally, we would like to warn both language teachers and learners about the 'technology's double face'[65]. We should consider that CALL as a pedagoigical phenomenon has its own merits and demerits. Language teachers and learners should avoid 'technocentrism'. As Papert[66] put it "when we talk about computers in education, we should not think about a machine having an effect. We should be talking about the opportunity offered us"[65].

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