Tina Čok

ICT-supported language learning tools for Chinese as a foreign Language: a content review

ABSTRACT

The paper presents a meta-analysis of 37 scientific papers dealing with the use and adoption of ICT for learning and teaching Chinese as a foreign language. It has shown that systematic content reviews providing overall insight into the nature and level of development in the field are rare. The author tries to fill this content gap by answering three research questions: 1) What is the overall state of research in the field of ICT-assisted learning of CFL in terms of language teaching methods? 2) Which learning technologies are in use for the specific teaching and learning methods for Chinese as a foreign language? 3) Are some learning technologies used more often for practis ng specific language skills than others?

Key words: ICT-supported language tools, Chinese as a foreign language (CFL), computer assisted language learning (CALL), language teaching and learning strategies

Jezikovnotehnološka orodja za učenje kitajščine kot tujega jezika: pregled vsebine

POVZETEK

V prispevku je predstavljena metaanaliza 37 znanstvenih člankov, ki obravnavajo uporabo in uvajanje IKT pri učenju in poučevanju kitajščine kot tujega jezika. Analiza je pokazala, da so vsebinski pregledi, ki bi kazali splošno stanje in raven razvoja tega področja, redki. Da bi zapolnili to raziskovalno vrzel, smo si postavili tri raziskovalna vprašanja: 1. kakšno je splošno stanje raziskav na področju računalniško podprtega učenja v smislu metodologije za učenje kitajščine kot tujega jezika, 2. katere jezikovne tehnologije so v uporabi za posamezne metode učenja in poučevanja kitajščine kot tujega jezika in 3. ali se določene jezikovne tehnologije pogosteje uporabljajo za urjenje specifičnih jezikovnih spretnosti.

Ključne besede: jezikovnotehnološka orodja, kitajščina kot tuji jezik, računalniško podprto učenje jezikov, strategije učenja in poučevanja jezikov

Introduction

The paper focuses on two primary interconnected topics: learning and teaching Chinese as a foreign language (LTCFL) and the use of language technology and tools. Since the late 1960s, various forms of computer-based language tools have been introduced into the language teaching and learning process. Today we can hardly imagine teaching a language without the help of at least one common presentation tool, such as PowerPoint, or the other computer or internet-based applications that facilitate and enrich content delivery, for example music or video clips on YouTube. Even if multimedia tools are nowadays widely used in classrooms, teachers and learners still face many barriers when using them. The more common complaints among educators include the time spent designing quality content exercises for their students, the lack of skills and knowledge needed to prepare web-based material, or the resistance that they sometimes come across from students on account of the introduction of computer-assisted language learning (CALL) strategies into their curriculum.

In his article, Egbert (2005) defined CALL as a method of language learning that can be present in any context with, through and around computer technology. It can take place in many different venues besides classrooms–more so in homes, libraries, and computer cafés rather than in formal educational settings. In addition, it occurs at various times and in diverse economic, cultural, political, social and linguistic realms that embody many forms of understanding, goals and standards.

For the Chinese language, a more detailed definition of CALL was proposed by Bourgerie (2003).

Since the early 1980s when computer-aided instruction emerged for Chinese, the field has expanded dramatically from a handful of programs to the hundreds available today. While many people embrace such innovations, others are frustrated with them or fail to see great benefits of emerging technologies, seeing them instead as false panaceas. Still others are overwhelmed by the sheer quantity of technology related teaching materials or unimpressed by the uneven quality of the offerings. (Bourgerie, 2003, p. 17)

For languages like Chinese, a language that foreign learners do not usually hear very often or have the chance to practice in their immediate environment, the barriers to learning are even more difficult to overcome. The adoption of ICT-supported tools for learning non-alphabetic languages is therefore even more important. "Technology integration has gradually gained prominence in CFL programs, since computers and the internet, being free of many time and location constraints, have proven to be "highly convenient facilitators of CFL learning" (Lin, 2015, p. 1). Lin (2015) goes even further by identifying ICT as an important factor in the transformation of a traditional lecture/drill-based CFL classroom into a more interactive and dynamic learning environment.

As identified in Graesser et al. (2008), computers can greatly help language learning, and the resulting learning gains are not negligible. "Meta-analyses have

revealed that computerized learning environments fare well compared to classroom instruction and other naturalistic control conditions […]" (Graesser, Chipman, and King, 2008, p. 213). However, the return on time and effort invested is negligible if these learning environments are not well suited to the specifics of LTCFL. The main aim of this paper is therefore to report on research trends in the use of learning technologies for LTCFL, which have been obtained by a content review of papers published in scientific journals indexed in the Web of Science (WOS) and which specialise in educational technology. The paper tries to answer three main research questions with a thorough analysis of the scientific studies involved: 1) What is the overall state of research in the field of ICT-assisted learning of CFL in terms of methods of language teaching? 2) which learning technologies are in use for the specific teaching and learning methods for Chinese as a foreign language? 3) are some learning technologies used more often than others for practising specific language skills? Another important by-product of the review is a systematic list of scholars and papers in the field of LTCFL and technology-aided learning that could be investigated further in the future.

In Chinese, as in any other computer-aided language teaching environment, the programs used can be basically divided into two types; those that depend on textbooks and those which are textbook independent.

For LTCFL [t]extbook-dependent programs have been developed based on certain Chinese textbooks. All the course materials, drills, and exercises are based on a particular textbook. For example, Hanzi (Ogdon Inc.) is a program helping students to learn all the characters from the textbook "Practical Chinese Reader (PCR)". The program includes animated characters, drills, and exercises. Textbook-independent programs are not based on any particular Chinese textbooks. They are independent tools which can be used by students no matter what textbook they use. Chinese word-processors, electronic dictionaries, and web tools belong to this category. For example, the Chinese word-processor NJStar (NJStar Software Corp.) has the capability of displaying Chinese Pinyin fonts with tone markers and it has an electronic dictionary. The Chinese learning tool Wenlin (Wenlin Institute Inc.) will read in Chinese texts in gb, big5, and unicode and provide pronunciation, English meaning and etymological information for words and characters. (Xie, 1999, p. 104)

The ubiquity of the internet in recent decades seems to speak in favour of textbook-independent programs and applications that can be combined together to form a rather complete computer-based learning environment.

In order to carry out a content review of scientific papers that deal with LTCFL and CALL, a theoretical basis was studied and compared using the papers. Two were classifications that needed a referential framework: methods of language teaching and types of learning and teaching technologies. With regard to methods of language teaching within CALL environments, most of the literature studied refers to Warschauer's (1996) division of methods into three phases, which coincide

with teaching methods. The proposed phases are classified as behavioristic, communicative and integrative.

Teaching methods for CALL

According to Warschauer (1996), the behavioristic method is "[i]nformed by the behaviorist learning model, this mode of CALL featured repetitive language drills, referred to as drill-and-practice. The communicative method appeared when new personal computers were creating greater possibilities for individual work. Communicative CALL stressed that computer-based activities should focus more on using forms than on the forms themselves, teach grammar implicitly rather than explicitly, allow and encourage students to generate original utterances rather than just manipulate prefabricated language, and use the target language predominantly or even exclusively. And finally the integrative CALL shifts to a perspective which seeks both to integrate various skills (e.g., listening, speaking, reading, and writing) and also integrate technology more fully into the language learning process. In integrative approaches, students learn to use a variety of technological tools as an ongoing process of language learning and use, rather than visiting the computer lab on a once a week basis for isolated exercises" (Yang, 2010, pp. 909–910).

A slightly different division comes from Bax (2003), who again divides the development of CALL into three phases, but bases his proposal more on the type of interaction that takes place between students and the computer or technology. The phases are called restricted, open and integrated. This is how Xie describes the stages:

During the first stage, computer programs were mostly for mechanical drills. The students had minimal interaction with other students while teachers have 'exaggerated fear and /or awe' toward using computers. In the second stage of open CALL, the focus was placed on 'linguistic skills development' and the students might interact with computers and other students occasionally. Finally the third stage of integrated CALL features computer mediated communication (CMC) and the students' interaction with others (students, teachers or native speakers). Use of computer becomes normal part of teaching (Xie, 2008, p. 153).

Technology tools classification

In the search for a comprehensive classification of the types of technology employed in teaching and learning processes, it was only possible to identify three. One example is that of Graesser et al. (2008), which divides teaching and learning technology tools into 10 main types: traditional computer-based training, multimedia, hypertext and hypermedia, interactive simulation, intelligent tutoring systems, inquiry-based information retrieval, animated pedagogical agents, virtual environments with agents, serious games and collaborative learning environments.

In the article *Computer-Mediated Technologies*, Graesser et al. (2008) present each of the tools as follows:

– Traditional computer-based training systems involve mastery learning. The learner (1) studies material presented in a lesson, (2) is examined with a multiple-choice test or another objective test, (3) gets feedback on the test performance, (4) restudies the material if the performance in step 2 is below threshold, and (5) progresses to a new topic if performance exceeds threshold. When using multimedia technology tools, the material can be delivered in different presentation modes (verbal, pictorial), sensory modalities (auditory, visual), and delivery media (text, video, simulations).

– Hypermedia and hypertext systems provide a large number of web pages with types of text, pictures, animations and other media. Each page has hot spots for the learner to click and explore. The learner has free rein to maneuver through the hypertext/hypermedia space, which of course, is an ideal environment for active learning and inquiry.

– Interactive simulation allows the student to actively control input parameters and observe the results on the system.

– Intelligent tutoring systems (ITSs) track the knowledge states of learners in fine detail and adaptively respond with activities that are sensitive to these knowledge states.

– Query-based information retrieval occurs when Google is used to access information on the Web.

– Animated pedagogical agents usually speak, point, gesture, walk and exhibit facial expressions. Some are based on human images, whereas others are animals or cartoon characters.

– Virtual environments with agents are those programs which mimic real-world settings and interactions, while computer games are considered 'serious,' because they feature pedagogical concepts and are employed for various learning purposes.

– In computer-supported collaborative learning (CSCL), groups of learners work together to construct knowledge on a topic in the pursuit of project goals that are typically provided by instructors.

Another classification based on language technology tools has been identified by Bourgerie (2003) in CD-ROM, Internet-Based Courses, Tools, Distances Learning and Other Sources, On-line Texts and Media, Resource Sites, and Testing Software.

A third attempt to classify learning technology tools, although much less concise, is advocated by Eady and Lockyer (2013), where technology tools have been divided into digital learning resources, tools for analysis, tools for communicating, collaborative learning tools and tools for creating. The application of these technology tools is explained by Eady and Lockyer (2013) in the article "Tools for learning: technology and teaching strategies" as follows: digital learning resources support information processing by helping students to develop mental

representations through the mix of media elements presented to them. Digital learning resources include content and sometimes learning activities. They combine multimedia elements, including text, image, video and audio to present information. Analysis and simulation tools support knowledge construction by allowing learners to manipulate information and visualize it in various ways. Tools for communication allow students to communicate their ideas and by so doing, they learn at the same time. A good example of this kind of tool is blogging platforms. Collaborative learning is typically understood to be a situation in which two or more students work together to seek understanding or meaning, as well as to solve a problem. Students might work together to construct meaning by creating an artifact or product. Using technology to create texts provides students with many opportunities. Students can gain confidence in their writing skills by learning how to use tools such as spell check and increase their vocabulary by using a thesaurus tool. Scaffolding takes place through models and online how-to videos to guide students through the writing process.

While methods of language teaching largely follow methodological and conceptual lines similar to those along which they were created, the three classification types for technology tools used in learning and teaching do differ to a major degree. The choices regarding the application of language teaching methods and classification of technology tools in the study, have been made according to the main focus of the paper and especially in order to help answer the three main research questions, which will be explained in greater detail later on.

Method

Materials

The data were based on articles published in the bibliographic resource WOS, an integrated and reliable database covering the most important scientific journals in the field of education, information and communication technology. No period restrictions were imposed during the search, since doing so could risk the omission of important articles, the subject in question being quite topical. The key words applied for the automatic search were *ICT* and *Chinese as a foreign language*, which produced limited results, although most of the papers found were in the domain of educational technology journals. To ensure that no significant paper was omitted, a manual search was performed to identify all the journals in the domain of educational technology. The search for papers on computer-based LCFL produced more results, so that the total count of suitable papers for the study was 37. By using the WOS database for this analysis, numerous articles that deal with the topic of interest, but which were written in Chinese and published in scientific journals were not indexed in the WOS and therefore had to be left out. Thus, all of the articles under analysis are written in English.

Selection criteria

The first criterion was that the study should be concerned with ICT-supported learning or teaching; the second criterion was that it had to deal with LTCFL, and not Chinese as a first language, where special attention is dedicated to teaching Chinese to students with an alphabetic language background. The reason for this selection is that there is a clear distinction between the learning and teaching strategies of Chinese for people whose language knowledge extends only to alphabetic languages and for those who can read and write a non-alphabetic language. This selection criterion excluded papers from Hong Kong, but included papers from Singapore.

Additionally, in one exceptional case, papers written by Taiwanese scholars whose study participants were foreign students from the US and Europe were used in relation to a study in which participants were learning Chinese as a first language and were heritage Chinese learners.

Procedure

For the first step, the content analysis was conducted following the two main search criteria defined earlier: ICT-supported learning and teaching and LTCFL. For the second step, the data analysis helped refine the categories and subcategories on which the content review is based.

The following coding variables were identified: journal title, year of publication, country of first author, research design – the analysis of which was based on research type (descriptive, experimental or developmental) – and the number and description of the study participants (learners, teachers, and learners and teachers), educational level (divided into K-12, high school, university and other), type of language technology or applied tool (10-type classification), method of language teaching (according to Warschauer), and language skills practised.

The 16 journals in which these papers were published are as follows: *Journal of the European Association for Computer Assisted Language Learning* (ReCALL), *The Asia Pacific Educational Researcher* (TAPER), *Turkish On-line Journal of Education Technology* (TOJET), *Australasian Journal of Educational Technology* (AJET), *System, Speech Communication*, *Procedia–Social and Behavioural Sciences*, *Language Learning & Technology* (LLT), *Journal of Neurolinguistics*, *Foreign Language Annals*, *Journal of Education Technology & Society* (JETS), *Computers in Human Behaviour* (CHB). *Computers & Education* (CE), *Computer Assisted Language Learning* (CALL), and *British Journal of Educational Technology* (BJET).

Results and discussion

The results of the paper analysis are as follows: the number of papers identified was 37, and all papers were published between 2005 and 2015. The distribution of papers by number in this 10-year period is presented in Figure 1. After the first paper on the topic was published in 2005, there was a steady increase in the number of

papers published until 2011, and an extensive rise in 2012 and 2013. In 2014 and 2015, an evident decrease in the number of papers was noted.
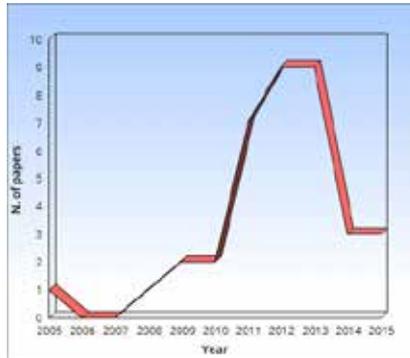

Figure1: The number of published papers by publication

Among the selected journals, AJET has the highest number of relevant papers (7), followed by CALL (5) and LLT (4). AJET published more papers (5) in the years 2012–2013, and CALL published more papers (4) in the years 2011–2012. The number of relevant papers by journal is presented in Figure 2.
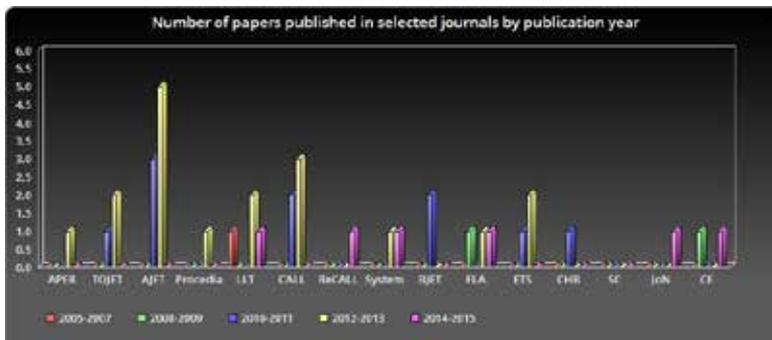

Figure2: The number of papers published in selected journals by publication year

More data are presented in the following tables. Table 1 presents papers classified by research design according to the research type. In Table 2, the papers are arranged by educational level. In Table 3, the papers have been analysed according to the 10-type classification of language technology and tools. The original categories according to Graesser et al. (2008) are computer -based training, multimedia, hypertext and hypermedia, interactive simulation, intelligent tutoring system, inquiry based information retrieval, animated pedagogical agents, virtual environments with agents, serious games and computer-supported collaborative learning. Among the selected papers, none dealt with the technologies or tools that could be categorized as interactive simulation, inquiry based information retrieval, or animated pedagogical agents, but three new categories were recognised and added to the original classification. The new categories are computer-mediated writing, computerized adaptive testing (CAT), and mobile-supported collaborative

learning. The highest number of papers (12) dealt with multimedia technology, followed by computer-based training (5). Two papers did not focus on any specific technology, but only on the theoretical basis of the use of language technologies; they were therefore excluded from this classification. The analysis of the language teaching methods (according to Warschauer) is presented in Table 4.

Table 1: The number of papers published by publication year according to research type

Category	2005-2007 (n.%)	2008-2009 (n.%)	2010-2011 (n.%)	2012-2013 (n.%)	2014-2015 (n.%)	Total (n.%)	Percentage of all papers
Descriptive	1 (5.26)	1 (5.26)	4 (21.05)	11 (57.90)	2 (10.53)	19 (100)	51.35
Developmental	0 (0.00)	1 (20.00)	1 (20.00)	2 (40.00)	1 (20.00)	5 (100)	13.51
Experimental	0 (0.00)	1 (7,70)	4 (30.77)	5 (38.46)	3 (23,07)	13 (100)	35.14
TOTAL	1 (2.63)	3 (7.89)	9 (26.32)	18 (47.37)	6 (15.79)	37 (100)	100

Table 2: The number of papers published by publication year according to school level

Category	2005–2007 (n.%)	2008–2009 (n.%)	2010–2011 (n.%)	2012–2013 (n.%)	2014–2015 (n.%)	Total (n.%)	Percentage of all papers
Primary	0 (0.00)	0 (0.00)	3 (50.00)	3 (50.00)	0 (0.00)	6 (100)	16.21
Secondary	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	2 (100)	5.41
Primary and secondary	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	2 (100)	5.41
Tertiary	1 (4.55)	2 (9.09)	4 (18.18)	10 (45.45)	5 (22.73)	22 (100)	59.46
Not defined	0 (0.00)	1 (20.00)	0 (0.00)	3 (60.00)	1 (20.00)	5 (100)	13.51
TOTAL	1 (2.70)	3 (8.11)	9 (24.32)	18 (48.65)	6 (16.22)	37 (100)	100

Table 3: The number of papers published by publication year according to the type of technology

Category	2005–2007 (n.%)	2008–2009 (n.%)	2010–2011 (n.%)	2012–2013 (n.%)	2014–2015 (n.%)	Total (n.%)	Percentage of all papers
Computer-based training	0 (0.00)	0 (0.00)	2 (40.00)	2 (40.00)	1 (20.00)	5 (100)	13.51
Multimedia	1 (8.33)	1(8.33)	1(8.33)	8 (66.68)	1(8.33)	12 (100)	32.43
Hypertext and hypermedia	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)	0 (0.00)	1 (100)	2.70
Intelligent tutoring system	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)	1(100)	2.70
Virtual envi-ronments	0 (0.00)	0 (0.00)	0 (0.00)	3 (75.00)	1 (25.00)	4 (100)	10.81
Serious games	0 (0.00)	1 (25.00)	2 (50.00)	1 (25.00)	0 (0.00)	4 (100)	10.81
Computer-supported colla-borative learning	0 (0.00)	1 (33.33)	1 (33.33)	0 (0.00)	1 (33.33)	3 (100)	8.11
Computer-mediated writing	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	2 (100)	5.41
Computerized adaptive testing	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)	0 (0.00)	1 (100)	2.70
Mobile-supported collaborative learning	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	2 (100)	5.41
None	0 (0.00)	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	2 (100)	5.41
TOTAL	1 (2.70)	3 (8.11)	9 (24.32)	18 (48.65)	6 (16.22)	37 (100)	100

Table 4: The number of papers published by publication year according to language teaching methods

Category	2005–2007 (n.%)	2008–2009 (n.%)	2010–2011 (n.%)	2012–2013 (n.%)	2014–2015 (n.%)	Total (n.%)	Percentage of all papers
Behaviouristic	0 (0.00)	0 (0.00)	1 (12.50)	4 (50.00)	3 (37.50)	8 (100)	21.62
Communicative	0 (0.00)	1 (25.00)	2 (50.00)	1 (25.00)	0 (0.00)	4 (100)	10.81
Integrative	1 (5.26)	2 (10.53)	5 (26.31)	9 (47.37)	2 (10.53)	19 (100)	51.35
None	0 (0.00)	0 (0.00)	1 (16.67)	4 (66.67)	1 (16.67)	6 (100)	16.22
TOTAL	1 (2.70)	3 (8.11)	9 (24.32)	18 (48.65)	6 (16.22)	37 (100)	100

As shown in Figure 1, studies in the field of ICT-supported LTCFL are quite recent, and the number of papers published in the selected Social Sciences Citation Index journals has increased only in the last few years.

What follows is a more detailed discussion of the results arising from the analysis of the single variables in the context of which the papers were studied.

The 37 papers were first divided into two broad categories: papers that discuss the use of ICT in a linguistic context and papers that treat the use of ICT in a meta-linguistic context. The papers that argue for the use of ICT in a linguistic context are far more numerous (30) than those dealing with meta-linguistic topics, such as motivation, interaction, attitude etc. For the purposes of this study, the papers have been divided according to 6 identified typologies: (1) papers that describe teaching and learning methods, (2) papers on the development and testing of ICT solutions, (3) assessments of tools and models, (4) papers on the general use of information technology for LTCFL, (5) papers dealing with the psycholinguistic effects of the use of ICT, and (6) papers that discuss conditions and barriers for the adoption of ICT for LTCFL.
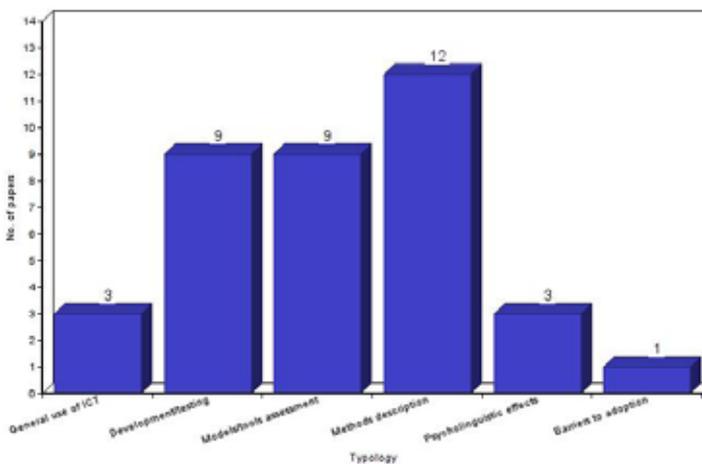

Figure 3: Number of papers by typology of the content discussed

Furthermore, two variables that were previously identified in the analysis can be refined further by their relationship with the learning technology. The two variables are the year in which the paper was published and the language skill on which it focuses.

In the attempt to classify types of learning technology for LTCFL, the author first explored the existing literature as well as any review studies that had already been conducted in this area. It was surprising to find so few articles dealing with this classification. Besides Bourgerie's article, which meticulously examined all the existing technology tools–especially for LTCFL, only two other generic classifications were identified: that of Eady and Lockyer (2013), and the other from Graesser et al. (2008). Bourgerie's classification, although very thorough, was not sufficiently standardized. The classes are a mix of media type, delivery format and access, while Eady's classification divided tools according to their purpose. Finally, the 10-type classification by Graesser et al of computer-mediated technologies in learning was adopted, because it entirely met the criteria for a general tool classification of this kind. The classification was applied in the first analysis phase and afterwards adapted to the actual content of the paper so that some categories were excluded while other new ones were added. In order to define the research design, a 3-category classification was applied, which was adopted from Jonassen's model (1996) by Istenič and Bagon. "The classification distinguishes *experimental research* based on experimental and control groups (Ross & Morrison, 1996); *descriptive research* based on descriptions events or participants' input describing, explaining, evaluating or investigating the problem (Kunpfer & McLellan 1996); and *developmental research* focused on design, development and evaluation of intervention or solutions (Richey & Nelson, 1996)" (Istenič and Bagon, 2014, p. 206).

Another important classification of the papers was based on the method of language teaching. All papers were first identified as belonging to the CALL method. Warschauer's division was adopted, as opposed to that of Bax, because it was again more general, and it comprises more methodological aspects, which could lead to better research results. Warschauer's division follows the phases of development which are as follows: behavioristic, communicative and integrative, where phases of development can also count as types of methods, since the beginning of a new phase does not necessarily mean the end of programs and methods from the previous phase; rather, the old is included within the new (Warschauer, 1996). In fact, "[t]he adoption of ICT in the language classroom has transformed teaching and learning from a behavioristic paradigm to a communicative paradigm and subsequently to an integrative paradigm (Kern & Warschhauer, 2000; Warschhauer 1996)" (Lin, 2015, p. 2).

Research design

There are many different classifications by which a study can be arranged, according to the adopted research design. Although it was not easy to distribute the papers in the preset categories, the simplest and neatest division seemed to be also the most comprehensive. Thus, the adopted 3-type classification was that of Istenič & Bagon, which was based on Jonassen's (1996) division into descriptive, developmental and experimental research designs.

Papers following the *descriptive research design* (for example, Lin, 2015; Ching, 2013) are the most numerous (19). These papers use mixed methods, surveys and interviews; the collected data are in most cases qualitatively analysed, since fewer studies adopted an approach involving quantitative analysis of data. The number of participants varies. In six papers, the participants numbered between 1 and 20, and in nine papers between 21 and 100. In three papers, the sample was greater than 100 participants, and one study surprisingly does not state the number of its participants.

There are 13 papers in the category of *experimental research design* (for example, Chai, 2012; Wong, 2011; Tseng, 2013), and they include papers about experiments. Not all of the papers use the classical experimental method of having a control group. Most of the studies in this category combine quantitative and qualitative approaches, using questionnaires as well as experiments and quasi-experiments. In this category, most of the studies were conducted on a sample of up to 20 (4) or between 21 and 100 (7) study participants. Only two papers deal with a study group with more than 100 participants. It should be noted that the small number of experimental studies with study groups consisting of more than 100 participants is quite peculiar to the results, since smaller research groups are usually unreliable and often irrelevant. Most of the experiments featured in the analysis were in fact carried out with participants from one or a maximum of two classes within the same institution, which again makes the results less dependable.

For the category of *developmental research design,* only five papers were identified (for example, Wang, 2012; Nesbitt, 2012); four of them presented the development of systems for language training and the other, the development of a system for language knowledge testing. Here, two papers studied a focus group with up to 20 participants: in one paper, participants numbered between 21 and 100, while the focus group of the other paper consisted of more than 1000 participants, which was made possible by the fact that the study was conducted online. Again, in one paper the number of participants was not defined.

In only six papers, the group of study participants comprised teachers. In the majority of the papers (30), the represented group of study participants included learners, and in one paper, learners and future teachers.

Out of 20 papers that were analysed, the groups of study participants consisted of university students or teachers, whose country of origin varied (Australia, Taiwan, Great Britain, USA, Germany, New Zealand and China). Three papers dealt with secondary education students (two from Singapore and one from Australia), while five papers dealt with primary school pupils, and all of these were from Singapore. In the remaining nine papers, the studied groups were mixed and consisted of teachers and students, first and second-level pupils or students not defined by educational level. What is striking about these results is first, the author's country with regard to the educational level of the study participants. The first and second educational levels are almost entirely represented by studies from Singapore,

which demonstrates that learning Chinese as a foreign language in Singapore (where 'foreign' here stands for a second language, since Chinese is one of the official languages in Singapore) is represented mainly at the primary and secondary educational level, while in Europe, Australia and the USA, CFL is mostly associated with tertiary level education.

The analysis of the first author's origin demonstrated that most of the researchers specialising in the field of LTCFL come from the USA and Taiwan (10 papers each); in nine papers the first author's origin is Singapore; in three papers the first author is from Australia, and in another three, from Great Britain. Only in one paper, does the first author come from Germany and in another, from New Zealand. It is very interesting to note that in none of the papers indexed in the WOS data base is the first author Chinese, which may be for two possible reasons: the first is that the majority of Chinese scholars who publish papers and studies in the field of LTCFL choose to do so in their national scientific journals written in Chinese, which might be recognized within the papers under analysis but not indexed in the WOS. The second possible, but unlikely, explanation is that scholars from China mainly do research in the field of learning and teaching Chinese as a first language.

Another interesting result of the comparison between the origins of first authors is that very few of these studies are done by European and Australian researchers, even though in these countries LTCFL holds a relatively strong position, especially in Great Britain and Australia, where in the past many Chinese immigrants' descendants learnt Chinese as a second language, and nowadays more and more non-Chinese decide to take Chinese classes as an investment in the future.

Type of language technology or tool applied and language teaching methods

In Table 3, a detailed overview of types of language technologies and tools is presented. The terms have been adopted from Graesser et al.(2008) and completed with new categories in order to define all of the technologies and tools represented in the papers under analysis. The higher number of papers examines multimedia technologies (12), followed by computer-based training (5) and virtual environments with agents, serious games (four categories each), and three in the category of computer-supported collaborative learning. It can be determined from the distribution of learning technologies and tools between categories of language teaching methods within CALL, that hypertext and hypermedia, as well as virtual environments, coincide with the last developmental phase of and method in CALL. This phase is integrative, while other technologies and tools are scattered within the context of the behavioristic and communicative method. Table 4 presents the distribution of the papers examined according to the methods of language teaching. Most of the papers (19) examine methods typical of integrative approaches; eight papers deal with methods typical of behavioristic approaches, four for communicative, while in six papers that are strictly theoretical, there is no evidence of teaching methodology.

Language skills

The categories identified by the content analysis regarding language skills fostered by the applied tool or technology are as follows: reading, listening, speaking, writing, vocabulary, all skills and other. The category with the most papers is writing (14), followed by other (8), which is represented mostly by meta-linguistic skills (motivation, interaction, attitude), speaking (7), and all skills (6). Only one paper explicitly examines the language technology that is exclusively used for training reading skills, while two papers study the effects of a learning tool on vocabulary capacity. Papers that study learning technology for training writing skills are also all methodologically categorized as being part of the behavioristic approach, especially because they are based upon drill exercises, which are typical for this kind of method. Analysis of the trained language skill by relationship with the learning technology has shown that–except for the categories of computer based training, computer mediated writing and especially serious games, which are predominantly used for training writing and reading Chinese characters–other technologies are applied for exercising various language skills at the same time. Except for serious games, which are apparently very successfully used for memorising characters and making this otherwise difficult and time-consuming practice much more interesting, other technologies can be implemented in several ways, depending on which skill the teachers or the learners want to hone.

Conclusions and future directions

According to the number of published papers, it can be assumed that LTCFL, with the support of computer technology and tools, is at the beginning of its developmental phase, and more so in a scientific context.

According to the content analysis, there is still much work to be done. In fact, most of the papers deal with the use, adaption and introduction of language learning technologies and tools, but not the actual impact, effect and suitability of the use of specific tools for specific skills based on studies of the cognitive processes that characterise CFL learning. Thus, this field has great potential for developing new language teaching methods and should be investigated further.

Furthermore, the content analysis has demonstrated that, for now, using computer and internet-based technology brings evident learning gains, especially for writing and speaking skills, the latter benefitting from the chance to be in touch with authentic speaking situations and to experience interaction, neither of which can be achieved in a classic learning environment.

To answer the first research question regarding the overall state of research in the field of ICT-assisted learning of CFL in terms of language teaching methods, it can be argued that much could still be done. There is still a very limited number of studies at hand, and most of them deal with the actual tool, but are not sufficiently focused on the methodological aspect of its use. The lack of a comprehensive

methodological background to the existing language learning tools for CFL might also be one of the main reasons for teachers' fear of or resistance to adopting ICT-supported language tools. There is clear evidence of numerous barriers that persist and prevent changing the learning environment from the predominant classic model to a more interactive and ICT-supported version. Nevertheless, it has been observed that new trends in teaching and learning, although often only theoretical, seem to support and follow the actual characteristics of new learners, who do not need to be introduced to knowledge by the teacher, but who are quite proactive in the learning process and know how to navigate the learning content by themselves, according to their own interests. In this new learning scenario, ICT plays a key role as the content media and the teacher's collaborator.

The second and third research questions are related to each other and will be answered together. The analysis has shown that ICT-supported tools for LTCFL are indeed very versatile. Most of them can be adopted in numerous and various ways, where the actual effects for the learner depend on the teacher's degree of skill, for it is the teacher's role to provide the content and wisely employ the tool according to the learning objectives. In addition, it has been observed that very often teachers are pushed by the institution to adopt technology for content delivery, but are left without support when it comes to guidance about how to do that. Although equipping the classroom with computers and the internet is appreciated, it is far from enough to expect all teachers to be technically acquainted with and methodologically prepared to take advantage of it. Very often the effects of this are the reverse, and learners do not appreciate the gains that ICT-supported language tools could have for their learning.

Although the field of ICT-assisted learning for CFL is rapidly evolving along with technological advancements and educational paradigms, affected interventions in technology are progressing at a much faster pace compared to the shifts in educational paradigms, and this seems to be the way forward. Although most of the papers under analysis are co-authored by Chinese scholars, it is vital to perform a similar content review for papers that have been published in important Chinese journals, and thus assure that this content review does not bypass state-of-the-art studies of new methodologies for ICT-supported LTCFL.

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Tina Čok, dipl. Sinologinja in italijanistka, Fakulteta za humanistične študije, Univerza na Primorskem, tina.cok@fhs.upr.si