What do we know about CALL? Claims and evidence

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Computers have been used in education for over 50 years. Advocates have asserted that computers would transform education, motivate students, make teachers' lives easier, and help students learn more effectively. Others have asserted that computers are "just a tool" and have emphasized the importance of the teacher in how well or poorly technology is used in education. Research on computer-assisted language learning (CALL) has been undertaken from the beginning in an attempt to see if CALL "works."

Research on the use and effectiveness of CALL began with the use of large mainframe computers in language teaching and learning in the 1950s. Researchers saw that students liked the novelty of this rare, new technology. Teachers spent a lot of time programming and thinking about how best to use the new medium. Advocates claimed that students got immediate feedback and were more engaged, thus learned language better. Detractors pointed out that the machines were very expensive and not available for widespread use.

When the computers changed in the early 1980s to small, individual PCs – they were "personal," after all – researchers saw that students liked the novelty of this new technology. Teachers again spent a lot of time programming and thinking about the new medium. Because many of those programming were teachers rather than programmers, or programmers and not teachers, the resulting software tended to be very basic and drill-oriented, especially in the US. Teachers in the UK were able to come up with more simulations discussion generators, such as London Adventure and Lemonade Stand. Teachers in the UK also did more work with discovery learning, such as whole-text deletion and cloze exercises. Advocates claimed that the immediate feedback and programmed quality of the drills (with record-keeping) helped students learn more efficiently. Teachers could spend time on "quality" interactions in the classroom, relegating skills practice to the machine. The simulations and discovery learning software created more discussion in the classroom among students and were easier logistically than similar exercises off the computer. Whole-text deletion was not used before computer-based applications were developed. Detractors pointed out that these were very expensive workbooks, and money could be better spent elsewhere. The digital divide between wealthy schools and poorer ones began.

A move from green and white Apple IIes to black and white DOS to the early graphical Macintosh computer in the late 1980s brought more novelty and research questions. Teachers moved away from programming and into using ready-made software. Still, the bulk of the software remained drill and practice. True graphic potential (Mac) and more widespread use (Windows) came in the early 1990s. Simulations and games became more common in instruction, even in the US. (Oregon Trail was an early US-based example.) More students enjoyed the novelty factor, and more teachers wondered how to use the software and potential of the new medium. With multimedia came claims about helping students learn because the software appealed to different learning styles, as well as the same claims as before: immediate feedback, record-keeping, more quality time for non-drill activities in the classroom, and collaborative work at the computer leading to productive discussion practice. Detractors raised

the issue of return on investment with these still expensive novelties, and the digital divide increased.

With the Internet in the mid-1990s and beyond came greater usage, more novelty and possibilities for students, and a return to a sort of programming for many teachers. The question of how best to use the medium persisted, as well. The digital divide became more destructive as ability to use computers and the Internet became more essential. At the same time, computer and Internet use have skyrocketed globally. More teachers and students have become computer and Internet literate in the last 10 years than ever before. While most web pages are still in English (366 million, the numbers are growing in all other major and many minor languages.

CALL research has been hampered by having a moving basis: large mainframe computers of the 1950s are as similar to computers and the Internet today as silent films are to current special effects-laden movies on DVDs with added content. Add in new hardware like interactive whiteboards and today's ubiquitous computing (wireless labs, the Blackberry, and clicker response tools are prime examples) for even more differences. Research is also limited by typically small numbers of subjects, the risk of Hawthorne effects (just trying something new, no matter what, can produce a positive response), and a tendency for researchers to chart new ground rather than to replicate prior work.

Given these changes, what do we know about CALL?

Consistent findings

A number of findings appear to have withstood the test of time. Some of these have been replicated over the years, giving them increased validity.

Word processing works

From early work by Daiute (1984), it is clear that word processing helps learners become better writers. The evidence is strong for the benefits of word-processing in encouraging longer writing and more revision for both first- and second-language writers (Daiute, 1985; Phinney, 1988, 1991; Neu & Scarcella, 1991; Bangert-Drowns, 1993). Writing improves writing skills, and the word processor makes revision far easier than writing on paper. The benefits also come in part through greater motivation from using the computer and reduced anxiety about writing because of the ease in editing and revision.

One size does not fit all

Research on learning styles in general indicates that learners do not all learn the same way (see Dunn, 1990 for relevant research). Dunn also points out that "responding to how students learn significantly increases their achievement and attitude test scores… no learning style characteristic is better or worse than any other learning style characteristic; and … [children] need to be taught to their individual learning style strengths if they are to master new and difficult academic material (1993: ¶ 6 below "Continuing Questions" subhead). Soo (1999) focuses in on the link between learning styles and motivation when teachers use CALL, and

Ngeow (1999) offers specific recommendations for approaches to use in connecting CALL and learning styles.

Multimedia's ability to offer the same information in multiple channels (text, graphics, audio, video) provides an approach that can be effective in language learning (Mayer & Moreno, 1997, and Clark & Mayer, 2003, cited in Kumar, n.d.). Multimedia and hypermedia research has also indicated that people process information at different rates, and that overloading processing capacity – by too much information in different modes, conflicting information, and the like – results in less learning than if just one medium is used (Moore, et al., n.d.). Clearly, the information needs to be presented carefully so that images, audio, and text present complementary rather than conflicting input. Too many "bells and whistles" detracts from learning.

Another difference is between deductive and inductive learners. Those who are deductive learners tend to prefer presentation of rules, followed by examples. Inductive learners, on the other hand, prefer figuring out the rules on their own. People are rarely, if ever, fully inductive or fully deductive in their learning. Data-driven learning (Johns, 1991) was designed for inductive learners, though all learners can benefit. A concordance – presentation of a target word or structure in a number of different sentences – allows learners to use extensive data and come up with their own rules (Bowker & Pearson, 2002; Hall & Lee, 2006).

The teacher's role is key

Computers and other forms of educational technology do not operate on their own. In studies that have been replicated in a variety of ways over the years, the teacher is a key variable. How the teacher sets the stage and gives instructions plays a large part in research outcomes. The title of an early article by Chris Jones (1986) is as apropos now as then: It's not so much the program, more what you do with it. Piper (1986), Abraham and Liou (1991), Esling (1991) and Levy (1991) examined student interaction at the computer; all found a substantial effect as a result of how the teacher defined and organized the tasks for students. It is better when learning on the computer is integrated with the other classroom activities; the teacher can help learners see the links among different types of tasks.

Most learners like feeling special

Differentiated instruction, individualized instruction, and individual education plans are all ways that create a customized learning experience for students. Some of the earliest computer-based drills started by asking the student to type in his/her name. The computer then customized its responses by adding the student's name, as in "Good work, Phuong!" and "Try again, Lucie!" Nowadays, teachers can also use publication of student work in print – with distribution around the school, for example – or on the Web to give students a sense of pride and individuality with their work by providing an extended audience.

On the other hand, a consistent risk in research with people is the "Hawthorne effect." This is the risk that being part of an experiment will produce a positive change in behavior, no matter what the experiment is doing. Using a new software program, adding audio, increasing the lighting,

working online: these are all changes that can produce a Hawthorne effect, especially in a short-term experiment without a control group. While there is some doubt about whether this is a valid construct, certainly ascribing all changes to technology risks missing some other variables that might affect the change. Technology use thrives on the willingness to avoid looking for additional variables, and the practice has muddied the waters in technology research for years.

Some skills practice is helpful

Some elements of language respond better to practice than others. The audiolingual method made the mistake of considering all elements of language in need of habit formation. After a shift by some theorists away from all drills, the field is moving back toward selective practice. Folse (2004) points out the benefits that multiple exposure brings to vocabulary learning. Rather than just workbook-style drills, learners can use a variety of ways to attain multiple exposure, including gap-filling exercises (Vandergrift, 1999). The "focus on form" movement (Schmidt, 1995; Doughty & Williams, 1998) points to context-based corrections in grammar and usage rather than practice for its own sake. Although deductive learners (as mentioned above) are especially likely to respond well to practice, decontextualized practice does not create fluency.

People like games

One of the programs I had on my first computer was called "Colossal Cave," later "Adventure." I spent a lot of time looking for ways to use it in language teaching, but couldn't get past the one- or two-word commands (north, south, enter, take key, etc.). London Adventure circa 1985 provided a gaming element and language learning, where users had to use appropriate requests in order to buy the items they needed in a limited amount of time. Other CALL software creators have found ways to add gaming elements to almost all software, including (or especially) drills. An individual may be competing against a clock, against his/her best performance, or against another user or team. Research on games in education is extensive. Dixon discusses mainframe-based word games on PLATO (Dixon, 1981). Randel et al. (1992) present a review of research on educational games from the early 1980s in *Simulation & Gaming*, a journal dedicated to that topic for over 30 years. Virtual worlds are an emerging area for gaming, with some good results in EFL settings (Hannson, 2005).

Computers and CMC are engaging, and engagement works

A consistent theme in CALL research is how much students like using computers (and now, the Internet) in language learning. Several reasons have been proposed: novelty, the effect of multimedia and multiple learning styles, and the fun factor with simulations and games, as mentioned above. All these encourage engagement, with the resulting openness to language acquisition.

Research also shows the need for "consciousness-raising" in order for "uptake" to occur (Ellis, Basturkmen, & Loewen, 2001). Highlighting of key words (Jourdenais, Ota, Satauffer, Boyson, & Doughty, 1995) and use of graphics and sound with text (Kumar, n.d.) can help learners pay attention to salient features. Language failure, whether with a computer or a person, can also be an incentive for attention to form (Von der Emde, Schneider, & Kotter, 2001; Lewis & Walker,

2003). When learners try to derive rules from language data, as with a concordancer, they also are more engaged then when simply going through repetitive workbook-style exercises.

Chapelle and Liu (2007) stress the importance of authentic tasks in helping learners acquire language. They also point out that CALL is not inherently "authentic": rather, "Authenticity results from an interaction between the materials and the situation in which CALL is used" (p.126). Tandem learning environments, online discussion, chat, and other Internet-mediated group interactions offer the possibility of authentic contexts for language use.

Ongoing areas of relevant research – qualitative and quantitative

Carol Chapelle (1997, 2005) has suggested linkages between second language acquisition (SLA) research and CALL. Chapelle notes that CALL needs a strong theoretical basis, such as that provided by SLA research. It would be helpful to have meta-studies that explore the theoretical foundations (if any) of past CALL research. Another large consideration in CALL research is the relative lack of replication. A few areas have had multiple studies, but most researchers are looking for the new question, not a new twist on an old question. We don't really know a lot without going back and looking again, in different settings and with different learners.

Word-processing: What happens with the use of spell-checkers? What kinds of digital/audio comments by teachers are most useful in word-processed documents? Do translation functions help or hurt English language learners?

Work in groups: Does it matter if the groups are spread out over time and space? What do students learn from social networking sites? What do students learn from class email partners? Individual keypals? How should the tasks be structured for learners to get the most out of class or individual partners?

Role of the teacher: Much has been done related to conversation at the computer, and some with tandem class projects and web quests. What happens with different computer-based activities? What about wireless labs? What really makes distance education work?

Multiple media and learning: How much information is too much? Are younger people really as good at multi-tasking as they say they are?

Use of simulations and games: What makes a simulation "authentic"? How much do students learn from different types of games, such as word games, arcade-style games, collaborative games?

Attention and engagement: What learners benefit most from data-driven learning? How should tasks be structured? How do students interact with different user interfaces? Do student responses to technology of different types vary with to their English proficiency level?

Autonomy/self-directed learning: What do learners need to be autonomous? What uses of the Internet help students learn?

More: How do students respond to search engines – what do they need to know to make effective use of search engines? What do students learn from having their own websites? Podcasts? Blogs? Is the Hawthorne effect a real consideration in CALL research?

In short, while we have made some progress in understanding what it is that happens when teachers and students use computer technology, there is still a long way to go. Small-scale classroom-based (action) research or larger-scale, longer-term projects – they are all part of deciphering the answer to the question: What works?

Resources: CALL bibliographies

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