THE IMPORTANCE OF FEEDBACK AND REINFORCEMENT IN COMPUTER-ASSISTED LANGUAGE LEARNING (CALL)

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Abstract

A major focus of research in Intelligent Tutoring Systems (ITS) has been the identification and implementation of Feedback Strategies that facilitate student learning. Much of this research has been carried out on procedural skills teaching systems in areas such as algebra, physics or computer programming. Nonetheless, very little emphasis has been placed on studies and research on these types of strategies for language learning (Intelligent Tutoring Systems for Foreign Language). This article is an attempt to clearly establish the importance and necessity of feedback and reinforcement in Computer Assisted Language Learning (CALL). A brief description will be given about CALL, and its significance for second and foreign language learning. The terms 'feedback' and 'reinforcement' will be explained, with a view to establishing their inevitability in language learning. Subsequently, a discussion of these very terms will be discussed in the light of CALL, touching on some experiments done in this regard and stressing their centrality in determining the effective use of the computer to promote language learning. The suitability of Artificial Intelligence in language processing and second and foreign language error correction will be established.

Key words: computer, feedback, reinforcement, second language acquisition, intelligent tutoring system, language teaching and learning, artificial intelligence.

Introduction

When the computer comes up for discussion among foreign language faculty members, there tends to be little disagreement about its value in word processing and in scholarly research that requires complex text manipulation. There is a great deal of disagreement, however, about its value in language teaching. Some foreign language teachers are enthusiastic, but many are skeptical or hostile. At the very least, this disagreement provides unarguable evidence that language-teaching software, in contrast to word-processing software, is not yet sufficiently developed to persuade us immediately of its worth. Nonetheless, it is no more reasonable to dismiss the entire enterprise of computer-assisted language education because current software is inadequate than it would be to dismiss the efficacy of textbooks because some are bad.

This kind of debate about the appropriate role of the computer in the classroom is fundamentally misconceived, because, it is based on, and serves to perpetuate, a problematic split that affects all foreign language education, a conceptual split between knowledge of language, some understanding of its linguistic rules, and the ability to put that knowledge to use. We operate today on the assumption that knowledge of language can be "taught," while the ability to use that knowledge is a set of complex skills—skills such as comprehending spoken discourse, speaking, reading, and writing-that students must acquire. We know that "teaching" a complex skill is not the same as teaching a body of knowledge; in fact, a complex skill cannot be taught but can only be practiced until it has been learned. All the teacher can do to assist in the learning of skills is to structure the class environment to encourage practice, continually adjusting the demands of the environment to allow learning to proceed at an optimal pace. The problem is that in today's ideology this conceptual split automatically devalues knowledge in relation

to the ability to use it, and the entire field of foreign language education is bedeviled by doubts about how (or even whether) knowledge actually contributes to that ability.

The computer can play two roles in research projects investigating the nature of language learning. First, since it can track many details at once and analyze the relations among them, it can deal with far larger and more complex amounts of data than can human researchers, and this ability is crucial to the investigation of anything as complex as the underlying reasons for language learners' errors. Experienced teachers have well-founded hunches about why students have certain problems, but even a very good teacher with a very small class cannot constantly keep track of the details of each student's every language production under minutely specified linguistic and communicative conditions, all of which are needed to diagnose why individual problems occur. The computer can keep track of everything it can be programmed to recognize, so if the researcher can specify the conditions under which a certain error is caused by one misunderstanding and can specify other conditions under which "the same error" has different causes, the computer's tabulation of these conditions can be read with considerable certainty as an analysis of an individual learner's underlying processing problems.

In other words, Artificial Intelligence (AI) can deal with new problems, once the general principles and techniques for working with computer applications for language learning have been learnt. For example, to recognise the erroneous sentence of a student, a computer programme should have the same correct and incorrect forms. In this way, and so that the computer application can provide the student with feedback about why the sentence has errors, the system should also include a record of wrong rules. For an identical syntax error but with a different vocabulary, this application again should have the exact expression pre-stored in its memory. However, an intelligent program would only have to have a rule that the student uses for such an erroneous production. The programme theoretically could recognise the same type of error in any context and any vocabulary. Thus, given the power of AI techniques to correct the user at the same time that he is committing the error, such applications are considered as the best ally of the teacher in correcting L2 errors.

By taking into account the above, this paper aims to highlight the importance of feedback and reinforcement - through the use of the computer and other technological applications and programmes - to improve linguistic and communicative competence, as it relates to Second Language Acquisition (SLA). This article also outlines the main criteria to consider when introducing computer applications to aid in language teaching and learning. To this end, this paper highlights three empirical studies done with a view to establishing the need for feedback and reinforcement in language learning.

CALL

Computer Assisted Language Learning (CALL) is a type of educational technology designed to serve as a learning tool. In simple terms, it refers to the use of computer applications in teaching and learning languages.

The use of computational tools has become a new medium which shapes the processes and products of communication. Because multimedia technology has opened new opportunities for communication between teachers and learners, and among those who speak a second language, many language teachers have realised the enormous potential for teaching computer-mediated learning (Levy, 1998; Warschauer & Healy, 1998; Warschauer & Kern, 2000).

CALL in the past decade stopped being a mere phenomenon in life and transformed itself into an indispensable tool for teaching modern languages. Along with other technological advances, such as video, the number of students who participate in the experience of CALL continues to increase speedily. Computer Mediated Communication (CMC), which has existed primitively since the 60 (Warschauer, 2000), spread only twenty years ago and today is probably one of the computer applications with a profound impact on the teaching- learning of languages. For the first time, students of modern languages can communicate directly and conveniently with other learners or speakers of the target language all day, from their school, work or home.

In other words, CALL suggests and affirms that the computer has a variety of uses for language teaching: it can be a tutor, offering practical skills; it can be a stimulus or catalyst for discussion and interaction, or as a tool for writing and research. Garrett (1987:70) highlights the fact that "the use of computers is not a method but is an environment in which we can implement a variety of methods, approaches and educational philosophies". In other words, the effectiveness of CALL is not in the medium

itself, but how it is used in the process of language teaching and learning. This assertion by Garrett has much validity since the most important potential of the computer lies in its ability to provide an environment for language learning in which students are supported individually to develop, expand and refine their own language and communication skills in a new language. Computer Assisted Language Learning must be the focus of our efforts and without doubt, the development of their potential will significantly affect the way in which languages are taught and learnt in this century.

Feedback and Reinforcement

In recent decades, many studies have emphasized the significance of interaction in second language acquisition. Several studies have investigated cognitive variables such as working memory, attention, inhibition and noticing (Gass, 1997; Mackey, Adams, Stafford & Winke, 2010), many others pointed to a refurbishment towards capturing the social aspect of learning (Lave & Wenger, 1990; Firth & Wagner, 1997) and situating it in a social context. After all, learning does not take place where learners are clean sheets and teachers are the painters. On the contrary, learning takes place with the co-participation of all agents involved. In a recent study, Ellis, Loewen and Erlam (2006) invited scholars to do more research on socio-psychological factors that may influence learners' receptivity to corrective feedback. Motivation, in our point of view, is a good candidate to predict learners' receptivity to teachers' correction and can direct their attentional resources.

Teachers generally situate corrective feedback episodes in a meaningful context, which is generally effective for the purposes of communicative and meaningful teaching, but also generally conflicts with grammar teaching purposes. These types of interactions are laid out in "initiation, response, follow-up" sequences (IRF). Teachers provide the correction at the follow up section where learners are naturally expecting a comment on the content of their response. In the follow up line, students are not expecting to see a comment on their form. This constitutes the first problem. The second problem is that teachers might give an overwhelming amount of correction that would ideally set a good model sentence to have the students notice the gap between their original utterance and the standard target language, but learners' working memory might be capable of processing such condense information at once.

The term *feedback* in this context for example, has been viewed differently in various sources. James (1998) restricts the scope of the term 'feedback' to a type of specific response to errors, i.e. the type of intervention that informs the student of the fact that there is an error, but gives no description or specific diagnosis. In contrast, other theoretical investigations of Second Language Acquisition (SLA) (Spada & Lightbown, 1993; Ellis, 1997, Doughty, 2001, Gregg, 2001) like the most of the CALL specialists (Heift & Schulze, 2003; Cowan, Choi & Kim., 2003; Maingard, 1999; Kreindler, 1998, Warschauer, 2000, Pennington, 1989), appear to extend the meaning of the term to include any type of information returned to the learner after perform a comprehension or production task.

In SLA, feedback is seen as a feature of classroom discourse (Van Lier, 1996). As such, it is in favour of a non-interventional descriptive approach (McDonough & McDonough, 1997) to SLA research, in which discourse analysis plays a major methodological role. Thus, feedback is the evaluation of the paradigm Initiation-Response-Feedback (IRF) (Van Lier, 1996), within which both initiation and feedback are performed by the teacher, sometimes with a stifling effect on the controller on the student's production. Sometimes, the student has difficulty producing meaningful, complete, and true statements, and may be apprehensive of public assessment given in the form of feedback.

Intelligent tutoring systems for foreign languages have incorporated techniques of Natural Language Processing (NLP), for example, for the analysis of natural language input from students or to model the competency of a foreign language. All this is to provide students with more flexible feedback strategies and help guides in the process of foreign language learning. These systems use specific techniques of parsers (parsing) to analyse the response of students and identify errors that occur in these sentences. These capabilities of natural language processing have allowed systems to handle more sophisticated feedback strategies as metalinguistic keys and "bug reports" based on an analysis of the error introduced by the student's response (Levin & Evans, 1995; Nagata, 1997, Sams, 1995).

Feedback and Reinforcement in CALL

In CALL, the emphasis may have originally been on the behavioural sense of the term 'feedback'.

As Kreindler (1998) correctly notes, the simple 'correct/incorrect' feedback has been the kind of response that CALL programs most frequently offered and the students learned what to expect from such programmes. This is the legacy of CALL based learning, which put learning again on the agenda by entering the information into small steps (easily digestible) and provided the reinforcement of good habits through feedback at all times. Just like James (1998), Tschichold (2003) believes that such feedback is useful only to a limited degree.

On the contrary, Kreindler (1998), whose approach indicates the fair closeness to cognition, argues for the flexibility of feedback forms, to give clues to correct answers without trying to 'bribe' the student with inflated praise (Schulze, 2003) and, if necessary, draw students to a variety of online resources powered by hypertext and network-based multimedia. These resources may well be dictionaries, glossaries, encyclopedias, concordances or the Internet (Kreindler, 1998). The criteria to provide good feedback in CALL are, according to Kreindler (1998), the following: (1) focus on the content and meaning, (2) support learning instead of testing, (3) be communicative and moderate (4) get personal involvement, (5) promote cognitive skills (eg. inference), (6) provide cultural enrichment, (7) differentiate among students, (8) be simple, clear and economical. Thus, it is obvious that for Kreindler (1998) feedback is a constituent part of the teaching and learning in a predominantly cognitive way.

All this, however, reflects and encourages student participation in receptive language skills rather than productive. On the contrary, Tschichold (2003), who also resents the kind of 'correct/incorrect' feedback, is interested in promoting a genuine second language (SL) input, which does not seem to be supported by Kreindler's approach (1998). While Kreindler (1998) is silent with respect to feedback in the form of the SL output, the point of view of Kuettner (1998) on feedback is more accurate. In his opinion, (Kuettner, 1998), the objective of learning the software is to transport, repeat, reinforce and analyse information. While the former appears to be suspiciously behavioural, the latter seems closer to a cognitive approach and would give way to feedback on form. The analysis of Kuettner (1998) to write support software reveals that teachers tend to believe that one of the virtues of good software packages is to have students analyse to understand, especially when it deals with more creative language learning for students who know how to use the computer. This is according to Chapelle (1997), who is against the mere click as an output activity that is often and unfortunately the case in some CALL programmes.

Therefore, feedback in CALL, and in its feeder disciplines, has come to signify the information returned to the learner about the outcome of some action taken which may take a number of ways. The term 'reinforcement' also seems to be used in a rather loose way. Kuettner (1998), for example, uses it in distribution with 'information', even though originally it was associated with behaviour or cognition. Maingard (1999), on the other hand, introduces the term 'reinforcement' in CALL within the framework of evolutionary epistemology: this approach, derived by Donald T.Campbell and Gary Cziko on the basis of the epistemology of Popper science, sees knowledge first as a product of variation and selection processes that characterize the evolution (Heylighen, 1995).

Maingard (1999) agrees in particular with the hierarchical organization of knowledge as presented by evolutionary epistemology and the fact that without the lower level, which is the foundation for all subsequent learning, no progress can occur. She sees the lack of a solid foundation in SL learning, especially in the lower levels of competency and is enraged by the call of those followers of social interaction in the area of CALL for more communication and 'creativity'. Her argument is that without the key elements of language, creativity has nothing with which to work. She, therefore, makes a request for the restoration of the lowest level of learning, in which automaticity occurs through practice and reinforcement.

Maingard (1999) is accompanied in her request by DeKeyser (2001) who also believes in progressive automaticity and automation of certain linguistic and communicative tasks. He supports the idea of a three-dimensional SL curriculum that would move along the central diagonal of the low complexity of form, low complexity of meaning and low social pressure, to a higher complexity of form and meaning and increased pressure of linguistic functioning in socially demanding communicative situations. He believes that the automatic progression at each level, which he sees in a continuum, rather in a number of distinctive points like what evolutionary epistemology does, can be achieved by error feedback. Therefore, error feedback here assumes a similar meaning to the interpretation of reinforcement by Maingard (1999), an action that allows the learner to eliminate misperceptions and thereby achieve automaticity of knowledge.

To this end, Ferreira (2006) conducted an empirical study based on effective feedback strategies for the teaching of languages in e-learning contexts. Much of this research had been directed to dealing with procedural skills' teaching systems in areas such as algebra, physics or computer programming, etc. However, there has been little emphasis on studies and research on such strategies in language teaching (ITS for foreign languages). This paper reported on the design of effective strategies for corrective feedback ITS in foreign languages.

Empirical evidence was explored concerning the effectiveness of feedback strategies in a study based on the experimental design - pre-test/post-test and control group - in which students interact with an e-learning application. The objective was to provide effective guidelines for researchers who develop feedback strategies for ITS for foreign language learning. Two groups of corrective feedback strategies were investigated: Group 1, which included the repetition of error and explicit correction, and Group 2 considered metalinguistic keys and elicitations from the response of the student (without giving the response) (Ferreira, 2006).

Ferreira (2006) reveals that, in general, the results showed that the strategies of Group 2 (metalinguistic clues and elicitations) supported the teaching-learning process of the subjunctive in Spanish more effectively than the strategies of Group 1 (repetition and explicit error correction). After three weeks of the treatment process, the strategies, attempting to look for, extract or elicit responses about the sequence of tenses and subjunctive clauses, were statistically more effective in producing the correct forms in contexts that required the use the subjunctive mood. Ferreira (2006:123) states, "Now, as the treatment period was relatively short (3 weeks) and also small number of subjects (24 subjects), we will have to conduct further studies to confirm the trends have been observed in this work".

However, despite these limitations, the study suggests that students of intermediate and advanced levels were supported in their learning more significantly by Group 2 strategies. It is proposed therefore that ITS for a foreign language should implement corrective feedback strategies that encourage students to correct themselves and their mistakes.

L'Haire and Faltin (2003: 481) make the following observation about contemporary CALL and its potential to deal with errors:

Computer Assisted Language Learning (CALL) is a field in high demand for automatic language processing tools. The voice recognition software and speech synthesizers are certainly the most prominent sellable types of current commercial CALL software. However, the need in CALL for error diagnosis and intelligent and authentic feedback is great. Reliable error diagnosis systems allow users to overcome the limitations of multiple choice type questions and filling in the gap exercises, and to present communicative tasks to learners.

Although these are not explicitly stated in the text, the operating assumptions here seem to be those of Piaget's constructivism (Levy, 1998). The student is seen as an individual working alone with the computer as tutor, and not as a mere instrument. "The success, therefore, of the computer in the role of tutor, depends on how reliable the programme to monitor student learning and how timely, accurate and appropriate is the feedback" (Levy, 1998: 90). It would also appear that the type of feedback mentioned above would not be nearly as threatening as the teacher's publicly given feedback within the "Initiation-Response-Follow-up" framework, although on the surface, the purpose and structure may appear to be the same.

In another research done, Morales & Ferreira (2008) conducted an empirical study based on BLENDED LEARNING (face to face and e-learning classes) in which they provided provide effective guidelines for researchers who develop computer platforms for foreign language learning. The main objective was to visualize how the methodological principles from the language teaching approaches - Task-Based Language Teaching (TBLT) and Cooperative Language Learning (CLL) - could be applied effectively in the design of activities to develop language skills in e-learning and blended environments.

To this end, empirical evidence was explored about the effectiveness of learning English as a foreign language, in the face to face vs. blended modalities, in a study based on an experimental design - pre-test and post-test with control group. The results showed that the increase in learning English as L2 was higher in the experimental group that used a blended format than the control group who worked with the face to face modality. We propose, then, that models of blended learning methodology be included and implemented in the design of platforms for language teaching.

The use of feedback included in the platform JClic for focus on form exercises strengthened the statement about the importance of using different strategies defined in CALL and ICALL applications investigated in studies which suggest that its use increases second language acquisition (Ferreira, 2006 & 2007). By incorporating these strategies in this model, the student was able to reflect and analyze in depth the linguistic elements of the target language. In this case, the feedback was an aid for learning, by using the application in the non face to face moments (e-learning) periods. Also, as JClic platform provides different resources for presenting materials, students benefited from a richer input in relation to the grammatical form than what generally would be provided in traditional instruction.

Ferreira & Kotz (2010), in another study about the importance of feedback in CALL, designed and implemented a computational parser for the processing of grammatical errors in Spanish as a Foreign Language. The particularity of this input parser is that it must process erroneous entries and for this to happen, it is necessary to predict the mistakes that the user might make at a particular time of learning and specific grammar topic. The particular objective is to contrast the taxonomy from a theoretical basis on specialized literature with empirical samples resulting from an observational study in traditional classes in order to obtain more detailed information about the mistakes that ELE students could potentially make, especially for those whose native language is English.

This research focus has been enriched by research from different disciplines, including second language acquisition, intelligent tutoring systems in procedural contexts, and intelligent tutoring systems for foreign languages. Thus, this research not only favours a specific area of study but it also nurtures both the face-to-face, non face-to-face and semi face-to-face modalities for language teaching.

According to the above, it should be noted that modern computer technology allows students to practise and get feedback on both their written and spoken output (Krashen, 1987). The spoken output requires the kind of evaluative technology that might not be necessary for the assessment of written output; often, it includes the analytical elements that characterize some of the computer support applications for writing. Therefore, the analysis begins with identifying the main trends that lead to errors and processing errors written in the framework of CALL.

The design of Intelligent CALL (ICALL) systems is founded on two fundamental assumptions about learning. First, individualized instruction by a competent tutor is far superior to the classroom style because both the content and the style of the instruction can be continuously adapted to best meet the needs of the situation. Secondly, students learn better in situations which more closely approximate the situations in which they will use their knowledge, i.e. they learn by doing, by making mistakes, and by constructing knowledge in a very individualized way. Initially, the feedback produced by Computer-Assisted Language Learning (CALL) systems was limited to simple error messages, using a ``wrong-try-again'' approach to interaction that offered little information about the nature of the learner's errors.

According to Garret (1995), four types of feedback are proposed for error treatment:
(1) Feedback that presents only the correct answer;
(2) Feedback that pinpoints the location of errors on the basis of the computer's letter-by-letter comparison of the student's input with the machine's stored correct version (pattern markup); (3) Feedback based on analysis of the anticipated wrong answers. Error messages associated with possible errors are stored in the computer and are presented if the student's response matches these possible errors (error-anticipation technique);
(4) Feedback based on an NLP approach, such as the "parsing'' technique, in which the computer does linguistic analysis of the student's response comparing it to an analysis derived from the relevant grammar rules and lexicon of the target language, and identifies problematic or missing items of the student's response.

In order for these feedback strategies to be effective, as part of an ITS for a foreign language, other key issues to be addressed have to do with the tutor model and the student model. Treatment of this type of corrective feedback strategies of the system requires engaging with issues such as:
(1) The incorporation of feedback strategies in a natural and authentic way within a teaching approach;
(2) The definition of the degree of explicitness of feedback strategies. It is necessary to choose between feedback strategies that draw student attention to the error discreetly and those who direct the student's attention to the problem area more explicitly;
(3) Taking into account the degree of effectiveness of feedback strategies in accordance with the types of

error, learning level and type of strategy.

Conclusion

It is sufficiently clear that multimedia technology offers, no doubt, many advantages. It encourages the process of foreign language learning, which always requires a long and continuing effort by the student, in the sense that it provides many opportunities and facilities to get a better performance in this effort, while adapting to the individual learning pace of each student. It helps to develop, especially, oral and written comprehension, vocabulary acquisition and retention, and it also helps to improve pronunciation.

A good deal of ambiguity commonly attends discussions of foreign language research in connection with the computer. Among the literature faculty in the foreign language departments of research-oriented institutions, the use of the computer is usually linked to scholarly textual research, in which the computer performs text manipulations such as collocations. In foreign language education, research projects are usually methodological, and research on the computer is often assumed to focus on the computer's efficacy in delivering foreign language instruction. In addition, the computer can collect the same kind of student language output as do paper-and-pencil exercises; it can be programmed to recognize correct and incorrect language and to supply scores on which to base conclusions about various methodological treatments.

The development of software is not recognized as research by most major research universities, any more than is the writing of textbooks. Furthermore, the computer-equipped "language lab" is almost universally thought of as a service unit, a place for the most mechanical, most tedious aspects of language instruction, not as the locus for substantive promotable research. For both these reasons, junior faculty members who are interested in the use of the computer are often warned that such activities will not count toward tenure. This is a serious problem, resulting in the waste of significant opportunities for the advancement not only of these faculty members but also of the field of foreign language education itself.

The solution depends on certain complementary changes. On the one hand, foreign language faculty members and administrators above the department level must understand what distinguishes this kind of research from "pedagogical" studies and what its value is. On the other hand, setting up a computer site to accommodate language-acquisition research by faculty members as well as language-learning activities by students is not a matter of extra hardware or even of much extra expense. The real essential is the staffing. To have validity as a research facility, the centre must be an academic unit directed by someone with research credentials in the field.

To accomplish that change in perception we need also to enhance the visible status of the research, and one factor in that status is the attitude toward the research locus itself. As long as the "language lab" is thought of as nothing more than a roomful of machinery where students slog through dreary impersonal drills, faculty efforts in that arena will have no prestige.

The most important potential of the computer lies in its ability to provide a richly supportive language-learning environment in which students are helped individually to develop, expand, and refine their own expressive and communicative abilities in a new language as well as to understand what language and language learning are all about—surely important parts of a liberal education. Computer-assisted learning must be the focus of our efforts, but our development of its potential will significantly affect our teaching and our research as well.

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