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Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education (ASCILITE)

Adelaide, Australia
7–10 December 2003

Editors
Geoffrey Crisp, Di Thiele, Ingrid Scholten, Sandra Barker, Judi Baron

Citations of works should have the following format:

Author, A. & Writer B. (2003). Paper title: What it's called. In G.Crisp, D.Thiele, I.Scholten, S.Barker and J.Baron (Eds), *Interact, Integrate, Impact: Proceedings of the 20th Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education*. Adelaide, 7-10 December 2003.

ISBN CDROM 0-9751702-1-X WEB 0-9751702-2-8

ascilite
Australasian Society For Computers
In Learning In Tertiary Education

Published by ASCILITE www.ascilite.org.au

HUMANISING AUTOMATED ONLINE LEARNING THROUGH INTELLIGENT FEEDBACK

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Abstract

Recently there has been considerable emphasis on constructivist approaches in online learning. This is not surprising since the new technologies, offering sophisticated synchronous and asynchronous communication environments, lend themselves to process-oriented activities in authentic, real-life settings. However, what has also come to light is that engaging students in this sort of learning requires a large commitment of time on the part of the tutor. This paper argues that including automated activities in the students' whole learning experience may help redistribute scarce tutor time and address the important issue of achieving linguistic accuracy in language learning. The focus of the paper is on how these activities might be made more personalised in nature than the traditional drill-and-practice paradigm, suggesting the use of intelligent feedback structures, including graphics and games.

Keywords

Online learning, intelligent feedback, language learning, CALL, ICALL, graphics

Introduction

The importance of feedback emerged very strongly, expressed by students of all ages, in a series of studies carried out by the author on student perceptions of the Web as a viable environment for language learning (Felix, 2001). This observation is supported by studies in other fields (Lyall & McNamara, 2000; Sims, 2000), as well as by earlier studies on distance education (Haughey, 1990). It is also an element strongly emphasised in papers dealing with quality indicators for online learning (Illinois Report, 1999; Ragan, 1998; Kearsley, 1998), and in discussions about creating interactivity and sustaining motivation (Goodfellow, Manning & Lamy, 1999; Labour, 2001; Fallows & Ahmet, 1999). Yet, despite compelling calls for meaningful, contextualised and, where possible, personalised feedback, a detailed survey of what is currently offered online for language learning (Felix, 2001) still shows a great preponderance of the drill-and-practice paradigm. There are several plausible reasons for this domination:

- The feedback freely available for us to look at online is not, and cannot be, a true indication of feedback in the courses concerned, since in many cases it may represent only part of what is being done. It is likely that personal feedback provided through chat sites, bulletin boards, discussion groups, audiographics and email remains largely invisible to the casual visitor. Equally importantly, server-based applications in which the program knows how the user has performed previously and tailors the on-screen material accordingly, are by necessity restricted to enrolled participants.
- For reasons of ease and speed, teacher developers favour the use of simple templates (such as *Quia* and *Hot Potatoes*) and applets to produce student exercises, and this naturally limits what can be done. While many teachers are attempting to contextualise the work and are including the use of illustrative graphics, these exercises still largely represent drill-and-practice of various items with feedback restricted to right or wrong indications.
- Questions with only one correct answer - or at least a very limited number of alternatives - are not only the sort of activity that computers can mark most easily, but also constitute the sort of drudgery that teachers have long been tempted to transfer from humans to machines. A powerful drive here,

therefore, is the desire to generate significant savings of time that would otherwise be put into marking.

The last two points clearly reflect an attitude that is still common: we ask what the computer can do for us, rather than what we can do with the technology (Felix 2002). The result is that activities are accompanied by mechanical feedback on rote learning of facts, vocabulary and grammar. While this process has some merit - students like the instant feedback that computers can provide, and some of them will spend many hours at the screen in pursuit of the perfect score in the exam - it is far removed from providing the full repertoire of human feedback.

> *The key action for the educator is the use of positive and encouraging feedback. The nature of this feedback will vary with circumstance and will range from non-verbal communication (such as smiles and nods of the head) through oral praise (using encouraging words such as 'good' or 'excellent' as appropriate) to formal written comments on written work. Praise, as a tool to inspire students, is particularly effective if directly linked to the student's achievement of a specified learning outcome. For the less motivated student, there is also benefit in focusing praise on the effort put in since this will reinforce the link between the work undertaken and the achievement of the desired outcome. The key requirement is to build the understanding that achievement is not merely a matter of luck or a preordained inevitability* (Fallows & Ahmet, 1999:3).

While these recommendations were made in the context of face to face teaching, there is no reason why online experiences should be more impoverished in terms of positive reinforcement. Overall, the proposed action might seem a tall order in an electronic environment, but in some instances the technology offers an advantage over what can be done in a classroom setting. Computers can provide individualised feedback when it is difficult in the classroom to attend to all students equally and fairly at all times; automated feedback can be more frequent and directly linked to very small achievements; a computer will tirelessly continue to give anonymous feedback, independent of moods and personal relationships, and independent of time and place. Of course, the more sophisticated the approach we adopt, the more resources in infrastructure and time will be required - a result that will seem paradoxical to those who embarked on computerisation in the first place in order to save time. Yet, commitment of time remains one of the crucial factors in the success or failure of online ventures (Felix, 2003a), especially now that there appears to be a move towards labour-intensive constructivist approaches. Looking at labour-saving automated activities, therefore, is more timely than ever, and finding ways of blending these into a pedagogically sound curriculum is a great challenge indeed.

The purpose of this paper, therefore, is to take a look at (1) why we might reconsider the use of automated computerised activities that are instructivist in nature, rather than dismissing these as inferior to social constructivist ones; and (2) how these can become more humanised and pedagogically sound than the traditional drill-and-practice paradigm.

A rationale for retaining instructivist elements in online learning

During the last decades there has been a move away from theories favouring instructivist approaches to constructivist ones, engaging students in problem solving, situated learning and co-operative activities. Interestingly this move does not reflect radically new philosophies in teaching but sees us returning the pendulum once again to progressive methods (see Windshitl, 2002; Bain, 2003), reflecting the theories of Vygotsky (1978), Dewey (1963) and Leont'ev (1978) who emphasise interpersonal, experiential, activity-based learning. It is important, though, to point out that the plethora of learning theories is so varied, and in some cases overlapping, that it would be naïve to suggest a black and white divide into strictly opposing schools of thought (Duffy & Cunningham, 1996; Goodyear, 2002). Furthermore, constructivism itself contains several different conceptual and philosophical paradigms, with the two major schools of thought representing cognitive constructivism on the one hand, and social constructivism on the other. Perhaps the most significant, yet still fairly simplistic difference between exponents of instructivist and social constructivist approaches is that the former focus on the individual in the group, believing that cognition occurs in the head of the individual, whereas the latter emphasise the socially and culturally situated context of cognition, in which knowledge is constructed in shared endeavours (Duffy &

Cunningham, 1996). Another important distinction is the focus on the outcome of learning in the former compared to inextricably linked processes and outcomes in the latter.

Few would dispute the value of social constructivist approaches in humanistic terms. After all, addressing needs and interests of students; engaging them in authentic, real-life tasks; allowing them ownership of the curriculum, to name only the most significant elements, constitutes sound pedagogical values. However, both enthusiasts and critics (Mason, 1993; Levy, 1997; Felix, 1999, 2002; Bain, 2003, and especially Windshitl 2002) have articulated challenges and concerns that cannot be ignored. The major issues that have been discussed are (1) the problems that might arise through poor group dynamics, resulting in what Kollock & Smith (1996) have termed *social dilemma*; (2) the need for labour-intensive authentic assessment procedures (Felix, 2003b); and (3) what seems most pertinent for language learning: the added difficulty in achieving linguistic accuracy. While it is not suggested here that these challenges are insurmountable, what has become abundantly clear to anyone involved in constructivist ventures is the fact that addressing them has major time implications (Felix 2003a). If we are serious about achieving the best results for our students, we must be prepared to invest serious time in monitoring group dynamics, devising elaborate assessment procedures that match the processes of learning in which students are engaged, and finding ways of raising linguistic accuracy without compromising a learning climate that emphasises risk-taking while allowing students to make errors in a safe environment. A tall order indeed, especially in view of the impossibility of conjuring up many extra hours in our working day. However, why not revisit what the computer can do for us in automated terms? Through many years of battling with time constraints, this author feels strongly about combining instructivist and constructivist approaches in online learning, because the former will free up considerable time to engage more fully in the latter. Naturally this claim only holds if we do not have to carry out all of the developments ourselves. There are numerous resources available on CD-ROM or on the Web that will engage students in many hours of work for listening and reading comprehension, and the acquisition of vocabulary and cultural knowledge. As mentioned above, however, these resources tend to consist predominantly of traditional drill-and-practice paradigms with poor feedback structures. If we are serious about the value of engaging students in meaningful, contextualised activities, it would seem unnatural to disrupt the overall climate and dynamics of the enterprise by sending students off to engage with impersonal, decontextualised materials. The second part of this paper will therefore look at how automated activities for language learning might be enriched and humanised in various creative ways, in particular detailing which features might be instrumental in the quest for better pedagogical practice in automated online feedback.

Humanising automated feedback

Feedback containing hints

As well as hints before an exercise is attempted, a hint facility can be provided if the first response was wrong and a further attempt is allowed. Hints are not at all widespread, but it should be obvious that feedback that consists solely of marking the error in red - still less blanking it out - does little to help the student learn. While students appreciate the immediacy of automated feedback, they often complain about its quality (Felix, 2000a, 2001) and some have specifically deplored the absence of useful online hints in Lanny & Musumeci (2000). Current sites display various forms of hints, which are conceptually so different from each other that it hardly makes sense to describe them by the same name. Although there is considerable overlap, we have broadly divided them here into structural and personalised types.

Structural hints
At a purely mechanical level, feedback uses pattern matching (by words, or by individual letter) to generate a report on how much of the response was correct. Ideally, all the elements that are correct will be identified. In practice, this is easier said than done. The simplest approach is to scan the response letter by letter (or word by word) from the beginning and display any matches. Some programmers stop the matching when the first error is found. Since this leads to a very small amount of help when the mistake occurs early in the answer, it might be better if the scan could be undertaken from the end of the response as well as from the beginning. The sort of activity in which pattern matching makes most sense is where the response is constrained. Requiring a set of scrambled words to be arranged in a sentence (by, for

example, drag and drop) lends itself well to this approach, since all chance of misspelling is automatically eliminated.

Personalised hints

These contain personalised messages such as "well done, Sandra" or "oops, have another go Paul". More helpfully, they can offer detailed comments on why a response was incorrect, with a reference to where more information can be found (see Fig.1). Comments that are largely positive, even when the response is incorrect, give a much better feel to a program than a large bank of variations on the theme of "Wrong! Try again" (Robinson, 1991; Brandl, 1995). However, it must be kept in mind that some students may feel patronised by anything other than being told that the answer was incorrect.

Figure 1. Graphics as semantic help with personalised message

The hint can take the form of an explanation of the point at issue, the object being to help the student engage in metacognitive reflection on the problem and use that understanding to produce a correct repeated response. This sort of feedback is going to be possible or, at least, highly accurate only for foreseen errors, though collecting student responses should allow for a rich database of likely errors to be built up over time. Two excellent examples of this type of hint have been developed by Heift (2001, 2002) in the context of teaching grammar, and by Pujolà (2001) to help with reading and listening comprehension. Heift's feedback is generated by an Intelligent Language Tutoring System (ILTS). The parser-based system analyses student input and provides error specific feedback, exclusively in the target language, and includes a facility that matches feedback messages to learner expertise and provides remedial exercises (Heift, 2001:99). The underlying pedagogy of the program reflects Garrett's (1987) discussion of the use of Natural Language Processing (NLP) for providing sophisticated feedback in which the individual explanation of errors mirrors more closely what might take place in a face to face setting. An interesting aspect of Pujolà's program is that it also provides a delayed two-step option that allows users to reflect on the reason for an error before accessing the explanation. Both authors have run evaluations on their systems which showed that the majority of learners do in fact make use of these hint facilities. Furthermore, Heift cites a number of studies that have found positive effects of metalinguistic feedback over traditional forms (Nagata, 1995, 1996; Nagata & Swisher, 1995). She also points to

research by Van der Linden (1993) which showed that lengthy feedback messages are not being attended to and that feedback dealing with multiple errors was found to be too complex. Virvou, Maras & Tsiriga (2000:13), who developed a similar program to Heift's for teaching the passive voice of English grammar, found that the 'Passive Voice Tutor was successful in achieving a high degree of compatibility with the human experts' opinion'.

Using a similar Intelligent Computer Assisted Language Learning (ICALL) system, Chen & Tokuda (2003), Chen, Tokuda & Xiao (2002) and Tokuda & Chen (2001) have developed a sophisticated program for online translation training based on template pattern matching. The templates use words or phrases as a minimal unit, with the databases selected by experienced language teachers in the light of responses collected from sample students. The program includes a heaviest common sequence algorithm for matches aimed at identifying, from among a large number of possible paths embedded within the template, the path with the greatest similarity to the learners' input translation. What the program delivers is error contingent feedback for each student input.

While less sophisticated in terms of ICALL, an interesting approach to providing personalised feedback comes in Arana's *Spanish Language Exercises* which provide explanatory comments on correct answers as well as erroneous ones. Reinforcing success in this way seems a humane approach to the material. It is motivating, and it is an excellent way of increasing the illusion of personal contact. Not that comments do not sometimes irritate. Jovial responses to correct answers - whether the same one every time or one selected at random from a small list - can grate. Elaborate sound effects tend to be the most irritating versions in programs where students will hear the same sound repeatedly at every right or wrong turn. Neutral responses (*Yes/Right* or *No/Sorry*) look safer here, even if they are not 'interesting'. The problem in creating something more imaginative is striking the right tone for the audience. Testing various options with the target group is imperative here. Alternatively, graphics offer attractive options.

Graphics as feedback device

Although research in this area is scarce, there is some evidence of positive effects of graphics used in teaching, especially in science subjects (Hedberg & Alexander, 1994; Kaufmann, Schmalstieg & Wagner, 2000; Moore, 1995; Dalgarno & Hedberg, 2001). Visual interface in general is seen as a fundamentally important element in online design (McGreal, 1997; Jung, 2001). Many different ways of integrating graphics into the learning resource are being used, ranging from simple stick figures to sophisticated simulations using virtual reality applications. To date there is no evidence that the latter produce better results than the former - investigations of this sort would contribute significantly to the field. Again, representation of graphics is here broadly divided into structural and personalised types.

Structural graphics
These are generally simple pictures and drawings to illustrate a particular structural point or reinforce what is being introduced in textual and/or aural forms. Multisensory input has long been held to benefit learning for two reasons. On the one hand different areas of the brain are stimulated simultaneously, on the other different learning styles (visual, auditory, symbolic) can be catered for (Dede 1996).

Very few studies have investigated the role of graphics specifically in language learning. Hew & Ohki (2001) found that Animated Graphical Annotation - a set of animated graphics representing visually the accent of Japanese words - was effective in improving students' listening skills. In our own studies we found a significant relationship between students' rating highly the usefulness of graphics (in this case simple stick figures) and working longer hours online (Felix 2000a). Amusingly, a participant at one of the author's presentations raised the question whether this could not simply have been the result of long download times! While this was not the case here, it is an important consideration in designing graphics. At no time should a desire for sophistication and look outweigh the pedagogical value of the item itself, especially not when functionality might be compromised.

Tokuda & Chen (2001) developed a part of speech tag parser which provides a visualised parsed tree of acceptable accuracy. This operates by applying the parser to the closest model translation to obtain the best matched path to the student input translation, and identifying all deviations from the correctly parsed

trees as errors. The parser not only provides a visualized tree demonstrating where students' errors are located but also acts as the base for setting up an efficient learner model showing how these errors can best be repaired (Chen et al., 2002).

Personalised graphics

Accompanying characters acting as a tutor-companion feedback device have the potential to change the entire dynamics and climate of an online course. Pinocchio in *Cyberitalian*, Lina and Leo in the popular Goethe German course for beginners and the witch Hexe Hilde in our own intermediate German course *Hildes Hexenwelt* add a personal dimension to interacting with a program that can add interest and curiosity and communicate humour and enthusiasm. It also helps in the creation of a larger and more varied repertoire of automated responses. Hexe Hilde who is young and quirky has her own special vocabulary which represents how German teenagers communicate these days. She can also swing a magic wand in approval or sweep away an incorrect response with her broom, appear as a contestant in a game show, and be the one to whom assignments are being sent. A word of caution: Overly enthusiastic, gratuitous use of these, especially in animated versions, can become as irritating as sound effects; we only need to remember Microsoft's experience with *Clippy*, the animated Help sprite in Office 2000, which became so hated that it was he abolished from Office XP.

Figure 2. Graphics as personalised dimension

Games

The literature shows an ever increasing interest in drawing from the game genre to enhance teaching programs (Amory, 2003; Jones, 2003), and this author's own focus group feedback sessions with students of all ages suggest very strongly a motivating effect if nothing else (Felix, 2000b). There are currently large repertoires of games freely available in German, French and Spanish in which feedback for vocabulary and grammar exercises is provided in the style of popular games (Felix, 2001). One example follows the model of *Who wants to be a millionaire?* with each successive correct answer visibly bringing the student closer to the goal. For true authenticity, a wrong answer should terminate the exercise, or at least, in *Weakest Link* style, return the score to zero, but perhaps this would be too demotivating. Another uses a matrix of tiles to construct a quiz format, where the rows might cover a stated domain (like geography) with each tile in that row containing a question. This exercise can be played by one, but it can also be set up as a competition between two players who take turns at picking questions. These TV quiz formats are visual and familiar to many, so they make sense as the basis for games, if designers want to include such activities in their courses.

In terms of student interest, there is good reason to provide a total score at the end - and quite possibly a running score as well when the questions are marked one by one. *French@Austin* has an attractive way of reporting the final results (correct, incorrect, not attempted) in a bar graph. Other sites store results and tap into student competitive spirit by printing out (say) the top 20 scores that have been achieved so far, or in the past day, week or month. It might seem that names need to be collected to make the league tables most meaningful, but many students find this threatening and will prefer the safety of anonymity or pseudonymity and forego the public triumph.

Conclusion

This paper presented a case for combining instructivist with social constructivist approaches in online language learning. What is significantly different in an online environment, when compared to a classroom setting, is the fact that we have the opportunity to deal simultaneously with radically different approaches for providing our students with materials, feedback and contexts for interaction. On the one hand, we have the ability to expose learners to reasonably sophisticated automated activities that will engage them in autonomous, predominantly cognitive and metacognitive processes. On the other, we are in a position to exploit the unique opportunities of networked systems to engage students in social constructivist learning, in which they interact and collaborate in process-oriented real-life activities. Although quite different, the two schools of thought complement each other well in an online environment, especially if we take care to humanise and personalise automated activities as much as possible within current technological limitations. It was suggested here that the use of intelligent feedback, including creative use of graphics and games might lead to a more blended learning climate than separating CALL activities and interpersonal activities, which is the predominant mode in face-to-face language teaching. It is hoped that this might (1) provide opportunities for a redistribution of tutors' time, provided of course that developments are not carried out simultaneously; (2) produce a more motivating learning climate than we find in traditional distance education and perhaps even some classrooms; and (3) lead to better linguistic accuracy. To test these bold assertions will make a rich topic for further research.

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