The Role of Scaffolding in a Learner-centered Tutoring System for Business English at a Distance

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This paper was shortlisted for the 'Best paper award' at the
Third EDEN Research Workshop, Oldenburg, Germany, 2004

Abstract

English Abstract

This paper considers some of the key theoretical frameworks and concepts in the field of learning and their application to a system for the tuition of business English. A critical overview of learner-centered technology is undertaken from the perspective of the mainstream theoretical frameworks that have been adopted since computer-assisted learning started. Attention is then given to the specific concept of educational scaffolding, a recently revitalised topic that many teachers and educational systems adopt to intervene in the learning process, assisting the learner mainly in the early stages. Finally, an application of some of these key theoretical principles to a personalized learner-centered system for the tuition of business English, called I-PETER, is presented.

Spanish Abstract

Este artículo considera algunos de los conceptos y marcos teóricos clave en el campo del aprendizaje y su aplicación a un sistema de tutorización de inglés para negocios. Se realiza un análisis crítico de la tecnología centrada en el aprendiente desde la perspectiva de los marcos teóricos fundamentales que se han ido adoptando desde el comienzo del aprendizaje asistido por ordenador. Además, se presta especial atención al concepto específico de andamiaje didáctico, un elemento revitalizado recientemente que muchos sistemas adoptan para intervenir en el proceso educativo, asistiendo al aprendiente sólo cuando éste lo necesita, que viene a ser habitualmente en las primeras etapas de su aprendizaje. Por último se presenta I-PETER, una aplicación de algunos de estos principios teóricos analizados a un sistema personalizado y centrado en el aprendiente para la tutorización del inglés para negocios.

Key Words

CALL, Scaffolding, Learner-centered technology

Introduction

The dominant educational paradigm is still very much "instructional" in the sense that learning is viewed as an information transmission process[1]. As Soloway et al. (1996) describe it: teachers have the information, learners don't, and lectures serve to transfer the information from the teachers' heads to those of their learners. However, there have been numerous arguments presented about the need to actively engage learners in the learning process: constructing understanding and meaning, not just receiving it.

Soloway (1997) offers a solution to the many problems of the traditional didactic instructional models in the design and development of a new set of technology-based tools. Although it could be argued that technology has not changed the core of the learning process substantially, it cannot be doubted that computer-assisted learning is here to stay. Among its appointed advantages over traditional face-to-face methods is the relative flexibility of access and usage in terms of time, space and progress, and the absence of personal relationships teacher-learner (which are not always positive and stimulating for the learner; Mueller, 2001), to name but a few. However, a common shortcoming of many of these systems is that they are not sufficiently flexible in two senses: they do not adapt to the different needs and preferences of each learner which, furthermore, typically change to a certain extent for a particular person in the different phases of the learning process. Individually customized software is, like private tuition, out of the question for the immense majority for practical reasons. Soloway claims that the best way to address the diverse needs of individual learners in their different learning stages is via what this author defines as *learner-centered technology*, which is discussed in the following section.

Throughout the last three decades of computer-assisted language learning research, different approaches have been developed, from the earliest vocabulary and grammar trainers to multimedia and Web-based workbenches that reflect the current interest in communicative intent and functions within Linguistics, and eclectic pedagogic theories and approaches including Cognitivism, Constructivism, and Scaffolding. The authors' experience of interactive on-line language learning using such frameworks is that, although it is currently unfeasible to design the perfect tutoring system, it is possible to solve a subset of problems present in a particular domain, especially if the system is sublanguage-based, which offers advantages such as considerable quantitative reductions in the scope of the domain (terminology, grammatical repertoire, etc.), qualitative simplifications for organising the corresponding syllabus, and a positive attitude on the part of a highly-motivated learner. In this paper a system called I-PETER (Intelligent PErsonalised Tutoring EnviRonment; Read et al., 2002; Bárcena et al., 2003; Read et al., 2003), based upon the previously mentioned disciplines, is presented as a proposal for providing *flexible, individualized learner-centered tuition of business English*. I-PETER is a system for on-line distance learning in a context where a very large number of students typically restrict the teacher's possibilities to provide individualised guidance.

This paper presents the extent to which the learner controls the system and the role played by scaffolding for providing not only effective assistance (what is needed and when it is needed), but also enhancing the learner's cognitive skills. In the following section, a critical overview of learner-centered technology is undertaken from the perspective of the mainstream theoretical frameworks that have been adopted since computer-assisted learning started. Attention is then given to the specific concept of educational scaffolding, a recently revitalised topic that many teachers and educational systems adopt to intervene in the learning process, assisting the learner mainly in the early stages. Finally, an application of some of these key theoretical principles to a personalized learner-centered system for the tuition of business

English is presented.

Towards learner-centered technology

Over the last twenty years research in computer-assisted learning has been moving progressively towards learner-centered systems, in which the student becomes more and more the protagonist of his own learning process, as he is expected to actively search for data and information using various cognitive capacities in a complementary, creative, and inquisitive way (Verlee Williams, 1999), based upon the continuous negotiation of goals and methods with the system.

The situation was different at the beginning of the 80s, when computer-based instruction was characterized by the use of behavioral-based software that was prescriptive in nature and relied heavily on drill-and-practice to teach segmented content and/or skills. The control of the learning process passed then largely from the teacher's hands to those of the computer programmer. This was a time of inert knowledge (no reasoning or judgment was stimulated), although it could also be argued that automated learning was somewhat less passive than the traditional print-based counterpart, since it allowed learners to self-pace their movement through established lesson programs. However, research shows that learners benefited to some extent from the technology when the learning objectives were behavioural: "[programmed instruction] opened up new possibilities for individualizing instruction, for teaching diagnostically, and for providing a real school situation for the scientific study of learning" (Saettler, 1990).

Sometime later, advances in technology and learning sciences have led researchers (e.g., Berryman, 1993; Streibel, 1993) to adopt a different point of view: they see learning with technology as a valid means for building problem-solving skills and for achieving learner autonomy. Regarding cognitive psychology, Mandler (1985) makes the observation that: "the emphasis is to develop systems and structures that can be said to construct the observable, evidential aspects of thought and action." Advocates of this view propose that the learning process is about changes in learners' perception and mental structures. The analysis of such structures enables us to present learners with appropriate experiences and problems in order to facilitate the growth of their knowledge. Educational cognitivist technology has therefore shifted psychological thought and research from a focus on "procedures for manipulating instructional materials to procedures for facilitating learner processing and interaction" (Saettler, 1990). Unlike behaviorism, it is descriptive in nature and emphasizes looking at how we know rather than how we respond, and analyzing how we plan and strategize our thinking, remembering, understanding, and communicating. The emphasis is on how learners develop skills in logic, solve problems, and follow directions, all clearly higher-order thinking skills.

The cognitive approach is the starting point for the constructivist models of learning that are proliferating these days, in which learners are seen to be engaged in the active construction of their understanding and knowledge, adapting their understanding to their existing mental structures. The emphasis is clearly placed upon individual cognition; a teacher's words do not directly become engraved in a learner's mind after entering through the ear; they are interpreted and reflected upon by the learner (Lave, 1993). Constructivists believe that learners construct their own reality or at least interpret it based upon their perceptions of experiences, so an individual's knowledge is a function of one's prior experiences, mental structures, and beliefs that are used to interpret objects and events. The methods of constructivism emphasize the learners' ability to solve real-life, practical problems; they tend to focus on projects that require solutions to problems rather than on instructional sequences that require the learning of certain content skills. While the role of the teacher (and/or the system) is basically reduced to facilitating the required resources and to act as a guide to learners, who set their own goals and "teach themselves" (Roblyer et al., 1997).

Therefore, the argument is that there is currently a strong trend away from instructivist systems in favour of constructivist ones, which are seen to be clearly superior in that they attempt to present learning materials in a fashion that is closely tuned to how the learner's internal cognitive processes actually take place, favouring comprehension, meaningful assimilation. However, designing and developing software that *truly* addresses the needs of learners is a real challenge. Since the learners are also users, all the principles of user-centered design, of course, still apply here. Easy-to-use software requires focusing on the its potential users from the very beginning, and checking each step of the process to be sure they will like and be comfortable with the final version. The user-centered design process starts by identifying the target audience, and representative users are ideally recruited to work with the (multi-disciplinary) team. These users can help establish the requirements for the product by answering key preliminary questions such as: what they want the software to do for them; in what sort of environment they will be using it; or what will their priorities be then.

It is to be expected that learners have additional needs that must be addressed and incorporated in their software. Many authors have attempted to provide exhaustive lists for specific educational domains. Soloway et al. (1996), for example, succinctly summarise them under broad categories of universal applicability:

- *Growth*: the main objective of educational software must be to promote the development of expertise; it must allow the student to "learn how to do while doing". He must also be aware of his newly acquired competence, not only as a motivational factor, but also to help integrate it into the rest of the existing knowledge.
- *Diversity*: cognitive, cultural, gender, etc. differences play a major role in the effectiveness of materials for individual learners. In order to be truly useful, software must address these differences.
- *Motivation*: in contrast to software developed for professionals, the learner's initial interest and continuing engagement cannot be taken for granted throughout the process until the end.

Scaffolding

Scaffolding is claimed by many to be a key concept in the quest for a more inquisitive, individualistic learner-centered model. Although it has been around for a long time under several names, there is no appropriate definition for "scaffolding" in the educational sense. McKenzie (1999) explains the metaphor: "we tend to think of structures thrown up alongside of buildings to support workers in their skyward efforts". Greening (1998) uses the term "scaffolding" in a wide context to refer to all forms of learning support, i.e., to the whole range of services provided to assist learning. McLoughlin & Marshall (2000) define "scaffolding" as "a form of assistance provided to a learner by a more capable teacher or peer that helps the [learner] perform a task that would normally not be possible to accomplish by working independently". All these contributions, however, fail to emphasize what is most interesting about scaffolding: not so much what it does while the support is there, but the fact that it enables the learner

continue with his learning process in an autonomous, self-sufficient manner when it is not there any more. In other words, it is crucial that the scaffolding does not imply long-term dependence on the part of the learner, which would inevitably lead to ill performance when he tries to apply the knowledge outside the "safe" context where it was learnt.

McKenzie (1999) identifies eight characteristics of scaffolding which can be directly related to learners' requirements as presented in the previous section. Firstly, the learner's awareness or expertise can start to "grow" through confident learning because *scaffolding provides clear directions*, that is to say, step-by-step instructions to explain what to do in order to meet the expectations for the learning activity (by means of user-friendly directions, anticipating problems or ambiguities, etc.). Secondly, *scaffolding points learners to worthy sources*, which means that confusing, misleading and unreliable information is to be avoided so that the learner concentrates his time and efforts in reasoning, reflecting, associating, analyzing, researching and assimilating. Thirdly, *scaffolding keeps learners on task*, which also basically means that by providing a pathway for the learner, he will not go astray, waste energy and become confused, all of which could eventually lead the learning process to a dead end. Fourthly, *scaffolding reduces uncertainty, surprise and disappointment* in order to try and eliminate distracting frustrations to the extent that is possible. Material designers are required to test every step to anticipate what might possibly go wrong before the material is given to the learners. Fifthly, *scaffolding clarifies purpose*, because this way the knowledge becomes more meaningful and worthy to the learner, which is fundamental for his motivation. Boredom fed by irrelevance and ignorance will, in the best of cases, slow learner progress. Sixthly, *scaffolding offers assessment to clarify expectations*, so the learner does not have to wait until the end of the course to obtain the whole picture of what he was supposed to learn, the amount of knowledge and depth expected of him, etc. This is of great importance to many learners who find it difficult to concentrate, and hence progress, with questions coming to their minds. Seventhly, *scaffolding delivers efficiency* in that, although there is still hard work to be done on the part of the learner, focus and clarity are crucial for orientating the learner and speeding up his work. Eighthly and finally, *scaffolding creates momentum*, in the sense of interest, inspiration and provocation, through the channeling and guidance provided.

In the next section an application of some of the previously mentioned principles of cognitive theories, in particular constructivism, and the conceptual framework of scaffolding is presented in an adaptable, personalized learner-centered system for the tuition of business English.

The role of scaffolding in a business English tutoring system

As mentioned in the introduction, I-PETER (Intelligent PErsonalised Tutoring EnviRonment) is a system for on-line distance learning in a context where the number of students restricts the teacher's possibilities to provide individualised guidance. This section attempts to present the extent to which I-PETER adapts to various learner profiles that evolve during the process, the ways in which the learner controls the system and the role played by scaffolding in providing effective assistance and enhancing the learner's cognitive skills. It should be briefly explained that there are two differentiated parts in this system: a *diagnostic task model* which assesses student performance[2], taking the form of a Bayesian network, and a *selection mechanism* that proposes appropriate materials and study strategies. I-PETER contains *domain models* that represent linguistic and didactic knowledge: the conceptual framework related to linguistic levels and knowledge stages, and the educational content (mostly specific to the field of business) and study strategies. Furthermore, there is a *student model*, which represents the knowledge that the student has learnt, the study strategies adopted, and his profile.

Being a learner-centered tool, the preliminary design step was to define its learner profile. The authors' experience in the face-to-face teaching of English for Specific Purposes, and specifically for business (with multimedia and telematic materials), has led to a distinction between: the "linguists" (teachers and translators of business English) and the "economists" (with a degree in Macro/microeconomics, MBAs, etc.), both as students and professionals. They have some similarities and one difference between them. The similarities lie in the small amount of time they have for studying and the type of study sessions (frequent and short, less than or equal to an hour, two or three times a week, either in work breaks or at home in the evening), as well as their high motivation. The implications of their study pattern is that the learners of this system, being busy adults, need to have short, intense and fruitful sessions, with no frills, instruction manuals or preliminaries, to make the most of the little time they have available. Also, since they are not computer experts, they demand very user-friendly interfaces. I-PETER provides both: a division of the syllabus into small units, so that they fit entirely into brief 30 minute study sessions, which has proven to be a positive cognitive and motivational factor, and a simple, intuitive interface (button menu-based access to all tools).

The difference between the system's user profiles lies in their expertise, since the "linguists" are generally more keen on learning via grammar explanations, as they are more familiar with the terminology, etc., while the "economists" typically aren't at all, and feel more inclined towards exclusively practical exercise-based learning. The way in which I-PETER adapts the system's domain structure to the learner is through one of its models called the *student model*. This stores the information that pertains to each learner, such as his preferences and restrictions expressed in the *student profile* module (e.g., degree of theoretical explanation [standard / minimum], learning goals [fill knowledge gap / improve knowledge stage / improve linguistic level / practise conceptual unit], initiative [student / system / mixed]) and the knowledge that the student has learnt so far. The student profile is a determining factor for the selection of the materials within the didactic model that are most appropriate for him, and selections can be accessed and partially modified by the learner at any time.

Furthermore, the system contains a *native language sequence model* which represents instructional strategies in the form of the set of sequences of conceptual units, materials, and exercises which are most appropriate depending upon the speaker's own native language (optionally selected from the student profile menu). In the authors' experience, this inevitably influences the new foreign language learning process, causing interferences, etc., and should therefore be taken into consideration in syllabus design. There is also a log (or record) of the learner activities and interactions with the system that represents the way in which the different materials within the system have been studied (e.g., sequence, time, results). Here the system takes into account heuristic information such as the time that has gone past since the learner last worked with this type of material and any other didactic criteria specified by the teacher. Therefore, the system negotiates the structure of the course with the user on the basis of all these elements: the default syllabus of the domain model[3], the profile established in the student model and the complete log.

I-PETER is not restricted to offer linear temporised courses; as seen above, in the student profile the student can choose between different modalities according to his learning goals. Therefore, for the most part there is little scaffolding in the standard sense, following the belief that it is preferable that assistance can be called on or off according the learner's own preferences. Such is the case with theoretical

explanations and error analysis[4], and other supplementary information (see below). There are only a couple of exceptions. Firstly, I-PETER attempts to avoid the dangers of monitored practice and short-tem memory learning by distinguishing two learning phases: "mechanical reproduction" and "non-attentive application", and using multiple topic-based exercises that provide extra practice and "secretly" test previously learnt items as well as the current item under study. However, no theoretical explanations are provided on any topic other than the one under study. Hence, if a mistake is repeatedly committed on a secondary, "non-attentive application" topic, I-PETER will rediagnose the learner's knowledge and probably propose him to go back and review the topic giving it more attention and time. The other aspect of I-PETER which follows scaffolding in the conventional sense is that the system provides the beginner with a series of linguistic reference tools such as hierarchically organised terminology trees, lists of irregular verbs, grammatical outlines, a notepad, etc., which gradually disappear from the screen as he progresses through the material and are only displayed again in the case of a level regression.

Learners are motivated when they view their study as personally meaningful. This is easy for most learners of languages for special purposes who, as mentioned above, are highly motivated. One of the ways to keep the learner on track in the course in I-PETER is, as seen above, making him the protagonist of his own learning process by letting him make a large number of decisions. Furthermore, the learner can complement, re-express or expand the system's theoretical explanations by using the Notepad provided and appending his own comments and examples. I-PETER also states the objectives of what the learner is about to study in such a way that he can relate to it and gain interest, i.e., not only in merely linguistic terms, but in functional extralinguistic terms, that is to say, what types of message they will be able to produce after having studied a certain topic (e.g., learning the imperatives will allow you to ask for favours and give commands). Similarly, the system informs the learner at the end of each unit and session of the potential uses of what he has just learnt and the *communication* that is now possible to establish after working on particular topics.

In prevision that the level of motivation on the part of the students may descend as the course goes on[5], the challenge in motivation in language courses is to keep the spirit high throughout. This does not mean that a language tutoring system must give lots of encouraging messages to the learner randomly (receiving what could be interpreted like patronizing messages would surely put the learner off rather than keep him interested), but that the system should identify decaying interest by a reduction in the curve of number and length of sessions and react accordingly. This is not currently done in I-PETER. What this system does is have all the quantitative and qualitative information (number and length of sessions so far, list of topics learnt, fine-grained level diagnosis, curve of errors, etc.) about the student accessible for consultation in the form of graphics (which allows for the concentration of more information in less space and is visually more appealing) which can be requested at any point in the session, in the hope that it will make the student feel more involved and encourage him to continue working hard.

Conclusion

This paper has presented some of the key theoretical frameworks and concepts in the field of learning, and their application to a system for the tuition of business English. The starting point of the design and development of such a system, named I-PETER, was the multiple difficulties associated with the organization and teaching of crowded courses of English (and English for special purposes), in particular in adapting to the individual skills, needs and profiles of the students. The authors concur with Soloway (1997) that the answer to such problems lies with learner-centered technology. Given the various theoretical approaches followed by software developers over the years, cognitivism and constructivism have been adopted for their emphasis on the learner's mental processing , the idea of him "constructing" his own knowledge, and the various attempts within these frameworks to devise software that enhances the ways in which the learner's internal cognitive processes take place, favouring high-order mental processing. In order to achieve these goals, the popular concept of scaffolding, "putting a supportive structure up when it is needed and taking it down when it is not" is also introduced and explored in our particular study domain.

The didactic architecture of I-PETER is based upon the idea of "adaptability by student knowledge modeling", which is materialized in four of its models, namely the student model, the student log, the student profile, and the native sequence model. The learner has an enormous degree of control of his study and the power to make decisions about many of its aspects, as long as his selections are reasonable and not counterproductive. Virtually everything in the system is negotiable while maintaining its strong pedagogic principles. As for the scaffolding in the conventional sense, it is mostly seen in aspects like the amount of theoretical explanations, the supply of error analysis, and other supplementary information, both for methodological and motivational purposes.

Footnotes

1 This paper has been written in the context of the research project I-PETER, which is funded by the *Vicerrectorado de Investigación* of the *Spanish Universidad Nacional de Educación a Distancia*.

2 One of the contributions of this system is that each student's command of business English is evaluated by interpreting his performance in terms of three related criteria (the knowledge stage [e.g., lower-intermediate, advanced], the linguistic level [e.g., lexical, grammatical] and the learning phase of the student [i.e., mechanical reproduction, non-attentive application]), rather than by a general linguistic competence ranking.

3 The relative order of the linguistic knowledge in the *content model* is based on standard materials on business English elaborated by English speakers for any type of learner, and is used only when the student gives full control to the system.

4 Errors are divided into three categories: formal or surface errors (e.g., mistakes in spelling, contraction, etc.), semantic or meaning errors (e.g., false friends, mistakes in words selection), and usage or contextual errors (e.g., wrong register and layout). The system interprets both correct and incorrect answers in order to diagnose the student's level of knowledge.

5 It is a well known fact in the distance learning community that the main challenge of these courses, whether technology-based or not, does not lie in their unpopularity or in the number of failed qualifications, but in course abandonment.

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