

LINGUISTIC COMPUTER TUTORS AND LEARNER AUTONOMY

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ABSTRACT

A one-to-one mode of tutoring is an invaluable asset of Intelligent Tutoring Systems (ITSs), as it guarantees fast progress of linguistic competence. Unfortunately, ITSs are rarely designed to support the development of more general skills, like learning strategies. Besides, ITSs do not promote an autonomous attitude to learning, as they usually play the traditional role of language instructors that hold full control over the learning process. These drawbacks could be overcome by equipping ITSs with intelligent modules, namely a student model and a tutor model. Characteristics of these two components are outlined and discussed from the pedagogical perspective.

1. Introduction

Among the multitude of teaching methods, it is difficult to find one which would be as effective as one-to-one tutoring. Bloom (1984) stated that learners taking individual lessons are, on average, as proficient in a given domain as the top 2% of those receiving classroom teaching. For obvious reasons, individual lessons will not replace group education. It should be possible, however, to devise a method more accessible than private tutoring but which provides its individualised, and effective, guidance. This method is the virtual tutoring provided by Intelligent Tutoring Systems (ITSs). An ITS is a computer system supported by artificial intelligence techniques, thanks to which it can not only transfer information to the learner, but also receive information from the learner and, based on this information, customise feedback and plan tutoring. Possibilities of intelligent tutoring were discussed in, for example, Costa (1992), Farr and Psotka (1992), Holland, Kaplan and Sams (1995), Psotka, Massey and Mutter (1988).

As appealing as the idea may seem, virtual tuition can provoke controversial attitudes. Technical and financial investments are the most obvious, but by far not the only problems. The particular point discussed in this paper is of a pedagogical nature: is the pedagogical philosophy underlying existing ITSs accept-

able? The purpose of the discussion is twofold. First, it is to point to the danger of using new technology to preserve the remnants of pedagogic ideas which have now been superseded. Second, it is to list, if not describe in detail, steps which could be taken to increase the pedagogic value of ITSs.

2. The architecture of Intelligent Tutoring Systems

As has already been said, learning with an ITS is highly individualised, as students receive customised feedback on what they are currently coping with. To be able to react meaningfully to a student's errors, an ITS must trace her/his task-solving process and collect results. This procedure is called student modelling, and the database with information about the learning process is a student model. Obviously, to be able to analyse the student's performance, an ITS must possess some expertise in the subject matter, which in the case of ITS-assisted second language learning will be the knowledge of at least the target language. The engine manipulating linguistic data to analyse student input and generate output, is a natural language processor (NLP). Conveying the instructional messages to the learner is the task of the tutor model. Of course, from the learner's perspective, the basic components are the learning materials and the interface. This architecture of an ITS is well described in literature, for example in Wenger (1987). At least theoretically, this is accepted as a near standard, even though in practice many systems may lack some of the components.

3. Linguistic ITSs

Existing linguistic ITSs are very few, and those that do exist lack one or more modules. (For example *Bridge* designed by Sams cannot tailor instruction to any learner-specific features, though it can analyse and generate written language and model the learner's errors). Even fewer have been formally tested for efficiency, though those that have been tested yield positive results. For example, the program *Reading Tutor* produced the following results:

In 2000-2001, an 8-month controlled study of 178 students in grades 1-4 at two schools compared using the Reading Tutor 20 minutes daily in a lab setting to spending the same time on Sustained Silent Reading (SSR) in the classroom. The Reading Tutor group outgained the SSR group on the Total Reading Composite score of the Woodcock Reading Mastery Test, and in 6 of 10 skills. (Mostow 2002)

From an examination of this and other available accounts of studies on ITSs it appears that their effectiveness is high, but it must be stated that achievement is measured only in terms of a calculable score. In the case of the *Reading Tutor*, this comprises results of tests in text comprehension and vocabulary. In another exemplary case, that of McEnry's study (McEnry, Baker and Wilson 1995), it is

the accuracy with which students learned to recognise parts of speech. The researchers compared the accuracy levels achieved by two groups of students – one taught by a human teacher and one using a system called *CyberTutor*. On the final test, the mean accuracy was 89.34% for the group using the *CyberTutor*, while it was 73.64% for the control group.

4. Modern and traditional learning purposes

The achievements reported in the above-mentioned studies are related to skills and sub-skills, or to specific linguistic items. The value of a student's achievements is obvious, but it must be stated explicitly: an outstanding score is not the only learning goal when one takes the perspective of modern approaches to learning, such as constructivism, humanistic pedagogy, or the learner-centred approach (described, respectively, in, e.g.: Bannister and Fransella 1981; Rogers 1969; Tarone and Yule 1989; Pemberton *et al.* 1996). These and related approaches stress that apart from measurable effects, the very learning process is also a goal in itself, taken that this process is the learner's unique construct, an exercise in creativity and an experience of general self-development. These ideas are related to the concept of learner autonomy which, ideally, implies "complete responsibility for one's own learning, carried out without the involvement of a teacher or pedagogic materials" (Dickinson 1987: 11). This new learner's role entails the transformation of the teacher's role. S/he should no longer be the instructor, or controller, but rather an advisor, or counsellor, whose task is to facilitate the learner's development towards ideal autonomy, as the assumption is that "autonomy is not inborn and must be acquired either by 'natural' means or (as most often happens) by formal learning, in a systematic, deliberate way" (Holec 1979: 3). (The details of the new role for the teacher were discussed in, e.g.: Kelly 1996; Dickinson 1987).

Having examined current pedagogic theories, one must state that ITSs have actually not been tested for their influence on the learner features highly valued in these theories. Paradoxically enough, ITSs are assessed positively, but not for what is advocated by modern pedagogy: not for promoting learner autonomy, nor for triggering creative thinking, nor even for enabling communicative learning.

There are at least three reasons for this paradox. The first, most obvious one, is of a technical and financial nature. Additional, and sophisticated, testing of an ITS demands better funding. However, this argument does not explain why little theoretical work has been devoted to the issues now discussed. The second reason is that measurable achievement is a well understood, traditional educational goal that actually motivates the efforts of ITS designers. Not surprisingly, then, traditional effectiveness assessment of a virtual tutor is a natural stage of any project. The third and most important reason, however, is that most ITSs to date have been by nature unsuitable for achieving some of the less traditional learn-

ing goals, such as learner autonomy. In fact, they involve instructionistic, not constructionistic learning, and they are highly tutor-centred, not learner-centred. It is usually the tutor that makes all important decisions, such as choosing the sequence of learning or the mode of feedback. Also the content of ITSs is frequently unsuitable for enhancing learner autonomy. Waters (1995: 353) wrote that "most commercially available [intelligent] systems support drill and practice of only the very simplest kind, based on fixed or random practice schedules". In fact, currently constructed ITSs may be supplied with multimedia and converse with the user in the target language, but the proportion between student-control and tutor-control of the system, as well as the type of tasks, has not changed much since Skinnerian behaviourism. A few examples constitute the next section.

5. The instructionistic nature of ITSs

In Waters's intelligent system, *The Audio Interactive Tutor* (TAIT) from 1995, the technology is very sophisticated, as the system can recognise spoken input, assess its appropriateness, and produce aural output. However, the tutoring component does not live up to modern views on the role of a tutor. The tutor model is called "the controller". The very name suggests its function: "based on the user model, it decides what pieces of the study material to present next" (Waters 1995: 326). The system does not leave much freedom of choice to learners then, nor does it make them conscious of what the tutor – controller's choices are based on. "Study" consists in repeating, in drill-like fashion, chunks of text.

Yang and Akahori's (1997) system for learning the passive voice in Japanese can accept student's free written input (also an impressive technological advancement), but the teaching method behind the technology is much less appealing: the student has only to obey instructions appearing on subsequent screens.

In *Bridge*, devised by Sams in 1995, students can do drills, engage in games, or even type in sentences, but they can only practise linguistic forms pre-set by the tutoring component ad-hoc.

Boucher's ITS for teaching English compounds to French students has a tutoring component called "teaching generator", whose task is to create teaching plans (Boucher, Danna and Sebillot 1994: 250). The rules of choosing the learning content remain unknown to the student. Exercises consist in converting a definition into a compound or vice-versa, so, again, we have to do with a low-level, reproductive task.

The systems just presented may be effective instructors, but it is difficult to find any traces of the designers' concern for the learners' autonomy, or creativity development.

6. Learner autonomy and non-intelligent CALL

The discrepancy between the modern educational theory which advocates learner autonomy and ITS practice seems to have received little attention, probably because linguistic ITSs are so rare. There is, of course, other educational technology, such as multimedia or Web-Based Teaching (WBT), which is believed to support autonomous learning. However, many studies have reported that while working with multimedia or the Internet, students felt lost and lonely, not autonomous. "Perhaps the most widespread misconception is that autonomy is synonymous with self-instruction. ... Total detachment is a principal determining feature not of autonomy but of autism", says Little (1991: 5). Numerous studies have invalidated the hypothesis that unrestrained freedom supports autonomy. This thesis, fashionable with designers of CALL (Computer-Assisted Language Learning) in the 80's, was an early reaction against behaviourism, and was later replaced by more balanced views. Now it is suggested that learners need a sense of guidance to feel safe and to develop quickly. For example, a study conducted by Toyoda (2001) revealed that only students with advanced computer skills and those computer-beginners who could elicit help from peers and the teacher profited from Internet-based writing classes. Those who could not, or did not want to, ask for assistance, reported dissatisfaction with WBT. Even students who attend on-line courses with teacher assistance are still failure-prone: the web may be too slow to grant real-time communication or anything approaching it. Consequently, "the fast-growing Web-based training model has likely done little to improve classroom training – and may actually make the two-sigma phenomenon more pronounced" (Ong and Ramachandran 2000).

7. Towards an autonomy-promoting ITS

It has been demonstrated that in educational technology there seem to exist two extremes, as far as the learner- versus the system-control is concerned (at least in the case of self-access instruction):

- with ITSs, students are frequently overwhelmed with tuition (but learn very effectively),
- with multimedia and the Internet, students are frequently deprived of any tuition (and may learn not as effectively as with ITSs).

In neither case is autonomy promoted, because autonomy needs *some* guidance to develop, in fact. The question is how to reconcile the effectiveness of ITSs (in terms of achievement) with the need to develop learner independence. A solution that should be tested in the future is to equip ITSs with mechanisms that guide the learner towards autonomy. With such mechanisms, ITSs should be able to play the role of an advisor or counsellor, consistently with the views of

the constructivist approach. The details of this role have been discussed in numerous publications mentioned earlier. Here it seems justified to reduce the teacher-as-counsellor's role to two basic functions, which is inevitable when trying to adapt pedagogic theory to technological practice. Namely, the new ITS, let us call it an Intelligent Counselling System, or ICS, should:

1. teach the student to make optimal choices, and
2. teach the student to handle the self-chosen course of study.

In the following two sections these functions will be discussed.

7.1. Teaching the student to make optimal choices

As for the first function, (i.e. teaching the student to make optimal choices) there arise several points to consider:

1. What choices are there for the learner to make?
2. What are the learner factors which can influence these choices?
3. How can an ICS make the student aware of points A and B above?
4. How can an ICS encourage the student to reflect on past choices and revise them, if necessary?

The most important learning decisions the student needs to make seem to be: difficulty level, learning content, types of tasks, and types of learning strategies. This set of learner decisions has been selected rather subjectively; however, any full-fledged theory concerning this issue has not been proposed yet.

Also the choice of crucial learner features is still a matter of intuition rather than tested pedagogical theory. The most obvious learner factors affecting her/his choices seem to be: competence level, learning needs, cognitive and emotional features.

To support the learner's self-reflection, the system could:

- procure types of information listed above,
- tell the student which of her/his learning choices seem optimal with respect to her/his individual characteristics (but allow her/him to decide independently),
- justify its own tutoring suggestions in order to raise the learner's consciousness and prepare her/him to make independent decisions in the future.

In order to be able to encourage the learner to reflect on her/his earlier steps (and, perhaps, change the route of learning), the system should:

- collect information about the student's past decisions and about the learning results,

- try to find correlation between the student's decisions and learning results, and
- ask the student to verify the hypothesised correlation and to make new choices, if necessary.

7.2. Teaching the learner to handle the self-chosen course of study

As for the second function (i.e. teaching the learner to handle the self-chosen course of study), it must be considered how an ICS could help the student to acquire the skills needed for independent learning.

Most importantly, it seems that an ICS should:

- check whether the current learning strategy use is appropriate, and
- check the student's learning results.

If results and/or strategies are not satisfactory, an ICS should offer a presentation of, and exercises in, better/new strategies.

8. Problems to solve

Each of the functions of an ICS postulated in the earlier sections poses huge problems that fall into two categories: student modelling and tutor modelling. An analysis of these functions shows that the student model in an ideal ICS would have to be able to:

1. elicit information about:
 - competence level (learning results),
 - learning needs,
 - cognitive and emotional features,
 - to-date learning decisions, and
 - current learning strategy use.
2. find relationship between:
 - the student's learning decisions and learning results, and
 - the student's learning strategy use and learning results.

Besides, the student model would have to be equipped with an interface so that the student could examine the model and assess her/his own development.

Needless to say, this theoretical proposal could not be put into practice (and tested) as a whole, because the necessary advancements in artificial intelligence and cognitive sciences are still insufficient. However, theoretical work on some of the above-listed points is already in progress, so devising ICSs should not be impossible in future. For example, Bull (1997) led research on possibilities of implementing a learning strategy component to a student model in a CALL sys-

tem. Crosby and Iding (1997) examined the relationship between learning styles and performance on tutorials, as a step preceding the development of an ITS responding to various learning styles (though in the domain of chemistry). The almost unexplored areas, and, at the same time, the biggest challenge for student modelling, remain the learner's emotional and social attitudes, as well as sociolinguistic and strategic components of the communicative competence.

Let us now have a closer look at the other function of our theoretical ICS, that is, tutoring. Within the proposal just explicated, the virtual tutor would:

- suggest the optimal learning decisions to the learner (but leaving her/him the freedom of decision),
- justify its suggestions,
- present learning strategies, and
- show the relation between progress on the one hand and learning strategies and various learning decisions on the other.

Generally, tutor modelling has been the most neglected domain of all those connected with ITSs, and only very few projects concentrate on this issue. An example is the system developed by Bull (1997), which presents learning strategies, although it does not encourage the learner to see the relation between strategy choice and the learner's features, or a specific learning context. In short, though very innovative in many respects, it can fail to raise the learner's consciousness of the learning processes. Such consciousness is not only a condition of autonomy, but also one of the most important determinants of learning effectiveness, as demonstrated by, for example, Ganz and Ganz (1990). Other works on tutoring in ITSs have been described earlier in this paper and have been shown to conform to the instructionist model of education, which does little to assist the development of autonomy.

9. Conclusion

Intelligent Tutoring Systems (ITSs) have proved to be very effective educational technology thanks to the one-to-one mode of tutoring. The effectiveness of ITSs is measured normally by achievement tests, which concentrate on linguistic competence. But constructivist pedagogy, learner-centred approaches, and the like stress that not only the calculable score is important, but also the learning process, which should be a creative experience. In these approaches the tutor is no more an instructor, but rather a counsellor, or facilitator. The counsellor's role is to guide the learner towards self-reliant, independent style of learning, frequently referred to as *learner autonomy*. It appears that existing ITSs do not frequently capitalise on this theory. Instead, they are usually made to play the role of virtual instructors – very effective ones, but doing little to promote their users' higher mental skills and autonomy.

Other educational technology, such as multimedia or the Internet, may not yield equally outstanding learning results, but is commonly believed to promote autonomy. However, many studies have reported that students working with multimedia or the Internet felt left on their own, rather than autonomous. The research question for future investigation is how to reconcile ITS effectiveness (in terms of achievement) with the need to develop learner independence. One possible solution is to reconcile subject-related counselling and autonomy-raising guidance in a new generation of ITSs, though the necessary research into cognitive and computer science may take years to complete.

REFERENCES

- Bannister, Don – Fay Fransella
1981 *Inquiring man*. Harmondsworth: Penguin.
- Bloom, Benjamin S.
1984 "The 2 Sigma problem: The search for methods of group instruction as effective as one-to-one tutoring", *Educational Researcher* 13/6: 3-15.
- Boucher, Paul – Frederic Danna – Pascale Sebillot
1994 "Compounds: An Intelligent Tutoring System for learning to use compounds in English", *CALL* 6/3: 249-272.
- Bull, Susan
1997 "Promoting effective learning strategy use in CALL", *CALL* 10/1: 3-39.
- Costa, Ernesto (ed.)
1992 *New directions for intelligent tutoring systems*. New York: Springer-Verlag.
- Crosby, Martha – Mary Iding
1997 "The Influence of cognitive styles on the effectiveness of a multimedia tutor", *CALL* 10/4: 375-386.
- Dickinson, Leslie
1987 *Self-Instruction in language learning*. Cambridge: Cambridge University Press.
- Farr, Marshall, J. – Joseph Psotka (eds.)
1992 *Intelligent instruction by computer: Theory and practice*. Washington-Philadelphia-London: Taylor & Francis.
- Ganz, M. N. – B. C. Ganz
1990 "Linking metacognition to classroom success", *High School Journal* 73/3: 180-185.
- Higgins, John – Tim Johns
1984 *Computers in language learning*. London: Collins ELT.
- Holec, Henri
1979 *Autonomy and foreign language learning*. Strasbourg: Council of Europe.
- Holland, V. Melissa – Jonathan D. Kaplan – Michelle R. Sams (eds.)
1995 *Intelligent Language Tutors: Theory shaping technology*. Mahwah, NJ: Lawrence Erlbaum.
- Kelly, Rena
1996 "Language counselling for learner autonomy: The skilled helper in self-access language learning", in: Richard Pemberton – S. L. Edward – W. W. F. Or – H. D. Pierson (eds.), 93-114.
- Little, David
1991 *Learner autonomy: Definitions, issues and problems*. Dublin: Authentic.

- McEnry, Tony – John P. Baker – Andrew Wilson
 1995 "A statistical analysis of corpus based computer vs. traditional human teaching methods of Part of Speech Analysis", *CALL* 8/2-3: 259-274.
- Pemberton, Richard – S. L. Edward – W. W. F. Or – H. D. Pierson (eds.)
 1996 *Taking control: Autonomy in language learning*. Hong Kong: Hong Kong University Press.
- Pstotka, Joseph – Dan Massey – Sharon A. Mutter
 1988 *Intelligent Tutoring Systems: Lessons learned*. Hillsdale, NJ: Lawrence Erlbaum.
- Rogers, Carl R.
 1969 *Freedom to learn*. Columbus, OH: Charles E. Merrill Publishing Co.
- Tarone, Elaine – George Yule
 1989 *Focus on the language learner*. Oxford: Oxford University Press.
- Warschauer, Mark – Deborah Healey
 1998 "Computers and language learning: An overview", *Language Teaching* 31: 57-71.
- Waters, Richard
 1995 "The Audio Interactive Tutor", *CALL* 8/4: 325-354.
- Wenger, Etienne
 1987 *Artificial Intelligence and tutoring systems: Computational and cognitive approaches to the communication of knowledge*. Los Altos, CA: Morgan and Kaufmann.

INTERNET SOURCES

- Mostow, Jack
 2002 "A Reading Tutor that listens" [of 10 January 2003], available at: <http://www-2cs.cmu.edu/~listen>
- Ong, Jim – Sowmya Ramachandran
 2000 "Intelligent Tutoring Systems: The What and the How" [of 16 July 2003], *Learning Circuits*, February 2000, available at: <http://www.learningcircuits.org/feb2000/ong.html>
- Toyoda, Etsuko
 2001 "Exercise of learner autonomy in project-oriented CALL" [of 7 June 2003], *CALL-EJ Online* 2/2, available at: <http://www.clec.ritsumeij.ac.jp/english/callejonline/5-2/toyoda.html>
- Yang, Jie Chi – Kanji Akahori
 1997 "Development of a CALL system for Japanese writing using natural language processing techniques: A study of passive voice" [of 26 July 2003]. [Proceedings of the workshop "Intelligent Educational Systems on the WWW", 8th World Conference of the AIED Society, Kobe, Japan], available at: http://www.contrib.andrew.cmu.edu/~plb/AIED97_workshop/Yang/Yang.html/