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The Didactics of Foreign Language Teaching with Multimedia

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ABSTRACT The way computers are used in foreign language teaching reflects teachers' ideas about how foreign languages should be learned. We describe different methods of foreign language teaching, one of which is at the base of our computer program *IT'S English*. In this program, different types of exercises are implemented: receptive, reproductive, and productive. To implement our ideas of a communicative approach to teaching into a computer program, we built an intelligent tutoring system, which incorporates a dictionary, grammar rules, and the digitized pronunciation of words and sentences stored on a CD-ROM. The software is flexible in that the learning environment it offers can shift from a teacher controlled setting to a fully learner controlled environment. Four groups of eight pupils used the program during eight weeks and were compared with students not using the program. The research showed that the students interacting with the software used its various components in an adequate and goal-appropriate way and found the use of the software to be a positive experience. After the experimental period, knowledge of vocabulary was significantly higher for one of the computer-using groups compared to its control group, although in the word (re)production tests no significant differences were found between the experimental and control groups. Implications of the results of the experiments for teacher education are discussed, with an emphasis on the importance of teachers learning how to assess the pedagogical approach of software and the didactic principles involved in its design and intended use.

Theoretical Background

Vocabulary Instruction in Communicative Methods

Vocabulary instruction is a major objective in foreign language teaching. Until recently, vocabulary acquisition meant learning word-translation pairs. This was the case in grammar-translation methods. In these methods, foreign

language instruction meant teaching the grammar rules of the foreign language and teaching its words by their translation. Nowadays, however, with the rise of communicative foreign language teaching methods, vocabulary instruction has changed. In this paper we focus on the implications of these ideas for the use of computers in education. We do not deal directly with teacher education, but rather with the implications for teacher education.

Functional Approach. Communicative instruction is task-centred rather than language-centred. Language is seen as a means of getting things done rather than a set of grammar rules and words. For vocabulary instruction, this functional approach implies that pupils must learn to use those words that are necessary to communicate about certain themes. But, which words must be learned? What must a student know about these words? How should efficient instruction be designed and prepared for during initial teacher education?

Van Ek (1976) has given some answers to the first two of these questions. He proposes a base lexicon that foreign language learners should at least know in order to be able to express themselves in English. This base lexicon consists of 6000 words that cover most realistic communicative themes in a newly acquired second language. Van Ek not only indicated which words should be known, but also what should be known about each word. This includes the lexical and social contexts in which the word is typically used, the meanings and translations of the word, idiomatic usage of the word, and finally, whether the student's knowledge should have a productive or a receptive character. This list of characteristics can be extended with characteristics of spelling, morphology (formation of the plural, conjugation of the verbs, etc.) and pronunciation. Sometimes the phonological and syntactic characteristics are called 'cues' and the semantic and communicative properties 'functions' (Miller & Fellbaum, 1992, p. 90). Knowing a word does not mean that a student should be able to list all its characteristics, but rather that he or she has a ready knowledge of the word. In speaking and writing, therefore, the student must bear in mind quite a number of characteristics of words. For advanced learners, word production is rather an automatic process that is monitored by subconscious mental activities. Beginners, however, will not yet have internalized all these aspects of words. Since the number of things on which people can simultaneously focus their attention is limited, beginners will make many mistakes in foreign language production.

In view of the many things students have to know about words, an efficient teaching strategy is of great importance. This is the third question given above, and the central topic of this article. Within the communicative paradigm, the major goal of vocabulary acquisition is that learners are able to productively use the words in spoken English. Therefore, words should be

learned in such a way that they can readily be used in 'real' communicative situations. Neuner et al (1981) have distinguished three consecutive stages in communicative foreign language instruction: a receptive stage, a reproductive stage and a productive stage. For each stage, they proposed certain exercise types. First, the student must learn the meaning of a word (receptive exercises). Then the student must learn to use the word in structured exercises (reproductive exercises). Finally, the student must practise the use of the word in free written or spoken language (productive exercises).

1. Receptive-stage Exercises. In receptive exercises, the words are introduced. The way in which this is done strongly influences the later quality of the productive use of the words. One of the basic assumptions of the communicative method is that words should be introduced in meaningful contexts. Words are represented in memory as networks of related elements. The introduction of words in context sentences, then, helps the building up of a broad semantic network (or 'system') in the foreign language (Schouten-van Parreren, 1985). This will speed up access time in real use of the language, because, when talking about a specific subject, all related words will become activated.

Words learned in lists of translation pairs, however, will not easily be embedded in a foreign language network. No fluent command of the foreign language will be achieved, because all activities in the foreign language are triggered by the mother tongue and will therefore be far too slow. Moreover, words learned in this way may cause interference errors, due to lack of 'system separation' (Van Parreren, 1970). With the context approach, students will get a better intuition of the situations and sentences in which a specific word can be used.

2. Reproductive-stage Exercises. In the reproductive stage, the students have to finish incomplete sentences or texts. There are many possibilities for constructing source texts. They may consist of a Cloze text (an exercise in which students use the context of a text to replace words omitted from it), one role of a dialogue, a box of sentence parts, a number of keywords, or a flowchart of notions to be expressed consecutively (Neuner et al, 1981).

3. Productive-stage Exercises. A dividing line between reproductive and productive exercises is hard to define. Some of the less-structured reproductive exercises make a strong appeal to productive skills. Real productive exercises, in contrast, show a lower degree of control. In these exercises, attention has to be paid to all aspects of language production at the same time. Examples of productive exercises are writing a letter or having a conversation.

In all three stages, the internalization of mistakes will be avoided by giving appropriate help and feedback. In view of the theoretical points of departure mentioned above, help in the receptive stage should, for each new word, consist of giving the meaning in the foreign language, or giving extra context sentences. In the reproductive stage, help should at least include these receptive help options. However, more specific help should also be given. In cloze texts, for instance, pupils can be aided by giving them either a context sentence or a meaningful description of the target word, with the target word left out. In exercises with a more productive character, help will be more complex. As pointed out before, the student will have to take many different aspects into consideration while producing sentences. Ideally, the help options give feedback on all these aspects of language production.

Didactic Principles in Foreign Language Teaching (FLT) and the Use of Computers

We distinguish three different trends in the historical development of FLT: a) the grammar-translation method; b) the audio-lingual method and c) the communicative approach. The history of FLT shows that the indicated trends have made different contributions to each of the four 'participants' in foreign language learning. These four participants in learning and instruction processes are: the learner, the teacher, the subject matter, and the media which are used to present the learning material. The three trends differ in relation to the questions: "What is language?" and "How must it be learned?"

The Grammar-translation Method. In the grammar-translation method language is considered as a system of rules to be learned and applied in exercises. Vocabulary acquisition means learning word-translation pairs. The types of computer programs used in this method are drill-and-practice or simple tutorial programs.

The Audio-lingual Method. Audio linguists, in contrast, consider language as a system consisting of a limited number of structures with empty slots in which elements can be substituted. Objectives are formulated in terms of structures that have to be learned. The learning materials consist of structure-and-pattern drills that are learned by reacting to a stimulus and getting feedback. Drill-and-practice programs fit into this method.

The Communicative Method. In the communicative approach to FLT, language is considered an instrument for interaction and communication. One direction in the communicative approach is based on structuring carefully the sequences of exercises: comprehension, reproduction, free production (Neuner et al, 1981). The learning material

should be authentic. Learning activities have to be task-based, interactive and meaningful.

In a classroom situation with perhaps 30 students and a considerable amount of written materials, it is difficult to create a learning environment that does justice to the communicative approach. Bouwens & Oud-de Glas (1991, p. 155) compared different teaching methods for teaching English as a foreign language in The Netherlands. They counted the different types of exercises in textbooks commonly used in the schools. Their conclusion was that few exercises in developing text comprehension were offered and often there were no exercises in free production in the foreign language. When the researchers asked foreign language teachers which exercises they actually did with their students in secondary schools, they discovered that the teachers used even more reproductive, closed exercises than were offered in the textbooks (p. 163).

Learning vocabulary by inferring the meaning of words from their context in a story is part of the communicative approach. However, while learning words by reading them in context is effective, it is not always efficient. Some contexts are uninformative and others are misleading. In our research project we typed three textbooks into the computer. We did not use the workbooks that accompanied the textbooks. We analyzed the texts in different ways. One analysis consisted of checking the meaningfulness of the context of words as they appeared in the textbooks. We chose 56 words at random. Only 16 of those 56 words (30%) appeared in meaningful contexts.

A human tutor who is available to detect and resolve lexical misunderstandings would be much better than a dictionary. However, given the shortage of tutors to sit at every young reader's elbow, we wondered how much of the tutoring task might be done by a computer. Suppose reading material is presented to the student by a computer that is programmed to answer questions about the meaning of words and to give examples of the usage in every-day English of all the words in the text?

The Construction of an Intelligent Tutoring System for Learning English – *IT'S English*

The Program

A computer program that reflects our assumptions should enable the user to retrieve semantic definitions and context sentences in English, as well as synonyms, antonyms, pronunciations, and the syntactic and morphological properties of words. In addition such a program should be capable of evaluating the user's use of language to enable him or her to apply the vocabulary in (re)productive exercises. To achieve all this we have developed such a program (*IT'S English*) which consists of several components: (a) an

automatic sentence parser which checks random-language input for syntactic, orthographic or inflectional correctness; (b) a database stored on a CD-ROM, which contains definitions and context sentences in everyday-English, as well as the grammatical properties and synonyms and antonyms of over 70,000 words; (c) another database also stored on CD-ROM with the digitized pronunciation of 5000 words, 1700 context sentences and a number of texts for the presentation of phonetic word representations and English intonation; (d) another database stored on CD-ROM with texts from the Notting Hill Gate textbook by Malmberg (3rd Grade); (e) an exercise generator, which generates exercises for text comprehension and (re)productive language use; and (f) a feedback generator, which uses the domain input of the parser to reveal and remedy learner errors in (re)productive exercises. The *Collins Cobuild English Language Dictionary* - COBUILD (Sinclair et al, 1987) - was chosen as a basis for the lexical CD-ROM database.

The Exercises

IT'S English closely follows the strategies outlined in the introduction. The different exercise modules reflect the three stages in vocabulary acquisition. They support the receptive, the reproductive and the productive stage. *IT'S English* has considerable knowledge about its domain. The Cobuild databases in combination with the parser cover most of the student needs to know about English vocabulary. In the next section the exercises available at the different stages will be discussed.

Receptive Exercises. In the receptive stage, the student can choose a story from the Notting Hill Gate text from the database. The student can browse through the story and ask for information at any moment. By means of the arrow keys all the words in the story can be highlighted. Once a word is highlighted, different types of information are available. First, the student has access to a set of semantically rich context sentences in which the actual word appears and from which its meaning can be deduced. Second, the student has access to the description of the meaning of the actual word, the pronunciation of a word, the grammatical category, the word forms, synonyms, antonyms and higher-order concepts of the word. Words that are important or new in a story can be marked by the teacher in advance. Furthermore, all actions a student undertakes with respect to the words in the story are recorded. At the end of a session, a student's specific logfile is constructed or adapted. It keeps track of the words about which the student asked information. It also keeps track of the kinds of information for which the student asked.

Reproductive Exercises. In the reproductive stage, *IT'S English* enables the teacher or the student to construct a cloze text. Due to the parser, these texts can be generated on the basis of syntactic information. This syntactic information combined with information on the actions of the student makes it possible to generate blanks in a structured way. A blank could, for instance, be generated for every verb, noun, preposition or adverb. This type of filling-in exercise is clearly superior to the cloze texts of current prevalence, in which only every *n*th word may be omitted. Since the parser can be put into operation in the analysis of the learners' answers, feedback can be provided which is aimed at various kinds of errors. This makes *IT'S English* different from traditional programs, in which every erroneous answer, plus the accompanying feedback, has to be anticipated and dealt with. The type of feedback that is provided by *IT'S English* for filling-in exercises can be of the following kind: (a) the typed-in answer is a synonym or part of a superordinate concept; (b) the word class is correct but the actual word is not; (c) information about possible 'typing errors' which is based on an algorithm; or (d) information about conjugation and other grammatical characteristics. It is also possible to provide help by giving a context sentence provided by the dictionary from which the target word has also been omitted. This has turned out to be particularly informative.

Productive Exercises. In the productive stage, *IT'S English* enables the student to write his own story. All the sentences are parsed and appropriate feedback is given as far as possible at the moment. The same mechanism at the disposal of the student in this stage also offers the teacher the means to write a story that can be made available to the student. It is also possible to enter text into the computer and let the program solve ambiguities only by presenting the possible grammatical categories of a word. The writer has access to the Cobuild Dictionary during his writing. The student's story can be used for receptive or reproductive exercises.

Parsing Productive Exercises. A syntactic parser is a computer program that can decide if a given sentence has a grammatical structure in a certain language. The program generally uses two kinds of knowledge. It uses declarative knowledge in the form of a lexicon and it uses procedural knowledge in the form of the set of syntactic rules that make up the grammar of that language. Furthermore, the program must follow a method of analyzing a sentence to determine its structure according to the grammar. This method is called the parsing technique and an algorithm for it was created for the software.

The Research

Design

Our research addressed the following questions:

1. How do learners use the different options offered by the program? With regard to the first question, the investigation had to establish the frequency of use of the available options for each of the different types of exercises. Frequency of use may be regarded as an indication of the value that the user attaches to a certain option.

2. What is their appreciation of the program as users? The frequency indication was supplemented with an explicit assessment by learners of the program as regards its presentability, usefulness, accessibility and perceived value. The learners' assessments were measured four times by means of a short questionnaire.

3. What are the learning results of the program? The learning results of *IT'S English* were measured along two parameters. The first of these concerned the knowledge and productive use of the students' newly acquired English words. The second concerned the learners' skills in deducing the meanings of English words from their contexts.

Procedure and Data Collection

In order to provide answers to the research questions, data were collected through the creation of an experimental teaching-learning setup, in which parts of the 'regular' teaching of English as a foreign language were replaced by *IT'S English* as a teaching aid. In particular those parts of the teaching were involved which concentrated on the learning of new English vocabulary items.

During a period of eight weeks one hour per week was devoted to *IT'S English* exercises by the pupils who participated in the research. The first six sessions started with the reading of a text, followed by the completion of a cloze text. During the first three sessions the cloze text was created by the learners themselves on the basis of an oral assignment given by the researcher/teacher. The assignment was then completed. During the following three sessions the cloze exercise was prepared by the researcher/teacher. For the remaining two computer-aided sessions the order was reversed. The completion of the cloze exercise came first, after which, if time allowed, the accompanying text or another text was read.

The pupils from the control group, who did not take part in the experimental computer-aided (CA) lessons, followed the normal lessons given by their own teacher. These normal lessons took place concurrently with the experimental lessons. They dealt with the same content, and thus presented the same words, as the computer-aided lessons.

The teaching experiment involved students of about 15 years of age at the two schools participating in the research. For technical and administrative reasons it was necessary to restrict the number of participating pupils. The two participating schools, both broad based institutions for secondary education, were approached through their English departments. One school was selected for its use of the Notting Hill Gate textbook, the other school for its use of Mainstream. The other selection criterion was the availability of computer rooms with (at least) eight separate personal computers for the experimental teaching-learning environment.

At each of the schools pupils from one middle-level class and one higher-level class took part in the experiment; eight pupils per class, yielding a total of 32 subjects. The four groups were matched by means of pre-tests with the control groups (four times eight pupils from the remaining four classes).

Tests

Learners' Use of Program Options. The data about program use were obtained from individual logfiles in which every action of each pupil-user was recorded. Every other week a short questionnaire was completed in which each pupil was asked for his or her opinion about certain user-aspects of the program.

Impact on Learning. In order to measure the learning results the following three pairs of parallel tests were created: the first test for knowledge of the lexical items presented in the program (knowledge of 20 items); the second test being of the (re)productive variety (a cloze text with 10 blanks and a list of 10 words, each to be used in a correct English sentence); and the third test, a distracter test consisting of 20 underlined, almost certainly unknown words, whose meaning was to be deduced from the context. One of each test was used as a pre-test and one as a post-test. The knowledge test and the (re)production test were method specific.

Results

User-aspects. Our first research question concerned the frequency with which pupils used information about English words which, thanks to being able to use CD-ROM, were available in *IT'S English*.

With the aid of straight counts it was established how often pupils used certain kinds of information about English words. The frequency counts took place in the four lessons during the last four weeks of the experiment. Data from the first four weeks were left out of consideration, among other reasons because of run-in problems with the program and hardware configurations in the network.

Receptive Exercises. The uses of information about English words were recorded separately for the reading exercises and the cloze exercises. The use of reading exercises, much more than is the case in the cloze exercises, is explorative in character. The use of options in the cloze exercises is more often governed by the omitted words and by those to be filled in. In the last four weeks of the experiment 48 reading exercises were completed (22 exercises by 16 Mainstream pupils and 26 exercises by 16 Notting Hill Gate pupils), during which information about English words was called up in one form or another, to a total of 469 times. This amounted to an average of 9.8 times per exercise. There is a remarkable difference between Mainstream pupils and Notting Hill Gate pupils in this regard: 7.2 as against 12 times respectively.

Cloze Exercises. During the four weeks of the experiment a total of 1987 words were filled in by the pupils. A total of 928 (=47%) of these were correct the first time. In filling in the other 1050 words (=53%) the pupils called up different forms of information available from the program about the omitted words. In slightly more than half of the cases pupils were able to fill in the correct word only if they used the information available from the program.

In the course of the experiment the order of the reading exercise and the cloze exercise was reversed. In Weeks 5 and 6, lessons started off with a reading exercise, followed by a cloze exercise over the same text. In Weeks 7 and 8 pupils started with the cloze exercise. This change was decided upon in order to study the use of the help options provided by the program under conditions in which the pupils, while doing cloze exercises, could not rely on their recall of words from the reading text.

The results show that in Weeks 5 and 6, pupils filled in 46% of the omitted words correctly the first time, leaving them to call up additional information in 54% of the remaining correct completions. In Weeks 7 and 8, 50% of the omitted words were filled in correctly the first time, leaving an equal percentage for extra information. The amount of extra information used in Weeks 7 and 8 was smaller than in Weeks 5 and 6. It is possible that a difference in degree of difficulty played a role in this.

For the 1050 cases in which a word was correctly filled in after extra information, information in some form or another was requested to a total of 1740 times. This amounts to an average of 1.7 times per omitted word.

Types of Exercises Compared

Reading Exercises. For the reading exercises, call-ups of meaning definitions were predominant. These constituted nearly half of all the cases of requested information. This type of information does seem the most relevant in the reading of a text. Unfamiliarity with a word during reading naturally leads to a search for the meaning of that word. Probably for that reason context sentences, which can also provide relevant information about the meaning of a word, occupied second place in the pupils' preferences for types of information. The other types of information were hardly used at all (perhaps sometimes out of curiosity). This is also quite understandable. Synonyms, antonyms, superordinates, information about word class, and morphological forms do not form obvious sources of information in the search for word meaning during reading. What is striking is the frequency with which information about the pronunciation of words was called up during reading. In part this might be explained by the novelty of this option and the pupils' natural curiosity.

We concluded that the pupils used the available types of information in an adequate and goal-oriented way during the reading of the English texts. They chose those types of information that were most relevant to their goal, which is understanding the English text.

Cloze Exercises. In the cloze exercises half of the requested information consisted of context sentences (in which, as may be recalled, the omitted cloze text word was also omitted). This, too, signaled a relevant preference. It allowed the omitted word to be placed in several contexts apart from its context in the exercise. Another recurring solution to the problem of filling in the blanks is deducing an omitted word from its available meaning definition. One-third of all the information requested during cloze exercises consisted of meaning definitions. The other types of information were hardly used, with the exception of synonyms, which constituted 5% of all requested information. This was also a relevant choice: when one knows a synonym, a word is easier to find.

Again the conclusion is warranted that pupils used the available information adequately and consciously and that they selected those types of information that led the most directly to the identification of a word. This conscious, goal-oriented selection of types of information may be further illustrated with a comparison between the types of information used in two different exercises, namely, reading and filling in words. Table I shows a comparison between the two types of exercises and the use of the help facility.

	Text conditions	
	Reading (%)	Cloze (%)
Meaning	56.3	36.13
Context	18.77	51.42
Sound	20.31	1.3
Synonyms	2.38	4.47
Other	2.24	6.68

Table I. The use of types of information in different exercises.

Preferences. The differences in preference between reading and cloze exercises is clear. The relevance of these preferences has already been discussed. The fact that pupils chose different types of information for different exercises again confirms the conclusion that the pupils working with *IT'S English* handled the information about words which is available from the program in an adequate, goal-oriented way.

Program Users' Affective Assessments

The assessment scores for all kinds of user-aspects of the program, as well as its educational effectiveness, were mildly positive on a five-point scale (scores between 2 and 3 where 1 was positive and 5 was negative). The only aspect that showed a mildly negative score (between 3 and 4) involved the speed of the program. Working with a network of XT-computers allowed insufficient speed for a number of actions. Reaction times exceeding two seconds quickly tended to become irritating. The use of the complete program is only optimal with advanced personal computers.

The Learning Results

Since the texts and two of the three tests for the participating schools (i.e. related to the two different textbooks in question) were different, the results for the two schools were analyzed separately. In order to determine the effects of the program a number of multivariate covariance analyses were carried out with the relevant pre-tests as covariables. In the (re)production tests no significant differences were found between the experimental and the control groups. By contrast, knowledge of vocabulary turned out to be significantly higher for the experimental Notting Hill Gate group than for the control group, with the pre-test as covariable. It is interesting to know in this respect that the pupils in question used the help options relatively often. Significant differences between the mean scores on the 'Deducing the meaning of English words' test were only found between the middle-level and higher-level pupils, with the latter showing higher scores. Since there was

prior control for differences in word-deduction skills, this result means that this particular skill improved more for the higher-level pupils during the eight weeks of the experiment than for the middle-level pupils.

Conclusions of the Research

Learning Words in Context

The help options offered by the program appear to have been used selectively by the pupils. In reading texts with new words they more often used the meaning definition of the new word, whereas in completing fill-in texts they more often tried to find the correct word by calling up context sentences in which the same word (again in its blank form) occurs in an everyday English context. This confirms our idea that learning words from contexts is a suitable method for more productive exercises.

Value of the Communicative Approach

The hardware configurations with which this research was carried out did not allow us to investigate free text production by computer. However, first results indicate that pupils who worked with the more communicative methods discussed here made greater progress in vocabulary acquisition than those who were taught in the more traditional context of the control group.

Swartz & Yazdani (1992, p. 199) say:

> While there are many different theories and approaches to foreign language teaching, communicative language teaching is currently enjoying much attention in the field. However, such a tutoring strategy is difficult to represent in an intelligent tutoring system (ITS) since it requires representing world knowledge and contextual information.

We did not implement a large amount of world knowledge in our ITS. The contextual information, however, had positive effects on learning strategy and results.

Implications for Teacher Education

In contrast to a technology-driven and opportunistic design philosophy, we believe that research such as ours supports the position that computers should be used in education – by judicious teachers and active, intentional learners – as supportive cognitive tools in the service of explicit pedagogical goals (Reusser, 1991). We also believe that our research has direct implications for teacher education programs.

If teachers however do not have the same goals and ideas about learning as those of the developer of a computer program, then we believe that the program will not fit into the curriculum and will not be used. Educational change depends on what teachers do and think (Fullan, 1982, p. 107). So if a computer program follows the ideas of a communicative approach to foreign language learning but the teacher does not follow this approach, the educational software will make no sense to him or her. On the other hand, good educational software can change teaching routines and ideas, so in the long-run, such software might lead more teachers and teacher educators to investigate such an instructional approach.

Recommendations

To reach this goal, a number of recommendations can be given relevant for initial teacher education.

1. The teacher should be given good documentation about the goals and the structure of the program. If the pedagogical assumptions of the software are made implicit, the teacher is more likely to think of their fit than that of his or her preferred teaching approach. Thus teacher education programs could include such descriptive materials along with any software that student teachers are given to experience.

2. During initial teacher training, teachers should not only learn to look at the computer screen when they familiarize themselves with a software package, but they should also learn to evaluate the structure of the program and the didactic principles involved.

3. Knowledge of didactic principles and how they can be implemented in educational software is more important for teachers than programming skills. This takes however considerable experience with different types of programs. This experience should be provided during initial teacher training.

4. Because the computer can take over many aspects of teaching, it is even more important that teachers learn to evaluate computer programs than it is that they learn to evaluate textbooks.

5. In language teacher training the use of computers should not be separated from the didactics of teaching foreign languages.

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