

*NOTE: This is the third article of a three-part series on the Media Aided Program in Beginning German at the University of Minnesota. The first two articles appeared in the Winter issue.*

## **THE COMPUTER-TUTOR IN MEDIA-AIDED LANGUAGE PROGRAMS**

*by Gerhard Clausing and Cecil Wood*

### *Introduction*

Computer-assisted instruction is a fully functioning option in one of three basic tracks<sup>1</sup> available to the student in the first-year German Program at the University of Minnesota. The student electing the computer component spends an average of two-fifths of his weekly study time with the component, which tutors virtually the entire instruction of grammar. In its present form the computer program has been in operation for two years. Data now being analyzed<sup>2</sup> demonstrates that the level of performance of equivalent students using identical basic materials, but whose grammar reinforcement was solely by computer, perform as well as or better than those whose grammar instruction took place in the classroom and via television.

Our theory of language for the classroom is simple enough. The student must internalize some grammatical rules and some vocabulary. These are his tasks, they cannot be done for him. Grammar and vocabulary learning is a necessary, but not sufficient, condition for language input or output. The teacher can organize these but he cannot synthesize them for a student.

The combination of grammar and vocabulary to perceive or generate a semantic identity ("meaning") is the unknown to be manipulated in the classroom. Thus the course must ask the student to:

1. Learn specific grammatical rules.
2. Learn specific vocabulary (high-frequency items).
3. Perceive the vocabulary as related to realia and concepts, and the grammatical rules as relating to relationships between realia and concepts.
4. Recognize or generate correct strings expressing states or processes involving beings, realia and concepts.

Deriving from this theory is the following implementation:

Grammar instruction is provided by computer with supplementary explanations in the television presentations, but with no classroom discussions or drilling of grammar. It is thus a highly controlled and standardized mechanism for transmitting grammar.

---

<sup>1</sup>These are the media-aided course, the regular course, and individualized course, which utilizes all components in various combinations.

<sup>2</sup>Forthcoming as research reports from the Consulting Group on Instructional Design, University of Minnesota.

## Computer-Tutor

The computer instructional program is based on textbook materials<sup>3</sup> which were developed and empirically validated over the last ten years. At the pre-computer stages, the materials were continually improved in experimental sections. We have performance charts on six students, complete audio tape records of their testing, charts of syllable by syllable performance by the individual students and a composite chart of their performance drill by drill. On the basis of this data, the drills and grammatical algorithms were edited until the drills as sequenced were viable by themselves, that is, without instructor input. The materials were sequenced and articulated to permit a student to follow the program without additional input from the classroom or other sources. The sequence has been verified with a number of students who used the program in a variety of experimental modes or as their sole source of instruction.<sup>4</sup>

Since knowledge of grammar is a necessary, but not a sufficient, condition for language performance, computerized instruction is supplemented by other instructional components. Selections of components is determined by the emphasis on final language goals (comprehension, speaking, reading or writing). The most important of all these components is the instructor, who bears the responsibility for coordinating the components and provides the basis for human interchange. In this context we will describe only computerized programmed instruction in grammar and leave the other components and the development data to be discussed in other papers.

### *The Student and the Computer*

The student learns grammar at the computer terminal, which is substantially a typewriter keyboard with a small television screen mounted above it as an inherent part. On this television screen appear both the messages sent by the computer and those which the student types to the computer. The messages are in English or German. The screen can contain 18 lines of 72 characters each on one page. A second page can be stored in addition to the one being displayed: pressing the "PAGE FLIP" key causes the alternative page to be dis-

---

<sup>3</sup>Cecil Wood, Charlotte von Wymetal, and Wolfgang Taraba, *Structural German*, (Minneapolis: Gilbert Publishing Co., 1965). Revised edition by same authors entitled *Programmed German*. (Minneapolis: University of Minnesota, 1971). A totally revised and expanded program, *Deutsch. A Media-Aided Language Program*, is planned.

<sup>4</sup>Martin Kuelbs, "The Genesis and Development of *Programmed German*," Research Report of the Consulting Group on Instructional Design, University of Minnesota, (1973).

played. The keyboard includes upper and lower case roman letters, numerals and punctuation, and has been modified for German to include the lower and upper case unlaute vowels *a*, *o*, and *u*. These are represented as the corresponding English letters with an added underline; normal umlauts are available with other terminals. The program can place text or accept answers from any designated place on the screen.

At the University of Minnesota the terminal in use is a Video Systems Terminal (VST) 2000. KRONOS is the time-sharing operating system used by the Control Data 6000 and 7000 series computers. The German program is (but need not be) run on a time sharing system; not necessarily on KRONOS and not necessarily on Control Data Corporation computers. The program could be technically adapted to any time-sharing or other operating system. Communication with the computer is over phone lines. The 6400 KRONOS system can be adapted to communicate with any teletype-compatible terminal. When the student has dialed the appropriate telephone number and placed the receiver in the coupler which connects the main computer with his terminal, a message appears on the screen before him asking him to sign on.

The keyboard before the student is almost identical with normal typewriter keyboards, except that its messages appear on the student's television screen instead of on paper. The student types a fifteen-character code, *2011301*, *rov6186* for instance, and the code *old*, *deutsch/un-493052*, followed by the codes *asc* and *run*. Then he is asked to identify himself by his own personal code. When he has typed in his identifying code, typically *021JKB103*, his instruction begins. He needs no technical knowledge at all to engage in the computer instruction except an ability to type. Numerous students "hunt and peck" just as successfully through the sequence. Any typing error made can be corrected instantly by using the back-space key. A 30-minute introductory lesson teaches the student all he needs to know about the computer program mechanism. The student does not need, and in fact cannot use, any knowledge about computers, electronics, or computer programming. The entire signing-on procedure takes the student 60 to 90 seconds. From then on he communicates with the computer with no technical knowledge except German which the computer will teach him as he proceeds through the program. There are students who are not motivated enough to be accurate or to learn even in short-term memory precisely what they must do to process the computer program. This is tantamount to "not getting more than a C" but this attitude does not let the student profit fully from the computer.

## Computer-Tutor

The student's work at the terminal parallels the printed textbook, which gives the student grammatical rules. The computer program applies each grammatical rule by giving an example and then asks the student to modify a German sentence to demonstrate that he can use the grammatical rule to construct semantically different sentences. If the program were English, instruction, he would be given a sentence: *He said they were not ready.* Assuming the student was learning how to form questions in English, he would be asked to turn it into a question. If the student typed as his response:

*Did he said they were not ready?*

The computer would reply,

*No, try it again.*

*Did he . . . . . they were not ready?*

If the student types as his response,

*Said he they were not ready?*

The computer would reply,

*No, try it again.*

*. . . . he . . . . .*

(The program matches words and position.)

If the student replied,

*Did he say they were not ready.*

The computer would reply,

*No, try it again.*

*Did he say they were not . . . .*

(Error-no question mark.)

If the student does not give the right response on the fourth try, the computer gives him the right answer and sends him on to a new problem. Four tries have been experimentally verified. Curiously enough students reacted negatively to getting the right answer on either the third or the fifth try.

The computer sequence is composed of a cumulative series of drills. Each drill presents a series of problems teaching, reinforcing and testing one specific grammatical point, for instance, verb conjugation, negation or questions, and later, dependent clauses, *if/then* constructions, relative clauses and infinitive phrases; in short, the cumulative rules of German grammar.

The student has some option in the program. If at any point in a drill he is able to complete five problems in succession without error on the first try, he may ask the machine to advance him to the next drill. He cannot otherwise go on to the next drill except by completing all the problems in the drill, for the computer keeps a record of each student's performance. If the student has to be given the correct answer by the computer four times in one drill, he is returned to the

beginning of the drill to start that drill over. In the original program some students discovered that if they were just patient and persistent, the computer would eventually let them advance no matter what nonsense they typed in, under the present system a student must learn the rule in question in order to get out of one drill and on to the next.

In theory, a student could get hung up indefinitely on his inability to understand a particular drill. If this should occur, the computer would loop him indefinitely, causing him to come to his instructor for explanation and help. At the same time the instructional program could be examined and improved on the basis of such demonstrated difficulties. In the two years the instructional program has been fully operational in the computer, however, not one such case has occurred. The programmed instruction was verified as programmed instruction before it was written into a computer-assisted instruction program.

When the student has done as many drills or problems as he wishes, he may at his convenience sign off by typing the code *OFF*. When he does so, the computer records the exact sentence at which he signed off, and the next time he signs on with his personal code he is returned to his work at exactly the point he left it.

The student spends between 50 to 100 hours at the terminal in the course of eight months to complete the program. He may do this at times, and in increments, at his own discretion. The computer system is functional from 8:30 a.m. until 2:00 a.m. of the next day. The actual hours during which the terminal is available for study are thus not limited by the central computer but only by student facilities available on campus.

While using the instructional program, the student has several further options. If a student can do five successive problems in a drill correctly he can choose to be advanced, but only to the next drill. He cannot, even theoretically, do less than five problems on each grammatical point. In practice, typing errors increase this theoretical five to eight or ten. Teachers, who have no problems with the drills or language, are sometimes constrained to do seven or eight problems when trying to advance as a student. The student may, by typing the German word for *AGAIN*, select any drill he wishes to review at any time. When he has reviewed enough to satisfy himself, he types the German word for *BACK* and is returned to his original place in the program.

The student also has the option of typing the German word for *WORDS*. He is then offered a German/English-English/German dictionary which he accesses by typing whatever English or German word he wants defined. When he has been given the definition he wants, he types *END* and it returned to his place of work.

## Computer-Tutor

The student may type *COMMENT* at any time he wishes to communicate with his instructor. He may then enter any remarks he wants to make and, when he types *END*, is restored to his working place. His remarks are preserved in a file which his instructor can read. The *COMMENT* file is used sparingly. Projected for 1974 is the ability to reply upon computer sign-on to classes or students who address us in *COMMENT*. Although the *COMMENT* option may become more functional when we can freely reply to students, live input is preferable and is more in accord with the goals of the course.

The student may sign off from his German program at any time and call for a program of testing. This routine is in operation in 1973-74. It was in operation during 1971-72, but our design of the instructional and testing features proved unsatisfactory, even though the computer program operated effectively. By using the appropriate codes the student can ask for a list of tests—all adjective endings, perfect tenses, etc., select a test and be given a grammatical quiz, consisting of a random selection of problems which he is given two chances to answer. The student's score is presented as percent correct and is given to him at the conclusion of the quiz. This is not used as a grading mechanism, but as a device to let the student determine his own progress. Our grading is never based on computer performance but on performance in the German language alone, as demonstrated in the classroom.

There seem to be certain obvious advantages in the above mode of instruction. The student proceeds at his own pace and discretion; he can review according to his own needs. In other words, he has individualized instruction: individualized learning if he is part of the media-aided course covering basic German in one year, and individualized pacing and emphasis if he taking the course independently. Further, he is able to profit from a program of instruction which has been designed along sound principles from descriptive linguistics (including generative-transformational thought) and which tests him, not on his ability to recite rules, but on his ability to apply them to the language in the traditions of pattern drill and direct method instruction. The student, moreover, is immediately corrected on errors—he receives a response within five seconds after he makes an entry (the average response time is less than two seconds). After he is well along in the program, the student's spelling, including unlauded vowels, is nearly perfect, as one might expect. The computer program has no tolerance even for trifling errors. Even omitted punctuation is considered an error.

Student reaction to computer instruction is overwhelmingly positive. Of all the aspects of their instruction, the students respond

more favorably to the computer than to any other component of their instruction except the instructor. On this, too, we will shortly have detailed data from the Language Seminar that has been coordinated by the Consulting Group on Instructional Design at the University of Minnesota, directed by Russell Burris. The number of students who are temperamentally incapable of adapting to computerized instruction is small. Initially, we accepted the possibility that the computer, being a machine, might cause a negative reaction in some people. In the two years of full-time computer use, four or five people out of 300 have appeared who could not stand working at the terminal. It was not quite clear whether this was due to antipathy to the machine or because they refused to be as accurate as the machine demands. In general, the students have welcomed the computerized instruction mode.

Every sequence of pattern drills culminates in a reading assignment with questions that employ the grammatical rules learned up to that point. The questions and the answers are also processed by interaction between computer and student, but since pattern matching responses from the computer are inadequate for this purpose, the computer programs which induce and examine input include a new phase: the question programs.

The student is given what appears to be a routine question. He is asked to answer in phrases or words. The computer then selects a routing appropriate for his answer and responds: with a new question, if the answer is correct; with a piece of instruction appropriate for his error if the answer is incorrect. These new branching routines are necessary because the student knows too many right answers for a simple pattern drill response to be effective. The non-acceptance of correct answers for mere formalistic reasons has a discouraging effect. The question-answer dialogues with the computer continue in the question-answer phase to the end of the computerized instruction which is supposed to be completed about four weeks before the end of the college year.

In summary, the computer terminal gives the student virtually all his grammar instruction for the basic algorithms of German grammar at a pace and in increments which are entirely at the student's discretion. At an average rate of three hours a week at the terminal (plus whatever home study time he needs), the student completes the computerized instruction in twenty-six weeks. While doing this, he has the following options:

1. He may advance faster if he learns and applies the grammar well.
2. He is obliged to repeat what he cannot do.

## **Computer-Tutor**

3. He can review at his discretion.
4. His place is marked at each terminal session and remembered for his next session.
5. He may leave a message for his instructor without leaving the terminal or losing his place in the program.
6. He has a bi-lingual dictionary for the course at his command.
7. He may quiz himself on a grammatical increment and receive a score. Since the computer selects quiz items at random, each quiz contains a different set of problems, even if retaken immediately.

### *The Instructor's Options*

The instructor has additional options in utilizing the computer. The computer-programming routines, are based on FORTAN and other sophisticated routines including MIL (Minnesota Instructional Language). These have been written by the programmers so that the instructional content is available to the teacher without any technical knowledge except for a few routines and codes which can be written on one sheet of paper and quickly learned. The instructor is thus able to deal with his subject unencumbered by any need for computer programming knowledge.

The computer memory scores the performance, sentence by sentence, of every student in the program. The performance file thus accumulated lets the instructor examine individual or group performance on a given drill or drill problem to find out how well a student is learning, how well a class is advancing, or how effectively a drill or a problem is constructed. Drill problems that are obscure, incorrect, or inadequate can be quickly identified. Student problems or class difficulties can be identified as well. Detailed data on this is being processed at the Consulting Group on Instructional Design.

The instructor can instantly call up and examine the text or drills and questions stored in the computer memory and change the file without any need for technical programming knowledge. He can correct errors, eliminate items, add new items, or make whatever changes he sees fit and have them working in the program five minutes after he has completed his corrections. Alterations of the MIL programs (the last phases of the question/answer routines which complete each instructional cycle) take longer, not because the computer routines delay the correction but because the pseudo-dialogues stored in the computer must be examined for logic. For instance, it will not do to have the computer reply "very good" to the answer "I don't know," but that is the instructor's problem, not a computer programming problem.



The instructor has a computer identification number just like his students, but *his* number permits him to rove in the instructional program (his students cannot advance at will) to examine whatever he pleases. The computer also provides for the instructor at any time: a class list, a complete list of how far each student has progressed, or a record, sentence by sentence, of an individual student's performance.

### *Outlook and Conclusion*

Two more routines will be available by next year. The first will be the capacity to direct a message to any student or class upon sign-on. The second is the capacity to direct a student, or a class, around chosen drills, to detour a group to alternate drills or supplementary drills, in order to examine alternative methods of instruction. In our list of priorities we have chosen to put these last.

The MIL programs have been tested on trial runs, appear to be operative and are contained in the 1973-74 program; others are being written. The necessary computer programs are available from the Human Learning Center programmers and have been constructed in a form that makes them usable by other institutions and language instructors. For this phase of programming we borrowed extensively from programs in legal and medical instruction developed under the direction of the Consulting Group on Instructional Design.

Although the present textbook *Programmed German*, which parallels the computer sequence, is effective, some of its content is socially outdated and is not fully co-ordinated with recent behavioral, semantic and context-oriented linguistic theory, particularly on spoken German.<sup>5</sup> We are therefore combining semantic theory and context orientation with the yield from the data on *Programmed German* to write a new instructional textbook, *Deutsch*. Like *Programmed German*, *Deutsch* or any other new text can be immediately written into the drill program and MIL files for student instruction.

The drill program and MIL program of the computer can easily be adapted to the instruction of other languages. Dutch and Swedish programs are being written this year;<sup>6</sup> others are being planned. No modifications by the computer programmers are needed.

---

<sup>5</sup>Gerhard Clausing, "Replicated Spoken German in Beginning Textbooks—An Appraisal and Proposal," *Die Unterrichtspraxis*, Vol. 7, No. 1 (Spring 1974). Cf. also Gerhard Clausing, *Zur Struktur des umgangssprachlichen Gesprächs*, forthcoming, which contains a detailed bibliography.

<sup>6</sup>Swedish: Richard Auld; Norwegian: Solveig Zempel; Classical Greek: Gerald Erickson, Michael Kunin, Walter Nichipor; all at the University of Minnesota.

## **Computer-Tutor**

Other adaptations need only the writing of a programmed grammar to be inserted into the computer. It must be noted that traditional textbooks will not do; their sequence and logic may not be tight and the student may be given drills for which he has not been adequately prepared. The computer, which keeps a sentence-by-sentence record of student performance, offers the possibility for numerous language learning experiments. Some of these experiments will be the subjects of subsequent papers.

As a final remark, it must be reiterated that the computer is only *one* component in a media-aided language program which includes a grammar, television instruction, and other components linked with the classroom or individualized instruction. The computer component constitutes two to four hours a week of the student's weekly preparation time, computer-assisted learning is phased out in the twenty-sixth week of a normal first-year college course—five-sixth of the way through the first year of college instruction.

Obviously the computer component also adapts well to completely individualized instruction, private study, or correspondence study. In fact, some of our students are now successfully using the computer as the major input in a course in "German for Reading Knowledge." In interaction with the other components, this course constitutes the first fully functioning media-aided language course of its kind.