Computer-Assisted Instruction and Its Use in Occupational Therapy Education

(automated instruction, PLATO, self-study, tutorial)

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A computer-assisted instruction system is described in this paper, and the rationale for integrating this system into an occupational therapy course is discussed. Student performance in this course is apparently enhanced by using computer-assisted instruction. Attitudes of both students and faculty concerning the use of a computer for instruction are also discussed.

The computer has entered nearly every phase of our society. It has found its way into business, research, home management, play, and education. In 1975, C.B. English (1) noted that occupational therapy could use the computer most often as a professional tool for a data bank of patient information, vocational aspirations of disabled clients, research data, and educational resources and instruction. Since then, Morris and Brown (2), and DiSante (3), reported on devices for physically disabled patients that were either a result of development in or a direct application of computer technology. Hawkins and Hawkins (4) later described the use of a computer for matching students and clinical sites. This was done to place students more effectively and was based on individual student needs as well as efficient use of specific clinical sites. The use of computers for analysis of research data has been evident in occupational therapy literature and papers read at national conferences. Occupational therapists are using computers in a variety of applications; however, since English's article, no further investigation of Computer-Assisted Instruction (CAI) in occupational therapy education has been presented. The following describes an orientation to one CAI system, the rationale for integrating CAI into coursework, and a report of student performance in a course incorporating CAI.

Orientation to CAI

Computer-Assisted Instruction (CAI) has become a primary tool in
education. It is found not only in a university or college research setting, but also in high schools, grammar schools, and even in the home, where it continues instruction during “homework” hours.

Lessons in CAI are usually presented in any one or combination of the following 11 modes of interaction: drill, practice, problem review, diagnosis and prescription, tutorial, gaming, simulation, fact finding, computation, logical problem solving, and exploration (5). The tutorial mode, used extensively in CAI, works on the same basis as a tutor working directly with an individual student—the process (see Figure 1) begins by the topic identification (lesson), then information or facts are presented by the tutor (text), and a judgment is made concerning the accuracy of the answer (OK). Given a correct response, the process is repeated from the information step until the entire topic is covered.

Not all students flow through this process with perfection and/or total comprehension. Support is then provided in the form of review information, hints, or help via other resources, or sometimes just a second chance to answer the question. A response elicits feedback that either reinforces the correct response or takes the form of a hint or help. It is important at this point that the student be allowed to have some control over the situation. It is frustrating to try over and over to answer a question and simply be told the answer is incorrect. Therefore, options that allow the student to be given the correct answer, or “hints” to help the student arrive at the correct answer, are usually built into the various modes of interaction.

At the University of Illinois the computer-assisted instructional lessons are presented via PLATO (Programmed Logic for Automatic Teaching Operations), which was invented and developed under the direction of Dr. Donald A. Bitzer, a professor of engineering who presently serves as the Director of the Computer-based Education Research Laboratory at the University. The original concept in 1960 was use of a computer primarily for educational instruction. Today the PLATO system at the University has grown from the original single prototype terminal run by an ILLIAC I computer to a system of approximately 1,300 terminals all sharing time and resources on the CDC 6500 model computer interfaced with a CYBER 73-24 model computer (7). The terminals are located at sites throughout the United States, including other universities and colleges that offer occupational therapy educational programs.

After 22 years of service, the PLATO system has continued to function primarily for instruction. Data processing capabilities for statistical analysis of research have been developed; however, most data processing performed is in connection with student performance in instructional lessons.

Integration of CAI

The Department of Occupational Therapy at the University of Illinois at Chicago has used CAI offerings on the PLATO system in connection with a neuroscience course. This course, like the other courses in the curriculum, is presented in a guided self-study approach. It is divided into three modules of study: 1. peripheral nervous system and spinal cord, 2. brainstem and cerebellum, and 3. cerebrum. Each module is composed of educational objectives, reading assignments (required and optional), and activities that include audiovisual aids, CAI, and classroom activities.

Lectures for this course are pre-

Figure 1
Adapted from diagram by Donald A. Bitzer (6)
presented on videotape. The series, Basics of Neurology, features Brian A. Curtis, Ph.D., Peoria School of Medicine, and was produced by the University of Illinois specifically for occupational therapy undergraduates. The series consists of 20 videotapes, each approximately 20 minutes in length.

Throughout the 6 years this course has been presented, the primary readings have been derived from a variety of neuroanatomy texts including Correlative Neuroanatomy and Functional Neurology by J. Chusid, The Human Nervous System by M. Barr, Basics of Neurology by B. Curtis, and Core Text of Neuroanatomy by M. Carpenter. The lecture and reading materials are supplemented by in-class analysis and discussion sessions with an occupational therapy instructor and CAI via PLATO.

The intent of the course is to understand the structure and function of the human nervous system as it relates to movement, posture, learning, and memory; to understand that pathological processes result in an inability to function in a normal manner; and to develop an understanding of neuropathology and the resultant dysfunction in order to plan and carry out remediation programs. The guided self-study approach requires a high degree of individual student participation in the learning process. Ideally, learning resources are available through a variety of media that support the students' variable learning styles and preferences. Classroom contact hours are substantially reduced and alternate methods are developed that either substitute for or supplement the learning processes that normally occur in the classical classroom setting.

The PLATO lessons are presented in one or in a combination of the first seven modes of interaction previously listed: for example, drill over names and functions of the cranial nerves; diagnosis of nerve palsies based on simulation of patient performance in examination; and a game styled after the television show, "Jeopardy," as aired on NBC network during the 1960s and 1970s.

A total of 21 lessons in this content area are available to students. These lessons have been either written or reviewed by the occupational therapy faculty and assessed in reference to content relevance and depth. Of the 21 lessons, 19 are required and 2 are optional resources for the course.

### Student Performance

Statistical data were obtained from the computer records on all 52 students enrolled in the course for fall 1981. The records included: last date used, total number of days the student used PLATO, total number of hours on the system, lessons the student had entered, and whether the lessons had been completed. These records are routinely collected on PLATO and therefore, no special data collection processes were required.

Since the data records were run several weeks after completion of the neuroscience course, the records identified 17 of the 52 students who had continued to use lessons, although not required in subsequent courses. These 17 students were interviewed to determine the number of hours on the system during the course offering. One student reported several hours in non-neuroscience lessons. Since the number of hours in neuroscience lessons could not be realistically determined, this student's performance has been eliminated from data pertaining to hours in CAI neuroscience lessons. Since the number of hours in neuroscience lessons could not be realistically determined, this student's performance has been eliminated from data pertaining to hours in CAI neuroscience lessons. The mean hours for the remaining 51 students was 13.3 hours, with a range of 0 to 23.6 hours. The range of lessons completed was 0 to 21 (N = 52) with a mean of 16.9 (N = 52) lessons completed per student. It was noted that three students chose

<table>
<thead>
<tr>
<th>No. Lessons Completed (N = 52)</th>
<th>A (n = 6)</th>
<th>B (n = 28)</th>
<th>C (n = 18)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19 - 21</td>
<td>21.2 (%)</td>
<td>28.9 (%)</td>
<td>1.9 (%)</td>
</tr>
<tr>
<td>(27)</td>
<td>(11)</td>
<td>(19)</td>
<td>(1)</td>
</tr>
<tr>
<td>16 - 18</td>
<td>7.7 (%)</td>
<td>15.4 (%)</td>
<td>3.8 (%)</td>
</tr>
<tr>
<td>(14)</td>
<td>(4)</td>
<td>(8)</td>
<td>(2)</td>
</tr>
<tr>
<td>11 - 15</td>
<td>0 (%)</td>
<td>5.8 (%)</td>
<td>3.8 (%)</td>
</tr>
<tr>
<td>(5)</td>
<td>(0)</td>
<td>(3)</td>
<td>(2)</td>
</tr>
<tr>
<td>6 - 10</td>
<td>1.9 (%)</td>
<td>1.9 (%)</td>
<td>1.9 (%)</td>
</tr>
<tr>
<td>(3)</td>
<td>(1)</td>
<td>(1)</td>
<td>(1)</td>
</tr>
<tr>
<td>0 - 5</td>
<td>0 (%)</td>
<td>1.9 (%)</td>
<td>3.8 (%)</td>
</tr>
<tr>
<td>(3)</td>
<td>(0)</td>
<td>(1)</td>
<td>(2)</td>
</tr>
</tbody>
</table>
not to use any of the CAI lessons. For the 49 students who did opt to use CAI, the range of 6 to 22 lessons with a mean of 18.02 completed lessons is obtained.

A comparison of the use of lessons with the course grade received provides a more complete view of student performance (see Table 1). Most of the students who completed all of the required lessons (19-21 lessons) received a higher grade in the course (A or B), whereas students who completed 5 or fewer of the lessons received lower course grades. These statements reflect general trends rather than specific expectations based on completion of CAI lessons. For example, 1 student completed 19 to 21 lessons and received a C in the course, whereas another student completed only 6 to 10 lessons and yet received an A for the course.

To assist in interpreting the above-noted discrepancy, a comparison of hours spent in CAI and course grade (Table 2) could be used. Here the trend shows a greater number of hours if more lessons are completed. On the surface, Table 2 appears to indicate that students who spent more time in CAI tended to receive higher grades.

In addition to the average total hours in CAI, the average time per lesson was determined for each of the course grades. The students who received an A averaged 45.0 minutes per lesson. The students who received B or C averaged 49.2 and 42 minutes per lesson, respectively. The greatest difference here is 7 minutes per lesson between the B and C groups. In other words, B students spent 17.1 percent more time per lesson than C students. This implies that little difference exists among students in terms of time per lesson. The more critical issue is the greater number of lessons completed with a coinciding increase of total time on the system.

**Data Limitations**

Several limitations must be considered. The records displayed a high number of lessons that had been entered but not completed. For the purpose of this paper it was assumed that all lessons entered were completed. This assumption was made because the record of lessons entered and completed shows only the last time the student entered a particular lesson. Therefore, a student may have completed a particular lesson and later re-entered the lesson by mistake or to review a section. Either of these actions would result in a record displaying an incomplete lesson performance.

In addition, the students had available to them lessons of other content areas including medical terminology, anatomy, psychology, business management, and note-files (Note-files allow the students to ask a question and get answers from other PLATO users). Students could have spent most of the recorded time in these other lessons rather than in the neuroscience lessons. Considering interactions with the students, the instructor believes that, except for the one student previously noted, this is not the case, but it remains a possibility. Another concern is that, because of the method of storage used in PLATO, the data may not be complete. Records are normally returned to disc storage every 6 to 8 minutes; however, when a "crash" (unplanned computer down time) occurs, any data concerning use since the last return are lost.

**Attitudinal Considerations**

If a CAI system is to be used in any course of study, the attitudes of both faculty and students need to be considered. The use of CAI represents change. As humans we all have a
tendency to resist or even fear change. Concerns expressed by faculty are primarily centered around fear.

Probably few, if any, occupational therapy educators experienced CAI as occupational therapy students. Lack of previous experience or change in concepts has not prevented educators from teaching content such as sensory integration or neurophysiological approaches to treatment. The educators lacking exposure in these content areas have sought out the knowledge via formal classes and workshops as well as self-study. Since CAI is a specialized topic in education, occupational therapy educators will need to seek out further knowledge in order to use this medium of instruction not only effectively but also efficiently and economically.

As with many industrial and business workers, educators have expressed fears of being displaced by the computer (5). The answer to whether good teachers will be displaced by CAI is contained in Grubb's definition of CAI as "the use of a computer to improve the student's interaction with his subject matter, materials, and teacher." (5, p 51) Although it is true that the teacher is an integral part of CAI, "studies conducted with programmed instruction have shown that it requires better teachers to teach in the context of automated instruction." (5, p 63) The results of such studies are not surprising when one considers that the teacher may need to provide special help to a number of students, each of whom is at a different point in a program of study (5). Therefore, the fear of being displaced may actually center around a fear of being judged as something less than a "good teacher."

Students may also exhibit fear over using CAI; the root of this fear, however, seems to be with the loss of direct teacher contact. This fear can be dispelled when the student is reassured that CAI is an extension of the teacher and that it, like the textbook, provides educational support for the acquisition of knowledge. Some students are afraid that they will "break or blow-up" the computer. This fear can also be laid aside with some basic education about computers.

Fewer and fewer students each year express concerns such as those noted above. This is due in part to more students having been exposed to CAI in previous coursework and in part to the novelty of a new teaching approach.

The regular evaluation of the neuroscience course is another source of students' attitudes. From the fall 1981 class, the following comments regarding PLATO were made:

PLATO—excellent learning resource (its errors were frustrating sometimes).

PLATO was also helpful.

PLATO was excellent—More information regarding the tracts through the brainstem would be beneficial.

PLATO was very useful.

I thought PLATO was especially good—both to learn the material and to review for tests.

PLATO needs revision on some of the cases—getting stuck and not being able to get unstuck is too frustrating (8).

These comments suggest that students overcame their concerns and used CAI as any other educational resource.

Conclusion

Computer-Assisted Instruction is becoming a more common method of learning throughout all levels of education. Occupational therapy educators need to become familiar with this method and use it in the educational process. Education today aims to develop people capable of working in today's as well as tomorrow's world. Computers are a part of the present health care system and will be an even greater part in the future. Occupational therapy education should help prepare the practitioners for the trend by first exposing them to computers through the educational process, or as Toffler said, "Education must shift into the future tense." (9, p 378)

Acknowledgment

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