Abstract  This review describes 30 years of experience at the University of Kansas Medical Center in using computers in the teaching of pharmacology to medical students and other health professionals. The Computer-Assisted Teaching System contains both Computer-Assisted Instruction (CAI) and Computer-Managed Instruction (CMI). The system has evolved from mainframe to microprocessors to the current World Wide Web system. The greatest challenge has been to meet the changes in technologies and teaching approaches. The system has been well received by students and has provided the faculty with the means of providing a novel approach to teaching pharmacology.

Keywords  Computer-Assisted Instruction · Computer-Managed Instruction · Competency-based · Java · World Wide Web

Introduction

The Department of Pharmacology, Toxicology and Therapeutics introduced a Computer-Assisted Teaching System (CATS) in the early 1970s to teach pharmacology to second year medical students and other health professionals. Drs. John Doull, Stata Norton, Stan Nelson and Ed Walaszek were the key individuals instrumental in designing and developing this system (Doull 2001). Since that time most faculty of the Department have contributed to the system in use today. The CATS is composed of two parts: Computer-Assisted Instruction (CAI) and Computer-Managed Instruction (CMI; Doull and Walaszek 1978). The system has evolved from mainframe to Web-based over a 30-year period. This review will describe the challenges involved to meet the changes in technologies and teaching approaches when using computers in education.

Since other medical schools were interested in sharing in the development and the use of this system, a Consortium of CATS users was established in 1974 to share the philosophy and teaching material of the CATS system. For more than 10 years, members of this CATS Consortium met on almost a yearly basis to share material and teaching philosophies. The discussions at these teaching sessions were critical in the evolution of teaching pharmacology in medical schools during that period and still influence how we teach pharmacology at the University of Kansas Medical Center. By the mid 1980s, there were 65 domestic and foreign schools that were members of the CATS Consortium (Pazdernik and Walaszek 1983). The leadership within the department changed in the 1990s and the Consortium was no longer continued but CATS continued to be a major teaching component of the pharmacology course at the University of Kansas Medical Center.

Guiding principles

When the CATS system was introduced in the early 1970s, five guiding principles were identified as being essential for a new teaching program in pharmacology (Pazdernik and Walaszek 1983). These were:

1. Pharmacology courses must be available at any time during the year to students.
2. Programs must be available to handle programs with different levels of preparation.
3. Students must be able to progress through the course at varying speeds (self-paced).
4. The system must provide for frequent and rapid feedback to both students and instructors (CMI).
5. The teaching program should utilize newer educational technology and techniques to provide optimal flexibility.

To meet these guiding principles, a modified “Keller Plan” (Keller and Sherman 1974; Russel 1974; Stoward 1976; Schwartz 1980; Walaszek 1982) was adopted. The course was divided into modules and students were required to demonstrate competence in each module. This could be referred to as “Competency-Based Curriculum” although the term today is more often applied to gaining competencies in clinical skills (Chambers 1993; Neidle 1994; Smith and Fuller 1996; Hill et al. 1997; Go 2001). A required demonstration of competence addresses a common criticism in basic science teaching – the so-called gap in knowledge. We ascertain that competency-based knowledge acquisition is as important as competency-based clinical skills. We set the passing range at 72% which at that time was approximately 14% higher than the score needed to pass National Board of Examiners Part I (Pazdernik and Walaszek 1983). To achieve this goal, we had to allow the students to take each module of the course multiple times. The actual number of times that we made available for students to demonstrate competency in each module varied considerably over the 30 years that we have used this system. Today we only give students two opportunities to take each module and have dropped the requirement for students to pass each module. This may have been a mistake because in the last few years we have had a greater percentage of students at our institution, than what we believe is acceptable, who have failed Part I of Boards on the first attempt. Many of these students pass our course but fail one or more blocks of our course or the final exam; a similar finding occurs in the other basic science courses. We abolished the requirement to pass each module when we introduced small group discussions into our pharmacology course, because the schedule does not allow for time to have small group discussions and offer more than two chances to demonstrate competency in each block of material.

Computer-Assisted Instruction (CAI)

CAI consists of 112 instructional programs. The majority of these are self-instructional programs that require fill-in-the-blank or response to simple multiple choice-type questions. Many are equivalent to an interactive lecture over the topic. Initially all CAI programs were written by faculty members in their area of expertise. During the second phase of CAI development, many of the programs were written by medical students in consultation with a faculty member who was an expert on the topic. The students’ experience as users of the programs enables them to write programs that are very efficient in teaching. This exercise also met their obligation for a communication skill requirement. The original CAI programs were on a mainframe computer, the programs then were converted to microcomputers and now the system solely operates on the World Wide Web system described below. During the transition to different operating systems, the programs were often updated for content and format. These updates were primarily carried out by just a couple of faculty to give more consistency to the programs. Faculty involved with updates need to be familiar with all the teaching materials of the entire faculty who participate in the course. Some of the original CAI programs made use of extensive branching paradigms that would take the students in different directions depending on their response. Student evaluations of different formats revealed that students favored more linear paradigms (text → question → response → text → question → response → text). With the more branching-format, the student would often select the wrong answer to get more information. Students find the “Drill and Practice” programs as the most time-efficient ways to master material for exams (Walaszek and Kreese 1992). We do have simulated autonomic laboratories that require problem-solving skills but for the most part today we depend on small group discussions for building problem-solving skills. Recent publications on the use of CAI in teaching pharmacology are found to be more prevalent in teaching of nursing students than medical students (Manias et al. 1999, 2000; Pagana and Caravaggio 1999; Pereira and Murzyn 2001; Rossignol and Scollin 2001).