Use of Technology Throughout the Curriculum

By George E. MacKinnon III, Ph.D., R.Ph., FASHP, and Hisham Mahrous, Ph.D., MBA

Technology and the Internet have revolutionized our lives. We bank and pay our bills electronically, trade stocks from our computer at home, and transfer money halfway around the world in the blink of an eye. These same emerging technologies will have a profound effect on health care, thus offering opportunities for pharmaceutical care while presenting new challenges to remain competitive and up-to-date. Pharmacy students of today, tomorrow’s practitioners, will be the most affected. Therefore, it makes sense to expose students throughout their educational process to these technologies. At the College of Pharmacy–Glendale, we have attempted to do just that.

Three specific innovations in the pharmacy curriculum will be discussed: (1) the use of personal digital assistants (PDAs) and the Internet to document and track pharmacy student interventions; (2) coursework involving the use of PDAs in the classroom; and (3) the use of a computer-based annual academic assessment (AAA) to track in a formative manner, the ongoing performance of students with respect to content and knowledge presented in the curriculum.

Midwestern University College of Pharmacy–Glendale (MWU-CPG) graduated its inaugural class of 93 students in May of 2001. MWU-CPG offers a year-round pharmacy curriculum leading to the Pharm.D. Degree in three calendar years, as opposed to four. Among the College’s foundational offerings are the integrated teaching of pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics over a six-quarter sequence and an experiential program woven throughout the entire three years of the program.1

The Era of Digital Communication in Patient Care

Electronic automation affects Americans in a multitude of ways, yet surprisingly in health care it has been elusive at best. One of the most common written transactions in health care is that of writing a prescription. Presently less than 2% of the 3 billion prescriptions prescribed are transmitted electronically by the 650,000 U.S. practicing physicians. Though an estimated 4% to 11% of physicians are using PDAs to generate prescriptions, the majority of these prescriptions are printed for patients and/or faxed to pharmacies for processing.2 Recent estimates however, suggest that 15% to 20% of practicing physicians own PDAs and use them primarily for data retrieval, such as scheduling and address keeping, though they use software to check drug dosages and interactions.3 By 2004, it is estimated that 20% of physicians will be using PDAs for clinical and administrative transactions.3

Several companies have developed platforms for the electronic prescribing market, some of which are Web-based, and others that run off PDAs. The movement towards electronic prescriptions will be inevitable, given the recent findings of the Institute of Medicine (IOM) Reports4,5 and efforts from special interests such as the Leapfrog Group. Though sometimes reluctant, physicians have adapted to technology innovations over the years as many used pagers then cell phones and now PDAs.

The 1999 IOM Report (To Err is Human: Building a Safer Health System)6 detailed the finding that as many as 98,000 Americans die unnecessarily every year of medical mistakes and errors, of which 7,000 deaths are attributable to the result of medication errors, costing upwards of $9 billion annually. The report concludes that most errors are not the result of flagrant recklessness but occur as a result of cumulative opportunities for human, systems-based, and technological errors in a very complex medical system.

The second IOM report (Crossing the Quality Chasm)7 released in 2001 attempted to chart a course for ensuring the health system in place does not inflict harm on those it intends to treat. Recommendations from this report suggest an environment in health care be created that fosters and rewards improvement by: "(1) creating an infrastructure to support evidence-based practice, (2) facilitating the use of information technology, (3) aligning payment incentives, and (4) preparing the workforce to better serve patients in a world of expanding knowledge and rapid change."

The private sector is also insisting upon changes in the health care system to ensure optimal outcomes are obtained. For example, the Leapfrog Group is a coalition of businesses formed to inform the health care industry that significant leaps in patient safety and customer value are desired and will be recognized and rewarded.8 In 2001, approximately 80 U.S. companies were included in the membership of the Leapfrog Group including AT&T, Boeing, Daimler-Chrysler, Ford, General Electric, General Motors, Honeywell, IBM, Motorola, Wells Fargo, and Xerox. Also participating are companies from the health care sector, including Eli Lilly, GlaxoSmithKline, Merck, Procter & Gamble, and Schering-Plough.

General Motors, North America’s largest private purchaser of health care, is spending approximately $3.9 billion annually for its 1.23 million beneficiaries.9 General Motors and similar corporations within the Leapfrog Group have said they want more accountability for the dollars they spend on health care and an assurance that quality practices are consistently occurring. In exchange, to those health care organizations and providers that meet their standards, Leapfrog members are willing to direct hundreds of millions of workers (resulting in billions of dollars). Of the three specific standards set by the Leapfrog Group for hospitals to meet to receive members’ business, the first is implementation of a computerized physician order entry (CPOE) system. The CPOE has been dubbed the “gold standard” of medical error reduction strategies. However, fewer than 1 in 10 hospitals in

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the U.S. had CPOE systems in place as of 2001.

■ Documentation of Student Interventions

The principal purpose of clinical documentation is to provide a record of what a practitioner does, why it is done, and where possible what outcomes are achieved. With respect to the provision of pharmaceutical care, it is essential to succinctly document what patient-specific decisions are made by pharmacists and why these decisions are made. For the profession of pharmacy to fully embrace the concept of patient-focused care, documentation of patient care-related activities and associated recommendations, actions, and outcomes must become an essential function of pharmacists, irrespective of practice setting.

In today’s health care arena, it is essential that all contributions to patients’ well-being be followed by proper documentation by the respective providers, including pharmacy students. Digital documentation such as the use of computer-stored medical records or electronic medical records (EMRs) is one vehicle that, if universally adopted, would assist in enhancing the communication among providers. To adequately prepare future pharmacists, students must be trained in the process of documentation related to patient care activities.

As increased financial constraints are placed on health care providers, it may become more difficult for colleges and schools of pharmacy to recruit volunteer faculty to assist in the experiential education of students. A lack of experiential sites could pose a significant barrier as programs move to implement the entry-level Pharm.D. Thus, colleges and schools of pharmacy must begin to document the contributions pharmacy students can make while participating in rotations to facilitate continued use and possible expansion of experiential programs. Documentation applications must be easy to use, portable, produce useful reports, and be replicated by others consistently.

PDAs can be used to collect, process, and transmit data that ultimately impacts the care delivered to patients. Most PDAs are powered by one of two operating systems: the Palm-OS (i.e., Palms and Visors) or Microsoft’s Pocket-PC (i.e., Casios and HP-Jornadas). The pharmacy student documentation system (PSDS) was conceived and designed by the authors and is based upon the work from the scannable data collection instrument Patient Care Activity Record (PCAR). The PSDS application operates on the handheld Hewlett Packard Jornada-680 and requires students only to “point-and-click” on a pre-programmed electronic form. Common reasons for interventions, actions taken, and recommendations provided are categorized as well as time involved, the outcomes of recommendations, who initiated the intervention, medications involved and the potential impact on patients’ health-related quality of life (HRQOL).

The PSDS application is programmed using Microsoft Visual Basic for CE operating with PocketPC that translates collected data into Microsoft Access files. A synchronization application was subsequently written to allow for an automatic link to a website to collate aggregate data from users. Upon submission of interventions students, preceptors, and sites can receive usage reports related to student activity at their respective site as well as comparative reports. No personal patient data is transmitted to the Web server.

■ PDAs in the Classroom

How prepared are our future graduates to embrace this technology? What type of impact can we expect in the pharmacy world? It has been argued that medical education both in the professional and postgraduate areas needs to be readdressed with focus given to the respective curricula on information technology and how it impacts the lives of physicians and patients.

In 2000, the College of Pharmacy—Glendale began to address these questions by offering the elective course, Applications of Handheld Devices in Healthcare. This course focuses on the creation of database applications and records management with PDAs and builds upon previous knowledge provided in a required Drug Information/Informatics course. The concepts and techniques for the systematic creation, storage, reproduction, distribution, and retention of medical patients’ records are discussed. Upon completion of the course, students should be able to:

- Develop database applications for use in rotation and/or for drug information
- Input inventory of a pharmacy and/or medical office records electronically
- Organize those records (normalization)
- Prepare records retention schedule
- Create and modify database structures for various platforms
- Enter records in a database
- Maintain and use records
- Write database queries
- Generate database reports
- Link database files
- Purge records
- Explain methods of maintaining active and inactive records
- Determine appropriate classification systems for various file groups
- Describe security for records
- Build relational tables, queries, forms and reports using MS Access

Student evaluations of the course have shown that a large number of students found the course to be beneficial to their understanding of data elements necessary in patient management and the unique challenge presented in capturing such data electronically. Annual enrollment is between 70 and 85 students in this elective (or approximately three-quarters of a pharmacy class). Ongoing discussions with the university’s colleges of osteopathic medicine and allied health (physician assistant, physical therapy, and occupational therapy) have occurred to see if there is interest in having these respective students take part in a similar course offering.

■ Annual Academic Assessment

The focus of this computer application relates to providing formative feedback on pharmacy students’ performance on an annual basis. The annual academic assessment (AAA) is conducted after four didactic quarters of study. The AAA provides non-threatening feedback to students relat-
ed to key concepts or knowledge they should have acquired throughout the first and second years of didactic study. First year students take their first AAA at the conclusion of the summer quarter (after completing four didactic quarters of instruction). Students in their final year of study again complete another AAA comprised of new material from their most recent four didactic quarters of instruction.

Material for the AAA is solicited from instructors of all courses and categorized according to respective course number and NAPLEX (North American Pharmacist Licensure Examination) competencies. Instructors submit material thought to be essential with respect to student learning outcomes from the respective courses. The first year assessment consists of material primarily from the biological and pharmaceutical sciences. The second year assessment consists of material from pharmacology, medicinal chemistry, pathophysiology, and pharmacotherapeutics.

Both 100-item assessments are administered via personal computers in the computer laboratory through an intranet over a two-hour period. Online administration allows students to review questions answered incorrectly and receive real-time feedback on their performance. Individual output is then generated for students allowing them to map their areas of strengths and weakness as they relate to the curriculum and NAPLEX competencies. The results of an attitudinal survey of students were favorable related to the appropriateness of the AAA format, optimal time for administration, and future use of computer assisted instruction (CAI) and computer-based assessment/evaluation at the College.

### Summary

Emerging computer technologies such as PDAs have the potential to increase communication between members of the health care team in assisting patients to achieve defined therapeutic outcomes while documenting the contribution the pharmacy community plays in patients’ health care. Likewise with the advent of computerized board examinations in pharmacy, students must obtain experience with and become comfortable taking online examinations prior to and after graduation. Ergo, we must employ these technologies in the classroom, where future practitioners can be exposed to the technology first and possibly embrace it in practice. However, we must remain vigilant to our approach of integrating technology into the pharmacy curriculum. As Albert Einstein once said: “Not everything that can be counted counts, and not everything that counts can be counted.”

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