

# An Educational Design to Teach Drug Information Across the Curriculum

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This paper describes the design and experience with a new integrated model for teaching drug information across the curriculum. There are three primary components of the system including: (i) teaching and reinforcing drug information knowledge and skills in an integrated manner consistently throughout the curriculum; (ii) outlining practice-based outcomes for drug information throughout the curriculum; and (iii) impressing upon students that drug information skills are a vital part of routine pharmacy practice. The new model has been generally well accepted by faculty and students. Preliminary feedback from the faculty suggests that first professional year students are better able to integrate information from several sources, such as patient parameters and literature evidence and search for information independent of a scheduled assignment, some barriers that need to be overcome with implementation have also been described, this model will be used for integrating other content areas in the curriculum.

## INTRODUCTION

In August 1995 the University of Kentucky College of Pharmacy implemented a new entry-level Doctor of Pharmacy program. A primary goal of the program is the development of generalist pharmacists capable of managing the drug therapy of patients and populations in a cost-effective manner. To be competent in this responsibility, practicing pharmacists need to be capable providers of drug information, a valued basic function unique to the profession. To develop this skill, students in the new curriculum are taught not only to "perceive and evaluate the medication information needs of patients and families, health care professional, and other personnel", but also to "use a systematic approach to address these needs by effectively searching, retrieving,

and evaluating the literature and appropriately communicating and applying this information to a patient care situation."<sup>(1)</sup> Valuing and using these skills is as important as learning them in formal coursework.

Consistent with new curricular designs in health professions education, students are introduced to patient care and simulated case studies beginning their first day of study. Because students need to locate and interpret reference materials to solve patient problems early in their program, they now learn and master drug information knowledge and skills incrementally across three years of the curriculum. This paper describes an educational design to teach drug information to pharmacy students to enable them to integrate these skills while mastering content in other courses.

## PHILOSOPHY OF THE NEW CURRICULUM

The former curriculum utilized a traditional design that offered primarily basic science early in the program with more practice, therapeutics-based content, and experiential education during the later stages. In response to faculty and student assessment of the former curriculum, some basic therapeutic courses that focus on prevention and treatment of disease and using and non-prescription Pharmaceuticals have been moved to the first year of the new curriculum. In addition, consistent with recommendations of health professions education literature, the faculty designed the new curriculum to incorporate problem-solving early in the program(2).

The faculty use a variety of active-learning, problem-solving methods in course-work. Early in the curriculum, students work through patient cases designed to be situated in practice and use cues such as prescriptions or medication orders to invoke student problem-solving and learning. In solving problems, students need to retrieve and interpret information. Cases are also designed to support stages of development of skills: first year—basic, well-defined problems; second year—intermediate, moderately defined problems, and the third year — complex, ill-defined problems.

A cornerstone of this program is a six-semester “Contemporary Aspects of Pharmacy Practice” course designed to integrate practice-oriented content such as drug information skills, health care systems, patient communication, pharmacy ethics, behavioral science, and pharmacy law. Outcomes and assessment strategies for the drug information curriculum have been developed to guide teaching and student development. Although consensus-derived objectives have been published for drug information education, no publication has identified practice-based outcomes for drug information in a pharmacy curriculum(3).

## TRADITIONAL METHOD OF TEACHING DRUG INFORMATION

Prior to the current curricular revision at the University of Kentucky, faculty taught drug information skills to both Bachelor of Science degree and Doctor of Pharmacy degree students. In the former curriculum, Bachelor of Science degree students participated in several lectures and problem-solving activities as a part of another course to learn the systematic approach to responding to drug information needs. On the other hand, the drug information component of the Doctor of Pharmacy curriculum was taught as a separate three credit-hour course to pharmacy students in their last year in the classroom prior to entering their 10-month clinical clerkship experience.

The concept of teaching drug information as a single course is consistent with the curricula of most colleges and schools of pharmacies that offer drug information courses. In two recent national surveys, approximately 85 percent of the respondents reported their institution offered a separate drug information course(4,5). The results described by Mullins also indicated that the semester credit-hour commitment ranged from one to four hours for all degree programs. The content of the University of Kentucky drug information course material focused primarily on developing competency in: (i) searching the secondary literature through databases, and (ii) critiquing and applying primary literature using simulated patient cases or drug policy controversies.

As the drug information faculty gained more experi-

ence with teaching drug information skills in a single course in the last classroom year, they noted several limitations in the curricular design and teaching methods. First, because of the placement in the curriculum, students received no or little drug information education during their first and second professional years. This design had consequences for both students and faculty who taught in these years. First- and second-professional year course instructors could not take advantage of having the students apply a systematic approach to addressing drug information needs in their courses. As a result, they had unclear expectations of student ability in regard to drug information skills. Some faculty took time from their own courses to teach drug literature searching skills which created redundancy, inefficiency, or confusion for students.

In addition, because faculty members who work in specialized drug information centers in tertiary care centers taught these skills in a separate course in isolation from professional practice and the other parts of the curriculum, students may have developed the perception that these are specialized skills not as important in routine pharmacy practice. For example, when students are asked to rate the value of courses to their career on a six-point scale with 1 being not valuable to 6 being very valuable, therapeutics (mean = 5.69) and pharmacokinetics (mean = 5.70) have been consistently rated higher than either drug information (mean = 3.77) or statistics (2.26).

## NEW INTEGRATED MODEL FOR TEACHING DRUG INFORMATION

The awareness of the limitation of the curricular design that teaches drug information skills at a later stage of the curriculum led the faculty to create a new curricular design. There are three primary new components of the system for teaching drug information at University of Kentucky: (i) teaching and reinforcing drug information knowledge and skills in an integrated manner consistently throughout the curriculum, in contrast to an individual course; (ii) outlining practice-based outcomes and requiring student demonstration of skill mastery for drug information throughout the curriculum (Appendix A); and (iii) impressing upon students that drug information skills are a vital part of routine pharmacy practice.

Consistent with the curricular philosophy, drug information practice-based outcomes and the related course topics are staged as basic, intermediate, and advanced during the first, second and third professional years. The faculty members with expertise in drug information currently teach modules in the contemporary aspects of pharmacy practice of content similar to the former curriculum. The purpose of these modules is to prepare students to integrate and make use of their skills in other courses and problem-solving activities. The drug information faculty member serves as a collaborator on cases and activity design and as a resource for other faculty to understand and develop mechanisms to help reinforce students drug information principles. Therefore, faculty members communicate a systematic approach to drug information skills to students as an integrated, basic function of pharmacy practice. Outcomes in the new curriculum are written as broad performance-based aims to serve as “guideposts” for teaching methods, student performance, and assessment strategies(5). Practice-based outcomes for the drug information section are written at a variety of levels in the cognitive, and where appropriate,

**Table I. A comparison of two curricular designs**

Former curricular design	New curricular design
Faculty member with expertise in drug information teaches drug information in one course late in the curriculum.	Faculty member with expertise in drug information teaches drug information modules across the curriculum beginning in the first semester.
Drug information faculty member is responsible for teaching one course.	Drug information faculty member is responsible for modules and collaboration with other faculty members to design cases and activities to reinforce the systematic approach to drug literature evaluation.
Drug information is taught as a specialized skill.	Drug information skill development is designed to be integrated into cases and other course content to reinforce the importance of drug information skills as a basic function of pharmacy practice.
Practice-based outcomes are not explicitly defined.	Drug information faculty member shares defined practice-based outcomes with students at the beginning of the curriculum to serve as basis of assessment.
Statistics is taught as a separate course by a statistician.	Statistics is taught by a statistician as an integrated component of drug information in collaboration with the drug information faculty member, emphasizing the relevance to drug information.
Drug information is not coordinated with other courses in the curriculum.	The drug information faculty member works with other faculty members to coordinate skill development.

affective domains to guide assessment(6,7). Statistics is now an integrated portion of the course sequence with the drug information faculty member working closely with a statistics faculty member to integrate material. Based upon clearly defined outcomes, the drug information faculty member assesses student competency throughout the curriculum, and most importantly at the stage when the student is expected to move to higher level skills. Table I describes attributes of the former and new curricular designs of teaching drug information.

In general, the first professional year includes the key elements for pharmacists to practice as drug information providers focusing primarily on the systematic approach to problem-solving in drug information, including the basics of searching (e.g., Internet, Medline, Toxline, and other databases). An important element of this year often assumed and overlooked for beginning pharmacy students is teaching them the scope, type of information, method of access, structure, and application of frequently used drug information tertiary resources. Most of this material is taught with focused small group discussions and problem-solving techniques, and reinforced using simple cases in which students are expected to bring and use reference materials during class to solve realistic pharmacy patient problems throughout the course. (Table II) At the end of the first professional year, students participate in a month-long Early Pharmacy Practice Experience rotation and are expected to assess practice sites for access to drug information and to utilize their early skills to support pharmacists in providing pharmaceutical care.

The second professional year focuses primarily on interpretation and application of the primary and secondary literature and addresses therapeutic controversies in more complex patient situations. An important contribution to the course has been the integration of basic statistics, which was previously taught as a separate course concurrently with the drug literature evaluation course. Because the drug literature evaluation course included teaching the students to assess statistics as an integral part of evaluating the

primary literature, students reported redundancy and inefficiency and often confusion about the applicability of statistics to drug literature. The drug information and statistics faculty members now work to integrate material to provide more continuity for the students, including using practical examples in teaching. During the third professional year drug information skills, faculty members will introduce population-based applications (e.g., pharmacoconomics, epidemiology, and drug policy decision-making).

Each academic year the students need to demonstrate an ability to integrate each drug information skill level within a simulated typical practice setting as a vital part of the routine practice of pharmacy. We considered this to be critical because of advancements in technology and availability of affordable resources in remote locations has expanded capabilities for application in several types of practice settings. This approach may also be helpful as our students enter the clerkship environment to help the voluntary faculty gain from the student's academic experiences to keep abreast of new resources and applications in the area of drug information.

Each time drug information skills are taught, the practice-based outcomes are shared with students prior to presentation of course material to help them understand the expectations and their responsibilities. Outcomes are also reviewed at completion of material to reinforce the student's responsibility for them throughout their academic and professional experiences. Once the material is presented, and competency assessed, resources are made available for guidance on an individual basis.

The faculty member who teaches drug information also shares the outcomes and activities with the faculty who are concurrently teaching other courses to the students. When given the list of outcomes and suggested tasks, the instructors of concurrently offered courses are able to provide activities for the students to help reinforce the skills into their own course material. Because the responsibility for reinforcement of skills is the responsibility of several faculty and facilitators, a faculty development program that focuses

**Table II. Example of professional year one patient case**

Students are expected to bring *Facts and Comparisons*, *USPDI*, and a medical dictionary to class.

#### Case material

You are a pharmacist in the PharmCo chain in Gadsby, Kentucky, a small town about 12 miles west of Lexington. One February morning, you look up to see Mr. Carter, a regular customer, approaching the counter. Mr. Carter is in his early 50's; you went to high school with his daughter. You notice that not only has he not removed his gloves, hat, and scarf upon entering the store, but he appears overly "bundled up" in a down parka with heavy turtleneck and sweater peeking out of the neck. This seems odd to you because it is a fairly warm day for February. Mr. Carter hands you a prescription for Lidex cream. You type the name Lee Carter into your computer, and his profile appears on the screen.

#### Objectives

To review basic communication skills.

To evaluate the information on a patient profile and apply that information appropriately.

To describe the effects of Graves disease in the body and the types and mechanisms of treatment.

To review the basic methods of systematically applying the literature.

#### Suggested questions

What are your general impressions about the situation and the patient? What do we know from the information given here? What does the profile tell you about the patient?

What does the fact that the patient has a history of Graves disease tell you about the patient today?

How does this treatment for Graves disease work in the body? What about other treatments? Why would this treatment be used for this patient over some other?

on building competency and consistency among faculty members has been provided on a limited basis. This initiative has also been extended to the voluntary faculty within the state which includes teaching drug information skills as an integral part of providing pharmaceutical care and making drug policy decisions. The new methods are expected to help to provide consistency, decrease duplication of effort and continue to reinforce these skills into practice-based settings.

#### EXPERIENCE WITH THE NEW METHOD

The new method has been used for two years in the new curriculum. By the end of the second year of the new curriculum, students have been assessed on 80 percent of the drug information material they would have received in the former curriculum. Several positive changes have occurred since implementation of this model, and faculty are working to improve some areas of the design. Communication on drug information skills has moved across the barriers of individual courses and has expanded and clarified what the expectations are for both groups. Faculty members in concurrent courses have been able to take full advantage of integrating these drug information skills into their course material at an earlier time in the student's academic career. Students also have more opportunity to learn what the expectations are for pharmacists in practice, as it relates to the key role as drug information providers.

During biweekly faculty meetings and focus groups for accreditation self-study basic science and clinical pharmacy faculty members have reported that students at this stage of their program are more "scholarly" and demonstrate advanced problem-solving skills that require information-seeking. They also report students are able to integrate information better from several sources such as patient parameters and literature evidence and search for information independent of a scheduled assignment.

Although the changes have been handled in a positive fashion, there are some key elements to consider in implementing this model. The faculty member who teaches drug information may naturally experience a discomfort with losing the ability to work within the confines of an individual course in which the drug information expert has full capacity of deciding what, when and how information is taught. Because the new structure requires a great deal of coordination of several individuals across courses; some flexibility may be decreased. Although there is a faculty member responsible for developing outcomes and making assessments to ensure competency, he or she must take on a new role and also serve as a mentor and facilitator for several other faculty to reinforce these skills. To achieve the intended student outcomes, faculty who teach in concurrent courses need a minimum competency in drug information. For the faculty member who teaches drug information, this will require a commitment to also teach a faculty development program that includes clerkship preceptors.

#### CONCLUSIONS AND PLANS FOR THE FUTURE

The three primary new components of the model for teaching drug information at University of Kentucky includes teaching the course topics in an integrated manner throughout the curriculum, outlining practice-based outcomes for drug information throughout the curriculum, and impressing upon students that drug information skills are a vital part of routine pharmacy practice. Practice-based outcomes and the related course topics are staged as basic, intermediate, and advanced during the first, second, and third professional years. Preliminary feedback from the faculty suggest that the first professional year students are able to integrate information better from several sources such as patient parameters and literature evidence and search for information independent of a scheduled assignment. Future plans include integration of second and third year outcomes into the curriculum, expand faculty development skills in the area of drug information, and maintain pharmaceutical care initiatives in the state of Kentucky for drug information skills. This model will be used for integrating other content areas in the curriculum.

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## APPENDIX A. OUTCOMES AND ASSESSMENT

Below are expectations for educational outcomes and methods of assessment throughout the curriculum:

### A. Professional Year 1 (beginning)

At the end of the PY1 drug information module, students should be able to:

1. Identify needs, depth of response, and obtain appropriate background information to adequately respond to a request in a patient care situation, when given a medication information request from a patient, family, or health care provider.

**Assessment:** Given a typical practice situation in class, students work independently to develop their approach to identifying drug information needs and requesting background information. Subsequent discussion and assessment occurs as a group.

2. Explain the scope, type of information, method of access, and types of questions that pharmacists would be able to address using the following resources:

American Hospital Formulary Service Book

Applied Therapeutics

Drug Interaction Facts

Drugs in Pregnancy and Lactation

Facts and Comparisons

Medical dictionary

Package insert

Physicians Desk Reference

Principles of Internal Medicine

Side effects of drugs

Pediatric drug handbook

**Assessment:** Students complete and receive feedback on a homework assignment in which they need to locate listed resources; describe the scope, type, method of access of each resource; and discuss, assess, compare and contrast the types of information that is available in the resources to pharmacists.

3. Define and discuss the strengths and weaknesses of the primary (*e.g.*, clinical trials), secondary (*e.g.*, indexing and abstracting systems) and tertiary literature (*e.g.*, texts).

**Assessment:** Examination

4. Assess a medication information need and use the computerized database Medline to find a citation that would provide evidence (*i.e.*, review article or practice guidelines) to adequately respond to the problem.

**Assessment:** Students are given a typical patient care situation and drug information question and have to independently find a citation for an article that would address the need.

5. Search the Internet for information at the FDA, AHCPR, White House, or other destination, if given an url (address), to respond to a medication information need.

**Assessment:** During class sessions and checked by the instructor, students are given an assignment and independently address medication information needs by searching and evaluating information on the Internet.

6. Distinguish between the types of articles available in the professional literature including a review, clinical study, editorial, case report, and letters to the editor.

**Assessment:** Examination.

7. Discuss the concept of drug-induced disease, and if given a typical patient situation, use a published case report to address a patient care situation.

**Assessment:** Students are given a typical patient care situation, and identify factors that indicate causality between the drug and side effect, and use the case report to address the situation.

8. Interpret and combine information from several sources into a concise verbal presentation.

**Assessment:** Students are given a typical patient care situation to apply a systematic approach utilizing several resources to address the drug information needs of the patient and to communicate that response verbally to a patient or health care provider.

9. Design a search strategy based upon their knowledge of the strengths and weaknesses of different types of literature (*e.g.*, primary, secondary and tertiary) and other types of communication (*e.g.*, calling agencies, asking experts).

**Assessment:** When given a patient case, the student is able to document the appropriate approach to address the drug information need using the primary, secondary, and tertiary literature and other methods of communication.

Discuss how drug information skills are a vital part of the routine practice of pharmacy, and appreciate and assume responsibility for integrating beginning-level drug information skills to beginning patient and population-based problems.

**Assessment:** When given several patient care scenarios, the students can identify and discuss several areas in which drug information skills can be integrated into the situation to assist patients, families or health professionals. Students demonstrate using these basic skills during problem-based learning case discussions in facilitated group sessions.

Potential tasks for faculty members to re-enforce drug information knowledge and skills in other courses:

1. Apply the systematic approach to addressing medication information needs including evaluating the situation, searching, retrieving, and evaluating the literature, and appropriately communicating and applying the information to the patient care situation.
2. Perform a Medline search and retrieve a review article.
3. Search the Internet for information from the FDA, AHCPR, White House (public policy), or other site (if given the url).
4. Use the resources (Outcome #2) in class to find information that they have generated from questions from faculty, their group, or themselves.

### B. Professional Year 2 (intermediate)

*Prior to beginning the PY2 drug information module, students are required to review and assess their own abilities in achieving the intended outcomes of PY1. At the end of the PY2 drug information module, students should be able to:*

1. Describe the publication process, including the peer review system.

**Assessment:** Examination

2. Search Medline and retrieve articles from the primary literature, If given a drug information question.

**Assessment:** Given a typical pharmacy situation or controversy in class, students work independently to obtain adequate scientific evidence to support a view. Subsequent discussion and assessment occurs as a group.

3. Search several secondary databases in Medlars including Health, Toxline, and AIDSline, among others, when given a drug information question.

**Assessment:** Given a typical pharmacy situation or controversy in class, students work independently to obtain adequate scientific evidence to support a view. Subsequent discussion and assessment occurs independently and as a group.

4. Distinguish between the capabilities, logic structures, and uses for several search engines on Internet; and use those search engines on Internet to expand opportunities to find information.

**Assessment:** Given a typical practice situation in class, students work independently to develop their approach to identifying drug information needs. Subsequent discussion and assessment occurs as a group.

5. Describe the predictive value of animal pharmacological and toxicological studies and the purpose and scope of each phase in the drug development process.

**Assessment:** Examination

6. Identify and adequately critique the research design according to preassigned criteria, when given a clinical study.

**Assessment:** Examination. Students independently and in groups are to identify research design attributes of a study and adequately critique the study according to preassigned criteria.

7. Identify, describe, and critique the appropriate use of statistical methods by examining risk of type I and II errors, power, and the use of the appropriate statistical test.

**Assessment:** Students, independently and in a group, are given a study and asked to critique the statistical methods for appropriateness and conclusions according to preassigned criteria. Subsequent discussion and assessment occurs independently, as a group. Examination.

8. Evaluate an article systematically using a evaluation tool, and draw an acceptable conclusion regarding the validity of the study. Attributes that should be evaluated include, but should not be limited to purpose and objectives, selection of subjects, study design, test methods, data presentation, statistical analysis, and author conclusion.

**Assessment:** Students are given a patient case with a therapeutic controversy and are provided studies with differing conclusions, both during class time and in examination. Students are asked to identify reasons for why the investigators developed differing conclusions and why they would select one therapy over another based on patient-specific parameters and scientific evidence.

9. Describe logistic and ethical issues associated with developing a clinical study, and when given a clinical question, design an adequate objective, study design, test methods, and statistical analysis.

**Assessment:** Students in groups are to develop an adequate objective, study design, test methods, and statistical analysis to adequately answer a clinical question that they are given in class. The students present and defend their methods as a group verbally in class and in a paper. Students use self and peer assessment to evaluate performance.

10. Discuss how drug information skills are a vital part of the routine practice of pharmacy, and appreciate and assume responsibility for integrating intermediate-level drug information skills to intermediate patient and population-based problems.

**Assessment:** When given several patient care scenarios on examination, the students will identify and discuss applications of drug information skills into the typical pharmacy situation to assist patients, families or health professionals. Students are given a self assessment to document evidence of accepting the value of drug information to pharmacy practice.

Potential tasks for faculty members to re-enforce drug information knowledge and skills in other courses:

1. Using Medline, or other appropriate database, search for clinical trials to support a therapeutic decision.
2. Obtain an article from Medline, Internet or other appropriate database to evaluate a topic of current interest.
3. Participate in a journal club.
4. Answer drug information questions based on the scientific literature and patient specific parameters.

### C. Professional Year 3 (advanced)

*Prior to beginning the PY3 drug information module, students are required to review and assess their own abilities in achieving the intended outcomes of PY1 and PY2. At the end of the PY3 drug information module, students should be able to:*

1. Describe and the basic concepts of a pharmacoeconomics study, including reasons for developing a study, methods, and appropriate methods for critique and application of the data in drug policy or patient care decision process; and if given a typical pharmacy situation or controversy, critique the utility of a pharmacoeconomic study, and apply information to a typical drug policy decision.

**Assessment:** In group discussion and assessment and examination, students are given a typical pharmacy situation or controversy and are to critique a pharmacoeconomic study based on objectives, design, patient population, test methods and statistics; make and defend a decision.

2. Describe and the basic concepts of a pharmacoepidemiology study, including reasons for developing a study, methods, and appropriate methods for critique and application of the data in drug policy or patient care decision process; and if given a typical pharmacy situation or controversy, critique the utility of a pharmacoepidemiology study, and apply information to a typical drug policy decision.

**Assessment:** In group discussion and assessment and examination, students are given a typical pharmacy situation or controversy and are to critique a pharmacoepidemiology study based on objectives, design, patient population, test methods and statistics; make and defend a decision.

3. Describe how meta-analysis, quality of life analyses, and surveys differ from a standard clinical trial, and apply information that is obtained from given studies to a direct patient care or drug policy decision.

**Assessment:** The students work in groups to evaluate and apply information obtained from a meta-analysis, quality of life analysis, and survey to different therapeutic controversies or patient care decisions. Subsequent discussion and assessment occurs as a group.

4. Describe continuous quality improvement tools, and use them in a patient care situation including medication use evaluation, drug use review among others, and design and evaluate a continuous quality improvement tool to use with a specific patient population.

**Assessment:** The students, in groups, to develop a continuous quality improvement tool by obtaining appropriate scientific evidence, researching their patient population, and developing an appropriate CQI tool, and develop an assessment mechanism to test the value of the CQI tool.

5. Describe the concept of evidence-based medicine, and describe how to integrate evidence-based medicine into a practice/health care environment situation.

**Assessment:** When given a patient population, students, in a group, assess the approach used to develop practice guidelines to determine appropriateness, and develop a strategy for use with the specific population.

6. Describe the role of formularies in a managed care environment., discuss the attribute to consider when evaluating a medication for formulary, and evaluate a medication for formulary

**Assessment:** When given a medication, patient care environment and patient population scenario, evaluate the appropriateness of a medication for a formulary. Identify important therapeutic outcomes, and determine the appropriateness of the medication for a formulary.

7. Discuss how drug information skills are a vital part of the routine practice of pharmacy, and appreciates and assumes responsibility for integrating advanced-level drug information skills to advanced patient and population-based problems.

**Assessment:** When given several patient care scenarios on examination, the students will identify and discuss applications of drug information skills into the typical pharmacy situation to assist patients, families or health professionals. Students are given a self assessment to document evidence of accepting the value of drug information to pharmacy practice.

Potential tasks for faculty members to re-enforce drug information knowledge and skills in other courses:

1. Apply a pharmacoeconomic study to a patient care situation to help select the most cost-effective alternative.
2. Apply a pharmacoepidemiology study to a patient care situation to help understand the risk-benefit of administering a medication to special population.

The practice-based outcomes provide the foundation for the drug information curriculum and are considered to be dynamic, in that it is expected in that they will change as the health care environment changes.