INTRODUCTION
In response to the newly adopted American Council of Pharmaceutical Education accreditation standards, colleges of pharmacy are designing curricula that develop pharmaceutical care skills through active learning and problem-solving activities. A goal of these standards is to change the teaching/learning environment from primarily faculty-centered and passive to student-centered and active. In response to a similar situation, over the years many colleges of medicine have adopted a teaching method called problem-based learning (PBL). In addition to its success in educating students to become professionals who can think clinically, the PBL method has some limitations(1). For example, this method requires multiple faculty members to meet several hours each week with small groups of 6-8 students. “Traditional” PBL, as it originally evolved in such medical schools as McMaster University, the University of New Mexico, and Harvard University, is a resource-intensive educational method. Many colleges of pharmacy, especially those in academic health centers with research, clinical, and teaching missions do not have adequate resources to implement this method properly as it was intended.

To address the need for developing active learning and problem-solving skills without intensive resources, the primary author of this article has developed an instructional method called “microsituation teaching” and employed it to redesign an endocrine pharmacology course for Professional Year Two (PY2) students. After the redesign, this faculty member gives lectures only 20 percent of the time in this course. For the other 80 percent of the course, he teaches using microsituations, or relatively well-defined mini-cases, that require students to apply basic science principles within the context of clinical practice. The goal is to use learning principles and methods similar to PBL but with considerably less resource requirements—one instructor to a class of 80 students—and with more direction. To support the development of systematic, pharmacy-based decision-making, the faculty member provides a sequence of items to consider in approaching each microsituation. In a large group, the faculty member guides the students’ reflection about each microsituation through a series of twists or “what-ifs”. Each case, therefore, is approached multiple times through many angles.

The use of case-based teaching is not new. Several descriptions of high quality teaching with the use of cases in individual courses or of integrating material from a variety of courses have appeared in the pharmacy education literature(2-4). The microsituation teaching model developed and described here is somewhat different from others, however, in that it involves a fairly large number of cases during a semester and multiple learning activities in each class session. Students work through the same case material with little “twists”, or from different angles, in each class session to reinforce patient-specific decision-making. Therefore, they reconsider the problem several times. By the end of the semester, students will have reviewed the same material on a minimum of five different occasions.

EVOLUTION OF THE TEACHING METHOD
The primary author has taught endocrine pharmacology and other courses or portions of courses in the College of Pharmacy for 25 years. Prior to the last two years, he taught endocrine pharmacology utilizing a lecture format requiring only passive student learning. The students appeared to highly appreciate and/or value the course content, stating that the lectures were organized and delivered effectively. Evidence for these impressions included continual excellent student evaluations each year, five Senior Class Outstanding Faculty Member awards, and a University of Kentucky National Alumni Association Great Teacher Award.

Despite such apparent success, the faculty member noted clear deficiencies. Students memorized and relied heavily on class notes rather than on assigned readings or references when studying for examinations. The faculty member became increasingly aware that students were coming to class less prepared, and he had more difficulty gaining their participation during classes. With the explosion of information in pharmacology, the amount of material to “cover” became greater each year and the amount of “trivia” to memorize for hourly examinations was expanding at an increasing rate.

Twenty years ago early in his career, the faculty member intuitively knew students needed case-based activities to
learn to apply pharmacology to patient situations. To address this need, he began giving cumulative open-book, problem-based essay final examinations but did so after a semester of lectures. Students were required to solve patient-related drug problems utilizing the information learned in class. Student performance on these final examinations and demonstration of what they had learned was poor. Class averages were consistently in the low 60s.

During the last five years of delivering a lecture-based course, the faculty member decided to employ three assignments based upon take-home “cases” each semester. For each case assignment, the faculty member gave the students a brief one-paragraph scenario involving patients who have one or more endocrine disease(s) and take the drug(s) discussed in the class. Students had two weeks to prepare a two-page, typed paper summarizing the problem(s), the approach to solving the problem(s) and the rationale. Following submission of these papers for grading, each case was discussed in class for a two-hour period. The case discussion papers were graded and returned with feedback to the students.

Performance on the portions of the final examination related to material addressed in the cases appeared to improve. Senior students and alumni provided positive feedback about this method when they served as members of focus groups utilized to design the new entry-level Doctor of Pharmacy curriculum. They reported that they learned and retained more information and were able to apply endocrine pharmacology to situations better when case-based and discussion methods were used rather than traditional lecture.

The faculty member became encouraged that case-based teaching had the potential to address the poor performance on his problem-based, open-book final examinations and apparent preference by students for learning through cases. In consultation with the co-author of this article, he discovered that in order for students to learn to problem-solve and apply pharmacological principles to cases, they needed to be taught and guided in the process. He had been teaching students at the level of lower-order thinking but expecting the students to use higher-order thinking under stressful testing situations with very little guidance. This discovery led to the collaboration to redesign the endocrine pharmacology course as one that employs a primarily problem-solving methodology.

THEORETICAL FRAMEWORK

Both microsituation teaching and problem-based learning have theoretical and research roots in new cognitive science teaching methods developed over the past fifteen to twenty years. Since the early 1980s, the computer revolution has fueled the speed of discovery of how the human mind works and solves problems(5). This line of inquiry has resulted in new teaching methods in which researchers have demonstrated impressive gains in human learning in a number of areas: mathematics, scientific reasoning, writing and reading(6). The relevance of this research to teaching has been equated to the importance of the discovery of penicillin to medicine(7).

Cognitive research has demonstrated that the mind stores information in frameworks or “schema”(5). Without previous knowledge or prior experience that develops a “big picture focus”, an individual may not understand or learn an individual concept or a fact well, if at all. In the cognitive learning theory literature, such information is called “inert” or “decontextualized” knowledge(6). To a human, this information is abstract and meaningless; and because it is not learned in a familiar context, humans may not remember it when needed at a later time. For example, a novice computer user taking a class on Internet searching may hear a lecturer or read a passage in a book describing how to use a “uniform resource locator” or “URL”. A first-time user will find this concept more useful and “alive” when he can type an address on an Internet browser and witness a web site appearing on the screen.

A goal of microsituation teaching in pharmacy is to help students learn basic science facts and concepts within the “big picture” framework of pharmacy practice. In other words, the expert, or faculty member, situates this information within the context of patient-specific pharmaceutical care. Unlike problem-based learning that uses complex and elaborate cases, the microsituations are purposely designed to be focused and require the explicit use of a basic science concept. Over time, students can be given more complex tasks to solve as they gain knowledge of a content area and competence in the problem-solving process. This feature is called “bootstrapping” or designing “increasingly complex microworlds” while providing structured support to move the students from dependence to independence and novice to more competent problem-solvers(8). An example of this type of learning is learning to ski using a graduated ski method. New skiers use short skis and no poles at the beginning of the week and by the end they have gradually built up through various stages of skiing on regulation-length skis and using poles(8).

Humans reach a threshold of problem-solving in which they cannot improve their performance of complex skills without the help of an expert or other support (9). The role of the expert, faculty member or professional teaching a learner/student is a “coach” to observe them carrying out a task and offering hints, suggestions, support, feedback and reminders to bring their performance closer to satisfactory and what is acceptable. During the process, a faculty member’s responsibility is to help students correct faulty or “buggy” (i.e., as in a “computer software bug”) thinking before they get too far off course.

An additional concept from the cognitive research literature to address the threshold for problem-solving is the concept of “modeling”. When the students are in a dependent phase of a novice, the expert/faculty member models the problem-solving process by making his/her own mental and physical processes visible and audible to help the student understand and deal with a problem or a situation(6). The expert/faculty member shows and explains the conditions to solve the problem expertly (i.e., the how, what, when, where and why) and allows students to observe and build an understanding of the processes for accomplishing the task. For example, a golfer trying to break the score of 100 may experience “muddling through”, or helpless, inefficient trial and error in trying to reach her goal. To improve her game, she may need to learn new information or employ special strategies unique to golf, building upon her own past experience and skill. A professional golf instructor can demonstrate to her how to “read” the green, to align her body properly, and to hold her club in a new way.

Finally, Spiro and colleagues demonstrated that when
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Table I. Topics addressed in PHR 933

| Diabetes                                      | Dysmenorrhea and endometriosis                      |
| insulins                                      | Osteoporosis                                         |
| Oral treatments for diabetes                  | Contraceptives                                       |
| Monitoring parameters for treatment           | Oral contraceptives                                   |
| Dosage adjustments in special populations and situations | Implants, Depo                                      |
| Diabetes/Drug interactions                    | Non-endocrine contraception                          |
| Managing hypertension in individuals with diabetes | Developing trends in contraception                   |
| Recent developments in diabetes research: insulin dosing, transplants etc | Androgens/Anabolics                                   |
| Glucocorticoids                               | BPH                                                  |
| Oral agents, comparative pharmacology         | Impotence, infertility                                |
| Physiologic vs. Pharmacologic doses, affects, uses | Abuse of androgenic/anabolic agents                  |
| Dosing principles, uses in various disorders | Thyroid disorders                                    |
| Glucocorticoid dependence and strategies to discontinue use | Dosing parameters                                    |
| inhaled steroids in asthma                    | Problems in special populations/ conditions          |
| Nasal steroids in allergic rhinitis           | Non-replacement dosing of thyroid hormones            |
| Topical steroids, uses, guidelines, comparisons between products | Agents for hyperthyroidism                           |
| Estrogens/Progesterones/Gonadotrophins/Releasing Factors | Drug/thyroid disease/thyroid treatment interactions |
| General reproduction/fertility requirements   | Mineralocorticoids/Mineralocorticoid Blockers        |
| Hormone Replacement therapy                  | Prolactin and Growth Hormone                         |
| infertility                                   | Oxytocics and Tocolytics                             |
|                                      | ADH, SIADH, DI                                       |
|                                      | Nocturnal enuresis                                   |

medical students worked through a medical problem only once, they did not adequately learn to master a process or concept. Part of this deficit can be attributed to try to medicine, a ill-structured, complex knowledge domain. Students, as novice learners, need to work through similar problems a number of times to develop “cognitive flexibility”, or an ability to internalize or reinforce how to problem-solve similar situations independently in the future. For learners to master knowledge, especially in a complex domain, they need to use and try it out in many ways. The researchers recommended “criss-crossing the landscape” of a problem by giving learners variations on a situation and multiple opportunities to solve it in order for deep understanding to occur.\(^2\)

Based upon cognitive science research in learning, the authors designed the microsituation teaching approach in pharmacy by using these concepts:

- situating a basic science fact or concept within the context of pharmacy practice;
- providing “bootstrapping” to move students from well-defined to complex problems;
- supporting learners at the beginning of problem-solving and gradually removing the structure;
- “expert” modeling mental and thinking processes to solve a problem within pharmacy;
- helping learners work out “bugs”, faulty thinking or incorrect misconceptions while learning to problem-solve and use basic science facts in the context of practice; and
- “criss-crossing the landscape” of a problem by providing opportunities for learners to solve variations of a patient problem multiple times.

METHODS FOR THE COURSE

Content

PHR 933, Pharmacologic Basis for Therapeutics: Endocrine Systems, is a three-credit hour (semester system)

\(^2\)See reference 10, p. 379.
problems in PY1, moderately ill-defined problems in PY2 and ill-defined/complex problems in PY3.

Courses in professional practice, pharmaceutics, medicinal chemistry and other topics, run parallel to the above physiology-pharmacology-pathology/therapeutics sequence for PY1 through PY3 students. The professional practice classes introduce the concept of and approaches to Pharmaceutical Care. The microsituation technique lends itself readily to reinforcing the Pharmaceutical Care concept in the curriculum through the application of basic science principles and the building of problem-solving skills.

Outcomes for PHR 933
At the end of the semester, students will be able to:
1. Discuss the most critical facts and principles of pharmacology for agents affecting the endocrine system
2. Apply the principles and facts of endocrine pharmacology to the:
   • management of patients with endocrine-related disorders;
   • management of patients with disorders in which endocrine-like substances play a major role in therapy;
   • use of endocrine-like substances in the prevention of disease or the modification or normal bodily function;
3. Analyze and correctly manage situations involving patients and drug therapy related to the endocrine system
4. Independently determine which facts and principles of endocrine pharmacology are necessary to manage patients and be able to find and evaluate those facts and principles in appropriate references
5. Use standard pharmacy texts and references rather than relying on class notes to pass examinations

The required textbooks for PHR 933 are: Modern Pharmacology with Clinical Applications (5th Edition), Craig and Stitzel; Applied Therapeutics (5th Edition), Koda-Kimble and Young; The Handbook of Non-Prescription Drugs (10th Edition), American Pharmaceutical Association; Medical Letter, and Facts and Comparisons. Recommended references are The Pharmacological Basis of Therapeutics (9th Edition), Goodman and Gilman; USPDI and Pharmacotherapy-A Pathophysiologic Approach (2nd Edition), DiPiro, et. al. A primary goal for the course is for students to be familiar with and use the standard text and reference books that they already own rather than searching and discovering new materials. Secondarily, students do take advantage of additional references and information from the Internet.

The Class Structure
Pre-class Student Preparation. At the beginning of the semester, the students are formed into groups of five to work together for the entire semester. The faculty member provides the students a list of required references and a protocol, or scaffold, to use for the entire course and, as each topic is addressed, the intended outcomes and 22 microsituations. The protocol and a sample microsituation are presented in Appendixes A and B. The faculty member strongly encourages the students to follow a specific sequence and approach to problem-solve each microsituation. Students are instructed to prepare for the class by first working on each case independently. Then, prior to class, they are to meet in their groups to review and refine their approach to solving the problem and plan for their presentations. Finally, all students are expected to come to class prepared as an individual and a small group to present the case formally to the entire class.

Formal Class Presentation. Students come to class with their reference materials and sit with their groups. To help the students visualize the expected level of their performance for the entire semester, the faculty member models the first case in front of the class by describing and explaining his own knowledge, reasoning and problem-solving process. To model that he encourages students to question himself and others, he purposefully builds in “bugs” and encourages students to question his thinking and solving of the case. For the rest of the semester, one group is selected randomly at the beginning of the class to present the case according to the previously assigned protocol. Each member of the group must deliver some portion of their presentation and be able to answer individual questions on material presented by any member of the group. During the formal case presentation, the faculty member or the class may ask for clarifying comments or expanded explanation.

Class Discussion. After the formal presentation, discussion is opened to the whole class, or to a second or third group chosen randomly, to comment on the approach and the facts discussed by the initial group. The faculty member handles questions by soliciting answers from the class, raising another question that may give a clue to the appropriate answer, or asking groups to check their references in class. Without directly providing answers, he models how to use references to find appropriate information to solve the problem and thinks “out loud” by continually reinforcing facts, attitudes toward practice, and basic science concepts.

Twists or “What-ifs”. Once the original case discussion is completed, the faculty member then “criss-crosses the landscape of the problem” by asking “what-if” questions related to the case or presenting twists on the case that will require the students to reaply the basic science facts in new situations. Another goal of this activity is to help the students integrate their knowledge learned in other classes to the microsituation. For example, if the microsituation involved an otherwise healthy, 25-year old woman who developed hypothyroidism, a “what-if” would be: “What if the patient were an 85-year old male with heart disease?” or “What if the patient had just been stabilized on Coumadin 7.5 mg/day”? The idea of the “what-if’s” is to begin to force the student to consider patient-specific parameters. A sample of “what-ifs” is provided in Appendix C. To address the “what-ifs”, groups are called upon to present their answers after a 5-10 minute caucus period. Students point out to the entire class the location in the textbooks where they found the answer, and why the answer is appropriate.

Wrap-up. At the close of the class, the faculty member conducts a rapid-fire wrap-up of the most important concepts that should have been learned in the topic area. The students are expected to list and briefly describe what they need to know for the topic area for the microsituation. Typically, these concepts are the content that the faculty member would have delivered in the traditional lecture.
based course. The faculty member makes certain to address all concepts, including those that were “missed” by the class. He also then explains related material not previously discussed and describes controversies with potential future developments in the area.

One Minute Writes. To make certain that individual students are preparing the material adequately and not solely relying on group work, the faculty member gives frequent, unannounced short, graded quizzes focusing on the basic concepts. This course feature, a classroom assessment technique, also allows him to track how well the students understand the material. He can clarify and address any misunderstandings in class that are identified through the quizzes in addition to those becoming evident through class discussions.

Examinations. The examinations for this course are all case-based and follow the same format as the cases used in the class. Specific questions involve the factors and thought sequences required to prepare the presentations in class and to answer the questions or twists on each case. The examinations are two hours and address a large amount of material. During the last hour, students may use references or textbooks to check specific details of their answers. Because of the comprehensive nature of the examination, students must thoroughly understand the material and know how to problem-solve the cases to complete the examination in the allotted period. They do not have enough time during the last hour to use the references to write their answers completely.

INSTRUCTOR PREPARATION FOR THE COURSE

To design a course that primarily uses microsituation teaching, the following approach is recommended:

1. The faculty member reviews course notes and important concepts and then develops lists of outcomes for each general topic of the formerly lecture-based course. These lists are eventually provided to the student as outcomes in the new course.

2. If the faculty member is not currently practicing pharmaceutical care, he/she should review the lists of concepts and outcomes with several practice-based faculty members. The purpose of this review is to seek input for completeness and for suggestions of the most common problems handled in daily practice for each general category.

3. Once the topics and concepts are identified, he/she reviews the required textbooks to make certain each concept/outcome is clearly explained and then notes the location in the book. Supplemental information may be required because it is not covered in the textbook (e.g., new drugs). To address this need, the faculty member should prepare appropriate handout material and/or directions for location of other resource materials such as books, articles or web sites.

4. The microsituations are designed focusing on specific concepts the student is to understand and apply but utilizing common problems seen in practice as much as possible. The faculty member writes the microsituations within the context of contemporary practice of the pharmacist. The structure of the case is from the perspective of the pharmacist as he/she enters the patient care picture. This perspective is in contrast to cases written for the physician from the diagnostic viewpoint or from a “medical records” or “grand rounds” format. A successful microsituation begins with a well-conceived purpose and objectives for addressing the concept. All microsituations are designed to address the future professional role of the student. For instance, cases reinforce the pharmaceutical care model and often include identification of actual and potential drug-related problems and the prevention of potential drug-related problems.

5. The faculty member must keep in mind when designing and implementing microsituation teaching that the goal of the method is for students to learn both basic science content and problem-solving in pharmacy practice simultaneously. The primary role of the faculty member is a coach or a facilitator of learning. To accomplish this goal, the faculty member needs to prepare for the process of microsituation teaching in advance by developing a series of questions to ask, or concepts to address for each case to ensure that the students master all of the concepts, facts or outcomes expected in the course. Alternate questions, lists of important concepts and “what-if’s” are not provided to the student with the cases but rather are kept by the faculty member to utilize during the actual class meetings to promote discussion. In addition, he/she should prepare several alternate twists or “what-ifs” on the microsituation to make certain that the students address the problem and concepts several times. For each microsituation, the instructor also prepares a list of the most important issues related to that situation to be used at the end of the class for a “wrap-up”.

STUDENT PERFORMANCE

The faculty member has observed that the quality of student preparation and development of problem-solving skills increases over the course of the semester. By the sixth or seventh microsituation, the students become adept problem-solvers. Additionally, student performance on the cumulative final examinations has improved dramatically. Examinations have been case-based and open-book and have not changed much from those used in the traditional lecture-based course. During the last year of the lecture-only format, the class average on the final examination was 67.5 percent. During the Fall 1997 semester, the class average on the final examination was 84.6 percent.

STUDENT EVALUATION OF THE METHOD

Two student evaluations of PHR 933 have been conducted: a standard university end-of-semester course evaluation and a questionnaire specifically focusing on the teaching method two months after the end of the course. In both, the student feedback on microsituation teaching has been extremely positive. Typical open-ended comments on the end-of-course evaluation are: “Active learning made this the most valuable class of the semester.” “Endocrine was my favorite class in pharmacy school. I have learned so much from Dr. Lubawy and this style of teaching.” “This is the best class this year. We learn much better and get more out of this class because we come to class prepared.” “I was very uncertain about this format initially, but it was great!”

Of the 80 students in the endocrine pharmacology class,
Table II. Means and standard deviations for variables of student self-reporting of learning (N=69)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much you learned in this course compared to other teaching methods?</td>
<td>5.13 (0.86)</td>
</tr>
<tr>
<td>How much you learned to use printed references?</td>
<td>5.12 (0.80)</td>
</tr>
<tr>
<td>How much you learned a problem-solving approach?</td>
<td>5.06 (0.87)</td>
</tr>
<tr>
<td>How much you learned to manage patients with endocrine related diseases?</td>
<td>4.96 (0.78)</td>
</tr>
<tr>
<td>How much you learned basic pharmacology facts (i.e., doses, mechanisms, side effects)?</td>
<td>4.62 (0.89)</td>
</tr>
<tr>
<td>How much could you solve patient-related problems at the beginning of the semester?</td>
<td>2.86 (0.99)</td>
</tr>
<tr>
<td>How much could you solve patient-related problems by the end of the semester?</td>
<td>5.00 (0.69)</td>
</tr>
</tbody>
</table>

*1= "very little" to 6= "a great deal."

Table III. Means and standard deviations for learning process variables (N=69)

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I did not learn much from this course because of the method of instruction.</td>
<td>1.53 (0.93)</td>
</tr>
<tr>
<td>I remember more from lecture format based courses.</td>
<td>2.30 (1.17)</td>
</tr>
<tr>
<td>If I knew my group was not going to present, I did NOT prepare.</td>
<td>2.05 (1.01)</td>
</tr>
<tr>
<td>For this class, rate the importance of coming to class prepared.</td>
<td>5.35 (0.92)</td>
</tr>
<tr>
<td>The quizzes were helpful.</td>
<td>4.04 (1.39)</td>
</tr>
<tr>
<td>After the second week I knew what was expected of me.</td>
<td>4.89 (0.93)</td>
</tr>
<tr>
<td>After the second week I knew how the class would function.</td>
<td>4.97 (0.86)</td>
</tr>
<tr>
<td>My group functioned well in preparing the cases.</td>
<td>4.06 (1.63)</td>
</tr>
</tbody>
</table>

*1= "strongly disagree" to 6= "strongly agree."

69 students (86.3 percent) were present in a second semester course the day the specially designed evaluation was administered to the class. Means and standard deviations of student self-reports of learning are presented in Table II. Additionally, students were asked to indicate whether they worked in a pharmacy setting since completing this course, either during the semester break and/or part-time since returning to school. Eighty-three percent of the students indicated they did work. Those who had worked responded to an item to estimate the extent they applied what they had learned in this class to their work in a pharmacy in comparison to lecture-based courses they had taken. On a three-point Likert scale with 1= "less," 2= "the same," and 3= "more," the average was 2.70 (SD= 0.67).

Students were asked questions to provide feedback about the teaching process. Means and standard deviations of variables focusing on the learning process are presented in Table III. Additionally, when asked to estimate the percentage of cases they had prepared before coming to class, an overwhelming number of respondents indicated that they prepared cases at least 75 percent of the time. Sixty-six respondents (62.3 percent) indicated they prepared 100 percent of the cases before coming to class, and 23 (33.3 percent) indicated they prepared approximately 75 percent of the cases. Only five percent of the class reported less than that level of preparation.

Students were asked to indicate one of four sequences of working independently and in groups when they studied the cases. The results of the sequencing were: 46 respondents (67 percent) indicated that they worked independently, worked in small groups prior to class, and then worked in class; 18 (26 percent) responded that they first worked independently, did not work in small groups, and then worked in class; two (three percent) replied that did not work independently but did work in small groups and in class; and four percent answered that they only worked in class. Fifty-seven of the respondents (82.6 percent) indicated that this teaching method should be used in more courses. When asked in how many additional courses during one semester would they recommend use of this format, 17 (24.6 percent) indicated one additional course, 34 (49.2 percent), two, 13 (18.8 percent), three.

In addition to evaluation questionnaires, students in PY2 Liaison Committee meetings (a focus group of representative students used to monitor curricular progression) report that they have to study a great deal during the semester to keep up with the course material. However, studying for examinations takes very little time in this course compared to others. They attribute this to having been through the material so many different ways before each class and as part of the class that they know the material well by the time of the examination.

PERSONAL REFLECTIONS

The microsituation teaching method developed for this course offers a number of advantages over a traditional lecture format.

1. The students appear to enjoy this method considerably, and both the faculty member and the students believe the method has increased student (and often faculty member) learning. Students routinely comment they feel motivated to learn because they continually see how they can apply what they are learning to practice. They are surprised how fast the time goes by, especially in the 2:00 to 3:15 time period during which the class meets twice weekly.

2. Extensive discussions in class allows continual (but subtle) referencing to and reinforcing of pharmaceutical care principles, modeling of caring behaviors and attitudes towards patients; and correcting faulty thinking patterns for facts, concepts and applications to patient care.

3. With a little bit of creativity, a great deal of risk-taking, and some help from clinical practice colleagues to design microsituations around the most commonly encountered problems or situations seen in practice, a faculty member can move from primarily lecture-based teaching to microsituation-based teaching relatively easily. The primary author has facilitated joint Pathology/Therapeutics PBLs in which approximately half of the participants were medical students and the other half, pharmacy students; and he has observed other faculty members develop and implement PBL cases with pharmacy students. The move to employing microsituations in a course with a single facilitator is easier than moving to traditional or even modified-PBL involving multiple tutors. When using the microsituation
teaching approach in the classroom, students have a common learning experience.

4. The use of little twists on each microsituation, the “what-ifs”, promotes better understanding of the principles and concepts as well as allows an appreciation for patient-specific decisions.

5. Each class period involves several different learning activities such as student presentations, “what-ifs”; questioning by the faculty member, short group caucus periods, expert modeling, one-minute writes, mini-lectures, and rapid-fire wrap-ups. This diversity in teaching/learning methods helps individuals who learn by different styles and helps to maintain interest while keeping students involved.

6. Although the teaching method is quite different from classical lecture-based approaches, students readily master what is required and expected of them each day. Starting the course with a structured scaffold that is incrementally lifted from the process as the semester progresses helps to support the development of student thinking and problem-solving over time. Through this method, the faculty member helps to facilitate the student’s development from a dependent to independent learner. These supports include: appropriately written instructions, modeling the first case in the course, and listing where in the references students should check for information on the first four or five microsituations as an introductory guide to the organization of the texts. After that time, students do not need these supports to master the cases and “what-if” discussions, no matter how complex the concepts. The author has found students require much less orientation and effort to use this method appropriately than faculty facilitators in PBL teaching.

7. In the evaluation of this teaching method, two-thirds of the students reported they followed the suggested sequence of preparing the microsituation initially on their own, working through the case with their group for a consensus approach, participating in the class discussion, reviewing for an hourly exam, and studying for the cumulative final examination. When following this sequence, students study the same material by the end of the semester five separate times, with five different perspectives while using different methods. This repetition reinforces learning and cognitive flexibility in problem-solving. One area needing future improvement of the course is a strategy to encourage all students to follow the suggested procedure.

8. Principles of traditional problem-based learning are utilized in a fairly large class, and considerably less faculty resources are expended. Extensive facilitator preparation and training required with PBLs are not needed, and the intensity of logistical planning, coordination, and troubleshooting is minimized. In addition, the uniformity of the learning experience eliminates inter-facilitator differences.

9. Basic facts of pharmacology formerly covered in dreadful “lists” (such as side effects) that were previously memorized, are discussed relative to patient counseling and disease state management, suddenly come alive with relevance.

10. The students report becoming more efficient at approaching cases and working together as the semester progresses. In addition, the quality of student presenta-tions improves and appears to reflect more efficient collaboration.

11. Students have ample opportunity to practice utilizing the references that pharmacists use to solve problems in everyday practice. Without being required to do so, students add tabs to the texts to facilitate locating information.

12. The method can be utilized to facilitate the overall outcomes of the curriculum. Faculty members can encourage model such characteristics as independent learning, developing problem-solving skills, encouraging life-long learning, integrating information from a variety of areas, developing communication skills, and developing professional attitudes and judgments.

ADVICE TO CONSIDER FOR IMPLEMENTATION

Some general thoughts and warnings to consider in implementing this method effectively are:

1. The faculty member must control the class, develop a comfort level with occasional chaos, help students find answers to questions rather than give students answers, provide continual positive feedback when appropriate, admit when he/she does not know an answer to a question, and be fairly energizing.

2. Students initially are skilled at finding out “what to do” for a particular patient but not always proficient at thinking of the “why” or at making specific recommendations on appropriate drug or dosage changes. Continually asking students, “Why did you suggest that?“ or “Why does that seem to work that way?” or “Why do you suppose this drug interacts with that one?” or “When would you recommend this drug over another?” is critical if students are to learn the scientific basis for decision-making. This continuous probing of student thinking helps them to lay a strong in-depth framework for understanding the concepts. In addition, the faculty member should force students to think quantitatively and form precise suggestions to meet the patient-specific need. For example, a student response such as “increasing the dose of insulin” is not as appropriate of a response as “increasing the morning dose of NPH/Regular insulin by three units of Regular.”

3. Similar to all teaching methods, faculty members should know what came before and what will follow the course in the curriculum. He/she should obtain some agreement between faculty members involved in the sections relative to the topic outcomes. The faculty member teaching the endocrine pharmacology course, for instance, has obtained agreement as to the outcomes of the preceding physiology course and the advanced therapeutics sequence that follows. For example, treatments of diabetic gastroparesis and diabetic neuropathy are not addressed in the endocrine pharmacology course but are in the advanced therapeutics course.

4. The primary author believes that one reason the microsituation technique works is that all examinations for courses in a particular semester in the program are clustered. All faculty members in a semester agree upon mutual two to three days three times a semester when all examinations are given, and other classes do not meet. Between examination periods, students can concentrate their work on preparing the microsituations and being involved during class time without the distraction
of sleep deprivation or cramming for examinations in other courses.

5. The case and “what-if” discussions provide the faculty member many opportunities to reinforce material from previous sections. This reinforcement is important. For instance, if the topic of diabetes is addressed first in the semester, the faculty member needs to make reference to problems of controlling blood sugar and why during the time the topic of side-effects of glucocorticoids are discussed in class later in the semester. This continual reference back and forth to other conditions and/or drugs helps student to integrate and connect their developing knowledge.

6. A major responsibility for the faculty member employing microsituation teaching is to make the students comfortable with discussing the cases during class and in asking even absurd questions. Unless students verbalize what is on their mind freely, they are less likely to learn.

7. The faculty member must be familiar with the overall philosophy of contemporary pharmacy practice and the overall philosophy of the professional curriculum. Problems with faculty “buy in” of overall goals are likely to be more evident with discussions than with lectures.

8. Despite an elaborate admissions process to select students with good interpersonal skills, there are students who are not comfortable working in groups, do not like giving presentations in front of the class, and who resist any attempt at active learning. Fortunately, they are in the minority. Microsituation teaching is an excellent method to help them learn to overcome these fears. An area for future improvement is to formally discuss group dynamics and functioning and include peer assessment procedures to provide feedback to group members.

CONCLUSION

A teaching method was developed for large group classroom use which follows some of the principles of problem based learning (PBL) but does not require the resource-intensive demands of traditional PBL. This method, employed in a second year pharmacology course, provides scaffolding for learning and changes the learning environment from faculty-centered and passive to student-centered and active. The method facilitates the attainment of a number of outcomes of the overall curriculum and reinforces principles and attitudes taught in other courses. Teaching focuses around student preparation for and presentation of solutions to multiple “microsituations” or mini-cases written from the perspective of a pharmacist as he/she would enter the patient care picture and based on common problems seen in practice. Each case has several “twists” that require the students to “criss-cross the same landscape” of the case but from different angles. Such “twists” reinforce skills related to developing patient specific recommendations for drug therapy. Class meetings typically involve four or five different learning activities and require students to utilize textbooks and references rather than class notes to learn material and pass exams. Student learning, as evidenced by performance on case-based cumulative final examinations, appears to be improved over traditional lecture formats. Student reception to the teaching format is excellent and enthusiastic.

REFERENCES


APPENDIX A. PROTOCOL FOR PROBLEM-SOLVING MICROSI TUATION

The student presentation uses the following guidelines for factors to be considered in this approximate sequence:

• Your gut impression of what is going on. List facts and likely issues.

• Descriptions of the subjective and objective information when appropriate. These are two separate blocks of information.

• Determination of what information you need to make better decisions. For instance, what would you ask the patient, and why? What lab test results would be helpful to you and why? What information would you require from the patient history and why?

• Mechanism of action of the drug summarized in three or four sentences, and/or one diagram. The mechanism of action of a drug is the manner by which it produces a particular effect. It usually includes biochemical, physiological and/or pathologic pathways or processes and may be described on different levels. It is also helpful to include an indication of the general class of the drug both chemically and therapeutically if appropriate. For example, “Insulin is a long chain polypeptide hypoglycemic agent. It lowers blood sugar by decreasing hepatic glucose production and increasing cellular uptake of glucose in fat and muscle cells.” Include any unique characteristics about this particular agent that may separate it from others in its class (i.e., “of all the insulins, Ultra-lente is composed of large insulin crystals and because of that is the slowest to be absorbed making it the longest acting of the available insulins.”)

• Description of the disease condition including causes, common symptoms, consequences of poor treatment both short-term and long-term (for example poor treatment of diabetes may result short-term in ketoacidosis and long-term in organ failure), diagnosis - clinical and laboratory, approximate incidence, predisposing factors and likely co-existing diseases when appropriate.

• Determination of desired therapeutic outcome(s), - which one(s) apply.
  Cure of the disease (infection)
  Reduction or elimination of symptoms (pain)
  Arresting or slowing the progression of the disease (arthritis)
  Preventing a disease or symptom (atherosclerosis)
  Altering factors that predispose or cause complications (blood sugar)
  Not complication or aggravating other existing disease states
• Avoiding or minimizing adverse effects of treatment
• Providing cost-effective therapy
• Maintaining the patient’s quality of life
• Determination of therapeutic alternatives. What therapies are available? Drug and non-drug to treat the patient’s disease
• Determination of an optimal individualized pharmacotherapeutic plan. Involves the optimal drug, dosage form, dose, schedule and duration of therapy that are best suited for a given patient, taking into account individual patient characteristics. The reasons for recommending or avoiding specific drugs should be stated. The individual drug, the dose, dose schedule or the dosage form selected often depend upon the disease itself and characteristics other than the primary disease being treated, i.e., other coexisting conditions or other drug therapy, for example.

A correct optimal individualized pharmacotherapeutic plan also involves appropriate non-drug treatment to improve the outcome of drug therapy and correction of any of the drug-related problems, including the mechanisms involved and the rationale for choosing the course of action taken. According to Strand, Cipolle, and Morley, drug-related problems are:
• Untreated indications, i.e., the patient needs drug therapy for a specific indication but is not receiving the drug therapy;
• Improper drug selection, i.e., the drug currently prescribed is either ineffective or toxic;
• Subtherapeutic dosage, i.e., too little of the correct drug has been prescribed;
• Failure to receive drugs, i.e., the patient is not taking or receiving the drug prescribed;
• Overdosage, i.e., too much of the correct drug is being taken;
• Adverse drug reactions, i.e., the patient has a medical condition resulting from an adverse drug reaction or a drug induced complication;
• Drug interaction, i.e., a medical problem has resulted from a drug-drug or a drug-food, or drug laboratory test interaction, including OTC drugs;
• Drug use without indication, i.e., the patient is taking a drug for which there is no valid medical condition.


• Identification of assessment parameters, i.e., the clinical and laboratory parameters necessary to evaluate the therapy for achievement of the desired therapeutic outcomes and for the detection and prevention of adverse effects. Monitoring for adverse effects should be directed toward presenting or identifying serious adverse effects that have a reasonable likelihood of occurrence. How would you or the patient know when therapy is working? What should the patient watch for or ignore? How often and under what circumstances should assessment parameters be monitored?
• Identification of the most pertinent patient counseling issues (of the eight issues required by OBRA, if not covered in other sections.)

When a whole list of items is appropriate to any of the above, indicate the three or four most common and or severe, and indicate where or how the rest may be found. When agents in a similar class have been discussed previously there is no need to review the mechanism of action other than to indicate any differences from the agent discussed earlier.

APPENDIX B. EXAMPLE OF A MICROSITUATION, CONCEPTS THAT CAN BE DISCUSSED AND WHAT-IFS.

Monica Sailles has had a lot of trouble with her asthma. For almost six months she took prednisone 5 mg, i TID. Recently her physician thought it might be good for her to discontinue the prednisone because he is concerned it may contribute to a worsening of her osteoporosis and edema. She comes into your pharmacy with a new prescription for Beclovent (beclomethasone) Inhaler ii puffs TID.

Concepts to be discussed with this microsituation
• Actions and toxicities of glucocorticoids
• Toxicity of acute dosing vs chronic dosing
• Mineralocorticoid side effects of various oral glucocorticoids
• Risk/benefit analysis of inhaled vs oral steroids
• Side effects of inhaled steroids and patient counseling issues
• Safety of inhaled steroids
• Dosing recommendations for inhaled steroids vs severity of asthma
• Inhaled steroid potency differences
• Patient monitoring and use of peak flow meters
• Inhaled steroids vs beta agonists: use, mechanisms of action
• Glucocorticoid dependence: why, symptoms, warnings, tapering schedules
• Alternate Day Therapy in diseases and in tapering steroids

APPENDIX C. SAMPLE "WHAT-IFS" FOR THIS CASE

• What if the prednisone had only been taken for five days?
• What if the prescription was for both a glucocorticoid inhaler and a beta agonist to be used together?
• What if the patient also had Type II diabetes?
• What should the dose of dexamethasone be?
• What if the patient was switched from prednisone to dexamethasone?
• What if the initial dose of prednisone was 60 mg, QOD?