

Pharmacy Dispensing
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About the Instructors

Dr. Valerie Hogue is an Associate Professor in the Department of Clinical and Administrative Pharmacy Sciences at Howard University School of Pharmacy. She is also clinical care coordinator and diabetes educator at CVS Health Connection in Washington, D.C. Dr. Hogue graduated from Howard University in 1987, and went on to complete a residency in clinical pharmacy at the University of California, San Francisco in 1988. She returned to her alma mater as a clinical faculty member in 1988. Among other committees, she has served on the Curriculum and Instructional Resources Committee for several years in the School of Pharmacy.

Dr. Hogue has developed her interest in improving teaching and learning through the incorporation of technology-supported problem-based learning into the Pharmacy Dispensing course, where she serves as coordinator. She has presented her results at national meetings such as the Annual Meeting of the American Association of Colleges of Pharmacy.

Clarence E. Curry, Jr., is an Associate Professor in the Department of Clinical and Administrative Pharmacy Sciences, of the School of Pharmacy, in the College of Pharmacy, Nursing and Allied Health Sciences. He completed pre-pharmacy studies at Clark College, earned the BS in Pharmacy degree from Mercer University and the Doctor of Pharmacy degree from Duquesne University. He also completed a residency in pharmacy at the Mercy Hospital of Pittsburgh.

Dr. Curry's principal practice interests are in ambulatory care. He has practiced in Howard University Hospital's family practice clinic and neurology clinic. He has provided patient education services in conjunction with diabetes clinic and consultative services to the interdisciplinary sickle cell disease group. He also co-founded the pharmacy compliance clinic.

Dr. Curry was the recipient of a 1993 Searle Fellowships in Pharmacy Program Mentor Award and the 1995 Howard University College of Pharmacy and Pharmaceutical Sciences Alumni Association Faculty Recognition Award. He has received three honored faculty awards from students during his years at Howard. He has served on numerous departmental, college, university, hospital, community and professional committees and task forces, including 2 three-year terms on the Local Human Rights Committee of the Northern Virginia Mental Health Institute and recent service on the American Association of Colleges of Pharmacy Professional Affairs Committee. In 1998, Dr. Curry was named to the Sigma Xi College of Distinguished Lecturers and a Distinguished Practitioner in the National Academy of Practice in Pharmacy.

Most recently, Dr. Curry's interests have included technology applications to curriculum and course enhancements. Since the summer of 2000, he participated as a Summer Scholar at New York University to learn more about how to wed technology to course needs and as a Visiting Fellow in the University of Delaware's Institute for Transforming Undergraduate Education. He has authored many articles, book chapters, abstracts and educational resources including a workbook and videotapes series designed for community pharmacy practitioners.

Part I. Introductory Information

Institutional

Name of College or University: Howard University
Total Enrollment: 10,215 students
Public or Private University: Private, Not-for-Profit Institution
Carnegie Classification: Doctoral/Research Universities-Extensive

Individual

Valerie W. Hogue
School: School of Pharmacy
Department/Division: Clinical and Administrative Pharmacy Sciences
Faculty Rank: Associate Professor
Highest Degree Earned: Doctor of Pharmacy
Number of Years teaching
at college level: 14 years
Awards received for excellence
In teaching: None

Individual

Clarence E. Curry, Jr.
School: School of Pharmacy
Department/Division: Clinical and Administrative Pharmacy Sciences
Faculty Rank: Associate Professor
Highest Degree Earned: Doctor of Pharmacy
Number of Years teaching
at college level: 25 years
Awards received for excellence
In teaching: Class of 1981, 1995 and 1998 Honored Faculty
1998 Howard University Student Association
Excellence Award Nominee

Course

Course Name: Pharmacy Dispensing Lecture
Course abbreviation and number: CLPS 80307-321-001
Number of semester credit hours: 3 credit hours
Catalog Description: Technology, record systems, inter-professional relationships, drug use control and other factors involved in dispensing prescription medications will be explored. Emphasis will be placed on prescription analysis and interpretation, identification and selection of brand-name products and generic equivalents for use in drug therapy; socio-behavioral aspects of patient counseling on proper use, handling, and storage of medications, as well as computer applications in dispensing procedures.
Number of students typically taught in course: 65 students
In what year do students typically enroll in this course: 3rd Professional Year of a four-year program
This course is best described as: Required general education course

Problem-Based Learning

What percentage of this course uses Problem-Based Learning? 35%
How long have you been teaching the course using PBL? Two course offerings
(Fall 2000 and 2001)
Is the course designated as PBL in any official way? No

Part II. Design of the Course

A. Rationale

Pharmaceutical dispensing is often portrayed as merely being the process of giving a drug product to a patient. It frequently appears much less exciting and students are easily drawn into this perspective, especially if they have prior work experience in a typical pharmacy. A practice philosophy which embodies pharmaceutical care must engender a more comprehensive approach to the dispensing process. The approach must consider the complexity and judgmental nature of the union between care and function, and not simply represent a mechanical physical process. Undeniably, dispensing of a drug to a patient involves a physical process. However, it is really more than that as it is also a multifaceted interactive process, which might involve a number of persons and require many decisions for task completion.

The authors believed that identifying specific objectives, keyed to desired behaviors for pharmacists in the dispensing process, would allow for the development of tailored case scenarios capable of stimulating the development of problem-solving skills in a setting of small group discovery. A more student-centered approach to learning would best support achieving these desired behaviors. While faculty usually value control of the learning process, teacher-centered instruction does not promote critical thinking, problem-solving, or lead to long-term self-learning.^{1,2} The process of pharmaceutical dispensing has the potential to generate questions about medications.

The primary goal for use of PBL was to empower students to independently explore answers to dispensing questions. As a self-learner, one is more likely to explore the answers to problems without requiring others to intervene. Problem-based learning is a teaching methodology that appropriately supports this learning process.³

B. Reflective Essay on the Course Content

The course has undergone a review of its content over the past four years. While there may have been modest content changes in the course, there was a major philosophical shift in the way this content was applied. Previously its content focused on the drugs and diseases without directly relating them to the dispensing process. Consequently, the schedule of lecture topics only included classes of pharmacological agents and did not incorporate other components of the dispensing process that would be critical to preparing pharmacists for the arena in which they practice. This approach also encouraged faculty to prepare lectures more suited for a pharmacotherapy course rather than a dispensing course.

The new focus, however, emphasized students providing pharmaceutical care while dispensing the product. Therefore, the content had to be reorganized in order to achieve that end. The idea was to make pharmaceutical care considerations a co-equal to the dispensing process since the profession has embraced this concept as its foundation for practice⁴. This was considered a "best practice" concern for the course; therefore, content was added to reinforce the philosophical and functional aspects of pharmaceutical care that would allow for its application in the various content areas.

We began by discussing this philosophical shift with the faculty who were involved in teaching the course. Faculty members were encouraged to present content in such a way to emphasize analysis and consultation. Consequently, they were requested to restructure their presentation content to include more patient care issues (i.e., side effects, how to apply/use certain dosage forms, medication storage, drug stability, drug-food interactions, interactions with prescription and OTC products, etc.). The Faculty

¹ Barr RB, Tagg J. From teaching to learning: A new paradigm for undergraduate education. *Change*, 27(6): 12-25; November/December 1995.

² Felder RM, Brent R. Navigating the bumpy road to student-centered instruction. *College Teaching* 44: 43-47.

³ Kabat HF. PBL: An approach to pharmaceutical education. A GAPS-Sponsored Monograph. March 1991.

⁴ Hepler CD, Strand LM. Opportunities and responsibilities in pharmaceutical care. *Am J Hosp Pharm* 1990; 47:533-543.

was requested to use part of their presentation period, where appropriate, to demonstrate products that may aide in patient compliance with medications and disease self-management (i.e., blood glucose and peak flow monitoring devices).

Other content changes have been included over time. We identified the need to incorporate content that would reflect contemporary practice that was not associated with a specific disease process or drug category. Therefore, content such as compounding/ extemporaneous preparations and sterile products preparation was added to the course. Since the course had already addressed dispensing considerations in the elderly, content was added to consider those dispensing issues in pediatric populations as well.

Problem-based learning has enjoyed increased use in pharmacy education as an enhanced way of addressing pharmaceutical care outcomes. The modifications in course content were deemed necessary by the authors in order to reflect the emphasis on pharmaceutical care. It was determined that problem-based learning would best facilitate the delivery of the new course content, since it could be easily incorporated into cases.⁵

C. Reflective Essay on Instructional Practice

Pharmacy Dispensing was a traditionally-taught, lecture-dominated course prior to and for the first two years of participation by the faculty authors. The exclusive use of a lecture-only format provided no real stimulus for students to explore information beyond that which was given to them in class by the lecturer. The course did not challenge students to think, investigate, and write. In addition, faculty interest in the course appeared less than optimal as student feedback suggested that the materials presented by course faculty followed too closely to those of another core course.

The primary course objectives are:

Identify a drug or product ingredient by trade, generic or common name, the therapeutic use or pharmacological rationale for its use, and the known postulated mechanism.

Demonstrate the ability to verify the appropriateness of a dosage regimen.

Describe proper labeling (including auxiliary/cautionary)

Identify, interpret or explain patient or pharmacokinetic factors that affect either the efficacy or safety of individual drug therapy.

Identify, interpret or evaluate sources of drug information for use in answering questions regarding prescription medications.

Describe proper aseptic techniques or sterilization procedures for preparing sterile products such as injectable, otic or ophthalmic preparations.

Recognize those nonprescription products that may alter the therapeutic effect of prescription medications.

Explain contemporary public health issues and principles of nutrition in relation to the treatment of diseases and medical or physiological conditions.

Since most of the course objectives are best achieved upon application, a solely teacher-centered approach was determined to be insufficient to accomplish the objectives. The faculty authors decided that more than one teaching method should be employed in the course, and that the course redesign should incorporate a more student-centered approach to complement the lecture method.

Problem-based learning is a student-centered approach to learning. The fundamental component of PBL is that the problem occurs first in the learning process, and through the use of problem-solving skills, students can actively engage in discussion leading to "new learning" with the assistance of faculty.⁶ PBL affects student study behaviors. Studies have demonstrated that PBL students are more likely to

⁵ Cisneros RM, Salisbury-Glennon JD, Anderson-Harper HM. Status of problem-based learning research in pharmacy education: A call for future research. *American Journal of Pharmaceutical Education*, Spring 2002; 66: 19- 26.

⁶Wilkerson L., Feletti G: Problem-based learning: One approach to increasing student participation. In Lucas AF, (ed.): *The Department Chairperson's Role in Enhancing College Teaching*. San Francisco, CA: Jossey-Bass, 1989, pp, 51-60.

participate in informal discussions with faculty or peers, and more likely to use reference materials outside of those provided by the lecturer.⁷

The faculty authors believed that these particular outcomes of PBL would be appropriate for the course since the principal goal of the dispensing process is to enable students to apply knowledge and skills gained throughout the curriculum in providing the appropriate medication, in the appropriate form, to the appropriate patient, under the appropriate conditions to meet specific therapeutic endpoints. Since the traditional lecture format is teacher-centered and does not encourage student engagement of critical thinking or self-directed learning, the authors did not believe this method should be the focus of learning. Consequently, problem-based learning was selected as the student-centered approach to implement in support of attaining the course objectives. Based on the literature, the authors believed that the use of PBL would increase student motivation for learning and improve their clinical reasoning process.^{8,9} However, a modified approach to its implementation was used due to limited faculty resources and insufficient time for general faculty development to involve course faculty in the use of PBL. Support for this type of implementation of PBL has been demonstrated in the literature.^{10,11}

D. PBL Context and Application

The Pharmacy Dispensing course uses a modified problem-based learning (PBL) format that included small, tutor less groups outside of the classroom session, and the floating facilitator model for the in-class meeting. Tutor less groups are used in PBL as a modified approach when adequate numbers of tutors are not available, particularly in a large classroom setting. An average of 65 students has been enrolled since redesigning the course in the Fall of 2000.

An orientation is held at the beginning of the semester and the students are introduced to the methodology to be used. A series of vignettes developed and produced by the University of Delaware are used to help the students understand some of the potential rewards and pitfalls of the PBL small group process. A discussion ensues where the students may ask questions and obtain answers about the way the process is to be conducted.

The students are also introduced to the course Web site. A complete review of the Web site is undertaken including hints about effective use of the general class discussion board as well as the individual small group discussion boards. This discussion includes how to select user names and passwords and how to login. Each student is assigned to a small group comprised of six to seven members. Group members elect a moderator and scribe to serve in this capacity throughout the semester. The moderator's role is to coordinate the discussion. Each group also has a scribe. The scribe's role is to record all pertinent information from the discussions, including the group consensus regarding learning issues. The scribe also transcribes the final case solution onto the group's discussion board for faculty review.

During the in-class small group session, the groups are given the first page of a case by the faculty. The groups deliberate for a period of one and one-half hours. Each case has been developed around three to five objectives. Each case has two pages with each page characterized by two to three tasks. While most tasks were therapeutically focused, some were non-therapeutically focused (e.g., insurance issues, ethical considerations). Only the first page of the case is provided for the first session. The process is designed so that the case under consideration is related to a topic or topics that are yet to be covered in lecture.

⁷Blumberg P, Michael, JA. Development of self-directed learning behaviors in a partially teacher-directed problem-based learning curriculum. *Teach. Learn. Med.* 4(1): 3-8, 1992.

⁸Bligh J, Lloyd-Jones G, Smith G. Early effects of a new problem-based clinically oriented curriculum on students' perception of teaching. *Med Educ.* 2000; 34(6): 487-9.

⁹Norman GR, Schmidt HG. The psychological basis of PBL: A review of the evidence. *Acad Med* 1992; 67(9): 557-65.

¹⁰Barrows HS, Tamblyn RM. An evaluation of problem-based learning in small groups utilizing a simulated patient. *J. Med. Educ.* 51: 52-54, 1976.

¹¹Barrows HS. A taxonomy of problem-based learning methods, *Med. Educ.* 20; 481-486, 1986.

This method engages the students in a manner that prepares them to participate more meaningfully in the coming lectures. The course web site contains faculty-selected links to pharmaceutical care websites. These sites provide a variety of pharmaceutical product, therapeutic, and disease-related information which the students can quickly access online to support information gathering.

The setting for these sessions is a large semi-tiered lecture hall with fixed tables having swivel chairs. Two faculty members move about the room during the sessions listening to the various group discussions, interjecting occasionally, but never providing expert content. At the conclusion of the session, scribes prepare a list of learning issues, a copy of which must be turned in to the instructor. The groups determine when they will meet outside of class.

The second page of the case is usually posted online about a week after the in-class meeting. That provides enough time for the group members to research their learning issues and report to their groups. Since the second page of the case reveals more information that provides greater clarity, completion of the first phase is important to validate or correct student thinking. Every group member is expected to post at least once during the period that a case is under consideration. Optimally, the groups will carry on a continuous dialogue via the discussion board following the in-class session up to the time of final posting of their group solution. Small groups are required to post case solutions onto their password-protected discussion boards within two weeks of receiving the case.

The outcome of the PBL activity is the creation of a case solution by each group. Students are required to complete five case solutions within the semester. The problem scenarios are developed by integrating topics using real-life situations. For example, the first problem scenario typically involves a patient with medication-related problems who has a history of diabetes, hypertension, and dyslipidemia.

Students are presented with the problem, although they have not encountered any of the topics before, and are expected to use problem-solving skills to achieve an appropriate outcome. Various approaches may be used to achieve an appropriate outcome. It is expected that their ability to use problem-solving skills will be enhanced by the discovery process employed. Once a solution is submitted, the two faculty members assess the work and meet to reach a consensus on the appropriateness of each case solution. The case solutions are worth, in total, 50% of the final course grade.

Self-evaluation of performance in small groups is required and submitted online when each final case solution has been posted. Moderators performed peer evaluations of each group member per case. Peer evaluations of each moderator were performed at the end of the semester. At the conclusion of the course, a class session is set aside to carry out the end-of-course awards program. Certificates of award are presented in a variety of categories such as the best case solution, awards for group moderators and/or scribes, or the best group communication for quality and consistent group posts.

Part III. Student Learning

A. Evidence of Students Meeting the Learning Objectives

Standards of Judgment Used to Evaluate Student Work:

Two faculty members review each set of group case solutions. The members independently make an assessment using the prepared written solution and follow that up by ranking the solutions attaching brief comments. The faculty members convene to review the rankings and comments and arrive at a final assessment. Although a faculty prepared solution is used in the assessments, it is recognized that groups vary in their thinking and may propose an approach to solving a problem that is not included in the prepared solution. This is why the assessment process is carried out as indicated.

The example of student work provided exemplifies the best work produced during the two cycles of the course redesign (Section 5). While it is not typical of what all students produced, several groups submitted good to very good case solutions. Students were evaluated on their ability to fulfill all the

learning objectives built into the case, to address all tasks in narrative form, and to identify and resolve all problems contained within the case. Lower assessments were received if: 1) solutions were not in narrative form, 2) any tasks were not addressed, and 3) any problems were not identified or remained unresolved. The example provided met all of these goals for the case.

The context of the problem involves a female senior citizen with type 2 diabetes mellitus, who presents to a modern independent community pharmacy desiring to purchase a glucometer and related supplies, and who requests that the pharmacist refill her medications previously filled at another pharmacy. During the process of receiving her prescriptions, she complains of having a feeling of "swimming in the head each morning" to the pharmacist. Four prescription bottles are provided by the patient.

Directions Provided to Guide Student Performance:

Small groups were given several directions to assist them in preparation of their case solutions. The following information has been excerpted from the document titled, ***Instructions for Case Development, Preparation, Small Group Participation and Posting of Case Solutions***, which were developed by the faculty authors and provided to students during the course orientation:

"To ensure that you successfully accomplish the objectives associated with the ongoing lecture series in this course, several cases have been constructed using a modified problem-based learning (PBL) methodology. This method has been designed to help you further develop your critical thinking and problem-solving skills. Technology (i.e. web-based communication) will be used to facilitate interaction among students and faculty.

Small Group Discussions

Each student will be randomly assigned to a small group at the beginning of the semester. During the semester, five cases will be posted on the web and the small groups must meet twice per case assignment for deliberation and resolution of the case. The groups will each meet for one in-class discussion and one out-of-class discussion. The out-of-class group meeting must be held as agreed upon by the members of individual small groups. The *first page of the case* will be distributed to the small groups during the *in-class discussion*. The *second page of the case* will be made available via the web for the out-of-class discussion session, at the discretion of the coordinator. Please check the web site for the post. The particular actions undertaken during the small group discussions are inclusive of the process indicated on the attached sheet entitled, "Role Descriptions for Specific Small Group Participants."

Cases

The cases that you receive are integrated across topical areas. This more closely represents the typical patient case that you will encounter in the practice environment. Cases will be distributed prior to the lecture presentation of the topics. Serious and scholarly deliberation is expected by each small group toward the solution of each case provided. Case solutions will be due two (2) weeks after its distribution.

Evaluations

Self evaluations of performance in the small groups are required. Each member must submit a self evaluation online at the conclusion of each case. No grades for case solutions will be given until self evaluations are submitted. Moderators are responsible for performing a peer evaluation of each member of the group for each case. Each member will perform a peer evaluation of the moderator at the conclusion of the semester. *Peer evaluations of the moderator must be turned into the course coordinator one week prior to the final exam.*

Strategies for Small Group Discussions: How Do We Begin?

During your small group deliberations, you should participate in the following:

Carry on salient discussions with the intent of accomplishing tasks presented in the case
Develop "learning issues" (determine what you don't know)
Rank learning issues in order of importance

Decide which questions will be followed up by the whole group or which should remain individual responsibilities

Determine what resources are needed to further research the issues

Reconvene to explore previous learning issues and integrate knowledge

Ask Yourself . . .

What do I know (already) about this situation (that is, the terms used, the circumstances described, the disease processes at issue, the drugs past and present, the patient-derived information, the actual facts stated versus supposed issues, the environment, etc.)

Have I seen such a situation, in total or in part, previously?

What do I believe is going here? (Is it possible for you to formulate several hypotheses about what might be taking place in the case?)

What is it I need to know to corroborate one or any of these hypotheses and lead to a conclusion?

Am I sure what the facts are?

Is there anything else I need to know?

What is (are) the proposed resolution(s) for the identified problem(s)?

In addition to the above instructions, students were provided with an example of how a case solution could be written. Faculty authors submitted, via the website, the solution to the first page of the first case after all solutions had been submitted for grading. Students were encouraged to submit their solutions in a narrative format addressing all of the tasks assigned. Student interaction with faculty facilitators occurred during the in-class session and through feedback provided based on learning issues derived by each group. Student interactions with other students occurred during in-class and out-of-class discussions.

B. Reflection on the Evidence of Student Learning

The case solutions serve as the primary evidence of students meeting the learning objectives. The course final grade is composed of an online midterm examination, a written final examination, and the case solutions. During the course redesign, it was the decision of the faculty authors to place equal value on the PBL activities and the examinations in order to emphasize the importance of the small group discovery process and to reward the efforts of students to deliver their best work. The case solutions are worth 50% of the course grade and the examinations together are worth 50% of the course grade. Since offering the redesigned course, all student groups have met the learning objectives through the PBL activities or the examinations.

However, the limitation of the evidence resides in the fact that the case solutions represent a group product, and the ability to assess the individual student's performance on each objective is difficult. Ideally, the examinations should assess the individual performance on these objectives; however, it is not administered as a modified essay but as a multiple-choice examination. The multiple-choice questions are carefully designed and meant to reflect the thought process that each student has experienced during the small group deliberations. However, one recommendation for change to improve the assessment of student performance would include the use of some essay questions on the examination. In fact, it is desirable to use an exercise that allows the students to reflect in such a way as to tie their responses in with specific objectives, thus showing conclusively that the objective was attained.

Further evidence of students meeting learning objectives can be examined at the following Web addresses: <http://www.med.howard.edu/dispensing> (Fall 2000) <http://tbbweb.howard.edu> (Fall 2001).

Observations of in-class small group discussions and evaluations of solutions indicate that groups identify and respond to the essential issues in the prepared solution as were outlined by the tasks. However, the groups often differ with respect to their handling of lesser concerns. The students' ability to respond to the principal issues of a case suggests strongly that learning is taking place.

While often the use of learning issues has been a concept requiring further explanation for some groups, it also can serve as an indicator of student learning. In addition, learning issues generated by all groups serve as a means of formative assessment, allowing the instructors to gauge the progress of the entire class towards goal. It also provides an indicator of areas that the lecturer might need to place added emphasis. Review of the learning issues submitted at the close of the in-class sessions has shown that students can identify gaps in their knowledge and pinpoint important learning that needs to take place. The case solutions have shown that they are capable of acquiring the missing information and assimilating it appropriately outside of a structured classroom teacher-controlled environment, while reaching sound conclusions.

Student Outcome Information:

Student Learning Satisfaction Surveys were conducted. Eighty-six percent (112 of 130) of the surveys were evaluated. Comparison of pre- and post-course student learning satisfaction surveys revealed that students were more satisfied with their ability to retrieve new information from references while completing this course than before ($p < 0.05$). A nearly significant difference was observed in students' satisfaction with the use of web-based technology to support the innovation (out-of-class PBL sessions) ($p = 0.082$). The student learning satisfaction survey showed that 82% were satisfied to very satisfied with participating in the in-class small group sessions. Sixty-nine percent were satisfied to very satisfied with participating in the out-of-class small group sessions. Seventy-three percent were satisfied to very satisfied with the online midterm examination. About half (54%) of the class used the pharmaceutical care links web page during case research. However, of those who used the links, 52% indicated they used the links most of the time. Ninety-seven percent (97%) of the students were satisfied to very satisfied with the selection of pharmaceutical care links available on the Web site.

Since only sixty-nine percent of the students were satisfied to very satisfied with participating in the out-of-class small group sessions, the faculty authors have considered modifying the methods of communication currently available to students by enabling the use of both synchronous and asynchronous communication on the Blackboard™ software. Currently, groups are able to communicate during their out-of-classroom sessions using password-protected small group discussion boards. While this is very useful for facilitating exchange of information, some students may desire a "live" discussion with group members similar to what is experienced during the in-class sessions. The synchronous virtual classroom or chat room can be more useful in this situation and may facilitate more stimulating and time-efficient discussions during the out-of-class sessions.

Verbal feedback from students during the semester of the first course offering; revealed student difficulty with effectively completing five problem scenarios during the semester. The faculty authors determined that the third problem scenario might have been presented too close in proximity to the fourth and caused students to rush the preparation of a solution. Since this was not the objective of the exercise, the faculty authors removed the third case during the second course offering to determine if this change would better suit the process. Course content from this case would be integrated into the subsequent case. It was determined that removal of the case helped facilitate the PBL process better for students and faculty.

C. Reflective Summary of the Course

The scholarship of teaching is clearly demonstrated when preparing a course portfolio. Evaluating teaching and learning methods allows the faculty member to determine the effectiveness of current practices in their course. Student understanding gained through the mastery of course objectives and their satisfaction with active-learning techniques is the outcome information necessary to determine this effectiveness.

In the fall semester of 2000, the faculty authors redesigned the Pharmacy Dispensing course, a lecture-dominated core course taught in the School of Pharmacy. The exclusive use of a lecture-only format provided no real stimulus for students to explore information beyond that which was given to them in

class by the lecturer. Since pharmaceutical dispensing is a multifaceted interactive process, identifying specific objectives keyed to desired behaviors for pharmacists in the dispensing process would allow for the development of tailored case scenarios capable of stimulating the development of problem-solving skills in a setting of small group discovery. The faculty authors believed that PBL is a teaching methodology that appropriately supports this learning process.

A modified PBL format was selected for the course, using ten to eleven small groups of six to seven students. A floating facilitator model is used for the in-class sessions while tutor less groups are used for out-of-classroom sessions.

The submission of a case solution is the primary evidence of student learning during the PBL activities. Small groups also develop learning issues following the in-class session, which serve as a means of formative assessment. Since offering the redesigned course, all student groups have met the learning objectives through the PBL activities or examinations. The student learning satisfaction survey showed that 82% were satisfied to very satisfied; with participating in the in-class small group sessions. Course modifications will include the addition of some essay questions to examinations and enabling synchronous communication during out-of-class small group discussions to facilitate more stimulating and time-efficient discussions.

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