

INSTRUCTIONAL DESIGN AND ASSESSMENT

An Elective Course in Differential Diagnostics

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Submitted May 13, 2011; accepted July 5, 2011; published November 10, 2011.

Objective. To design an elective course to teach the principles of differential diagnostics to second-year pharmacy students, critically evaluate the benefits of this approach to self-directed learning, and assess obstacles to implementation that other programs may encounter.

Design. Students attended seven 2-hour class sessions in which the instructor presented a chief complaint, and the class researched and discussed possible causes and arrived at the accurate diagnosis. Each student also was assigned a unique, simulated patient case to work on outside of class. Students asked questions and researched the answers, providing a written rationale for needing the information and the source of the information. Students gave a 10-minute presentation on their diagnosis and treatment recommendations during the last class session.

Assessment. All students (N = 21) successfully determined their patients' diagnoses and made appropriate treatment recommendations. Fifteen students reported that the most valuable information in solving their case was subjective rather than objective in nature (ie, interviewing the patient rather than reviewing laboratory test results). The majority of the 15 students who completed a post-course survey instrument agreed or strongly agreed that this elective allowed them to practice varied skill sets and integrate past and future curricular content.

Conclusion. PharmD students may benefit from instruction in the basic principles of differential diagnostics.

Keywords: pharmacy education, differential diagnostics, elective

INTRODUCTION

Pharmacist clinicians practicing in increasingly demanding settings require extensive knowledge; critical-thinking skills; the ability to effectively work with and understand other providers; and an appreciation for the basic principles of differential diagnostics to provide pharmacotherapy in various outpatient and inpatient settings.¹⁻⁸ Instruction in the basic principles of differential diagnostics prepares nonphysician health care providers with the fundamental abilities and critical inquiry skills to ensure they understand their patients and the underlying cause of a disorder or complaint before "prescribing" the best drug regimen to manage the patient's symptoms.⁹⁻¹³ The complex thought process needed to provide effective patient care is becoming part of the daily demands for pharmacists¹²⁻¹⁷ and requires competence, patience, empathy, and tenacity, among other attributes. Development of these attributes in future pharmacists is the mission and charge of pharmacy education.¹⁸

PharmD students receive instruction on pharmacotherapy pertaining to disease states affecting various systems and are expected to competently assign the best patient-specific treatment regimen to ensure the effective provision of comprehensive medication management, clinical consulting, and collaborative prescribing.¹⁹⁻²⁶ While not trained to be diagnosticians, throughout the curricula, PharmD students are introduced to didactic information and given assignments that require them to be familiar with the diagnostic tests ordered to diagnose many disease states.¹⁸ In professional practice settings, pharmacist clinicians often must decide whether they should recommend prescription and/or nonprescription medications based on their patients' complaints.^{5,6,11-15,17} Thus, pharmacists must be able to accurately assess a patient's presenting complaint and recommend the most appropriate course of action, a responsibility that places the pharmacist in a pivotal role with respect to the patient's health care. To this end, some may argue that PharmD students should be formally exposed to and instructed in the principles of differential diagnostics to effectively prepare them to assess medication problems and understand the needs of their patients prior to recommending or assigning any medication intervention.

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Educational methods give PharmD students an opportunity to use problem-based learning approaches to patient-care issues of varying complexity, such as identifying patient problems, responding to chief complaints, and addressing pharmacotherapy for multiple disease states; however, PharmD students are given little to no instruction in differential diagnostics, despite being increasingly expected to perform patient care activities.^{1-8,11,15,17-31}

Programs training physicians, physician assistants, dentists, and other prescribers use similar educational methods as those used with PharmD students (ie, problem-based learning), yet there is less emphasis on the use of the principles of differential diagnostics in PharmD curricula, perhaps because pharmacists do not formally diagnose patients' ailments as part of their daily practice. To better prepare PharmD students to effectively interact with other healthcare providers and provide quality patient care, an elective course was developed focusing on problem-solving using the basic principles of differential diagnostics. To date, there is no literature report of a similar course having been developed, implemented, or evaluated in pharmacy education. All components of this elective, including survey tools and assessment rubrics, were reviewed and granted exempt status by the university's institutional research board.

This elective was created to expose students to the basic principles of differential diagnostics through practice and demonstration of information-gathering skills, research into and assignment of patient-specific pharmacotherapy, and integration of knowledge across the curriculum using individualized, simulated patient cases. The objectives of this elective course were correlated with ACPE educational standards.¹⁸ This paper (1) describes the elective, (2) critically evaluates the benefits of this approach to self-directed learning, (3) identifies potential obstacles other programs may encounter at the stage of implementation, (4) offers suggestions to reduce the impact of these obstacles, and (5) presents results of students' aggregate performance and perceptions regarding the utility of the elective.

DESIGN

The content and delivery of the elective course were designed according to the basic principles of differential diagnostics presented in medicine and pharmacy textbooks and resources featuring topics such as patient interviewing, laboratory result interpretation, physical assessment, and disease-state management.^{32,33} The course was offered to second-year pharmacy (P2) students starting in the fall term within a 3-year curriculum in which students were given more extensive instruction on pharmacotherapy topics than in their first year, during which greater emphasis was placed on foundational sciences. Within the

classroom setting, students had access to wireless Internet and were allowed to access online resources during class, facilitating the instructor's use of the Socratic method.^{34,35}

The content delivery of the elective course was reinforced with drug information exercises and various types of student-directed active-learning strategies. Blackboard Learning system (Blackboard Inc., Washington, DC) was used to communicate Microsoft PowerPoint presentations to students or announce which chapters in the textbook to read before the 2-hour class sessions. To ensure that all students participated verbally and through written active-learning assignments, the instructor monitored student participation in the classroom. Outside the classroom, participation relied heavily on e-mail to facilitate correspondence between students and the instructor.

In the first 2-hour class session, students began working on a patient case in which the instructor asked them to consider the chief complaint: "It hurts!" (Appendix 1). The instructor asked that each student write 10 medical conditions that could be responsible for this complaint. Students referred to prior notes from their P1 year on pathophysiology and disease processes to inform their approach to this complaint. Conditions listed by students included angina, chronic pain disorder, neuropathy, headaches, gastroesophageal reflux disease (GERD), and others. The instructor then selected and listed 10 of these conditions on a whiteboard and asked students to research their texts and/or online references to "rule out" the diseases until they reached the patient's diagnosis. One of the 10 conditions identified by the class as infection was the accurate diagnosis, specifically brought on by skin excoriations resulting from the patient's self-injurious behavior and long-term battle with Munchausen syndrome. Students were given unlimited attempts to obtain the information and laboratory test results consistent with this diagnosis during this first meeting. During this 2-hour session, students researched various conditions and asked the instructor questions 1 at a time, gradually learning more about their patient. Having developed this case prior to the course, the instructor answered each question progressively, and the responses informed students' subsequent queries.

After 32 questions about the case had been answered by the instructor, students concluded that the patient was indeed suffering from a self-induced condition in which the patient admittedly enjoyed "assuming the role of the patient" and injecting herself with contaminated needles or engaging in skin mutilation that resulted in infection. After this description, students researched further, arriving at the possibility of Munchausen syndrome. After the instructor confirmed the diagnosis, students had to assign the best pharmacotherapy based on patient-specific factors,

Table 1. Description of the Fall Term (August-December) Showing the Differential Diagnostic Elective Schedule and Topics Addressed in the Concurrent Required Courses.

Elective Schedule and Content per Meeting (2 hours/meeting)	Courses in Which P2s Are Concurrently Enrolled (2 weeks/course)^a
Meeting 1: Introduction to the course. Chief complaint: "It hurts!" Topics discussed: Pancreatitis, Deep vein thrombus, Migraines	Week 1-2: Introduction to Patient Care
Meeting 2: Chief complaint: "I can't breathe." Topics discussed: Pulmonary embolism, Pneumonia, Heart failure exacerbation	Week 3-4: Cardiovascular Pharmacotherapy I
Meeting 3: Chief complaint: "It hurts to talk." Topics discussed: Nerve pain (neuralgia), Infection, Laryngitis	Week 5-6: Neuropsychiatric Pharmacy I
Meeting 4: Chief complaint: "My leg aches." Topics discussed: Neuropathy, Peripheral arterial disease, Injury / blood loss	Week 7-8: Neuropsychiatric Pharmacy II
Meeting 5: Chief complaint: "I'm tired." Topics discussed: Anemia, Liver disease (hepatic encephalopathy), Substance abuse	Week 9-10: Renal Pharmacotherapy
Meeting 6: Chief complaint: "I want to die." Topics discussed: Substance intoxication, Uncontrolled depression, Drug-induced psychosis	Week 11-12: Endocrine Pharmacotherapy
Meeting 7: Chief complaint: "My belly feels full." Topics discussed: Gastro-esophageal reflux disease, Peptic ulcer, Liver disease (ascites)	Week 13-14: Male and Female Health
Meeting 8: Final Class Day. Presentations.	Week 15-16: Gastrointestinal and Hepatic Pharmacotherapy

^a Includes only the didactic courses here. Second-year pharmacy (P2) students are also engaging in IPPE and some have committed to more than one elective at a time.

such as poor adherence to psychiatric medications, past drug intolerances that would preclude certain treatment options, allergies, prior adverse reactions, and other factors. By the end of the session, the class had recommended a medication regimen for cellulitis based on information and treatment guidelines found in their pharmacotherapy textbook.

Students continued to attend 2-hour class sessions similar to the first ones and learned about other conditions throughout the course (Table 1). Other examples of in-class topics included immune suppression secondary to infection with human immunodeficiency virus (HIV) as the basis for the presentation of opportunistic infections; hypervolemic hyponatremia resulting from a combination of recreational drug use and water intoxication; and drug-induced pancreatitis from the overuse of nonprescription weight-loss medications, further exacerbated by excessive alcohol consumption.

Students also were assigned a patient case to work on independently. At the end of the first class session, students were each randomly assigned a chief complaint based on a unique patient case, which they would work on with the instructor outside of class (Table 2). Cases were created based on a variety of the instructor's past clinical experiences and included specific information that would steer students toward a particular diagnosis; however, they were designed not to confuse students as they approached their diagnoses. For example, students

were not asked to differentiate between types of thalassemia but may have been asked to differentiate between "shortness of breath" induced by a condition such as cystic fibrosis or drug-induced pulmonary fibrosis based on the patient-specific information they received.

The instructor also gave students a set of rules on how they should ask for patient information. After being given only their patients' chief complaints, they were allowed to ask no more than 20 questions in their pursuit of the correct diagnosis. Each of the questions students asked about their patient had to be accompanied with a brief narrative, in the students' own words explaining why they wanted to know the information requested. In addition, each query was to be accompanied by a reference from the literature that supported students' thought processes to ensure each question was focused and relevant to the case. For example, students could not just ask for "abnormal laboratory values," but they could ask for "liver function tests" if they could provide an accompanying rationale, such as "My patient presented with pain in the right upper quadrant, is jaundiced, and has a history of HIV infection, and I would like to rule out conditions such as hepatitis or a drug-induced disorder." Students also provided citations from primary, secondary, and tertiary resources supporting their thought process. Although assigned individual cases, students were allowed to consult any references and discuss their case with peers within and outside the elective, other students from different

Table 2. Sample Descriptions of Chief Complaints Assigned to Students and the Correct Diagnoses^a

Assigned Chief Complaint (CC)/Setting^b	Correct Diagnosis
“My breath is terrible. . . can you help me?” The patient approaches healthcare providers about this concern during patient education session in the hospital.	Bulimia nervosa (chronic enamel erosion)
“My side aches so badly!” The patient has just been admitted to the emergency room for treatment of acute discomfort.	Urinary tract infection (chronic) progressing to pyelonephritis
“I have white stuff on my tongue.” The patient walks into a clinic and asks the pharmacist for a special mouthwash that will eliminate a strange plaque on his tongue.	Human immunodeficiency virus (asymptomatic, early onset; candidiasis)
“I feel exhausted.” The patient approaches the medical team at a community hospital after being referred by his general practitioner.	Anemia of chronic kidney disease

^a Only 4 student cases are summarized here; there were 21 cases total so that students would each have their own.

^b Students were given only their patients’ chief complaint and had to ask questions to obtain additional information (maximum 20 questions).

health professions programs, their course instructor, and other faculty members.

Once students had reached the correct diagnosis, they were instructed to research and assign the best pharmacotherapy regimen to treat their patient and create a presentation on their case to present to the class. Presentations could be no more than 10 minutes long and were peer-evaluated using the same rubric as that used by the instructor to facilitate peer and instructor evaluation of the content. Students underwent “grilling” sessions during their presentation to assess their understanding of their patient and were encouraged to complete a voluntary feedback survey tool to evaluate how the elective impacted their learning.

Students received attendance expectations and procedures addressing absences as part of the course syllabus. Students’ final course grades for this elective were “pass” or “no-pass,” depending on whether they had met specific course criteria, which had been communicated to them by means of an instructor-developed rubric delineating the course objectives. Students were informed that if they did not achieve the required criteria for any given area, according to the rubric, they would have to successfully complete remedial assignments before a final grade could be rendered.

One full-time faculty instructor coordinated and taught the elective, assessed student learning, and communicated final grades. Time invested in the design, preparation, delivery, assessment, and evaluation of the course included approximately 16 hours in the classroom, less than 8 hours generating 21 unique patient cases, and creation of all assessment rubrics and related student evaluation survey tools for the course. This elective course met

for 16 hours and combined in-class meetings with virtual office hours and assignments.

EVALUATION AND ASSESSMENT

All 21 students enrolled in the elective received full-credit and passed the course, arrived at the correct diagnosis for their individual patient case, and assigned the correct pharmacotherapy for the patient based on patient-specific information and available resources. Aggregately, students asked 277 questions to arrive at the correct diagnoses for their patient cases, which is roughly 66% of the number of questions they were expected to ask. Requests for information from the instructor commonly involved items that would require direct patient interaction or direct provider interaction and included follow-up questions or requests for clarification of information obtained from the patient. Students also commonly asked the instructor about the patient’s social history, past medical history, and medications prior to admission. Information about medication specifics, such as the duration of medication use, dosing, and adherence patterns, was requested often, while specific laboratory test results, such as international normalized ratios, CD4 counts, hemoglobin A1c, and serum iron, were requested only once. During online interactions with students, the instructor tracked all questions and divided them into 2 categories. Students consistently favored asking the instructor for information that might be obtained only by talking directly to the patient or ascertained only through observation if they were in a clinical setting (71%), rather than asking for information related to laboratory test results, physician’s physical examinations, or standardized diagnostic questionnaires (29%). The lowest number

of questions asked by a student was 7 and the highest was 19. None of the students exceeded the 20-question limit set by the instructor in order to diagnose their patient.

Throughout the process, e-mail interactions between students and the instructor were professional and efficient. All students followed the guidelines set forth and created a presentation using Microsoft PowerPoint. All presentations were submitted to the instructor on the due date to ensure they were reviewed, collectively uploaded, and ready to be presented during the final class session. Each student evaluated 2 of the 21 presentations for the purpose of providing constructive feedback, focusing mostly on the presenter's public speaking skills, use of verbal fillers (eg, um, uh) and pauses, and eye contact with the audience.

In the instructor's review of the presentations and cited resources, no instances of plagiarism were found in the students' work. Of the 159 citations used, only 5% referenced primary literature, while up to 83% came from Web sites, drug information databases, and practice guidelines. All remaining references were from student pharmacotherapy textbooks. Within their presentations, students stated that this course should be required in all PharmD programs. Peer evaluations rendered "pass" grades for everyone. A traditional multiple-choice assessment was not used in this course to assess learning, as the instructor felt that the objectives of the elective were met as designed. There was additional value in the 1-to-1 interactions, as they allowed the instructor to gauge deficiencies in students' understanding and probe their thought processes throughout the elective. Course survey questions were created to allow students to evaluate how this course impacted their learning. Assessment rubrics also were created to evaluate students' achievement of

various skill sets and benchmarks (eg, correctly diagnosing their patient, providing a rationale for their queries, and assigning the best patient-specific pharmacotherapy regimen). Student evaluations of the elective course, their assignment, and their perceptions regarding their learning were captured in a postcourse online survey instrument created by the instructor and delivered via the Blackboard Learning system (Blackboard Inc., Washington, DC). Fourteen students (67%) responded to the postcourse survey and reported that they agreed or strongly agreed that they were able to practice skills in developing an individualized approach to gathering information, research and assign patient-specific pharmacotherapy, and integrate knowledge across the curriculum using an individualized and simulated patient case. All respondents agreed or strongly agreed that interactions in the classroom and via e-mail were professional and reiterated that this elective, or a similar project, should be required in PharmD studies. Most students (86% to 100%) agreed or strongly agreed that they were able to find and use new resources, collaborate with colleagues, and interact on a one-to-one basis with the professor in such a way that they knew what was expected of them, and the majority of students enjoyed most aspects of this elective course and found it rewarding (Table 3).

DISCUSSION

A course in differential diagnostic principles in the PharmD curriculum provided an innovative platform for students to practice a variety of skill sets, problem-solve, learn, and direct their own learning of past and future pharmacotherapy topics, and research pharmacotherapy while working toward a diagnosis. Not surprisingly, students found that directly interacting with their patient

Table 3. Pharmacy Students' Perceptions of an Elective Course in Learning Differential Diagnostics, %

Survey Item	Strongly				Strongly Disagree
	Agree	Agree	Neutral	Disagree	
I knew what was expected of me	80	13	0	0	0
I received adequate guidance	85	15	0	0	0
I maintained professional online interactions	100	0	0	0	0
I experienced and maintained professional classroom interactions	100	0	0	0	0
This should be a required activity in PharmD curricula	100	0	0	0	0
I was able to teach myself future pharmacotherapy content	100	0	0	0	0
I was able to apply and integrate prior pharmacotherapy content	100	0	0	0	0
I was adequately challenged throughout the course	100	0	0	0	0
I had positive interactions with the professor	93	0	0	7	0
I developed an individual approach to patient care	100	0	0	0	0
I collaborated with other students during this elective	64	0	36	0	0
I was prompted to seek out new resources	86	0	14	0	0
I was able to practice my drug information skills	100	0	0	0	0

was more fruitful than obtaining laboratory test results. The most common approach students took early on was establishing their patient's history; inquiring about the patient's social history, pre-admission medications, allergies, intolerances, and recent events prior to the complaint; and obtaining a more detailed description of the specific symptoms from the perspective of either their patient or the healthcare provider. However, students still asked for general information and laboratory test results that might be sought in most if not all admissions, such as height, weight, complete blood counts, basic/comprehensive metabolic panels, urinalyses, and vital signs. Specific tests, such as international normalized ratios, toxicology screens, arterial blood gases, HIV screenings, and biopsies, were rarely requested. Results from clinician-administered rating scales and questionnaires (eg, questionnaire for alcohol intake practices, mental status examination) were sought mostly to support students' theories about their patients' etiology of disease and its relation to the chief complaint.

While the benefits of this elective suggest that pharmacy educators should integrate these methods into their teaching, there may be barriers to their implementation. This course was offered as an elective to P2 students in a 3-year, year-round PharmD model of education. Instructors in other programs, particularly traditional 4-year models, may want to wait until the beginning of students' pharmacotherapy courses to offer such an elective. Only 21 students enrolled in the course. While 1 instructor could easily manage 21 students and their patient cases through classroom sessions and online interactions, anyone undertaking a similar approach should carefully consider the instructor resources available and time commitment required. In models involving 30 or 40 students instructed in this manner, it might be advisable for the students to be divided into groups, each managed by a different instructor. With classes as large as 100 to 200 students, it might be useful to have students engaged in this exercise longitudinally at different times during the academic year (ie, some during the fall and others during the spring). The most critical determinants of success for this approach is enthusiasm on the part of students and faculty members, availability of instructors, a wide array of clinical expertise within the department, ability to generate multiple cases or collaborate with other colleges and schools for materials, and willingness to use technology to facilitate communication.

Another consideration that should be taken into account when implementing a similar elective is that differential diagnostics is not traditionally taught in the PharmD curricula because diagnosing patients is not a pharmacist's primary function; thus, it may be difficult

to justify spending the time and resources exposing students to this activity. However, based on students' work, presentations, and anonymous evaluations and perceptions in the current report, this approach may be a worthy pursuit if the objectives are to engage students, allow them to hone their problem-solving skills, ensure that they learn from the content and commit to self-directed learning in a manner that optimizes their understanding of the complexity of their patients.

Should the teaching of differential diagnostics become a priority for pharmacy educators, it may be advisable to integrate a traditional method of assessment, ie, multiple-choice examinations, into the models. The instructor for this course was satisfied with students' demonstration of their skills through a presentation, question-and-answer "grilling" sessions, written reports, and direct interactions with each student. The instructor considered using an objective clinical structured evaluation, but because of restraints on class time, faculty involvement, and access to scripted patients, chose instead to assess students' knowledge of the patient by asking questions during and after each presentation and allowing students to provide a rationale for each treatment strategy. Practical assessments, such as objective structured clinical examinations, also may be feasible options to consider in evaluating such a course, considering the potential scarcity of resources, the need to develop well-accepted grading rubrics, and the need to prevent faculty and student exhaustion.

CONCLUSION

Implementing an elective course teaching P2 students the basic principles of differential diagnostics in a 3-year PharmD curriculum allowed students to meet the objectives of the course through problem-solving and integration of knowledge across various pharmacotherapy topics. Combining classroom instruction, online interactions, and student-directed learning was an effective method of delivering this course and allowing students to practice varied skill sets within this framework.

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Appendix 1. “It Hurts” Activity in a Differential Diagnostic Elective Course for Second-Year Doctor of Pharmacy Students

	Description of Classroom Activity
Instructor reviews the syllabus then gives students the first chief complaint and models the approach to information-gathering; Chief complaint: “It hurts!” and asks students to provide some potential diagnoses or causative conditions.	Students provide a list of various potential causes for pain. ^a <ol style="list-style-type: none"> 1. Angina 2. Neuropathy 3. GERD 4. Infection 5. Hepatitis 6. Renal failure 7. Myocardial infarction 8. Headaches 9. Fibromyalgia 10. Opiate withdrawal
Instructor asks students to “rule out each of these conditions. Students (n = 21) break into pairs to divide the diagnoses	Students spend 40 minutes researching the conditions above and formulate questions they would like to know about the patient in order to best conclude a diagnosis.
Instructor asks students to begin their line of questioning	Students begin asking questions to the instructor about the patient in the following format: <ol style="list-style-type: none"> 1. Example Question: “Does our patient have any documented history of opiate use or abuse?” 2. Example rationale: “This will help us determine if this is related to discomfort brought on by opiate withdrawal or investigate other pain disorders.” 3. Example reference to resources: “Within our therapeutic textbook, we found that withdrawal from chronic use of opiates can lead to pain from abdominal cramping or a variety of other symptoms.”
Instructor provides students with information to the following about the patient.	Sample of information provided by the instructor: <ol style="list-style-type: none"> 1. Past medical history 2. Allergies 3. Drug intolerances 4. Current diagnoses 5. Medication adherence patterns 6. Complete blood counts 7. Social history 8. History of present illness 9. Liver function tests 10. Physical exam

(Continued)

Appendix 1. (Continued)

	Description of Classroom Activity
Instructor recaps all the possible links signaling the patient's diagnosis and students put the pieces together	Vital elements to this case: <ol style="list-style-type: none">1. This patient was a diabetes type 1 patient with history of self-induced hypoglycemia (use of insulin to acquire care)2. Psychiatric history – prior diagnosis of Bipolar type II3. Erythematic skin excoriations per physical exam4. Patient is febrile.5. White blood cells elevated with differential white blood cell shift6. Age 24; female, no cardiovascular, gastrointestinal, or other chronic conditions.7. General comprehensive metabolic panel (including liver enzymes) were within normal limits.8. Patient's story about skin excoriations is inconsistent.9. Urine drug screen results revealed no illicit substance use.10. Patient admitted to causing the wounds herself.
Students reached the diagnoses on their own.	Students research the pharmacotherapy options for patients with Munchausen syndrome and made the following recommendations (summary): <ol style="list-style-type: none">1. Currently, she is not adherent with lithium 600mg PO QAM and 300mg PO QPM; current level undetectable; find out why she is not adherent and refer to psychiatrist for follow-up and medication stabilization.2. Ensure antibiotic regimen is initiated for cellulitis; culture and sensitivity and consulting the area's antibiogram will help guide the treatment; initiate empiric agents that treat infections from gram positive, gram negative and anaerobic micro-organisms.3. Patient is currently on insulin glargine and uses lispro insulin on "as needed basis." This patient may benefit from more frequent visits with her primary care provider to meet her needs to assume the role of the patient and provide her with an outlet for continued care and monitoring.

^a Roll call in electives is only taken when electives begin during the early part of the semester to ensure the appropriate roster is submitted to the registrar's office. Participation is mandatory. Students' verbal and written contributions made during class are tracked by the instructor through the use of question-and-answer sessions and a variety of written active-learning exercises.