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# Design of drug-induced diseases elective utilizing active learning ☆

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## Abstract

*Objectives:* To describe active learning utilized in a drug-induced diseases (DID) elective and determine inter-rater reliability of the assessment rubric for oral case-based presentations.
*Methods:* The design of this DID elective focuses on problem-based learning to enhance students' critical thinking and problem-solving skills pertaining to the treatment of inducible diseases and general medicine. Each class incorporates active learning, utilization of drug information resources, and group work. The primary course assessment is student developed oral case-based presentations evaluated with a standard rubric.
*Results:* The intra-class correlation coefficient (ICC) was calculated amongst evaluators to assess the inter-rater reliability of the DID rubric for 21 case-based presentations during the Fall 2013 semester. Composite scores for the case-based presentations demonstrated good inter-rater reliability with an ICC of 0.628.
*Conclusions:* Teaching methods utilizing active learning are described for this DID elective. The rubric for the student developed oral case-based presentations demonstrated good inter-rater reliability amongst evaluators and could be modified for use in other professional courses.


*Keywords:* Drug-induced diseases; Active learning; Case-based presentation; Rubric

## Introduction

The Center for Advancement of Pharmaceutical Education (CAPE) places emphasis on evidence-based, patient-centered pharmaceutical care.[1] Active learning, defined as "an instructional method that engages students in the learning process through meaningful learning activities,"[2] is a student-centered approach to teaching that is widely used in health science classrooms today, including colleges and schools of pharmacy. This method shifts the role of faculty away from "dispenser of information" to "facilitator of student learning".[3] The Accreditation Council for Pharmacy Education (ACPE) has been a strong proponent of active learning since the late 1990s, encouraging colleges and schools of pharmacy to use such strategies throughout curriculums enhancing students' critical thinking and problem-solving skills.[4]

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A survey of over 1000 faculty at US colleges and schools of pharmacy, conducted by Stewart and colleagues in 2010, identified more than 83% use at least 2 active learning techniques in their classrooms.[5] Various active learning strategies are employed by faculty. According to the survey, problem-based learning (PBL), which includes case-based learning, was the most commonly reported active learning strategy, followed by discussion-based and team-based learning.[5] The problem-based approach to student learning has played a role in pharmacy education for decades. It was discussed by Strand, Morley, and Cipolle in the late 1980s as a pedagogic method that "…requires the student to assume primary responsibility for the identification of a particular problem and 'ground' this problem in the context of a relevant, sound, integrated knowledge base."[6] PBL typically involves a patient case based on one that a healthcare professional might encounter in a real-life situation.[3] With guidance from an instructor, students work through the patient case to address the problems. This type of learning has been shown to not only improve students' problem-solving, critical-thinking, and communication skills but encourages them to become self-directed, life-long learners.

Assessment of this type of active, student-centered learning is important. An article from the 2007 American Association of Colleges of Pharmacy (AACP) Institute looked at various performance assessments used in the academic setting. The author addressed the need for both formative (to improve learning) and summative (to determine a grade) type assessments based on learning objectives and curricular outcomes.[7] One such assessment was the scoring rubric. Literature describes the use of rubrics for assessing active learning activities.[8–11] A pilot study at the University of Arkansas for Medical Sciences College of Pharmacy discussed the implementation of rubrics for assessing student case presentations in their therapeutics recitation course.[12] The rubrics were used by instructors, student peers, and as student self-assessments. The authors found the grading rubric to successfully evaluate not only student knowledge and presentation skills, but also their critical thinking and professional behavior.

The Drug-Induced Diseases (DID) course at Butler University College of Pharmacy and Health Sciences (COPHS) is a professional pharmacy elective that focuses on PBL to enhance critical thinking and problem-solving skills pertaining to the treatment of inducible diseases and general medicine. The purpose of this article is to describe a unique, active learning approach utilized in this elective where students developed oral case-based presentations for assessment in lieu of traditional examinations. We also discuss the inter-rater reliability of the rubric utilized in the grading of the oral case-based presentations.

## Material and methods

The DID professional pharmacy elective was first designed and established as a course at Butler University COPHS in 2009. The textbook *Drug-Induced Diseases: Prevention, Detection, and Management*[13] served as the original backbone for the course; however, use of primary literature and electronic databases now serve as the principle learning resource. This DID elective provides students exposure to common and relevant adverse reactions, focusing on identification of the responsible agent and subsequent alteration of the original treatment plan. Student learning outcomes and course objectives are listed in Table 1. The current course is co-coordinated by 2 faculty

Table 1
Student Learning Outcomes and Course Learning Objectives.

| |
|---|
| *Student Learning Outcomes* |
| Apply knowledge and skills to make appropriate decisions regarding the safe and effective use of medications or the need for referral to other health care providers. These decisions should include consideration of social, economic and cultural factors. |
| Find, understand, analyze, evaluate and use information to make informed and rational decisions. |
| Effectively communicate pharmaceutical and health-related information and collaborate with other healthcare professionals to ensure the provision of quality patient care. |
| Practice independent learning and modify ideas and behaviors based on newly acquired knowledge. |
| Demonstrate ethical conduct in personal and professional settings and respect and exhibit empathy for patients' differences, values, and preferences. |
| Promote health improvement, wellness, and disease prevention. |
| *Course Learning Objectives* |
| By the end of this course, for given disease states, students should be able to: |
| Interpret and evaluate various patient case scenarios for a possible identification of a drug induced disease. |
| Explain the mechanism and rationale for specific medication classes inducing selected disease states. |
| Understand and explain the pathophysiology of selected disease states. |
| Identify appropriate criteria for alteration versus continuation of offending medication. |
| Create and verbally communicate patient cases to other students and instructors. |
| Expand verbal communication skills with both patients and health care professionals. |
| Utilize drug knowledge from previous courses (e.g. Therapeutics and Self-care) in order to further develop the working drug knowledge base of the student. |

Table 2
Course Topics.

| |
|---|
| Factors Contributing to Drug Induced Disease |
| Drug Allergy versus Pseudoallergy |
| Blood Pressure Alterations |
| Heart Failure |
| Anemia and Thrombocytopenia |
| Cognitive Disorders and Delirium |
| Bone and Joint |
| Endocrine |
| Musculoskeletal Disorders |
| Temperature Dysregulation |
| Acute Kidney Injury |
| Diarrhea and Constipation |

members, one with an acute care practice setting and one with an ambulatory care practice setting. This variety in experiences allows for different discussion points and practical view points from each patient care venue. The course is 3 credit hours and meets once weekly for a 150 minute period during the fall semester, encompassing 14 different class periods. An outline of course topics is included in Table 2. Average enrollment is 15 students completing their third professional year (P3). In addition to faculty co-coordination, pharmacy residents participate in and lead 4 class discussions. A required reading is completed prior to each class period. Throughout every class, a heavy focus is placed on active participation, utilization of drug information resources, and group work. This is often accomplished by the evaluation of a clinical patient case, researching and presenting a drug information question, or participating in a therapeutic debate of treatment options. The course design and focus was selected to help students develop critical thinking and oral presentation skills as they prepare to transition to advanced pharmacy practice experiences (APPEs).

Each class period is designed to incorporate several levels of the cognitive dimensions built within Bloom's taxonomy.[14] One example of this instructional design is in our drug-induced heart failure class. Students are assigned a reading focused on medications that cause peripheral edema.[15] Upon arrival to class, students complete a 5 question short answer quiz, focused on previous material and the assigned reading (knowledge). The lead class instructor facilitates a group discussion focused around heart failure, including pathophysiology and desired treatment goals (comprehension). Students are then broken into smaller groups of 3 and provided a patient case. Each case has a possible cause for a heart failure exacerbation and a challenging patient situation for consideration. Student groups work to identify the cause, mechanism, treatment plan, evidence-based treatment recommendations, and patient education (analysis & synthesis). Class instructors act as the healthcare provider for each group, answering questions the students have about the patient case. At the conclusion, each group presents their case to the class and a group member participates in a role play patient education session with the lead class instructor (application & evaluation). While each class is set up differently, every experience is designed to facilitate teamwork and higher order cognitive thinking.

During the semester, students are assessed through a total of 4 in-class short answer quizzes and 2 outside-class patient application assignments, covering material taught previously and required readings for the upcoming class. Instead of a traditional examination format, students work in pairs to complete three oral case-based presentations, evaluated with a standard rubric. A summary of course assessment components and scoring is included in Table 3. For each case-based presentation, students are required to partner with a different student and create a drug-induced clinical case. This includes building a unique patient case, consisting of a timeline for onset of symptoms, appropriate laboratory evaluation, potential mechanism for development, and a subsequent treatment plan. Each student group is tasked with producing 3 legitimate and feasible treatment solutions for their case. The final piece is to orally present the case, discuss alternative solutions, and provide justification of the preferred solution to peers and a course instructor. The student group must then respond to questions posed by peers and a course instructor. Each student group receives feedback from their peers and a course instructor via a standardized rubric (Appendix 1). Additionally, each student completes a self-reflection utilizing the same rubric.

The assessment rubric was created and designed by course coordinators and has been modified marginally since development, to enhance clarity and provide direction to

Table 3
Course assessment and scoring.

| Course Component | Description | Score |
|---|---|---|
| Quizzes/Assignments | 4 short-answer in-class quizzes and 2 case-based out-of-class assignments scheduled throughout semester. | 25 points |
| Case-based Presentation | Student pairs complete 3 case-based presentations. Drug-induced case is developed by students and orally presented to peers and faculty for assessment. | 150 points |
| Assessment Points | Awarded for completion of self-reflection and peer feedback for each case-based presentation. | 30 points |
| Course Evaluation Points | Awarded for completion of midpoint and final course evaluations. | 10 points<br>Course Total = 215 points |

student and faculty alike. The current rubric consists of 5 main categories evaluating originality and professionalism, depth of problem, solution, references, and presentation of the case. There is also a section allowing for general comments and suggestions for improvement. The rubric categories and content were developed specifically for the DID elective course and included assessment of the students' knowledge, skills, and attitudes to provide evidence-based patient-centered pharmaceutical care as recommended from the CAPE Educational Outcomes and ACPE Standards.[1,4] Within each of the 5 main categories, there are 3 bullet point descriptors which are scored independently at a level of no/limited proficiency, some proficiency, proficiency, and high proficiency. Individual bullet points for each descriptor are illustrated in Appendix 1. Students can earn up to 10 points in each main category, resulting in an overall score out of 50. The overall score for the presentation is determined by the rubric point scoring from the course instructor. Student self and peer feedback are not incorporated into the overall score, but serve as a method to provide feedback for improvement in future presentations.

Through utilization of a non-traditional assessment strategy, we were able to incorporate multiple CAPE Educational Outcomes into the student developed oral case-based presentations.[1] In formulating patient cases, the students had to apply and integrate the foundational knowledge gained over the course of the semester. After creating a patient case, the students then had to construct plausible options for their case, improving clinical reasoning skills. Although this assessment was not in an actual patient care setting, the students still had to consider what patient data would need to be collected and interpreted in order to create an appropriate care plan. By assimilating all this data and formulating a care plan for their fictional patients, the students were actively practicing problem solving skills as well. Finally, the assessment integrated communication skills, as the plans were presented to peers and a course instructor. Students were required to answer questions and defend their choices extemporaneously. For these reasons, this type of assessment was an effective method to ascertain students' application of the class material.

Since inception, the course has undergone moderate revisions based on end of course student evaluations and faculty self-reflection. Butler University utilizes the IDEA service, Student Ratings of Instruction System, to assess teaching effectiveness through standard end of course evaluations.[16] Each year, the syllabus is reviewed for content changes, applicability based on Butler University COPHS curricular changes, and rubric clarity. The current rubric in use was evaluated for inter-rater reliability amongst evaluators in this study. The intra-class correlation coefficient (ICC) was calculated amongst evaluators to assess the inter-rater reliability of the DID case-based presentation rubric. Higher ICC values indicate a stronger inter-rater reliability, suggestive of stronger agreement between raters. Inter-rater reliability is poor with an ICC less than 0.4, fair for 0.4-0.59, good for 0.6-0.74, and excellent for 0.75-1.[17-19] Approval was obtained from Butler University Institutional Review Board to evaluate inter-rater reliability for rubric assessment.

## Results

During the Fall 2013 semester, there were 14 P3 pharmacy students enrolled in the DID elective course. Oral case-based presentations were completed in groups of 2 students resulting in 7 groups for each case-based presentation. All 3 case-based presentations were assessed by 3 evaluators utilizing the current course rubric. Potential evaluators included 2 faculty course coordinators, 2 non-course faculty members, and 2 university funded pharmacy residents. The groups of 3 evaluators included 1 from each type of classification (course coordinator, non-course faculty, and resident). Outside of the non-course faculty, all evaluators facilitated a class discussion during the semester.

For the rubric described above, the composite score for each group case-based presentation was calculated. The composite rubric score was analyzed between the multiple independent evaluators using a two-way ICC. The ICC analysis was used to assess the inter-rater reliability between 3 independent evaluators for a total of 21 case-based presentations during the fall 2013 semester. Composite scores for the case-based presentations demonstrated good inter-rater reliability with an ICC of 0.628.

At the end of the course, 12 of the 14 (86%) enrolled students completed course evaluations. When asked the level of agreement on a positive statement regarding course excellence, mean student score was 4.8 on a 5-point scale with five being definitely true. Student feedback showcased over 90% of students reported substantial or exceptional progress on learning to apply course material, acquiring skills to work in a team, and learning how to utilize resources to answer questions or solve problems. Most importantly, 92% of students reported that this course contributed to substantial or exceptional progress on developing specific skills and competencies needed by practicing pharmacists. Specific written comments related to the course from students included: "I felt like it helped me gain knowledge for my profession and was a good refresher on topics covered in therapeutics."; "I appreciate that this class incorporates so much drug information and it is very helpful in the real world."; "I enjoyed the cases in class and the exams because it gave us a better idea of what happens in real life. I think this is a very strong aspect of the course and really made me enjoy class."; and "I probably learned more useful skills than any other course. I really made progress on looking for and evaluating evidence". Overall, the course was well received and student comments were positive.

## Discussion

We are the not the first to report active learning within a DID course. An article, published in 2013, described the

implementation of active learning activities into a college of pharmacy's DID and toxicology course.[2] This study's primary objective was to assess students' preferred teaching method, comparing traditional teacher-focused to active learning exercises. Although students found the active learning activities helpful, they preferred the traditional lecture format since it required less work. The authors concluded that active learning should continually be incorporated into the curriculum to increase students' acceptance of this teaching method, encouraging life-long learning. Although this previous research highlights the importance of active learning within a similar course, our findings additionally report the use of unique assessment format and rubric reliability amongst evaluators.

As the number of pharmacy students and the demand for more practical, real-world assessment grows, so does the body of literature on methods of assessment. In 2007, faculty in a drug information course designed and revised a journal club rubric 5 times over the course of 3 years.[20] The authors utilized faculty and student feedback to improve the rubric, demonstrating they were able to elicit strong inter-rater reliability with purposeful and thoughtful revision of their rubric over time. In another study by Peeters and colleagues at the University of Toledo, the investigators collected data over 2 years regarding the assessment of high-stakes student presentations in a capstone pharmacy course.[8] Much like our rubric, the faculty assessed both delivery skills and content, but made some modifications before the second year of data. Peeters and colleagues found a high level of inter-rater reliability and only a small degree of evaluator leniency. They noted that the results supported the importance of limiting rating scales to 4 categories, which was also utilized by our rubric.

By using our current method of assessment, we were able to assess students' knowledge while minimizing faculty exam preparation time and workload, as all grading was real-time during one class period assigned for case-based presentations. However, there are some limitations to consider. We attempted to limit for potential rubric familiarity by including non-course faculty; however, course coordinator bias cannot be completely ruled out. Additionally, while the small sample size allowed for demonstration of good inter-rater reliability amongst evaluators, a larger sample size may strengthen that relationship.

Student evaluation of this course was positive and no student had concerns with the overall course format or workload. Purposeful use of PBL to prepare students for the experiential setting and use of a reliable, easy rubric for in-class assessment could be applied to other courses within other professional programs. Further modification of the course rubric may be considered for implementation in other professional courses. Prior to implementation, consideration of key concepts for the course and creation of a strategy for determining success is necessary. Use of PBL can help students successfully build life-long skills and competencies necessary for their professional field

## Conclusions

This article describes the active learning teaching methods utilized in a DID elective including student developed oral case-based presentations. Assessment format and corresponding rubric integrated meaningful learning objectives, provided substantial feedback, minimized faculty grading time, and decreased variability between evaluators. Active learning in this DID elective encourages students to become self-directed, life-long learners as they transition to APPEs.

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## Conflicts of interest

None.

## Appendix A. Supplementary Information

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.cptl.2015.09.007.

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