INSTRUCTIONAL DESIGN AND ASSESSMENT

Teaching Student Pharmacists to Apply Drug Literature to Patient Cases

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Objective. To implement a series of activities designed to build drug literature evaluation skills and assess their impact on student pharmacists' ability to apply study results to patient cases.

Design. Coursework was integrated across two didactic and pharmacy practice laboratory (PPL) courses. Team and individual journal clubs were used in traditional and case-based approaches during PPL courses to reinforce skills introduced in didactic courses. Student performance and perceptions were assessed during orientation for the third professional (P3) year and after the objective structured clinical examination (OSCE) at the end of the P3 year in identical drug literature evaluation assessments and pre- and post-intervention surveys of students.

Assessment. Mean scores on team and individual journal club sessions were $91.8\% \pm 7.3\%$ and $88.0\% \pm 8.2\%$. Of 64 students who completed both P3 assessments, 29 (45.3%) earned a passing score on the drug literature evaluation assessment at orientation compared to 57 (89.1%) after the OSCE.

Conclusion. Student performance and confidence improved on objective assessments following a series of both team and individual, and traditional and case-based journal clubs.

Keywords: drug literature evaluation, patient-centered care, pharmacy practice laboratory, spiral integration

INTRODUCTION

The Pharmacists' Patient Care Process (PPCP), published in May 2014 by the Joint Commission of Pharmacy Practitioners, describes a patient-centered approach to pharmacist-provided clinical care centered on five steps: collecting patient information, assessing patient information, developing an evidence-based care plan, implementing the care plan, and following up to ensure the plan is effective.¹ The ability to interpret and evaluate medical literature, and then to directly apply findings to a patient is essential for the third step. A key element of the 2016 Accreditation Council for Pharmacy Education (ACPE) Standard 10 is that doctor of pharmacy (PharmD) program curricula are designed to prepare student pharmacists to use the PPCP in practice.² Similarly, ensuring each student can apply information from the medical literature to patient care is a key element supporting ACPE Standard 2, Educational Outcome 2.1 (Patient-Centered Care).

Journal club, which is a group discussion and evaluation of a piece of medical literature, is a common learning tool used in the education of student pharmacists, as well as other health care professionals, with the goals of improving evidence-based practice skills and bringing

emerging drug information to the attention of practice site personnel.³ Journal club discussions commonly focus on the primary article being evaluated, as well as potentially related pharmacology, general drug information, relevant clinical practice guidelines, and key prior studies; however, traditional journal clubs may not involve applying the article to the care of an actual or simulated patient. There is a paucity of published information describing learning activities designed to integrate drug literature evaluation and patient-centered care-related skills in pharmacy education. Specifically, published articles do not describe activities implemented in the curriculum prior to advanced pharmacy practice experiences (APPEs).^{4,5}

Critical evaluation of the available information about a treatment for a specific patient is a vital role the pharmacist plays on the health care team. To be practice ready, student pharmacists need to demonstrate a competence in this critical evaluation skill. The objectives of this paper are to describe a series of activities designed to longitudinally build drug literature evaluation skills and assess the impact of the activities on students' ability to apply results from primary drug literature to patient cases.

DESIGN

The Manchester University PharmD program has adopted a spiral model of integration where related topics are integrated with previously encountered related

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coursework (ie, vertical integration) and among disciplines (ie, horizontal integration).⁶⁻⁸ This curricular approach consists of intentional reinforcement, increasing depth and breadth with higher level objectives, logical sequencing, and flexibility to course aims. Drug literature-related skills are integrated throughout the curriculum in this fashion. Foundational principles of evidence-based medicine are taught in two courses: a required, fall first professional (P1) year course focused on gathering and interpreting information from tertiary drug information resources, and a required spring second professional (P2) year course focused on summarizing, interpreting, and evaluating primary drug literature. To continue developing student pharmacists' drug literature evaluation skills, the pharmacy practice laboratory (PPL) and drug information faculty collaborated to develop skill-based activities in the third professional (P3) year that reinforce and build on concepts already incorporated in the didactic curriculum.

In addition to efforts aimed at enhancing spiral integration, Manchester University has transitioned from an ability-based outcomes (ABOs) model to an entrustable professional activities (EPA) model.⁹ The longitudinal assessment of drug literature evaluation skills fits naturally into the EPA model and the drug literature evaluation activities serve as the milestone assessments of the relevant program-specific EPAs. Both didactic courses introduce the application of information to patient-specific and population health scenarios in order for students to meet two EPAs: use drug literature to inform and support patient-care decisions, and make a recommendation impacting populations. Subsequent PPL activities reinforce these skills. These EPAs support a program-defined graduate attribute that graduates will be known as critical thinkers who use literature and other resources to evaluate and inform effective decisions. They were mapped to the following Center for the Advancement of Pharmacy Education (CAPE) Outcomes for programmatic assessment purposes: 1.1 (Learner), 2.1 (Caregiver), 3.1 (Problem Solver), and 3.2 (Educator) for EPA 1; 1.1, 2.2 (Manager), 2.4 (Provider), and 3.1 (Problem Solver) for EPA 2.² The focus of the described activities, assessment, and evaluation is on preparing students to meet EPA 1.

Both didactic courses incorporate significant active-learning, including use of problem-based learning, project-based learning, flipped classroom, and discussion guided by a constructivist approach to pedagogy.¹⁰ These courses contain outcomes and associated learning objectives geared toward developing students to provide drug information that addresses population and patient-specific pharmacy care. In particular, the P2 drug literature evaluation course is completely taught using a flipped

classroom approach. Although traditional examinations are employed as assessment strategies, these approaches only account for approximately 40% of course points. Other assessment strategies include general and patient-specific drug information questions, article evaluations, journal club handouts, and a drug formulary monograph.

In order to further guide students toward achieving EPA 1, a 2-hour, case-based article discussion was introduced into the P2 drug literature evaluation course as an additional patient-specific assessment strategy. Students prepared for class by reading two provided articles focusing on heart failure interventions.^{11,12} During class, students engaged in small-group discussion-based activities where they focused on applying these studies to a patient case. The primary class objectives were for students to determine (1) whether the study would apply to the patient as determined by inclusion criteria, exclusion criteria, and baseline characteristics, and (2) whether results were of sufficient statistical and clinical significance to warrant use for the patient. These objectives were also used to inform design of all subsequent described activities.

To continue development of evidence-based medicine skills prior to beginning APPEs in the fourth professional (P4) year, students engaged in a journal club series during their P3 year that spanned the fall and spring PPL sequence. The purpose of the journal club activities were for students to continue to practice summarizing, interpreting, and evaluating primary literature, but also to integrate use of tertiary resources (eg, drug information databases, clinical practice guidelines) and ultimately, apply findings to a patient case. The most important learning objectives of this activity, as previously described, were deemed to be of special importance because of their relevance in preparing students to practice within the PPCP, and the need to reinforce this skill set introduced during the P2 year.

Students were provided with directions, rubrics, and a journal club handout template in advance of each journal club activity (materials available from the corresponding author). Directions described the roles for journal club leader(s) (ie, student[s] responsible for preparing a handout, presenting the article, and generating discussion) and participants (ie, students who have read the article and are prepared to discuss it). Rubrics, based on a published, validated rubric,¹³ contained 20 items that focused on content (50% of points), presentation (25% of points), and handout (25% of points); students who did not earn at least 70% (fall P3) or 75% (spring P3) of content points were required to repeat the assignment. The journal club template, used throughout the curriculum, described suggested content for each section of the handout and correlating discussion, as well as provided question-based

prompts to help students form their critique of the article. Articles were selected by instructors to ensure they integrated with and complemented concurrent therapeutics topics. Three core faculty instructors (two PPL-focused and one drug information-focused) served as journal club facilitators, whose roles included supporting the journal club leader, posing questions to the leader and participants in order to generate discussion, ensuring the article was accurately interpreted and applied to the case, and evaluating the leader. The drug information instructor prepared an “at a glance” document that noted key information from the methods and results, highlighted potential strengths and limitations of the article, and suggested questions to pose to the students. The facilitators were not bound to this document, but it was available as a reference.

In the P3 fall semester, preformed student learning teams (consisting of four to six students and used across the curriculum) were responsible for collaboratively leading a traditional journal club. Teams were provided a peer-reviewed, scientific article and collaborated to prepare a journal club handout and lead the discussion during PPL. Teams leading journal club were allotted 30 minutes to summarize, interpret, and evaluate the study. Individual students were selected at random by the instructor to lead different portions of the discussion. Each student also participated in another team’s journal club discussion, so that there were four to six student participants in each journal club, and assessed the other team’s performance using an open-ended evaluation form.

In the P3 spring semester, each student was responsible for individually leading a case-based journal club presentation. Students were provided with a brief patient case, associated with a patient- or caregiver-initiated drug information question, and a peer-reviewed scientific article. Students were responsible for preparing a journal club handout and leading a discussion with four to six peer participants and an instructor. During a 30-minute discussion in PPL, the student leader was required to summarize, interpret, and evaluate the study, and also responsible for describing how they would apply the results of the study to address the patient case and patient-specific drug information question.

During the spring semester, students also participated in five peer journal club discussions. Active participation was promoted in several ways. The leader was required to phrase at least three critique points as questions to the audience, in order to gather input from the participants prior to forming their final opinion about the point. The leader also rated their peers’ participation using a defined five-point scale, where the highest score (ie, “actively participates and meaningfully contributes to the

discussion”) could be awarded to no more than two participants per journal club. Finally, participants were required to ask at least three thoughtful questions during journal club throughout the semester. In order to count, questions had to demonstrate knowledge of the article and critical thinking (eg, “Did you think the observed effect size was clinically significant given the patient’s therapeutic goals?”). Basic questions (eg, “Was the result for the primary endpoint statistically significant?”) were welcomed, but did not count toward this requirement. Faculty facilitators evaluated and kept track of questions throughout the semester.

EVALUATION AND ASSESSMENT

In order to continually assess student performance and ensure that students were meeting EPA 1, a longitudinal assessment of the 2015 to 2016 cohort of students enrolled in P3 PPL was conducted. The assessment focused on both performance and perceptions.

Students could earn up to 50 points for participating in the fall P3 team journal club. This included 10 points from completing a pre- and post-journal club worksheet during the week when the student participated in another team’s journal club. Individual students brainstormed study strengths and limitations, as well as questions prior to journal club, and then evaluated the presenting team after journal club. Grades were based on completion of the assigned activities, and grades were assessed by faculty members. Teams could also earn up to 40 points for leading a journal club session based on a standard rubric (available from the corresponding author); the mean (SD) score among 16 teams was $91.8\% \pm 7.3\%$.

Students could earn up to 50 points from the spring P3 individual case-based journal club session. This included 10 points from participation in other students’ journal club sessions as rated by the student leader and faculty facilitator. Median participation score was 9 points (range 2 to 10). Students could earn up to 40 points for leading journal club based on a standard rubric (available from the corresponding author) completed by an instructor; the mean score among 71 students was $88.0\% \pm 8.2\%$.

In addition to the instructor evaluations of P3 PPL journal club activities, three additional structured assessments were considered. First, student performance on specific items from the P2 spring drug literature evaluation course final examination (May 2015) was assessed in order to establish baseline performance prior to the P3 year. These items were intentionally developed with this assessment in mind. Electronic examination results were available for 71 students (100% response rate). Three multiple-choice/multiple-select questions required students to determine

(1) whether a study would apply to a patient when inclusion criteria, exclusion criteria, and baseline characteristics were considered (71.8% of students selected the correct answer), (2) whether results were statistically significant (100% of students selected the correct answer), and (3) whether results were clinically significant. The third objective was assessed using a multiple-select question where students were instructed to identify factors that suggested the clinical significance of study results; three answers were correct and one was incorrect. Approximately 62%, 66%, and 69% of students appropriately selected the correct answer for each item, and 62% of students appropriately did not select the incorrect item.

Second, in order to provide students with a re-orientation to evidence-based medicine principles, and to support a comparison of their knowledge pre- and post-P3 PPL, a drug literature activity was developed as part of the fall P3 orientation (August 2015). Four days prior to orientation, students were provided with a copy of a published clinical trial and the diabetes management algorithm from the 2013 American Association of Clinical Endocrinologists (AACE) diabetes guidelines. Students were instructed to review both documents prior to

the orientation activity.^{14,15} During orientation, students were given a brief patient case and worksheet to complete individually in 25 minutes. While this activity did not count toward the course grade, it was presented by faculty members and conducted with the same tone that a high-stakes objective structured clinical examination (OSCE) would have had. The activity was graded by a single individual using a structured rubric; student results were not returned. The activity consisted of seven questions (Table 1); each question was mapped to one of the two previously described objectives.

At the conclusion of the P3 spring semester (April 2016), each student was required to pass all stations on an OSCE. An exact duplicate of the fall P3 orientation drug literature activity was administered as an OSCE station under identical conditions as described above in order to measure whether there was any change in student performance following the journal club sequence. Ordinal data was described using median and interquartile range (IQR). Results were compared between the P3 orientation activity and the P3 OSCE for each item using the Wilcoxon signed rank test for paired data. Rate of correct answers to each item and overall pass rates (ie, a score

Table 1. Student Pharmacists Correctly Answering Assessment Items Pre- and Post-intervention (N=64)

Assessment Items	Fall 2015 Orientation, No. (%) ^a	Spring 2016 OSCE, No. (%) ^a	<i>p</i> value
Identify two key ways the patient is similar to the patients in the study considering inclusion criteria, exclusion criteria, or baseline characteristics.	36 (56.3)	58 (90.6)	<.001
Identify two key ways the patient is dissimilar from the patients in the study considering inclusion criteria, exclusion criteria, or baseline characteristics.	32 (50)	57 (89.1)	<.001
Based on this study, what amount of A1C lowering can be expected with canagliflozin?	59 (92.2)	64 (100)	N/A ^b
Based on this study, what amount of A1C lowering can be expected with sitagliptin?	55 (85.9)	61 (95.3)	.07
Was there a statistically significant difference between groups in terms of A1C reduction? Why or why not?	17 (26.6)	29 (45.3)	.017
Will the A1C reduction observed with either medication be considered clinically significant for this patient, considering the standard goal A1C in the AACE treatment algorithm? Why or why not?	24 (37.5)	47 (73.4)	<.001
Will you recommend canagliflozin, sitagliptin, or something else for this patient?	10 (15.6)	43 (67.2)	<.001

Abbreviations: P3=Third Professional Year; OSCE=Objective Structured Clinical Examination;

AACE=American Association of Clinical Endocrinology

^aNumber and percentage of students who earned full credit on the item; partial credit was available

^bUnable to be computed due to 100% correct on P3 OSCE

of at least 10 of 14 points) were compared using the McNemar test. Missing data from students who were not present at both assessments was excluded. An alpha value of .05 was used to determine statistical significance. SPSS Statistics, version 22, (IBM, Armonk, NY) was used to calculate inferential statistics.

Sixty-four (90.1%) of 71 eligible students completed both the P3 orientation and the P3 drug literature activity. Median total score increased from the P3 orientation (median score 9 points [64.3%], IQR 7 to 11 points [50.0% to 78.6%]) to the P3 OSCE (median score 12 points [85.7%], IQR 11 to 13.25 points [78.6% to 94.6%], $p < .001$). Twenty-nine (45.3%) students earned a passing score on the P3 orientation assessment on their first attempt, compared to 57 (89.1%) on the P3 OSCE ($p < .001$). Results for most individual items also improved as illustrated in Table 1.

Additional data were gathered to determine the impact of the journal club sequence on student perceptions of the series of activities and assessments designed to enable them to achieve EPA 1. It was determined to be essential to gather student perceptions in this area primarily because of several of the more novel aspects of the spring P3 journal club, including the case-based approach and the multiple methods used to increase participation. Students' perceptions were assessed on the pre- (September 2015) and post-intervention (May 2016) surveys. Survey items were rated on five-point Likert-type scales, and developed based on previous longitudinal studies of drug information skills.^{16,17} The pre-intervention survey focused on student self-rating of their confidence in completing skills related to EPA 1, as well as their perceptions of the importance of such activities to their academic and professional development. The post-intervention survey asked students to rate the same items again, as well as their confidence in completing the same skills compared to their confidence level at the beginning of the P3 year. This facilitated both quasi-experimental and retrospective pre/post comparisons. The post-intervention survey also asked students to rate the value of the various activities and assessments described above on their ability to interpret and evaluate clinical studies and apply clinical study information to specific patients.

Both surveys were administered using SurveyMonkey Gold (SurveyMonkey, San Mateo, CA). Students were given one week to complete each survey, and sent two reminders. They were told that the surveys would take 5 to 10 minutes to complete, all responses would be confidential, and their perceptions would help evaluate and improve the journal club sequence. As an incentive for completing the survey, students were told that two points would be added to their journal club score in each

semester of the PPL course. Students were informed they were not required to participate and could stop the assessment at any time. The project was granted expedited approval by the Manchester University institutional review board (IRB).

Ordinal data were described using median and interquartile range (IQR). Results were compared between the pre- and post-intervention surveys for each item using the Wilcoxon signed rank test for paired data. Students who did not complete both surveys and duplicate responses were excluded from analysis of pre- and post-items. If a student only completed the post-intervention survey, only responses for items that only appeared on that survey were included. An alpha value of .05 was used to determine statistical significance. SPSS Statistics, version 22, was used to conduct inferential statistics.

Forty-four (62%) of 71 eligible students took both the pre- and post-intervention survey. Student confidence in executing most of the selected skills marginally improved after participating in the P3 journal club sequence when directly compared to responses provided at the beginning of the P3 year (Table 2). However, substantial improvement was seen in self-confidence in leading a journal club discussion from the pre-intervention survey (median 2 [IQR=2 to 3]) to the post-intervention survey (median 4 [IQR=3 to 4], $p < .001$). Self-confidence in participating in a journal club discussion also improved from the pre-intervention survey (median 3 [IQR=2 to 4]) to the post-intervention survey (median 4 [IQR=4 to 4], $p < .001$). Student responses regarding their perceptions of the importance of the topic were similar across surveys. A total of 48 out of 71 eligible students (response rate 67.6%) took the post-intervention survey. The majority of students indicated in the post-intervention survey that they felt more confident in executing the selected skills at the end of the P3 year compared to the beginning of the P3 year (Table 3). The majority of students agreed that all of the surveyed activities were valuable or highly valuable in developing their ability to interpret and evaluate clinical studies and apply such information to specific patients (Table 4). No activity received the lowest rating ("not at all valuable") from any student for either outcome, and no activity received more than five (10.4%) of the second lowest ratings ("not valuable") for any outcome.

DISCUSSION

This article describes a longitudinally integrated series of activities designed to build student pharmacists' drug literature evaluation skills, and the results of an assessment of student pharmacists' ability to apply results from primary drug literature to patient cases. Students' ability to determine whether the study would apply to the

Table 2. Student Perception of Self-Confidence and Topic Importance Pre- versus Post-intervention (N=44 Participants)

Item	Pre-Survey (median [IQR ^b])	Post-Survey (median [IQR])	p value
Rate your confidence in completing the following activities^a:			
Interpreting information from a clinical study.	4 (3 to 4)	4 (3 to 4)	.022
Determining whether a clinical study applies to a specific patient using inclusion and exclusion criteria.	4 (4 to 4)	4 (4 to 4.25)	.011
Determining whether a clinical study applies to a specific patient using baseline characteristics.	4 (4 to 4)	4 (4 to 4)	.029
Determining statistical significance of clinical study results.	3 (2 to 3.25)	3 (3 to 4)	.001
Determining clinical significance of clinical study results.	3 (3 to 4)	4 (3 to 4)	.078
Leading a journal club discussion.	2 (2 to 3)	4 (3 to 4)	<.001
Participating in a journal club discussion.	3 (2 to 4)	4 (4 to 4)	<.001
Rate your agreement with the following items^b:			
I enjoy reading clinical studies.	3 (2 to 4)	3 (3 to 4)	.045
I am interested in reading clinical studies.	3 (2.75 to 4)	3 (3 to 4)	.079
I am likely to use information from clinical studies as an APPE student.	4 (4 to 5)	4 (4 to 5)	.28
I am likely to use information from clinical studies as a licensed pharmacist.	4 (4 to 4.5)	4 (4 to 5)	.66
It is important for my development that I am able to use information from clinical studies.	4 (4 to 5)	4 (4 to 5)	.68

Abbreviations: APPE: Advanced Pharmacy Practice Experience; IQR: Interquartile Range; P3: Third Professional Year

^a1=not at all confident, 5=highly confident

^b1=strongly disagree, 5=strongly agree

patient, considering inclusion criteria, exclusion criteria, and baseline characteristics improved over the course of the longitudinal drug literature evaluation activities. Students' ability to determine whether the results were of statistical and clinical significance to warrant use for the patient likewise improved.

The most significant finding of this assessment was the substantial improvement in pass rate from the objective literature evaluation activity from the beginning of the fall P3 semester to the end of the spring P3 semester; student performance improved on each item and overall the first-time pass rate approximately doubled from 45% to 89%. This is particularly notable given that the primary activity in the P3 year specifically designed to develop

students in evidence-based practice skills was the journal club sequence in the PPL course. We also found that students highly valued all related activities (eg, activities from the P2 drug literature evaluation course, journal club sequence) in developing them as evidence-based clinicians. Improvement in self-confidence was observed across all assessed items from the fall P3 to spring P3 semesters, but with substantial improvement noted for student confidence in leading and participating in a journal club discussion in both the quasi-experimental and the retrospective pre- and post-intervention assessments. Students agreed that this coursework had relevance to their future practice. Finally, strengths of this sequence of activities included purposeful integration and scaffolding,

Table 3. Student Self-Confidence Post-intervention (N=48 Participants)

Rate your confidence in completing the following activities compared to the beginning of the P3 year^{a,b}:	
Interpreting information from a clinical study.	4 (4 to 4)
Determining whether a clinical study applies to a specific patient using inclusion and exclusion criteria.	4 (4 to 4)
Determining whether a clinical study applies to a specific patient using baseline characteristics.	4 (4 to 4)
Determining statistical significance of clinical study results.	3.5 (3 to 4)
Determining clinical significance of clinical study results.	4 (3 to 4)
Leading a journal club discussion.	4 (3 to 4)
Participating in a journal club discussion.	4 (3 to 4)

Abbreviations: P3: Third professional year; IQR: Interquartile Range; P2: Second Professional Year; PPL: Pharmacy Practice Laboratory

^a1=considerably less confident, 3=similarly confident, 5=considerably more confident

^bmedian (IQR)

Table 4. Student Assessment of the Value of Longitudinal Activities (N=48 Participations)

Activity	Interpret and evaluate clinical studies ^b	Apply clinical study information to specific patients ^b
Rate the value of the following activities in preparing you to^a:		
Attending and participating in class during the P2 drug literature evaluation course.	5 (4 to 5)	4 (4 to 5)
Completing out of class assignments during the P2 drug literature evaluation course.	4 (4 to 5)	4 (4 to 5)
Completing the P3 orientation clinical study application activity.	4 (3 to 4)	4 (3 to 4)
Leading journal club as part of a team during Fall P3 PPL.	4 (4 to 5)	4 (4 to 5)
Participating in another team's journal club during Fall P3 PPL.	4 (4 to 4)	4 (4 to 4.5)
Leading case-based journal club as an individual during Spring P3 PPL.	4 (4 to 5)	4 (4 to 5)
Participating in other individuals' case-based journal club during Spring P3 PPL.	4 (4 to 4)	4 (4 to 5)

Abbreviations: P3: Third professional year; IQR: Interquartile Range; P2: Second Professional Year; PPL: Pharmacy Practice Laboratory

^a1=not at all valuable, 3=neutral (I don't remember doing this), 5=highly valuable

^bmedian(IQR)

increasing difficulty and student independence, and integration of patient case and drug literature skills in a pre-APPE setting. Informally, students expressed an increase in their comfort and confidence levels in completing and presenting a journal club meeting, and this was reflected in the P4 year through both informal and formal feedback from APPE preceptors.

The ultimate purpose of cultivating journal club skills is building students' ability to apply knowledge learned from a journal club discussion to a given patient case. Few PharmD programs contain formal activities where drug literature is directly applied to a patient case or describe student confidence in this skill.^{18,19} A review of the literature identified two reports of drug literature activities in which students applied literature evaluation skills to a patient scenario: an application activity conducted during APPEs, and a pharmacy practice resident journal club that incorporated a patient case.^{4,5} However, no similar activities conducted with student pharmacists prior to starting their APPEs were found. The study with APPE students used literature application for patient evaluation in a primary care setting and reported improved student performance on an examination. The study with pharmacy residents reported positive resident perceptions of drug literature activities, which began as discussions relating articles to disease states and guidelines, and progressed to application of literature to patient cases. These articles could suggest that such activities may benefit student pharmacists. Our report is unique because it is the first to describe a case-based,

literature evaluation activity systemically applied in an entire pre-APPE cohort. Our assessment demonstrated substantial improvement in student performance and highly positive perceptions.

There were several limitations to this study that could have affected the results. First, an advanced elective focused on application of drug literature in the neuropsychiatry setting was offered concurrent to the P3 journal club sequence. This spring semester elective course could have been partially responsible for improvements in performance on the objective assessment. Students enrolled in the elective performed better on both structured assessments, with similar improvement noted compared to the overall cohort. Each student enrolled in the elective (n=13) passed the spring P3 assessment, and eight (61.5%) students passed the fall P3 assessment. Additionally, we received anecdotal feedback that faculty facilitators each had a different style and degree of active involvement in the journal club discussion, which could have decreased consistency in grading. However, we believe there is value in students observing different journal club facilitation styles prior to APPEs, and purposefully rotated so that student groups interacted with each of the three faculty members at different points.

Although a higher response rate would have made generalization of the results from this project more applicable, this response rate was considered appropriate because participation incentives were minimized to avoid coercion. Savvy students may have been unmotivated to

respond by the low bonus point value when the total points available in the courses were considered. Likewise, since the first review of the journal club was not associated with a grade, students may not have been as diligent in completing the assessment. The timing of the first review at the beginning of the fall semester, immediately following an academic break, may have resulted in students being less efficient at reviewing literature and guidelines. However, it was conducted in a style consistent with the high stakes OSCE. Student reporting of their self-confidence and perceptions of the assessed activities could be falsely elevated as surveys were distributed by a faculty member commonly associated with drug literature-related activities; however, participation was confidential and surveys were electronically administered. Recall bias could prompt students to report falsely elevated self-confidence at the end of the P3 year; however, we controlled for this effect by conducting both the retrospective pre-/post-intervention (to examine perceived changes in self-confidence), as well as the quasi-experimental comparison (to increase objectivity). Similarly, using the same journal article for both assessments may have resulted in improved performance due to learner effect. While the authors acknowledge this as a potential bias, the fact that students reviewed the article at the beginning and end of the academic year (eight months apart) and considering that multiple journal club activities occurred throughout the didactic curriculum, learner effect is likely of minimal concern. Anecdotally, few students recalled having completed the original P3 orientation activity by the time the P3 OSCE was conducted.

As literature evaluation activities continue to evolve within the pharmacy curriculum, potential future directions include incorporating additional elements to increase individual student participation during the P3 journal club sessions and increasing the time dedicated to journal club sessions in the PPL course. Additional time could provide enhanced student participation and discussion, and allow for more immediate feedback from facilitators. These activities could also be enriched by requiring student self-assessment of journal club performance and comparing that to the instructor evaluation, an approach students may encounter on APPEs. Future directions also may include formal evaluation of performance in these key EPAs during APPEs. Similarly, student performance and perceptions of their abilities as participators could be assessed in a future project. Although not formally assessed, these learning interventions were relatively simple to implement and not resource intensive. Based on the ease of implementation of the journal club sessions and the significant improvements in student performance on the OSCE, we conclude that this

is a curricular effort worth continuing and perhaps a model to use for teaching and/or improving other skills.

CONCLUSION

This integrated, longitudinal activity helped pre-APPE student pharmacists develop their literature evaluation skills. It culminated in the application of clinical trial information to a patient case and prepared students to apply the PPCP. The results demonstrate both improved student performance and self-confidence on key learning objectives through the series of team and individual, and traditional and case-based journal clubs.

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