RESEARCH

Evaluation of Video-enhanced Case-based Activities Guided by the Pharmacists’ Patient Care Process

Catherine Bourg Rebitch, PharmD, Virginia H. Fleming, PharmD, Russ Palmer, MEd, Hui Rong, PhD, Ikseon Choi, PhD

a University of Georgia College of Pharmacy, Athens, Georgia
b Learning, Design and Technology Program, University of Georgia, Athens, Georgia

Submitted July 25, 2017; accepted October 18, 2017; published May 2019.

Objective. To design and develop a series of technology-enhanced, case-based learning activities framed by the Pharmacists’ Patient Care Process (PPCP), and to evaluate the impact of these activities on student perceptions and performance.

Methods. A mixed methods approach was used to generate both quantitative and qualitative data. Survey and focus group interviews were used to analyze student perceptions. Performance on a pre- and post-assessment was used to measure the impact of PPCP case-based learning activities.

Results. Students demonstrated positive attitudes overall towards the case-based learning activities. Themes emerged during focus group interviews regarding awareness of the PPCP, engagement in learning, and a desire for realistic experiences. Significant changes were observed for the pre- and post-assessment within the plan and follow-up parameters, as well as for the total score within each disease state.

Conclusion. The use of technology-enhanced, case-based modules framed around a standardized patient care process resulted in positive student perceptions and improved scores on a patient case assessment. The PPCP may be a useful framework for case development to aid students in application of drug therapy knowledge.

Keywords: pharmacists’ patient care process, case-based learning, video-enhanced cases, student perceptions

INTRODUCTION

The Doctor of Pharmacy (PharmD) curriculum is intended to produce graduates who possess the clinical, problem-solving, and communication skills needed to provide effective patient care as part of a healthcare team. While lectures are often used to communicate basic knowledge, they have a limited capacity to support students’ ability to apply knowledge in clinical practice, which is one of the overarching goals of the PharmD program. Exposure to real-world problem-solving is essential for students to learn to apply foundational concepts. There is increasing interest among pharmacy educators in using teaching methods that better prepare students for clinical environments such as advanced pharmacy practice experiences (APPEs) as well as future practice.

To narrow the gap between knowledge acquisition in classrooms and real-world problem-solving in professional contexts, researchers have recommended the use of case-based learning as an effective way to help students become competent problem solvers. In general, case-based learning is a pedagogical practice of using real or realistic events as learning resources to allow students to apply content knowledge in authentic contexts and engage in problem solving. Previous literature has shown that such an approach can develop students’ problem-solving skills. By exploring real cases experienced by practitioners, students may learn how to reason and develop appropriate solutions in similar situations. Apart from the effectiveness of the approach having been verified in various disciplines, the flexibility of case-based learning, which can be adapted for use in various instructional formats, also contributes to its popularity. As a result of these strengths, case-based learning is highly recommended for promoting pharmacy students’ competencies.

The Accreditation Council for Pharmacy Education (ACPE) Standards for the Doctor of Pharmacy degree state that “the curriculum should prepare students to provide patient-centered care as described in the
Pharmacists’ Patient Care Process (PPCP) model endorsed by the Joint Commission of Pharmacy Practitioners (JCPP). In 2013-2014 the PPCP was developed and adopted by the JCPP. The PPCP was developed to promote consistent expectations regarding patient care and to permit objective measurement of clinical outcomes that are comparable from one pharmacist to another. Since its inception, national pharmacy associations have been working to implement the process across the profession, and the Accreditation Council for Pharmacy Education (ACPE) incorporated it into the 2016 Standards for the Doctor of Pharmacy degree.

The PPCP represents a model for solving patient problems, and involves the following five steps: collecting patient information, assessing the information collected, developing a treatment plan, implementing the plan, and monitoring/evaluating the patient. In educational environments, problem-solving models support the development of clinical reasoning skills as well as process skills, such as working as a team to define problems, explain solutions, and evaluate solution outcomes.

To date, little research has been reported on the implementation of the PPCP in pharmacy education. In a literature search conducted using the EBSCOhost Multi-Database Search for the term “pharmacists’ patient care process,” we identified 12 articles, of which only one reported on the use of the PPCP as an instructional tool. The study investigated the introduction of the PPCP early in a pharmacy school curriculum and found that students applying the process to patient cases performed at an overall similar level of competence to students in a historic comparison group, but were more successful in their ability to identify patients’ drug-related problems. With ACPE 2016 standards now in effect, it is important to continue to critically investigate how the PPCP can be effectively integrated into the design of learning experiences in doctor of pharmacy degree programs.

Considering the strong rationale for case-based learning as an instructional approach and the introduction of PPCP into the ACPE accreditation standards, we designed and developed a series of technology-enhanced case-based learning (CBL) activities framed by the PPCP, which are hereafter referred to as PPCP-CBL activities. The purpose of this study was to understand and report on the effect of the PPCP-CBL activities on students’ performance. A single group design with repeated measures was used to measure learning gains from the intervention. In addition, a learner perceptions survey and a focus-group interview were administered to understand students’ learning experience with the intervention. The study was approved by the Institutional Review Board at the University of Georgia.

In order to help students learn how to apply drug therapy knowledge to make clinical decisions and recommendations regarding a patient case, the investigators adapted one of the most recent case-based learning models that has been empirically validated for medical education, veterinary education, and teacher education. Upon review of other theoretical approaches to problem solving, this approach was selected because it had been previously validated in medical literature and matched well with our research questions. A partnership between the University of Georgia College of Pharmacy and a researcher in the College of Education who developed the approach allowed for face-to-face collaboration, which enhanced project planning, implementation, and analysis. We developed a complex patient case, which was segmented into three parts to engage students in the process of clinical decision-making at three points during the semester. Five design features guided the development of the case. The first four features were derived from the previously cited approach. These features were: organize learning around critical decision points in the case; provide rich context (eg, video case portrayal) and realistic resources; provide support by guiding students with question prompts at decision points to focus their reasoning efforts; and, after students make each case decision, provide modeling of an expert pharmacist’s decision-making process, thereby allowing students to consider their own decisions in the case compared with the expert’s approach. The fifth and final feature incorporated into the design was to align student inquiry and exploration of the case with the PPCP. This feature was the authors’ adaptation to the selected instructional design model in order to align with the pharmacy education context and incorporate the PPCP as a problem-solving model into the learning experience.
During the development process, a representative case derived from an actual clinical practice situation was chosen first. Then the course coordinator identified each of the critical decision points encountered by the pharmacist in the case. These junctures were the moments where the pharmacist could have interpreted or acted upon the situation in several different ways. They served as hinges in the case where students focused their reasoning efforts. Second, in order to provide students with a rich context that aligned with real-world practice, the events in the case were portrayed through video segments embedded in interactive e-learning modules. Students were also provided with realistic resources such as patient laboratory sessions, progress notes, and medication lists. Each video segment ended at the precise moment when the pharmacist in the story needed to make a critical decision regarding patient care. Third, at each of the critical decision points, students were guided by question prompts to take on the role of the pharmacist and think critically about how they would approach the decision. Fourth, a video interview was conducted, by applying a critical incident method, to elicit the clinical reasoning process of an expert pharmacist for each of the decision points in the case. The expert’s interview video was embedded in each e-learning module and was accessible to students immediately after they had responded to the question prompts about how they would have approached each decision. After observing each expert interview video, students were asked to revise their initial answers to the questions, thereby providing them with an opportunity to consider their original approach to the problem compared with the expert’s approach.

Finally, the PPCP was used to frame and support student learning in several ways. Students were able to review an explanation of the PPCP as described by the Joint Commission of Pharmacy Practitioners at the beginning of each case segment. Additionally, the question prompts used to guide student inquiry at each decision point were specifically aligned with the phases of the PPCP, and the visual representation of the process was synced with the pharmacist’s comments during the interview videos, providing students with an opportunity to consider the process model alongside the thinking of an expert.

For implementation, the case was divided into three module activities, each of which was used by students for one week for a total of three weeks. For each module, students interacted individually with the resources described above before attending a class session designed to provide an opportunity for collaborative learning. During each class session, student teams discussed the clinical problem and the questions from the module prior to working together to develop a subjective objective assessment plan (SOAP) note to represent the team’s collective approach to the problem. Student teams were pre-assigned at random and consisted of 24 teams of approximately six students each.

Separate from the PPCP-CBL activities, a pre-assessment and post-assessment were developed to measure the effectiveness of the interventions on student performance. Each of these assessments consisted of a written patient case, and required students to make decisions about patient care by responding to a set of questions that were aligned with the patient care process and identical to the questions used in the PPCP-CBL activities. The situations in each of the assessment cases were the same with regard to the amount and complexity of disease states, but included different patient parameters (e.g., demographics, laboratory values, medications). The differences between the assessments were intentionally included to minimize the practice effect, which can occur when students recall test items previously presented to them. Thus, the pre-assessment case, PPCP-CBL activities, and post-assessment case included slightly different patients but were structurally aligned to measure the impact of the PPCP-CBL activities on students’ ability to apply drug therapy knowledge to make clinical decisions and recommendations. Students completed each assessment
individually, and were given up to one hour to do so using the university’s online learning management system.

Excerpts from the scoring rubric are featured in Figure 5 and Figure 6. The scoring rubric for the assessments included the following rating scale for each PPCP parameter: 3 points if each factor on the rubric was identified, 2 points if more than half of the factors were identified, 1 point if less than half of the factors were identified, and 0 points if no factors were identified. Each parameter was evaluated separately so that students could receive a combination of scores (e.g., 1 out of 3 for “Diabetes-Collect” and a 2 out of 3 for “Diabetes-Assess.”) Mean scores were calculated for each parameter within each disease state, as well as the mean total score for each disease state. A paired samples t-test was conducted to determine if there was a significant difference between the scores of the pre- and post-assessment case groups. Significance was set as $p<.05$.

Eligible participants included 142 second-year pharmacy students enrolled in the Disease State Management course offered in spring 2016. During the first week of the class, all students completed the online pre-assessment. In the following nine weeks, all students participated in the three PPCP-CBL activities as part of the course requirements. In the 11th week of the class, students completed the online post-assessment. Seventy-three students consented on the first day of class, allowing us to use their data from the aforementioned activities. Study participants were also asked to complete a perceptions survey following the completion of the post-assessment to gather feedback about their learning experience with the intervention. The survey asked students to rate their level of agreement on 12 items, using a five-point Likert scale ranging from strongly agree to strongly disagree. Thirty-seven students responded to the survey. Additionally,
among the 73 students who consented for their data to be used, 10 responded to an open request for volunteers to participate in a focus group interview to further elicit student perceptions regarding their experience with the PPCP-CBL activities. A semi-structured interview guide consisting of 16 questions was used to guide the focus group meeting.

A paired samples $t$ test was used to analyze quantitative data to determine the impact of case-based activities on students’ performance. Descriptive statistics were used to analyze the survey. The focus group interview lasted approximately one hour and was captured with a digital audio recorder. After the interview, the recording was transcribed verbatim. Two researchers then independently coded the transcript inductively in a two-stage cycle using the qualitative data analysis software Atlas.ti (Berlin, Germany). First, initial coding was conducted to create a starting point and provide analytic leads for further exploration. Then, in the second cycle, themes were constructed by grouping initial codes into categories of repeating ideas. After independently analyzing the data, the two researchers met to compare their themes and resolve differences through discussion. Representative quotes demonstrating the link between the themes and the data are included in Table 1.
RESULTS

Three overarching themes and one instructional design recommendation emerged from the focus group analysis. Excerpts for the recommendation and themes are included in Table 1. First, focus group participants unanimously agreed that the PPCP-CBL activities helped them learn to apply drug therapy knowledge to make clinical decisions. The cases provided a context for the application of the information encountered through the course lectures, affording students an opportunity to connect their knowledge of drugs and diseases with patient care. Second, students indicated deep engagement in the learning experience, linked closely to their perceptions of the cases as realistic, relevant, and interactive. They felt the cases helped them think like professionals and prepared them for the complexity of the real world. For instance, one student said, “I think that it’s definitely a good way to kind of like put your toes in the water and get ready for what you might see, what you might experience in the real world.” Several students agreed that seeing the patient and pharmacist interact and answering questions at critical decision points helped them to identify with the role of the pharmacist and to feel responsible for the patient. In general, students suggested that watching the video interactions was better than simply reading information on paper, and helped them gain insight into approaches for communicating with patients. Third, students recognized the value of using the PPCP as a systematic guideline for approaching the case activities. They perceived the PPCP as supplying a framework for providing patient

---

**Pre and Post Assessment Scoring Rubric for the “Collect” Parameter**

| Collect | Diabetes |
|---------|----------|
| □ Current diabetes medications |
| □ Lifestyle history (ex. smoker, exercise) |
| □ Meal recall |
| □ A1c |
| □ SMBG |
| □ Weight/BMI |
| □ Medication adherence |

| Collect | Blood Pressure |
|---------|---------------|
| □ Meal recall |
| □ Lifestyle history (ex. smoker, exercise) |
| □ BP readings |
| □ Baseline labs (Ex. SCr/K) |
| □ Weight/BMI |
| □ Previous therapies/intolerances |

| Collect | Dyslipidemia |
|---------|-------------|
| □ Lifestyle history (ex. smoker, exercise) |
| □ Meal recall |
| □ Lipid panel |
| □ Weight/BMI |
| □ Other components of ASCVD risk (ex. age, race, gender, etc.) |
| □ Previous therapies/intolerances |

Figure 5. An excerpt from the “Collect” parameter of the PPCP-CBL pre- and post-assessment rubric detailing the checklist criteria for student performance.
care, which they could transfer into their routine practice. Specifically, they reported increased preparedness in applying drug therapy knowledge to solve clinical problems, and understood the relevance to their future practice as pharmacists. However, they also described patient care as a fluid activity that does not require them to repeatedly think about the PPCP moment to moment, even though the PPCP may serve as a general guide to their overall approach.

In addition to the three overarching themes, several students recommended providing additional interactive case-based learning approaches throughout the semester, and specifically opportunities to directly collect subjective patient information instead of only watching the information collection occur during the video scenarios. Suggestions focused on transforming the early stages of the case so that students would be able to ask questions and receive answers from patient-actors in the classroom.

Additionally, 12 survey questions were used to examine students’ learning experience from participating in the case-based activities. Results of the survey are summarized in Table 2. Students demonstrated positive attitudes overall towards the case-based learning activities, with the highest means noted for presence of expert interviews and ability to apply information based on the cases. The realistic and interactive nature of the video cases, case organization and facilitation, and the integration of the PPCP model all contributed to students’ positive learning experience. The lowest mean result on the survey instrument related to student desire to have more CBL activities within the curriculum. This may have been because students perceived that active learning resulted in an increased workload.

In addition to the focus group and survey analysis, an analysis of student performance on the pre- and post-assessment was conducted. Significant changes between pre- and post-assessment scores were observed for the following parameters: diabetes plan, follow-up, and total; blood pressure plan, follow-up, and total; and lipids plan, follow-up, and total. These results are summarized in Table 3.

**DISCUSSION**

The doctor of pharmacy curriculum should integrate didactic, skills-based, and experiential training in order to
produce a graduate capable of practicing within a variety of patient care environments. Faculty members at our institution as well as clinical preceptors for our fourth-year students both recognized student difficulty in applying foundational knowledge from the first and second years to more application-based courses in the third year, as well as to APPEs in their final year. We hypothesized that by exposing students in a second-year disease state management course to a series of video-based case scenarios framed by the PPCP, their performance on a case-based assessment would improve from the beginning to the end of the semester.

Several observations can be made from our data analysis. First, the use of a structured rubric was vital to the consistency of assessment grading. The rubric was validated during grading of the first 10% of cases to ensure accuracy. Although we believe that the rubric was accurate, there were some potential limitations that may have affected the results. We did not see a significant difference pre- or post-assessment on the “Collect” and “Assess” parameters for any of the disease states. This could have been caused by students misinterpreting the “Collect” question, the number of parameters on the “Collect” portion of the rubric, or the potential for this question to be repetitive. For example, many students did not list general statements about what information they would need to collect if this information was provided already in the given case scenario. Likewise, there were several parameters within the “Assess” rubric that a second-year student might not know to mention such as that a patient was not currently being treated for a certain condition (eg, the student might make a recommendation about management but not state first that the patient had a condition that had not been treated previously).

Significant differences pre- and post-assessment were observed for the plan and follow-up portion of the assessment, as well as the total score within each of the three disease states. Although these changes were only observed in one cohort of students over the course of one semester, they may indicate that the students had developed improved ability to apply drug therapy knowledge in order to make clinical assessments, decisions, and recommendations when given a patient case. Improvement in these skills at an earlier point in the curriculum will hopefully lead to second-year pharmacy students that are more confident and competent at critical thinking and clinical decision-making and who will be better prepared for more application-based course work and APPEs.

Several themes surfaced based on survey responses and focus group interviews. Students appreciated the use of a structured rubric to ensure consistent grading. They noted that the use of case scenarios made the learning experience more authentic. Students also appreciated the increased awareness of the Pharmacists’ Patient Care Process and the importance of collecting subjective patient information in a realistic manner. Overall, students felt that the use of video-based case scenarios was effective in preparing them for clinical practice.
of a standardized patient care process to assist them in approaching complex cases. The use of a model that included expert interviews helped students to solidify key learning points from each case. The focus group relied on volunteers; thus, a potential limitation is that the participants were not randomly sampled from within the target population.

Regarding limitations in our study design, for course purposes, grading of the pre- and post-assessments was based on completeness and timeliness. This may have resulted in varying degrees of effort by the students, who may not have performed to their full ability because the case assessments were not graded based on content. The study timeframe was from January 2016 to April 2016.

Table 2. Survey Results of Students’ Perceptions of Learning

| Item                                                                 | Mean (SD)a   |
|----------------------------------------------------------------------|--------------|
| The case activities helped me better apply drug therapy knowledge to make clinical decisions. | 4.38 (0.54)  |
| The case activities increased my understanding of the subject matter. | 4.27 (0.65)  |
| The use of video had an overall positive effect on my learning.      | 4.19 (0.81)  |
| Video-based cases provide more realistic and meaningful contexts than many paper-based cases. | 4.32 (0.85)  |
| The way the instructor(s) facilitate the case-based activities is conducive to my learning. | 4.22 (0.48)  |
| The case-based learning activities are well-organized.               | 4.16 (0.73)  |
| I would like to have more case-based learning activities of this kind in the curriculum. | 3.97 (0.76)  |
| Interactive patient cases motivated learning better than lectures.  | 4.32 (0.58)  |
| Interactive patient cases motivated learning better than written resources. | 4.08 (0.83)  |
| Hearing video interviews with an expert positively affected my learning experience. | 4.49 (0.69)  |
| The integration of the patient care process model helps me make decisions. | 4.08 (0.72)  |
| The integration of the Patient Care Process model into the case activities had an overall positive effect on my learning | 4.05 (0.74)  |

a Likert scale of 1 to 5 on which 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

Table 3. Analysis of Student Performance Before and After Engaging in the Pharmacists’ Patient Care Process Using Case-based Learning Activities

|                        | Pre-assessment Mean (SD) | Post-assessment Mean (SD) | t (n=74) | p valuea |
|------------------------|--------------------------|---------------------------|----------|----------|
|                        |                          |                           |          |          |
| Diabetes               |                          |                           |          |          |
| Collect                | 1.30 (.60)               | 1.21 (.59)                | 1.14     | .26      |
| Assess                 | 1.18 (.58)               | 1.33 (.71)                | -1.46    | .15      |
| Plan                   | 1.10 (.85)               | 1.60 (.97)                | -3.69    | <.001*   |
| Follow up              | 1.19 (.53)               | 1.37 (.60)                | -2.05    | .045*    |
| Total                  | 4.78 (2.01)              | 5.51 (2.08)               | -2.70    | .009*    |
| Blood Pressure         |                          |                           |          |          |
| Collect                | 1.00 (.65)               | .87 (.60)                 | 1.42     | .16      |
| Assess                 | 1.07 (.61)               | 1.27 (.79)                | -1.89    | .06      |
| Plan                   | 1.40 (.85)               | 2.10 (.84)                | -5.83    | <.001*   |
| Follow up              | 1.09 (.54)               | 1.43 (.70)                | -5.22    | <.001*   |
| Total                  | 4.57 (1.72)              | 5.67 (2.01)               | -5.77    | <.001*   |
| Lipids                 |                          |                           |          |          |
| Collect                | .90 (.67)                | .87 (.74)                 | .36      | .72      |
| Assess                 | 1.04 (.48)               | 1.18 (.49)                | -1.76    | .08      |
| Plan                   | 1.73 (.98)               | 2.07 (.89)                | -2.67    | .010*    |
| Follow up              | 1.24 (.76)               | 1.45 (.70)                | -2.07    | .042*    |
| Total                  | 4.91 (2.02)              | 5.57 (1.95)               | -2.51    | .015*    |

a Statistical significance (p value is significant if equal or less than .05)

* Paired samples t-test used to compare means

SD=Standard deviation
2016, and while the case assessment contained disease states that were discussed within the case-based modules, students received this material in the didactic environment during the previous semester. Lastly, the two faculty members who participated in grading the assessments for research purposes also developed the rubric. Measures taken to reduce bias included deidentification of student artifacts, completion of informed consent and data analysis by other members of the research team, and validation of grading consistency by members of the research team who did not participate in the grading process.

The results of our study may demonstrate potential benefits of case-based learning, use of technology within instructional design, and incorporating a standardized patient care process within classroom activities. At the University of Georgia College of Pharmacy, the Pharmacists’ Patient Care Process is an integral part of our new curriculum. Pharmacotherapy, previously a third-year course with a flipped classroom model, is now a four-semester course beginning in the second year that includes both didactic and case-based components. Students work in teams to evaluate patient cases during class. In addition, students are introduced to technology-enhanced case-based activities in the first year of the curriculum, with the goal of providing realistic scenarios for problem solving. Future analysis should include a comparison of student performance, comparing the students who were exposed to the enhanced activities in disease state management to previous students, to see if it translates to improved clinical performance and application ability in third-year courses and APPEs.

CONCLUSION

The use of technology-enhanced case-based modules framed around a standardized patient care process resulted in positive student perceptions and improved scores on a pre- and post-assessment of the patient case. The Pharmacists’ Patient Care Process has been integrated into the new curriculum at the University of Georgia College of Pharmacy, and future directions include assessment of similar activities in new courses, as well as evaluation of student performance on APPEs to address additional classroom curricular needs.

REFERENCES

1. Doyle T. Learner-Centered Teaching. Sterling, VA: Stylus Publishing, LLC; 2011.
2. Catizone C, Maine L, Menighan T. Continuing our collaboration to create practice-ready, team-oriented patient care pharmacists. Am J Pharm Educ. 2013;77(3):Article 43.
3. Entry-level Competencies Needed for Pharmacy Practice in Hospitals and Health-Systems. aacp.org. http://www.aacp.org/resources/education/cape/Documents/Other Pharmacy Association Related Documents/Entry-level competencies for hospitals and health-system 2010.pdf. Published January 2011. Accessed February 3, 2016.
4. Vlasses PH, Patel N, Rouse MJ, Ray MD, Smith GH, Beardsley RS. Employer expectations of new pharmacy graduates: Implications for the pharmacy degree accreditation standards. Am J Pharm Educ. 2013;77(3):Article 47.
5. Zellner WA, Vlasses PH, Beardsley RS. Summary of the ACPE consensus conference on advancing quality in pharmacy education. Am J Pharm Educ. 2013;77(3):Article 44.
6. Jonassen DH. Learning to Solve Problems: A Handbook for Designing Problem-solving Learning environments. New York, NY: Routledge; 2011.
7. Choi I, Hong YC, Park H, Lee Y. Case-based learning for anesthesiology: Enhancing dynamic decision-making skills through cognitive apprenticeship and cognitive flexibility. In: Luckin R, Goodyear P, Grabowski B, Puntambeker S, Underwood J, Winters N, eds. Handbook on Design in Educational Technology. New York, NY: Routledge; 2013:230-240.
8. Choi I, Lee K. Designing and implementing a case-based learning environment for enhancing ill-structured problem solving: Classroom management problems for prospective teachers. Educ Tech Res Dev. 2009;57(1):99-129.
9. Grauer GF, Forrester SD, Shuman C, Sanderson MW. Comparison of student performance after lecture-based and case-based/problem-based teaching in a large group. J Vet Med Educ. 2008;35(2):310-317.
10. Ramaekers SPJ, Beukelen PV, Kremer WDJ, Keulen HV, Pilot A. An instructional model for training competence in solving clinical problems. J Vet Med Educ. 2011;38(4):360-372.
11. Kolodner JL. Educational implications of analogy - a view from case-based reasoning. Am Psychol. 1997;52(1):57-66.
12. ACPE Standards 2016. acpe-accredit.org. https://www.acpe-accredit.org/deans/standardsrevision.asp. Published February 2, 2015. Accessed February 12, 2016.
13. Bennett MS, Kliethermes MA, Derr S, Irwin A. APHA academies reflect on the pharmacists’ patient care process of the joint commission of pharmacy practitioners. J Am Pharm Assoc. 2015;55(3):230-236.
14. Antonenko PD, Jahanzad F, Greenwood C. Fostering collaborative problem solving and 21st century skills using the DEEPER scaffolding framework. J Coll Sci Teach. 2014;43(6):79-88.
15. Kautz DD, Kuiper R, Pesut DJ, Knight-Brown P, Daneker D. Promoting clinical reasoning in undergraduate nursing students: Application and evaluation of the outcome present state test (OPT) model of clinical reasoning. Int J Nurs Educ Scholarsh. 2005;2(1):1-19.
16. Hoffman K, Dempsey J, Levett-Jones T, et al. The design and implementation of an interactive computerised decision support framework (ICDSF) as a strategy to improve nursing students’ clinical reasoning skills. Nurse Educ Today. 2011;31(6):587-594.
17. Rivkin A. Thinking clinically from the beginning: early introduction of the pharmacists’ patient care process. Am J Pharm Educ. 2016;80(10):Article 164.
18. Choi I, Lee SJ, Kang J. Implementing a case-based e-learning environment in a lecture-oriented anesthesiology class: Do learning styles matter in complex problem solving over time? Brit J Educ Techn. 2009;40(5):933-947.
19. Creevy KE, Cornell KK, Schmiedt C, et al. Impact of expert commentary and student reflection on veterinary clinical decision-making skills in an innovative electronic-learning case-based platform. Journal of Veterinary Medical Education. 2018;45(3):307-319.
20. Crandall B, Klein G, Hoffman R. *Working minds: A practitioner’s guide to cognitive task analysis*. Cambridge, MA: MIT Press; 2006.

21. Klein G, Calderwood R, MacGregor D. Critical decision method for eliciting knowledge. *IEEE Trans. Syst. Man Cybernet.* 1989;19(3):462-472.

22. The Pharmacists’ Patient Care Process. Joint Commission of Pharmacy Practitioners website https://jcpp.net/patient-care-process/. Accessed July 18, 2017.

23. Payne DG, Wenger MJ. Practice effects in memory: Data, theory, and unanswered questions. In Herrmann DJ, McEvoy C, Hertel H, Johnson M, eds. *Basic and applied memory research: Practical applications* (Vol. 2). Mahwah, NJ: Lawrence Erlbaum Associates; 1996:123-139.

24. Lemay S, Bédard M, Rouleau I, Tremblay P. Practice effect and test-retest reliability of attentional and executive tests in middle-aged to elderly subjects. *The Clinical Neuropsychologist*. 2004;18(2):284-302.

25. Glaser, BG. *Theoretical sensitivity*. Mill Valley, CA: Sociology Press; 1978.

26. Auerbach CF, Silverstein LB. *Qualitative Data: An Introduction to Coding and Analysis*. New York, NY: New York University Press; 2003.