Received: 3 August 2022 | Accepted: 12 September 2022

DOI: 10.1002/prp2.1014

INVITED REVIEW

American Society for Pharmacology and Experimental Therapeutics Division for Pharmacology Education at EB2022—Meeting report

Joe B. Blumer[1] | Marieke Kruidering[2] | Katharina Brandl[3] | Brooks McPhail[4] | Mark A. Simmons[5]

[1]Department of Cell and Molecular Pharmacology and Experimental Therapeutics, Medical University of South Carolina, Charleston, South Carolina, USA

[2]Department of Pharmacology, College of Medicine, University of California, San Francisco, California, USA

[3]Skaggs School of Pharmacy and Pharmaceutical Sciences, University of California San Diego, La Jolla, California, USA

[4]Department of Biomedical Sciences, University of South Carolina School of Medicine Greenville Campus, Greenville, South Carolina, USA

[5]Department of Pharmaceutical Sciences, University of Maryland Eastern Shore, Princess Anne, Maryland, USA

Correspondence
Joe B. Blumer, Department of Cell and Molecular Pharmacology and Experimental Therapeutics, Medical University of South Carolina, Charleston, SC, USA.
Email: blumerjb@musc.edu

Abstract

The American Society for Pharmacology and Experimental Therapeutics (ASPET) held its annual meeting at the Experimental Biology 2022 conference in Philadelphia, PA on April 2–5, 2022. The authors provide a synopsis and discussion of each of the four sessions presented at the meeting under the ASPET Division for Pharmacology Education (DPE).

KEYWORDS
gamification, knowledge objectives, multiple choice questions, pharmacology education, patient-oriented problem-solving

1 | INTRODUCTION

The American Society for Pharmacology and Experimental Therapeutics (ASPET) Division for Pharmacology Education (DPE) serves to promote the development of pedagogical skills in pharmacology educators and educational research in pharmacology. The primary focus is on pharmacology teaching and learning by graduate and health sciences students. To this end, the four activities described here, which were presented as part of the Experimental Biology 2022 (EB 2022) conference held in Philadelphia, PA from April 2 to 5, 2022, were highly relevant and applicable for all DPE members. To allow wider access to those who could not attend the ASPET DPE sessions described here, we provide summaries of the four activities below with links to useful resources.

Abbreviations: ACLS, advanced cardiac life support; AMSPC, Association of Medical School Pharmacology Chairs; A-POPS, automated patient-oriented problem-solving system; ASPET, American Society for Pharmacology and Experimental Therapeutics; DPE, Division for Pharmacology Education; MCQ, multiple choice question.

Section 2: Submitted by Mark A. Simmons.

Section 3: Submitted by Joe B. Blumer and Brooks McPhail.

Section 4: Submitted by Marieke Kruidering.

Section 5: Submitted by Katharina Brandl.

2 | AUTOMATING THE PATIENT-ORIENTED PROBLEM-SOLVING SYSTEM IN PHARMACOLOGY

Cat Fry (ASPET) and Mark Simmons chaired a workshop on using the automated patient-oriented problem-solving system (A-POPS) in pharmacology. The POPS are simulations of clinical problems used to teach pharmacology to large or small classes of students.[1,2] Each exercise is designed for a group of four students (with each of the students playing a different role). Every exercise contains a pretest and a posttest, designed to be completed by the students individually. The four student parts contain answers to a subset of the pretest questions and information about one episode in the clinical problem. Students must exchange information and work together to address the clinical problem by applying appropriate pharmacological knowledge and concepts.

There are currently 12 POPS exercises in PDF format available on the ASPET website. Over the past 2 years, Dr. Simmons has worked with Dr. Jeff Graham at the University of Toronto and Allan Sura of DeckChair Learning to automate the exercises (A-POPS). Three of the exercises, Drug Treatment of Heart Failure by Rob Rockhold (University of Mississippi), Pharmacokinetics Applied to the Treatment of Asthma by David C. McMillan (University of Nebraska), and Therapy of Diabetes Mellitus by Jayne S. Reuben (Texas A&M), were made available during the workshop for participants to work through while playing the various student roles to test the new format and provide feedback.

The A-POPS makes using the exercises much easier for instructors to implement in addition to providing several powerful analytical tools for immediate feedback on student and group performance. The automated system has numerous advantages over using the PDFs, including: the entire POPs process is automated and streamlined; students can meet virtually or in person; all groups can run simultaneously or asynchronously; there is no need to schedule breakout rooms; there are no handouts to produce, collate, or distribute. With the DeckChair system, the instructor assigns each student one of four License Keys for their role as either Student 1, Student 2, Student 3, or Student 4. The students register at DeckChair according to their assignments are presented by the software.

Feedback and student performance metrics are extensive and obtained instantaneously. Question responses and times spent on each phase of the exercise are recorded for each group. Student performance on Pretest and Posttest are scored for both accuracy and fluency (time spent to complete). Instructors can opt to allow students access to the exercise ad libitum and to type in notes during the exercise to be available for later study.

At the EB workshop, POPS authors Rob Rockhold, David McMillan, and Jayne Reuben facilitated the exercises and helped collect feedback. Jeff Graham provided a demonstration of the powerful analytics available in the DeckChair Learning system.

The POPS are written by pharmacologists and have been peer reviewed by both a basic scientist and a clinician. They provide a structured format for student-directed (peer-to peer teaching) learning of specific topics in pharmacology. They are an easily implemented activity for use in PBL, TBL, and IPE. If you would like a demonstration of the A-POPS please contact Mark Simmons (masimmons1@umes.edu) or Allan Sura (alsura@deckchairlearning.com).

3 | ENVISIONING THE FUTURE OF PHARMACOLOGY EDUCATION FOR THE NEXT DECADE

Pharmacology education is continuously evolving due to the introduction of new drugs on the market each year as well as changes in teaching methods that incorporate more active learning exercises. Deciding which drugs to teach is further complicated by a national trend to reduce the amount of time dedicated to the delivery of pharmacology and other basic science content in medical education.[3] For example, in 2022, 46 new drugs were introduced to the market; however, only 24% of medical schools contain a stand-alone pharmacology course. This is a decrease from 2012 when 41% of medical schools contained stand-alone pharmacology courses and only 22 new drugs were introduced to the market.[4,5] Due to these changes, it is difficult for content experts to maintain an up-to-date drug list without a standard reference source. In addition, medical educators should also consider the impact of expanding their drug lists on the cognitive load of the learner.

Pharmacologists often rely on various resources to determine which drugs are presented to learners. The Knowledge Objectives in Medical Pharmacology is a document that is sponsored by the Association of Medical School Pharmacology Chairs (AMSPC),[6] which provides teaching material such as learning objectives and drug lists for medical educators. Unfortunately, this document has not been updated since 2012. Creating an up-to-date central resource that identifies and incorporates relevant teaching topics, materials, and practices would greatly assist pharmacology content experts in creating and delivering their teaching material.

During the ASPET 2022 conference, Joe B. Blumer and Kelly Quesnelle (University of South Carolina-Greenville School of Medicine) chaired a session entitled Envisioning the Future of Pharmacology Education, which included discussions led by a panel of pharmacology educators (Brooks McPhail, Ph.D.; Michael Lee, Ph.D., University of Texas-Austin Dell Medical School; John Szarek, Ph.D., Geisinger Commonwealth School of Medicine). The goals of the session included: (1) analyzing the conflict between increased drug approvals and reduced curricular time; (2) reframing pharmacology education goals while considering the theoretical lens of cognitive overload; (3) appraising the resources available to pharmacology educators; (4) curating best practices for teaching hypertension and diabetes treatments, which included drug lists, learning objectives, and teaching pedagogies; and (5) networking with colleagues to create best practices and set a precedent for future DPE webinars, collaborations, and publications. Participants in the session were divided into groups and given an expansive draft drug list and learning objectives for teaching medications used to treat either

hypertension or diabetes. The goal of the exercise was to refine the drug lists and learning objectives through elimination, prioritization, and consideration of the cognitive load placed on learners. In addition, participants were asked to reflect on the appropriate balance of deep scientific understanding of the material, clinical relevance, and exam preparation. This exercise was followed by a panelist-led, large-group discussion of how each group determined which drugs to include as essential, what informed each group's selection of learning objectives for each topic, preferred instructional method(s), and the benefits to including the information shared in the session in future ASPET sessions and/or publications.

4 | ARE YOU MEASURING WHAT YOU THINK YOU ARE? WRITING BOARD-STYLE MULTIPLE CHOICE QUESTIONS

Rupa Tuan (University of California, San Francisco), Robert Augustyniak (Lincoln Memorial University), and Marieke Kruidering chaired a workshop on writing board-style multiple choice questions (MCQs) with the assistance of Adrienne Ables (Adrienne Ables Consulting, LLC) and Miguel Paniagua (NBME).

It is important for health science faculty to provide board-style questions in their own curriculum to prepare their learners for licensing exams. Yet, many faculty are not trained in writing these questions. This NMBE writing workshop addressed that gap. This workshop focused on best practices and pitfalls in creating higher order, clinically relevant vignettes for MCQs. The topics included multiple choice formats, technical item flaws, and patient characteristics.

What to test? The presenters encouraged the participants to be specific about what it is you want to test by taking the following into consideration: (1) High frequency—what are students likely to experience in real-life practice? (2) High impact—what do they need to understand in order to avoid serious harm to their patients? (3) Essential aspect—what should future physicians know? and (4) Higher order thinking—is there a way to assess this on MCQ examinations?

What goes in the clinical vignette? The patient vignette should include: (1) Patient description (age, sex); (2) Site of care; (3) Symptoms, signs, complaints; and (4) Duration. The following may also be included depending on the scenario: (5) Physical examination; (6) Pertinent findings (typically included); (7) Review of systems; (8) History—medical, social, family, immunizations; (9) Vital signs; (10) Results of diagnostic studies; (11) Risk factors; and (12) Community information.

Mitigating bias. The presenters emphasized the importance of using clear and universal language and to avoid buzz words, vague terms ("some," "often"), regional terms, "window dressing," and teaching in the stem. In addition, mitigating bias and eliminating unjustified patient stereotypes are important initiatives in teaching, learning, and assessment. Item writers are encouraged to be mindful of characteristics of a patient such as race/ethnicity, age, sex/gender identity, socioeconomic status, native language, occupation/military status, etc. and to consider revising items that may result in incorrect conclusions, misdiagnoses, or harmful patient stereotypes.

Item flaws to avoid include testing a negative concept using "except," testing multiple concepts at once, testing straight recall, or failing the "cover-the-options" test, that is, when the learner can determine the answer (or type of answer) without reading the answer options.

Finally, the answer options need to be parallel, that is, similar in length and style, unique in content, plausible and attractive, and match grammatically with the stem.

In summary, the rules for one-best answer items are to (1) use vignettes with relevant information; (2) ensure lead-ins are focused and close-ended; (3) ensure options are homogeneous; (4) follow the cover-the-options rule, and (5) ask a colleague to review your questions.

Participants at the ASPET workshop were provided hardcopies of the NBME Item–Writing Guide. QR codes for the free pdf version[7] of the NBME Item–Writing Guide and the NBOME Item-Writing guide were also provided. After the large group didactic session, the small groups started their work by identifying the "mistakes" in provided MCQs and applying the guide to rewrite the question. The room was buzzing with energy as six tables with faculty from pharmacology, physiology, and anatomy worked their way through several "suboptimal questions." The wrap-up revealed that each table did successfully improve the question and was able to provide a rewritten vignette that was more accurate and fair. Both presenters and audience agreed it was a fruitful Monday morning.

5 | TEACHING BLITZ

Research studies have repeatedly demonstrated the benefits of active learning approaches such as increased content knowledge, critical thinking and problem-solving abilities, and positive attitudes toward learning.[8] During the EB 2022 conference, Niru Nirthanan (Griffith University, Queensland, Australia) Michelle Duffourc (East Tennessee State University, Johnson City), and Katharina Brandl (University of California, San Diego) chaired a session entitled "Teaching Blitz," which showcased two exemplars of innovative and active learning strategies to enhance learner engagement and experience as well as learning outcomes.

The first session entitled "Escaping the Didactic—Using gamification to teach critical care pharmacology" was led by Nicholas B. Conway, a fourth-year medical student from Florida International University. Escape rooms are innovative learner-focused activities in which a group of students is challenged with simulators and puzzles to advance through an exercise and achieve a specific goal.[9] This is a perfect example of "gamification in medical education"; the use of game design elements that are naturally appealing to Millennials.[9,10] The escape room presented by Nicholas Conway is an online activity to teach pharmacology applicable to advanced cardiac life support (ACLS). This activity was designed for fourth-year medical students to achieve high levels of knowledge, satisfaction, and confidence in ACLS pharmacology. Out of 112 fourth-year medical students that participated in the "Escape Room," 111 completed the post-session confidence survey in which students were asked to agree on the statement "The ACLS module improved my knowledge of medical

decision making for patients in cardiac arrest" on a 7-point Likert scale (1—"Strongly Disagree" through 7—"Strongly Agree) The mean agreement with the statement was 6.6 (SD 0.8). On a 10-point Likert scale, students rated their pre- and post-session confidence in "Addressing a patient in cardiac arrest" at 7.7 (SD 2.1) and 8.4 (SD 1.6), respectively. The audience at EB 2022 also had the opportunity to experience the Escape room. Participants were able to work on six stations incorporating simulators, puzzles, and clues related to ACLS-relevant pharmacologic concepts and algorithms. The session ended with a Q&A part in which the audience discussed how such an exercise could be implemented in their curriculum.

The second session entitled "Decoding Medication Tradenames: Connecting the Dots from Pharmacology Principles to Practice" was presented by Yasmin Hussein Mohamed Elsobky (College of Pharmacy, Alexandria University, Egypt) and Islam Mohamed (California Northstate University College of Pharmacy, Elk Grove). This session aimed to decode tradenames and use them as an innovative tool to help students memorize these together with important drug characteristics. Learning tradenames is a challenging task and students usually are not exposed to them during their first 2 years of medical or pharmacy school.[11] However, once on rotation, students must know tradenames as clinicians will constantly refer to it.[12] The presenters demonstrated many different techniques for decoding hidden messages in medication tradenames. This can be used as an effective educational tool to convey key foundational knowledge such as drug mechanism, pharmacological or site of action, pharmacological class, how often to take the medication, and other drug characteristics. For example, Augmentin® (amoxicillin and clavulanic acid) describes the "augmented" effect clavulanic acid has on amoxicillin to combat antibiotic resistance and broaden antimicrobial coverage. The "Xa" in Xarelto® describes the drug as an inhibitor of Factor Xa. Cefobid® (cefperazone) denotes to take the drug "bid," twice daily. Multiple examples were discussed, and participants experienced the knowledge gain first-hand as they were assessed in a pre- and a post-quiz on many different tradenames.

AUTHOR CONTRIBUTIONS

JBB, MK, KB, BM, and MAS drafted the manuscript. All authors worked on the manuscript and approved the final manuscript.

ACKNOWLEDGMENTS

The authors thank ASPET and the ASPET Division for Pharmacology Education for sponsoring, hosting, and organizing the pharmacology education sessions described in this manuscript.

CONFLICT OF INTEREST

The authors have no conflicts of interest to declare.

ORCID

Joe B. Blumer https://orcid.org/0000-0002-0020-3815

REFERENCES

1. Simmons MA. Revised pharmacology patient-oriented problem-solving exercises now available. *Pharmacologist*. 2016;58:30-32. Accessed May 9, 2022. https://issuu.com/aspetpublications/docs/v58_n3_9_16_web/30
2. Simmons MA. Updates to the patient-oriented problem-solving (POPS) exercises in pharmacology. *Pharmacologist*. 2020;62:46. Accessed May 9, 2022. https://www.aspet.org/docs/default-source/news-files/the-pharmacologist/v62_n1_03_2020.pdf?sfvrsn=f8499cd2_0
3. Quesnelle KM, Zaveri NT, Schneid SD, et al. Design of a foundational sciences curriculum: applying the ICAP framework to pharmacology education in integrated medical curricula. *Pharmacol Res Perspect*. 2021;9:e00762. doi:10.1002/prp2.762
4. Mullard A. 2020 FDA drug approvals. *Nat Rev Drug Discov*. 2021;20:85-90.
5. Association of American Medical Colleges. Number of medical schools including topic as an independent course or part of an integrated course: pharmacology. *AAMC Curriculum Inventory*, 2010–2018.
6. Eisenberg R, Faingold C, eds. *Knowledge Objectives in Medical Pharmacology*. Association of Medical School Pharmacology Chairs>; 2012.
7. The NBME item writing guide. Accessed June 21, 2022. https://www.nbme.org/sites/default/files/2020-11/NBME_Item%20Writing%20Guide_2020.pdf
8. Bucklin BA, Asdigian NL, Hawkins JL, Klein U. Making it stick: use of active learning strategies in continuing medical education. *BMC Med Educ*. 2021;21(1):44.
9. Guckian J, Eveson L, May H. The great escape? The rise of the escape room in medical education. *Future Healthc J*. 2020;7(2):112-115.
10. van Gaalen AEJ, Brouwer J, Schönrock-Adema J, Bouwkamp-Timmer T, Jaarsma ADC, Georgiadis JR. Gamification of health professions education: a systematic review. *Adv Health Sci Educ Theory Pract*. 2021;26(2):683-711.
11. Karpa KD, Vrana KE. Creating a virtual pharmacology curriculum in a problem-based learning environment: one medical School's experience. *Acad Med*. 2013;88(2):198-205.
12. Summers A, Ruderman C, Leung F-H, Slater M. Examining patterns in medication documentation of trade and generic names in an academic family practice training Centre. *BMC Med Educ*. 2017;17(1):175.

How to cite this article: Blumer JB, Kruidering M, Brandl K, McPhail B, Simmons MA. American Society for Pharmacology and Experimental Therapeutics Division for Pharmacology Education at EB2022—Meeting report. *Pharmacol Res Perspect*. 2022;10:e01014. doi: 10.1002/prp2.1014