REVIEWS

An Active-Learning Strategies Primer for Achieving Ability-Based Educational Outcomes

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Active learning is an important component of pharmacy education. By engaging students in the learning process, they are better able to apply the knowledge they gain. This paper describes evidence supporting the use of active-learning strategies in pharmacy education and also offers strategies for implementing active learning in pharmacy curricula in the classroom and during pharmacy practice experiences.

Keywords: active learning, teaching methods, competency-based education, problem-based learning, curriculum, health knowledge, experiential learning

INTRODUCTION

Pharmacy practice has transitioned away from a product-centered emphasis, toward a patient-centered focus. The 2004 report of the Center for the Advancement of Pharmaceutical Education (CAPE) delineates 3 main practice functions for first-professional degree pharmacy graduates: pharmaceutical care, systems management, and public health. Each practice function integrates professional abilities with general abilities, such as critical thinking, communication, ethical decision-making, and self-learning.[1] In its most recent standards, the Accreditation Council for Pharmacy Education (ACPE) adopted the CAPE 2004 outcomes as the required professional competencies and outcomes that must be achieved by pharmacy graduates of accredited US colleges and schools of pharmacy. Furthermore, ACPE accreditation standards stipulate that active-learning strategies be used throughout curricula to foster student learning and achievement of ability outcomes.[2]

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The purpose of this paper is twofold: to enhance understanding of active learning and its role in pharmacy education, and to provide strategies for implementing active learning into pharmacy curricula. Evidence supports the use of active learning to stimulate higher-order thinking and improve student motivation to learn.[3] Faculty members, including adjunct faculty preceptors, should seek to integrate active learning into classroom-based courses and practice experiences throughout all professional pharmacy program curricula.

Learning without meaning is often soon forgotten because, without understanding, it is difficult to apply information to future reasoning. Simply put, learning is the product of teaching, but it does not always take place just because an instructor teaches. How teachers understand learning will influence the way they teach *and* how their students learn as well.[4] It is important for teachers to transition their concept of learning from simple knowledge acquisition, with learners memorizing by rote, toward more consequential knowledge construction with application of skills. Extending learning to include knowledge and skill applications can require a substantial change in how teachers both understand and approach the

teaching-learning process. This transition moves from an instructor-centered and often lecture-based teaching format toward a learner-centered teaching format that may include discussion and case-based applications. When teachers develop as educators, their perception of teaching and learning grow along this continuum.[5]

Meaningful learning should be distinguished from rote learning in that meaningful learning results in understanding while rote learning ends in memorization and often eventual forgetting. Ausubel identified 3 crucial conditions for meaningful learning.[6] Teachers must use instructional materials that are potentially meaningful and that students find relevant to pharmacy practice. When instructional materials are seen as relevant to problems that students encounter in their current service or pharmacists encounter in patient care, course concepts are no longer perceived as esoteric. Students need to be motivated to learn beyond rote methods. Affect (or emotion) often has been neglected as a dimension of motivation and learning.[7] Having positive emotions and attitudes of professionalism toward learning course content can play a substantial role as student pharmacists construct the knowledge and skills they will need in pharmacy practice. As students develop in their pharmacy education, teachers must be able to evaluate where students are in their acquisition of knowledge and skills and build on what they already know, while challenging them with more complex material.

Active learning is an approach to teaching rather than a single, specific method. It requires active student participation in classroom activities that have been carefully structured by teachers. This strategy can facilitate student engagement, enhance relevance, and improve motivation by actively involving students within their classroom and experiential learning environments. Active learning involves shifting some control of the learning environment from the teacher to the learner. While there are numerous methods of active learning, many of which are described in this paper, they all share one important aspect: the learner must be actively engaged in the classroom teaching-learning process. Faculty perceptions of students' "careful listening," "paying close attention," and "being alert" do not qualify as active learning.[8] In an active-learning approach, each learner must actively engage in the learning environment and apply constructed knowledge, skills, and attitudes. Active learning can foster students' motivation to learn beyond rote memorization, focus teaching and learning on the most important information, and help students process and understand this information, which will help them retain what they have learned.

Active learning engages students as partners in the teaching-learning process and helps them take more responsibility for their own learning. In a traditional lecture, passive learning predominates and typically involves one-way delivery of information and course content from teacher to learners. While it may seem efficient for transmitting large bodies of information, passive learning often requires less effort from a student and the resulting rote memorization becomes the default "learning" outcome. Described as bulimic learning,[9,10] this teaching approach often leads to students binging on information, which is retained in their short-term memories, and subsequent purging just after an examination or other evaluation. Traditional lectures and passive learning have been repeatedly criticized, notably in Bligh's book, *What's the Use of Lectures?*[11] On the other hand, well-designed active learning can cultivate more thorough learning wherein students relate new facts and concepts to knowledge and skills they already possess. Understanding and applying the content of a course can extend students' learning to new situations or contexts. The two-way communication with various forms of discussion involved in active learning are described in Bligh's alternative book, *What's the Point in Discussion?*[12] Active-learning strategies used by teachers can foster two-way communication and promote students' comprehension and meaningful application of knowledge.

The benefit of active learning to courses and curricula is that it involves student engagement in activities, stimulating higher-order thinking, problem solving, and critical analysis, and providing feedback about the learning process to both teacher and students.[14] It also places greater emphasis on student exploration of attitudes, values, and habits, and can increase student motivation to learn and improve their abilities.[13] Engaging students in their learning is essential. Not just any active-learning strategy will provide the intended outcomes of engagement. Five key changes in teaching practice toward a learner-centered instructional orientation have been recognized: shifting and sharing power between the teacher and student; transitioning the teacher's role from an expert who lectures to a coach who facilitates; creating a course environment that motivates students to accept more responsibility for their learning; aligning course content with learning-strategy development; and involving students in the purpose and process of evaluation, which can include peer evaluations with feedback.[15] As implied by the term *active* learning, focusing on learning can help teachers to concentrate less on specific teaching techniques and more on methods to promote learning among their students.

Student attention during a traditional 60-minute lecture increases during the first 10 minutes, declines steadily for the next 45 minutes, and then increases again during the last few minutes of the lecture.[16] Similarly,

student retention of information presented during the lecture declines substantially after 10 minutes and continues to diminish until the last few minutes of the lecture session.[17] Immediately following the lecture, students remember approximately 70% of information presented during the first 10 minutes of the lecture but only approximately 20% of that presented during the last 10 minutes.[18]

One means of improving student attention and retention during lectures is to integrate short active-learning strategies throughout the lecture. Ruhl evaluated this strategy by dividing a 45-minute lecture into thirds and inserting a 2-minute break after each 15-minute interval. During the 2-minute breaks, students worked in pairs to compare and clarify their lecture notes. Ruhl compared student retention with this approach to retention in a group of students who listened to a traditional lecture and found that both short-term and long-term retention of lecture material was better in the student group in which the active-learning approach was used.[19]

Reports in the pharmacy education literature also support use of active learning in the classroom. Darbishire and colleagues implemented active-learning activities that consisted of skill-based learning stations and simulated patient interactions to help student pharmacists learn diabetes care. They found that student knowledge and confidence improved, and students reported that this use of active-learning strategies contributed to their learning.[20] Marshall described how the active-learning approach in a women's health course facilitated student provision of pharmaceutical care learned in the classroom to the outpatient setting. Active-learning strategies used in the course consisted of cooperative learning groups, student presentations, and interactive lectures.[21] Thompson and colleagues reported that the active-learning approach, used in a drug information course fostered a questioning attitude among pharmacy students more so than did conventional classroom-based methods. In class and as one large group, students participated in a mini research project in which they worked together to develop a research question with related hypotheses, conducted a simple experiment, and analyzed data to form conclusions. From participating in this active-learning strategy, students quickly realized the difficulty in conducting and controlling experiments, while also gaining insights into validity threats.[22] Reddy implemented active learning in a pharmaceutics course, including case-based learning and "quick thinks" (active cognitive tasks focused on processing, application, and analysis of course content), inserted into lectures every 15 minutes. Compared with students who completed a traditional lecture-based pharmaceutics course, students who completed the active learning-based

course scored significantly higher on the midterm and final examinations. Reddy reported that active-learning tasks improved student confidence in problem solving, fostered critical-thinking abilities, and achieved enhanced student outcomes.[23]

ACTIVE-LEARNING INSTRUCTIONAL METHODS

Active learning is not a single teaching method but rather an approach with multiple possible methods. Active learning can involve adding small, intermittent activities to existing courses or can require a complete restructuring of an entire course by using a distinct active-learning approach. No single approach is exclusively better than any other, and some strategies may work better with certain teacher personalities and teaching styles. However, in his book for higher education instructors entitled *Teaching Tips*, McKeachie states "The best answer to the question, 'What is the most effective method of teaching?' is that it depends on the goal, the student, the content, and the teacher. The next best answer may be 'students teaching other students.'"[24] Along with enabling two-way communication between a teacher and students, active-learning strategies also can facilitate active engagement of peer interactions as students help other students solve problems.

Learners can have difficulty transferring knowledge and skills from one context to another,[25] and skills may vary in complexity, depending on context. A key strategy to overcoming such barriers throughout any pharmacy curriculum is to provide numerous relevant examples. Learning with understanding can be facilitated by discussing how underlying principles can be applied in various contexts.[25-27] It is important for all instructors, regardless of discipline or course content, to foster problem-solving, a type of active learning, within their courses.

Classroom-Based Active-Learning Strategies

Along with more complex methods described below, simple and straightforward active-learning strategies can be implemented in any classroom setting. Appendix 1 provides examples of strategies for active learning that can be applied to both large and small classes.[28-31]

Cooperative Learning. Social Interdependence Theory, which underlies cooperative learning, proposes that learning has a distinctly social element and that learning from peers is a powerful influence toward student cognitive development.[32] Cooperative learning is supported by 5 major principles. The first is "positive interdependence," wherein no individual student alone can do the entire project well, but together, a group can cooperatively attain its goal. The second principle is "individual

accountability," wherein every group member is accountable to the group, social loafing is curtailed, and peer evaluations often are used to allow for individual grades beyond single project-based grades for the entire group. The third principle is "promotive interaction," wherein individual students encourage and facilitate one another's efforts for the group. The fourth principle is "intentionally focusing on social skills," such as leadership, facilitating group interactions, communication, and conflict management. The fifth principle is "deliberate group processing," wherein groups must reflect periodically on how they are functioning and how they might improve their learning processes.

Cooperative learning is more than simply placing learners into groups, as students do not necessarily understand effective teamwork until they have participated in and learned from this course application. To facilitate this cooperative learning, specific course time should be directed toward explicit discussion of teamwork principles. Instead of allowing students to select their own likeminded groups, teachers should form groups that are diverse in knowledge and abilities, and thus, capable of fostering peer teaching among students.[32] Learners need to understand *how* groups should work as well as how group processes can be improved, as described by Earl[33] and Ford.[34]

Problem-Based Learning. Pioneered by McMaster University in Canada, problem-based learning (PBL) presents students with real-world, open-ended problems to solve.[35] Traditional lectures are not usually part of this approach. The process begins with giving small groups of students an authentic problem to solve. Students then must determine what knowledge they already possess and what knowledge or concepts they need to learn in order to solve the problem. Students are self-directed and responsible for constructing their own learning, with faculty members serving as guides or resources for where to find needed information. Defining characteristics of the PBL method include: knowledge acquisition that is student-driven and uses inductive reasoning, which is often part of an analytical problem-solving approach; problems that are context-specific and authentic to what the student will face as a practitioner; problems that are complex and often ambiguous, requiring students to analyze their problem-solving strategies; students who are collaborative and interdependent, working in small groups that take responsibility for their individual as well as the group's learning; and basic and clinical sciences, which are integrated as concepts and become part of student inquiry-based learning. Numerous reports in the pharmacy literature also have shown that PBL is an effective method for enhancing student learning and abilities.[36-40]

Team-Based Learning. Developed by Larry Michaelson, team-based learning is a large-class, case-based teaching and learning strategy that involves the development of multiple teams within a class and use of course concepts to solve problems.[41] Classroom time is primarily used for team activities that apply course concepts. Acquisition of course content knowledge occurs primarily through reading or other preparatory assignments prior to class. Students are held accountable for their preparation through quizzes at the beginning of class. After individually completing a quiz or readiness-assurance test (RAT), students complete the same RAT as a team. Both individual and team performances on the RAT are factored into the student's grade. Following the RAT, class time is used to apply course content in a series of team application exercises. Team-based learning (TBL) has 4 essential tenets: teams must be strategically formed and managed properly; students must be held accountable for their individual performance and their contributions to the team; students must receive frequent and timely feedback on their performance; and team application exercises must be designed to promote learning and team development. Team-based learning has been successfully implemented into many disciplines, including pharmacy.[42-44]

Case-Based Learning. Case-based learning is a more general active-learning strategy that is similar to PBL and TBL in that it uses real-world cases as applications for learning. This method is commonly used with large classes (dissimilar to the small-group recitations in PBL) and seldom involves group work, RATs, or other specifics of TBL. In case-based learning, cases often are preceded by an assigned reading and/or a mini-lecture, whereas classroom time is predominantly focused on cases that involve application of content and subsequent class (large-group) discussions. Audience-response system "clickers" can be used to facilitate these large group discussions and promote student engagement beyond the customary few vocal students.

Ability-Based Education and Assessment-as-Learning. Originated by Alverno College, ability-based education (ABE) uses frequent formative assessment and feedback to improve student performance.[45] A critical piece of this strategy is assessment-as-learning, another form of active learning. Assessment and feedback from self, peers, and/or experts become part of the learning process. ABE involves first determining what ability outcome(s) students are to achieve in a course. Practice opportunities in the form of homework assignments or in-class active-learning strategies (eg, patient cases or clinical problems to solve) are then developed to give students an opportunity to practice ability outcome(s). Along with

the practice opportunity, clear and specific performance criteria are created and communicated to students so they understand what constitutes a good performance on the practice opportunity. Finally, each student receives assessment and feedback that are based on performance criteria and cite specific examples of elements of the student's performance. Students can then use this assessment and feedback to improve their next performance. Over the past several years in pharmacy education, ABE and assessment-as-learning have been successful approaches to help student pharmacists learn and achieve ability outcomes.[46-50]

Overcoming the Barriers to Implementing Active Learning

Implementing an active-learning approach often is not easy and may involve overcoming numerous barriers.[3] Active learning often requires more time and sacrifice of course content coverage in class. Even so, educators who implement active learning into their courses can add content through the course Web site, such as specific articles with quizzes to ensure reading completion, short online pre-class mini lectures, or even full lectures online.

Other barriers pertain to time involved with creating active-learning tasks, risks involved with implementing them, and institutional culture or lack of "buy-in" to active learning. The amount of time required to devise the specific components of active learning may involve preparation time similar to that required for creating a new lecture. Some teachers may lack the confidence to implement active learning or may feel that it is risky to share control of the class session with students. One strategy to address these potential barriers is careful planning of the class session, perhaps by creating an agenda or outline that details session goals along with placement and time allotment for active-learning strategies. It may be easier to start by implementing active learning on a small scale, using strategies such as those described in Appendix 1. An institutional culture that is supportive of using active learning and provides incentives for faculty members to implement active learning is of paramount importance.

Other potential barriers include lack of student interest, willingness, or preparedness to participate in active learning. Traditional lectures, with their one-way transmission of information, require little effort from the student. Active learning is a departure from passive learning, as it requires students to think critically and actively engage in the learning process. Because of this, some students may resist active learning, leading to poor student evaluations of the course and/or course instructor(s). Giving students clear expectations and instructions on how to participate in this type of classroom learning experience

can be helpful. Students can be held accountable for pre-class preparation by being quizzed or given an alternate short in-class assessment. If students are expected to learn basic course concepts through pre-class preparation, such as reading assignments, instructors should not use class time to lecture on these basic concepts but rather should be forthright and help students understand the rationale for implementing active learning. For students who are new to this approach to learning in the classroom, the instructor should ensure that initial participation is fun, for example, through the use of a short, active-learning game. Creating a suitable environment in which students can learn, think, be assessed, and receive feedback is important. Finally, instructors should seek ways to motivate student participation, such as awarding participation points or promoting friendly competition. For example, the group that "wins" the game could receive some sort of prize. Students may resist active learning at first, but giving them a clear understanding of the purpose of these activities and holding them accountable for participation may improve their participation in class and their performance on course evaluations. As a result, students may even prove to be more excited and motivated to learn.[3]

Implementing Active Learning in Experiential Settings

Pharmacy practice experiences closely follow the time-honored tradition of pharmacy training through apprenticeships. Experiential learning can combine active learning with real-world experiences, abstract concepts, and reflection. Observation and shadowing should not be considered active learning unless intentional reflective activities are completed as part of those activities. Active learning occurs as students actively participate in pharmacy practice experiences, and students must actively engage in processing these experiences in order for them to evolve into new knowledge, skills, attitudes, and behaviors.[51] John Dewey asserted that learning experiences must be fruitful and creative.[52] Experiential activities are valuable and meaningful only when students are actively engaged in both doing and learning, and such activities occur when caring for a patient, dispensing a medicine, or interacting with a healthcare provider.[53] Pharmacy faculty members can encourage students to actively engage in their practice experiences by requiring them to interact with elements of their experiences, reflect on their experiences, and consider the implications for future experiences and learning. Various strategies can support active learning during practice experiences, but combinations of these strategies are most likely to be effective in helping students achieve their educational goals.[54-55] Appendix 2 offers tips for increasing active learning in the practice setting.

PBL applies particularly well to experiential learning and comprises a foundation for learning when students are actively engaged in patient care. The patient-care environment provides an endless supply of real-world problems for students to solve. In this setting, students must be given an opportunity to determine what subject content they already know and what further information is needed. The preceptor should serve as a guide and resource for finding this information and help students cultivate inductive reasoning and analytical problem-solving skills, resisting the temptation to simply give students an answer. However, to further increase a student's sense of responsibility, a preceptor may articulate how the students' efforts can be used to improve patient care. A preceptor should attempt to incorporate both basic *and* clinical sciences into the student's thought process as the student attempts to solve a problem.

In the experiential setting, preceptors may use Socratic questioning to guide students in identifying pertinent problems, which further develops the student's skills. Socratic questioning is a time-honored teaching method in which the teacher responds to the learner's question with a carefully directed question intended to promote additional reflection and discovery.[56] It is different from repeated questioning simply for the sake of demonstrating knowledge. Socratic questioning can broaden and deepen the learning that students gain from their experiences by deliberately focusing on a specific learning area. Socratic questioning also can serve as a formative assessment tool to provide evidence and subsequent feedback on students' thoughtful engagement with tasks.

Self-assessment is essential to life-long learning, but it must be a self-directed behavior, in which learners seek formative assessment feedback from others.[57] At least initially, students will need preceptors to model and facilitate this behavior. Formative feedback is essential to deep learning and should be based explicitly on student performance of specific abilities.[58-60] Feedback can be short, verbal formative assessments that occur frequently and are not summative evaluations and do not involve comparisons with other students.[46] To help students achieve and readily engage in self-reflection, preceptors should provide timely and constructive feedback that helps students develop into reflective practitioners.[61] Feedback should have a specific focus that encourages students to respond by: reflecting on their current levels of aptitude and skill; stating their own goals relative to the specific focus; and explaining how they will move forward in achieving those goals.[61] Ability-based education is well suited for experiential learning because of its structured and frequent formative assessments and feedback.

Service learning provides students an opportunity to develop knowledge, skills, attitudes, values, habits, and ethics that cannot be learned solely in the classroom. It not only enhances the community through service but also can act as a powerful reflective learning experience for students.[62] In 2001, AACP's Professional Affairs Committee issued a report that outlined characteristics of service learning in pharmacy education. Specifically, service learning should: meet identified needs in the community and establish a relationship between the community and the academic institution; foster civic responsibility and a sense of caring for others; be integrated into pharmacy curricula; provide students with structured time for reflection on the service experience; extend student learning from the classroom into the community; and balance the service provided with the learning that occurs.[63] Service learning differs from volunteering in that it is a deliberate provision of structured time for reflection on each student's service experience. Reflection on the experience within the context of professionalism is key to the success of this learning strategy.[62] and instructors should provide students timely and meaningful feedback regarding reflections. Service learning is distinct from other forms of experiential learning in that it has students engage with their community to meet an identified need, such as disease screening outside of a healthcare clinic, education about optimal medication use and healthy living, and facilitating drug acquisition and/or disposal. Service learning also can include activities distinct from pharmacy, such as enhancing general public safety, protecting the environment, or working with an organization such as Habitat for Humanity to build a house for a needy family. The focus is on service and civic responsibilities to meet community needs. Reflection with feedback is essential regardless of whether the service-learning activities are components of a classroom-based course or offered as an experiential practice opportunity.

While a variety of previously discussed active-learning methods can be applied to instruction and facilitation of learning in the experiential setting, this forum also presents a unique set of challenges. In the sense that the traditional classroom setting allows for some isolation and control of external influences on learning experiences, the experiential setting is often just the opposite. The addition of other healthcare practitioners, patient populations, and institutional rules can create a level of complexity not encountered in traditional classroom-based learning environments. Thus, the key to facilitating successful learning opportunities in the experiential setting often involves predicting possible obstacles and creative positioning of remedies that assist in preserving the utility of the experience. Appendix 3 offers tips for overcoming these associated obstacles and challenges.

In the continually changing environment of pharmacy practice, developing independent, competent pharmacists

who are prepared for continuous professional growth is a paramount responsibility for pharmacy educators, especially in doctor of pharmacy programs.[2] Developing the required self-directed learning skills involves integration of both classroom and experiential learning, because classroom education is the foundation on which experiential education is built and practical experiences reinforce what is learned in the classroom.[64] Active-learning opportunities in the didactic setting help set the groundwork for experiential learning by involving students in their own instruction and facilitating progression from dependent to independent learning.[65]

CONCLUSION

Preparing pharmacy graduates to provide patient-centered care requires that students actively integrate knowledge, skills, attitudes, values, and behaviors in pharmacy practice activities. In pharmacy education, there has been a shift of emphasis from teaching to learning. Active-learning strategies should be incorporated into existing pharmacy curricula through both didactic courses and pharmacy practice experiences to help students progressively advance to deeper levels of learning. As barriers to the use of active-learning methods are recognized, they can and should be overcome. Pharmacy students must be prepared to be self-motivated, lifelong learners who can meet the challenges they will face as pharmacists in an ever-changing healthcare environment.

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Appendix 1. Strategies for Active Learning in the Classroom

Think-Pair-Share

Students are given a problem and first spend 1-2 minutes thinking about the problem alone (the "think" step). Next, the student spends 3-5 minutes discussing the problem with another student (the "pair" step). For example, during a pharmacotherapeutics class session, students are presented with patient data and asked to individually review the data to assess a patient's primary medical problem [Think]. The instructor then prompts students to turn to their neighbors and compare their patient assessments [Pair]. Finally, the instructor asks student pairs to report their patient assessment to the entire class [Share]. This active-learning strategy works well in large and small classroom settings at any time during the class session and is an effective way to get students involved, particularly those who are apprehensive about speaking out in class. It also provides the instructor with feedback on what students have grasped and which concepts they are finding more difficult.

Minute Writes

Students are posed a specific or open-ended question regarding a course concept and are asked to write a response in 1-2 minutes. For example, in a lecture teaching critical evaluation of primary literature, an instructor might pose the following open-ended question to gauge students' grasp of "external validity"—*Over the next couple of minutes, write down how you think this study's inclusion and exclusion criteria help you to evaluate external validity. I will collect responses and, without revealing names, will share some sample responses and give my feedback.* This active-learning strategy works well in large and small classroom settings at any time during the class session and is an effective technique for determining student progress, both in understanding of course material and reaction to course material.

Muddiest Point

As with "Minute Writes," students are given a couple of minutes to write the "muddiest point" or most confusing concept to understand from a class session. This typically occurs at the end of the class session and works well in large and small classes. The instructor collects the muddiest points and then provides clarification at the next class session or perhaps via email or online discussion.

Notes Exchange

The lecture is paused for 3-5 minutes, particularly after the instructor has covered an important concept, and students are instructed to exchange and compare their lecture notes. This active learning strategy works well in large and small classroom settings during the middle to end of the class session. It is an effective method for students to gain another perspective or another way of arranging the course material and is especially good for students who have poor note-taking skills. More competent note-takers have an opportunity to provide feedback to less-competent note-takers on improving their notes, which can further reinforce learning for the good note taker as well.

Socratic Questioning

Rather than providing students with answers, an instructor queries students in a manner that helps them uncover the answer themselves. Socratic questioning involves asking students about their thought process, probing their assumptions, and inquiring about their evidence. Some examples of Socratic-type questions include: *What do you think causes this phenomenon to happen and why? What are the consequences of that assumption? How does this concept tie in with what you've learned previously? What are the strengths and weaknesses of your evidence?* This active-learning strategy can be used in large and small classes but sometimes comes under criticism for use in large classrooms because it can single out students and potentially cause embarrassment with resulting disengagement. Nonetheless, if done well, it is an effective means of helping students work through the process of finding the solution.

Debates

The instructor chooses a controversial topic that has a pro and con viewpoint. Students are assigned to debate teams and given a position to defend. Students must develop and present logical, compelling arguments to support their position and also to rebut the other team's arguments. This active-learning strategy works well in a small class setting but can be used in a large class as well. In an effort to involve students in the audience, the instructor can ask the audience to serve as judges to determine which debate team presents the most convincing arguments.

Fishbowl

Students are placed in a group of 4-8 students and are seated in front of the classroom in a circle (or "fishbowl") along with an extra empty seat. The group is given a topic to discuss. Only students sitting in the fishbowl can take part in the discussion. If a student in the audience wants to participate in the discussion, he/she must come into the fishbowl and occupy the empty seat. Topic selection is key to driving discussion in the fishbowl and compelling students in the audience to come into the fishbowl to comment. Controversial topics work well, as the "forbidden fruit" phenomenon compels students to enter the fishbowl to voice their opinions. This active-learning strategy works best in a small classroom but can be used in large classrooms as well.

Role Plays

Students are assigned roles to act out in a situational context. For example, if the goal is to improve communication abilities with patients, the instructor may place students into groups of 3—1 student assumes the role of the patient, another assumes

the role of a pharmacist, and 1 student serves as peer assessor of the communication performance. Students switch roles so that each student gets the opportunity to play patient, pharmacist, and peer assessor. This active-learning strategy works well in small classes but can be adapted to large classes. In very large classes, the instructor may wish to use teaching assistants to walk around the classroom to observe and give feedback to groups.

Student Presentations

Students, as individuals or small groups, are assigned a topic which they have to research and about which they must develop and execute a presentation to the class. The student is placed in the role of teacher, which can greatly enhance understanding of the topic. This active-learning strategy works well in small classes but can be implemented in large classes if there is time for all students to present. To increase involvement of the entire class, students in the audience can be asked to provide peer assessment. If class time does not permit, presentations can be recorded, viewed, and assessed outside of class time. A rubric can be provided to guide the assessment and educate students about important elements for evaluation.

Games

Following the format of "Jeopardy" or other game shows, such as "Who Wants to be a Millionaire?", games promote friendly competition among students and are an effective means of reviewing knowledge and facts in a fun and engaging manner. Games may also be a valuable instructional tool if a course concept or theory is more easily illustrated rather than discussed. For example, the concept of chance findings in research may be presented as a game in which students flip a coin 10 times and compare how many heads and tails each student gets. If a coin is flipped 10 times, the true value should be 5 heads and 5 tails; however, it is highly likely that many students will get other combinations of heads and tails. This game illustrates how chance can affect the number of heads and tails resulting from a coin flip. Depending on the game, it can work in both small and large classrooms, although complex games in large classrooms are often more difficult to plan and execute.

Polling Devices/Audience Response Systems (ARS)/Clickers

Audience response systems (ARS) can help instructors efficiently and effectively gauge students' understanding of course concepts in a large class. With formative assessment (ie, not for course grade), an instructor could pose conceptual questions to the class in a multiple-choice format and students submit their answers via the ARS. The percentage of the class giving each answer is then revealed. This approach involves the entire class in the learning process and can afford students an anonymous way of participating in the class session while also demonstrating their confusion about or understanding of the concept without having to raise their hands and risk giving an incorrect answer. ARS responses can also be downloaded with student identification to assess individual responses and be used for summative assessment as with quizzes (ie, toward course grading). ARS works well in both large and small classrooms and can be integrated into a classroom session for formative or summative assessment.

Case Studies

Vignettes or scenarios require students to apply their knowledge, skills, and attitudes to solve a problem relating to the course material. This strategy works well in large and small classrooms and can be inserted at points throughout the class session. It can be easily paired with the think-pair-share strategy and provides an opportunity for peer and expert assessment.

Online Supplementation

Thoughtful use of online assignments can optimize active-learning classroom strategies. Often referred to as Blended Learning (BL), online formats combined with face-to-face classroom time can engage students' active involvement with desired outcome processes and concepts, and support students' inquiry, reflection, and deeper learning of complex concepts and skills.[28-30] BL has been shown to increase students' sense of responsibility to prepare for and make the most of face-to-face learning, time management skills, and enthusiasm during face-to-face time with peers and faculty.[31] Online learning can take the form of web-based reading, lecture, and other activities on a specific topic or issue in preparation for highly interactive classroom strategies. Online work might also include activities such as self-assessment quizzing with interactive display or student-moderated discussion forums. Weblogs can serve as a reflective journaling tool, and wikis (ie, a website storing an interactive document that allows multiple users to add or edit content) can enable collaborative student writing. Many institutions already have an electronic course management system, such as Blackboard (Blackboard Inc., Washington DC) or Desire2Learn (Desire2Learn Incorporated, Kitchener, Ontario, Canada), that allows instructors to post readings, facilitate online discussions through discussion boards, and make assignments available to students for further practice with course material.

Appendix 2. Suggestions to Increase Active Learning in the Experiential Setting

Engaging reticent students
    Discuss topics of students' choice where they must present and be prepared to answer questions.
    Online reading and self-assessment questions completed prior to face-to-face discussion can encourage all students to prepare adequately and guide students to reflect on how the material can be applied to patient care.
    Provide examples of how an introductory or advanced pharmacy practice experience (IPPE or APPE) activity can help students be better prepared for classroom exams, the North American Pharmacist Licensure Exam (NAPLEX), or future practice. Include activities that are not grade-focused but provide students with opportunities to note their own progress.

Ensure that any "shadowing" experiences are active[54]
    Hold brief reflection or debriefing sessions at the end of each day or experience to summarize at least one new item learned
    Consider use of progressively challenging interactions as students progress through the curriculum.
    Portray the experience as an opportunity to apply what is being learned in other didactic courses and engage students by using real-life examples.
    For IPPE students, community pharmacy practice experience should include an emphasis on active counseling on nonprescription products and prescription drugs (especially the top 200) with feedback from the preceptor.

Use principles of adult-learning theory to continually challenge and engage students[55]
    Encourage progression through levels of learning, from recall to understanding, understanding to application, etc.
    Include learning objectives in the IPPE and APPE syllabi that identify activities at higher levels of learning so students will know what to expect.
    Encourage students to become self-directed with their learning issues.

Find ways to challenge students on a day-to-day basis
    Incorporate a "question or learning issue of the day" that students must research and answer by the end of the day
    Encourage other clinicians to challenge students with problem-solving activities.
    Pair different levels of learners and have the less-experienced learner instruct the more-experienced learner on an activity or topic.
        The more-experienced learner can provide feedback and helpful tips.
        The less-experienced learner can let the more-experienced student know which techniques were most helpful.
        A binder containing the feedback and tips from these experiences can be compiled and maintained by the students to be used by future practice experience students.
    As students prepare for the day, encourage them to think about future interventions for their patients, not just the immediate next step.

Appendix 3. Tips for Overcoming Obstacles and Challenges in Implementing Active-Learning Strategies in the Experiential Setting

Technology Issues
    Facilitate student access and proficiency with computer systems.
    Prepare a manual or "cheat sheet" with helpful hints on how to navigate the software/system.
    Arrange an orientation with a pharmacy-informatics specialist.
    Invite students to come to the practice experience site early to shadow the student finishing the practice experience for the purpose of learning to navigate the software/computer system.

Promoting Effective Group Work
    Assign students different patients and activities.
    Plan time for students to meet at the end of the day to teach each other what they have learned.
    Consider including end-of-week summaries in an APPE site binder or in portfolios.
    Pair up with other faculty/preceptors, pharmacy residents, and additional students for case and topic discussions, or journal clubs.
    Consider that students may feel more pressure to perform when they present in front of a larger group.
    Ensure that each member of the group is responsible for participating in some way.
    Incorporate group dynamics as a learning opportunity.
    Stronger students can mentor weaker students.

Students can teach each other learning issues they have identified and about the resources they have used to answer the questions.

Accommodating Different Cultural Issues and Learning Styles

Culture can affect both receipt and delivery of information, whether the recipient of information is another healthcare provider, patient, or student. Cultural diversity and its impact on both learning and teaching must be considered in any educational setting. Colleges and schools of pharmacy can provide formal cultural diversity training for both preceptors and experiential students.

Incorporate a variety of learning modalities when possible.

Student Motivation and difficulties with students' perceived activity relevance[64]

Determine students' future goals by having them complete a questionnaire prior to the start of the practice experience.
Ask students what would be most helpful in improving their clinical skills or in preparing them for a future practice site.

Explain the rationale behind the activity.
Try to plan activities that will help students perform better in their planned future practice site.
Provide examples of opportunities that may exist on the practice experience and allow students to direct some of these activities early on. This allows them to feel that they have input and are being heard.

Reiterate that practice experiences are the best time to develop therapeutic problem-solving skills.

Have the students reflect on what they believe worked or did not work for activities and include this information in portfolios or use in continuous quality improvement for the practice experience.

Encourage residents to assist with motivating students.
Residents' professional experience is closer to that of students and may enable them to establish a better connection, which facilitates motivation.

Provide examples of how certain student activities have benefited their current practice/knowledge.

Provide examples of how activities can later impact other components of a patient's care.

Gaining Active-Learning Confidence for the Preceptor

Remember that experiential education integrates prior classroom course work.

Allocate time for faculty and preceptors to meet informally and share positive experiences they have had with students during their practice experience.

Share "teaching tips" for activities that worked well during practice experiences.

Arrange for new faculty and preceptors to shadow "best practices" of established faculty during practice experiences for 1-2 days

Time Constraints

Create an opportunity for students to teach one another, especially when APPE and IPPE students are together.

Use upper-level students and residents to precept when appropriate, and devise a hierarchical approach for practice experiences so the main preceptor can delegate some activities.

Pharmacy technicians and other allied health professionals can assist with some teaching activities. This reminds students of the value that all disciplines bring to the patient

Consider all dispensing, clinical, and other activities as opportunities to teach. It is not always necessary to devise separate teaching activities.

Keeping Practice Experiences Organized

At the beginning of a practice experience, provide students with a calendar that structures due dates for assignments, midpoint and final assessments, as well as any topic discussions, journal clubs, and/or case presentations

Allocate time to discuss with students the plan for the next day.

Allocate time at the end of the day for debriefing and next-day planning

Establish regular intervals or occasions for feedback. Spend 5-10 minutes at the beginning and end of each week to discuss plans for the week, reflect on progress, and discuss expectations for the next week.