Evaluating Pharmacy Faculty’s Awareness of Teaching and Learning Myths and Misconceptions

Melissa S. Medina, EdD,a,b Ashley N. Castleberry, PharmD, MEd,c Adam Persky, PhDb,d

a University of Oklahoma Health Sciences Center, College of Pharmacy, Oklahoma City, Oklahoma
b Associate Editor, American Journal of Pharmaceutical Education, Arlington, Virginia
c University of Texas at Austin, College of Pharmacy, Austin, Texas
d University of North Carolina, Eshelman School of Pharmacy, Chapel Hill, North Carolina

Submitted June 1, 2021; accepted December 7, 2021; published November 2022.

Objective. To assess pharmacy faculty’s knowledge of prominent and prevalent teaching and learning myths and misconceptions and evidence-based strategies prior to training.

Methods. Participants completed a baseline assessment containing 16 true-false knowledge questions about teaching and learning misconceptions (10) and myths (six), one open-ended application question, and four participant demographic questions including years of experience in pharmacy academia, the focus of their institution (teaching or research), the number of education meetings attended, and whether they had formal training in education. After completing the baseline assessment of the top 16 misconceptions and myths, faculty were trained on the top 10 evidence-based teaching and learning strategies. At session completion, faculty were provided the assessment answers and scored their original responses.

Results. Results from the survey revealed that most responders (56%) had been in academics between one and 10 years and attended two to 10 education meetings (62%). The majority of participants worked at teaching-intensive universities (56%), and most had no formal training in teaching (65%). The average score on the assessment was 43% for the myths section versus 70% for the misconceptions section. Faculty participants were overconfident in their predictions (predicted = 74%, actual = 60%). Faculty demographics did not influence the assessment scores.

Conclusion. Pharmacy faculty may not know which teaching and learning strategies are evidence based and which are myths or misconceptions. In addition, they are likely to be overconfident in their knowledge of this evidence. This provides opportunity for faculty development in these areas.

Keywords: learning myths, evidence-based education, faculty development

INTRODUCTION

Educational misconceptions and myths can be inadvertently embedded into the teaching practices of Doctor of Pharmacy (PharmD) faculty.¹ These myths and misconceptions originate from sources such as opinions, observations of other teachers, personal experience, and the media. They can be grounded in ideas like, “it worked for me as a student,” “don’t fix what isn’t broken,” or “that’s how it has always been done.” Regardless of the source or justification, educational myths and misconceptions can be damaging to teaching and learning.¹ Take the common teaching aphorism, “those who can, do; those who can’t, teach.”² This century-old saying is grounded in opinion but has

perpetuated as a myth that disparages teachers and can underlie policies and practices related to teaching.¹ Yet, as research has shown, the best way to learn something is to teach it, “to teach is to learn”; “those who understand, teach.”¹³ Believing the above myth may cause one to reject the use of peer teaching as a strategy for helping students become self-aware and self-directed learners and reflective practitioners, which are important pharmacy education outcomes.³,⁴ Unfortunately, not all faculty are aware of teaching myths and misconceptions, especially if they have not been specifically addressed and debunked during resident or graduate student teaching certificate programs or professional development workshops.

To date, no studies have evaluated pharmacy faculty members’ beliefs of common teaching myths and misconceptions or their knowledge of conventional evidence-based teaching and learning strategies. Evaluating faculty members’ teaching knowledge and beliefs can help them
more intentionally select their future professional development to address their knowledge deficits and weaknesses. This study was designed to assess pharmacy faculty members’ knowledge of 10 misconceptions about evidence-based teaching and learning strategies and six teaching myths prior to training on these topics. The top 10 evidence-based teaching and learning strategies (activating prior knowledge, feedback, elaboration, scaffolding, testing, personalization, spacing, metacognition, distinctiveness, and peer teaching) were selected from the educational literature.5-10

METHODS
This study was conducted with a convenience sample in a session at the 2019 annual meeting of the American Association of Colleges of Pharmacy. Two hundred copies of a handout and survey were provided to attendees. The exact number of participants at the session was unable to be captured. The first page of the handout asked attendees to complete a 16-item baseline assessment and provide some demographic information (Appendix 1 and 2). This baseline assessment contained 10 true-false questions pertaining to misconceptions and the related content of the presentation and six true-false questions on myths about teaching and learning (see Appendix 2). Participants were also asked to predict their scores before starting the baseline assessment. After completion, participants engaged in one hour of instruction and activities delivered by the investigators related to the top 10 teaching and learning strategies. The length of the session did not allow for instruction related to the six teaching myths. The assessment was collected at the end of the session. The study received institutional review board approval.

Data were summarized using descriptive statistics. A one-way analysis of variance (ANOVA) with a post hoc Tukey test was used to analyze data based on baseline differences in demographics. Two metacognitive measures were calculated. The first was bias, which is the difference between a participant’s predicted score and their actual score, and it measures degree of over- or underconfidence.11 The second measure is absolute bias, or the absolute value of the bias score; this measures accuracy, or how close the predicted score was to the actual score. Statistical significance was set at p<.05.

RESULTS
A total of 80 participants completed the survey. Demographics of the responders can be found in Appendix 1. Most responders had been in academics between one and 10 years (56%) and had attended two to 10 AACP annual meetings (62%). The majority came from teaching-intensive universities (56%), and most had no formal training in teaching (65%). When comparing performance on the knowledge portion, there were no differences based on length in academia, number of AACP meetings attended, type of university they were currently working in, or whether they had formal educational training.

The assessment included 10 misconception questions related to knowledge of the top 10 evidence-based teaching strategies in addition to six questions about learning myths. The average score on the assessment was 43% for the myths section versus 70% for the misconceptions section (p<.001). See Appendix 2 for individual item results.

We also examined the bias, which compares the predicted score to the actual score and indicates over- or underconfidence. In general, responders were overconfident in their predictions of their overall score (predicted=74%, actual=60%; range: 19%-51%). There were no significant differences within years in academia, number of AACP meetings attended, institution type, or whether participants had formal training. We next examined the absolute bias, which assesses metacognitive accuracy. Here, participants were relatively inaccurate, showing on average a 16-point difference between predicted scores and actual scores (range: 0%-51%).

DISCUSSION
The purpose of this study was to capture participants’ knowledge about evidence-based teaching and learning misconceptions and myths in a population of faculty attending a national conference on teaching. We found that session attendees had moderately high knowledge about evidence-based strategies but poor knowledge about learning myths. Knowledge of these topics was not influenced by time in academia, the number of AACP meetings attended, the type of institution participants were from, or whether they had some degree of teacher training.

Six of the 10 misconceptions about evidence-based teaching strategies had average scores greater than 80%, indicating participants had common knowledge around these topics (scaffolding, 98%; personalization, 96%; retrieval, 91%; feedback, 90%; prior knowledge, 89%; and collaborative learning, 81%). Faculty members’ knowledge about these areas may be the result of training since these are common areas of emphasis in teaching certificate programs and at the annual AACP meeting. Items with the lowest average scores were contrast (61%), metacognition (36%), elaboration (35%), and spacing (25%), indicating that participants would benefit from more development in these teaching and learning topics.

In addition to the questions about knowledge of the top 10 teaching and learning strategies, the assessment
included six questions about learning myths. Scores on these items were significantly lower than those on the knowledge items (43% vs 70%, \(p<.001\)). Myth questions included topics of the learning pyramid, learning styles, inquiry-based learning fits all, attention span, lecture is best, and hemispheric dominance. It is possible that participants answered these questions incorrectly because they had seen other faculty in their institution using these strategies or they had experienced the strategy in their own teaching. Relatedly, another reason could be that these myths are passed down from mentors to mentees during training, much like folklore. There is plenty of evidence that even teachers with formal training believe some of these myths.\(^{12}\) Despite the evidence suggesting otherwise, learning myths are also still present in research articles and presentations. Sometimes myths persist because people have difficulty judging what is true or false. We make these true-false judgments in several ways, such as accepting new information by default, accepting new information when it aligns with what we believe to be true, and accepting new information when it is repeated more often.\(^{13}\) As a result of such experiences, observations, mentoring, and training, people often mistake common practice for best practice.\(^{1}\) Furthermore, sometimes faculty reject new ideas because they contradict the status quo.\(^{1}\) Because of these reasons, changing teaching practice is challenging. If instructors hold on to these teaching myths, it may be difficult to design the most effective instruction.

Another finding of this study revealed that all respondents were overconfident in their understanding of these topics, as indicated by their predictive scores being greater than their actual scores. This could be due to the pervasive nature of teaching and learning myths, limited faculty development in these areas, reliance on past experience and previous practice, and/or personal biases.\(^{14}\) This could indicate that development is needed on these topics to ensure that evidence-based teaching and learning strategies are being used in our classrooms, laboratories, and experiential learning sites.

The strengths of this study are that the sample comprised active pharmacy educators and the questionnaire entailed a simplified assessment of knowledge. Some limitations are that the sample was a convenience sample of those that attended a specific conference session and that over the 200 attendees, not all participants completed the assessment. Those who attended the conference, and this session specifically, may have had a special interest in teaching since they pursued this development related to teaching and learning. Therefore, results may not be applicable to all pharmacy faculty, as the sample did not fully represent the Academy as a whole. The exact number of participants at the session was unknown, so the actual response rate is uncertain. However, the study did capture participants’ demographics, and this sample included faculty from different levels, programs, and years of experience. Additionally, a limited number of items was used to assess each strategy (one per item), and only certain strategies were sampled. Finally, the study was only designed to measure baseline misconceptions, myths, and knowledge, not long-term retention and/or application of what participants learned or remembered.

As with any training situation, assessing prior knowledge is useful in tailoring instruction, and, thus, this approach may be useful as a screening tool for faculty development efforts at the local or national level. The results of this study suggest that faculty may need more educational opportunities around certain topics such as learning myths.

**CONCLUSION**

Pharmacy faculty may not know which teaching and learning strategies are evidence based and which are myths. With limited time, they may not be able to develop their understanding of these topics efficiently. In addition, they are likely to be overconfident in their knowledge of this evidence. Providing specific and concise faculty development in these areas, especially related to debunking educational myths, is warranted to promote evidence-based teaching practices to advance pharmacy education. In the Academy overall, there can be better screening of conference proposals or manuscripts to prevent the spread of misinformation. Individuals have the responsibility to use evidence-based literature to inform their teaching practices. Instructors may use popular press books as justification of their evidence-based teaching, but these books are not peer reviewed and, as such, may be subject to misinformation. We encourage everyone to use the strongest evidence possible to support their instructional decisions, such as data from meta-analyses and systematic reviews, just as they would in clinical practice.

**REFERENCES**

1. Sauntson H. Twenty-seven educational myths and how to debunk them. https://teacherofsci.com/educational-myths/. Accessed November 11, 2022.
2. Shaw GB. Man and Superman. Cambridge, Mass.: The University Press; 1903.
3. Ten Cate O, Durning S. Dimensions and psychology of peer teaching in medical education. Med Teach. 2007;29(6):546-552.
4. Medina MS, Plaza CM, Stowe CD, et al. Report of the 2012-2013 Academic Affairs Standing Committee: Revising the Center for the Advancement of Pharmacy Education (CAPE) Educational Outcomes 2013. Am J Pharm Educ. 2013;77(8):1.
5. Benassi VA, Overson CE, Hakala CM. Applying the Science of Learning in Education: Infusing psychological science into the curriculum.
Appendix 1. Summary of Teaching and Learning Misconceptions and Myths Assessment Scores by Demographics

| Metric                          | No. (%) | Predicted score, average (SD) | Score, average (SD) | Misconceptions, section average (SD) | Myths, section average (SD) | Bias | Absolute bias |
|--------------------------------|---------|--------------------------------|---------------------|--------------------------------------|----------------------------|------|---------------|
| Overall                        | 80 (100)| 74 (12)                        | 60 (11)             | 70 (14)                              | 44 (21)                    | 14 (15)| 16 (12)       |
| Length in academia             |         |                                |                     |                                      |                            |      |               |
| <1 year                        | 5 (6)   | 74 (10)                        | 61 (7)              | 66 (17)                              | 53 (30)                    | 12 (7) | 12 (7)        |
| 1-5 years                      | 24 (30) | 73 (11)                        | 61 (11)             | 70 (12)                              | 46 (22)                    | 14 (16)| 15 (13)       |
| 6-10 years                     | 21 (26) | 73 (15)                        | 57 (13)             | 66 (15)                              | 41 (20)                    | 11 (15)| 19 (15)       |
| >10 years                      | 20 (25) | 76 (12)                        | 62 (11)             | 76 (12)                              | 38 (16)                    | 17 (18)| 18 (11)       |
| No answer                      | 10 (13) | 74 (11)                        | 63 (11)             | 70 (17)                              | 50 (21)                    | 11 (6) | 11 (6)        |
| Number of AACP meetings        |         |                                |                     |                                      |                            |      |               |
| 1                              | 16 (20) | 76 (9)                         | 57 (11)             | 63 (14)                              | 48 (21)                    | 18 (12)| 18 (12)       |
| 2 to 5                         | 39 (49) | 72 (12)                        | 61 (12)             | 72 (12)                              | 42 (23)                    | 11 (16)| 15 (13)       |
| 6 to 10                        | 10 (13) | 72 (15)                        | 61 (12)             | 70 (14)                              | 47 (11)                    | 11 (17)| 17 (11)       |
| >10                            | 9 (11)  | 81 (9)                         | 60 (6)              | 77 (7)                               | 32 (13)                    | 20 (14)| 20 (14)       |
| No answer                      | 6 (8)   | 74 (14)                        | 63 (13)             | 68 (22)                              | 53 (20)                    | 12 (6) | 12 (6)        |
| Institution                    |         |                                |                     |                                      |                            |      |               |
| Balanced                       | 15 (19) | 72 (13)                        | 56 (13)             | 67 (17)                              | 38 (16)                    | 15 (18)| 18 (15)       |
| Research intensive             | 11 (14) | 74 (12)                        | 64 (11)             | 67 (16)                              | 58 (25)                    | 8 (21) | 15 (16)       |
| Teaching intensive             | 45 (56) | 73 (11)                        | 60 (10)             | 72 (11)                              | 41 (20)                    | 15 (14)| 17 (11)       |
| No answer                      | 9 (11)  | 74 (12)                        | 62 (11)             | 70 (18)                              | 48 (22)                    | 11 (7) | 16 (11)       |
| Formal teaching training       |         |                                |                     |                                      |                            |      |               |
| Yes                            | 19 (24) | 75 (11)                        | 60 (14)             | 66 (16)                              | 50 (25)                    | 14 (18)| 17 (15)       |
| No                             | 52 (65) | 74 (12)                        | 60 (10)             | 71 (12)                              | 40 (18)                    | 14 (15)| 16 (12)       |
| No answer                      | 9 (11)  | 74 (12)                        | 62 (11)             | 70 (18)                              | 48 (21)                    | 11 (7) | 11 (7)        |
### Appendix 2. List of Teaching and Learning Misconceptions and Myths Question Topics With Performance, Respective Category, and References

| Question No. | Average correct, % | Misconceptions and myths | Evidence-based teaching and learning reality |
|--------------|--------------------|--------------------------|---------------------------------------------|
| 1 | 89 | Misconception: prior knowledge<sup>15</sup> If students are unprepared for class (ie, do not do prior reading), taking a quiz on their baseline knowledge and understanding does not help them learn. | Anything that helps activate prior knowledge can facilitate learning. We learn by connecting new learning to previously learned material.<sup>15</sup> |
| 2 | 90 | Misconception: feedback<sup>16</sup> When providing feedback, the most important aspect is letting the student know whether their answer was correct or incorrect. | Appropriate feedback involves informing the learner what is correct or incorrect, why the answer is correct or incorrect and where they can go for more practice. Knowing that answers are correct or incorrect is not as helpful as knowing why.<sup>16,17</sup> |
| 3 | 35 | Misconception: elaboration<sup>18</sup> When learning new content, it is helpful to associate it with information already recorded in short-term memory. | Concrete information is better remembered than abstract, and we learn better when we tie new learning to prior learned material (in long-term storage). In general, it is hard for us to learn abstract ideas, and we do better with concrete examples; thus, we must relate the abstract idea to a concrete example or experience.<sup>18,19</sup> |
| 4 | 98 | Misconception: scaffolding<sup>20</sup> For novice learners, breaking down tasks to component pieces doesn’t improve learning outcomes. | Working memory is limited. If too much information is presented at once, the amount of information will exceed our working memory. Scaffolding allows students to learn pieces of the bigger puzzle one at a time, so they are less likely to overwhelm their working memory.<sup>20,21</sup> |
| 5 | 91 | Misconception: retrieval<sup>22</sup> After reading and studying a chapter of text, research has shown rereading and restudying that chapter is better than taking a practice test (ie, restudy > practice test). | When we retrieve information from memory, that piece of information is placed onto our memory’s workbench, and new “tags” are placed on that information, strengthening the memory. Testing helps consolidate knowledge and skills and helps ensure information is accessible when it is needed to solve a problem.<sup>22-24</sup> |
| 6 | 96 | Misconception: personalization<sup>25</sup> Learning is not improved by having students state why what they are learning is important to them. | It is important for students to make personal connections to material: Why is it important for them to learn this material?<sup>10,26</sup> |
| 7 | 25 | Misconception: spacing<sup>27</sup> Cramming (practicing all at once) before an exam results in lower examination grades than distributing practice over the days preceding the exam. | Studying the day before an exam (cramming) can lead to high performance on an exam. But that does not mean the material is learned well. We have to differentiate between information that is easily accessible and information that is stored well in memory. Cramming leads to high accessibility but poor storage. Spacing of practice increases the ability to store information for longer periods of time.<sup>27-29</sup> |
| 8 | 36 | Misconception: metacognition<sup>30</sup> Students with high confidence in a task perform the task better. | Humans are generally poor at judging their abilities. A student can have high confidence but perform poorly (overconfident) and a student can have low confidence and perform well (underconfident). However, higher-performing students tend to be better judges of their knowledge than lower-performing students.<sup>30,31</sup> |

(Continued)
### Question No. 9
- **Average correct, %**: 61
- **Misconceptions and myths**: Misconception: contrast
  Students will learn more when finding the similarities between individual beta-blockers than finding their distinctive qualities.
- **Evidence-based teaching and learning reality**: Research shows that participants learn more when they are looking for differences between concepts. Deep levels of processing encourage recall because of distinctiveness (stimulus is different from other memory traces) and elaboration (extracting meaning and interconnecting concepts).³²,³³

### Question No. 10
- **Average correct, %**: 81
- **Misconceptions and myths**: Misconception: collaborative learning
  Students teaching other students in an interdependent way is an ineffective learning strategy with small effect sizes.
- **Evidence-based teaching and learning reality**: Peer instruction falls under the category of cooperative or collaborative learning. It first requires students to do individual work, then to work with peers in an interdependent manner. Effect sizes compared to other instructional approaches can be large.³⁴,³⁵

### Question No. 11
- **Average correct, %**: 24
- **Misconceptions and myths**: Myth: learning pyramid
  People generally remember most of what they read.
- **Evidence-based teaching and learning reality**: The learning pyramid or cone of learning has a long history. In essence, it suggests people learn 10% of what they read, 20% of what they hear, 30% of what they see, and 90% of what they do. However, there is no data to support these numbers.³⁶,³⁹

### Question No. 12
- **Average correct, %**: 33
- **Misconceptions and myths**: Myth: learning styles
  Individuals learn better when they receive information in their preferred learning style (for example, visual, auditory, or kinesthetic).
- **Evidence-based teaching and learning reality**: Learning styles have persisted in education for decades. Learning styles suggest that a learner with a keenness for visual information will do better (learn more) when presented with visual information. This is called meshing but has not been proven in research. Additionally, characterizing learning styles is full of issues with validity and reliability.⁴⁰,⁴¹

### Question No. 13
- **Average correct, %**: 83
- **Misconceptions and myths**: Myth: inquiry-based learning
  Minimal guidance during the instruction (eg, problem-based learning, inquiry-based learning) is largely effective for novice to intermediate learners.
- **Evidence-based teaching and learning reality**: Minimal guidance during instruction is not effective for everyone. Novice or intermediate students may struggle in such environments. Novices benefit from things like worked examples, which offer much more support than minimal guidance. Minimal guidance may work better for individuals that have appropriate background knowledge and know where to find appropriate information.⁴²

### Question No. 14
- **Average correct, %**: 16
- **Misconceptions and myths**: Myth: attention span
  The human attention span is about eight to 10 minutes; thus, we need to design classes in short chunks.
- **Evidence-based teaching and learning reality**: Attention span is context dependent. Some classroom research suggests it is about 10 minutes based on note density and heart rate. However, we can be distracted by things around us (attentional blink), pay attention for very long periods of time when motivated (flow), have reduced attention when hungry, or have increased attention when in a positive mood. And, regarding attention at the physiological level, it can take seconds to deplete neurotransmitters that impact attention.⁴³-⁴⁷

### Question No. 15
- **Average correct, %**: 76
- **Misconceptions and myths**: Myth: lecture ineffectiveness
  Lecture is an ineffective instructional strategy.
- **Evidence-based teaching and learning reality**: Lecture is an effective instructional strategy depending on the context being used, just like any other strategy. It is an efficient and effective way to provide information to students and can be effectively used as preclass preparation or for a “time for telling” during a case discussion.⁴⁸,⁴⁹
| Question No. | Average correct, % | Misconceptions and myths | Evidence-based teaching and learning reality |
|-------------|--------------------|--------------------------|---------------------------------------------|
| 16          | 30                 | Myth: left vs right brain\[^{12,37,38,50}\] Differences in hemispheric dominance (left brain or right brain) can help to explain individual differences among learners. | There is a popular myth among educators that traditional learning favors the left hemisphere (the “academic” brain) and neglects the right hemisphere (the “creative” or “artistic” brain). When performing any task “everything in the brain (is) in flux—both sides, the front and back, the top and bottom to think that you could reduce this to a simple left-right dichotomy would be misleading and oversimplified.”[^{50}] |