Currents in Pharmacy Teaching and Learning (xxxx) xxxx–xxxx

Contents lists available at ScienceDirect

Currents in Pharmacy Teaching and Learning

journal homepage: www.elsevier.com/locate/cptl

Commentary

An evidence-based analysis of learning practices: the need for pharmacy students to employ more effective study strategies

Daniel Brown*

Lloyd L. Gregory School of Pharmacy, Palm Beach Atlantic University, West Palm Beach, FL 33416-4708

ARTICLE INFO

Keywords:
Learning
Metacognition
Study Strategy
Pharmacy Student

ABSTRACT

Introduction: Learning is a process of constructing neural connections between what is being learned and what has already been learned. Superficial thought processes associated with memorization produce shallow, short-term learning. Higher-order thought processing (critical thinking) produces deep, long-term learning. Pharmacy students should study in ways that enable them to retain and apply what they learn.

Predominant learning practices: Investigators who surveyed the learning practices of pharmacy students have reported that most students resort to cramming in preparation for an upcoming exam. The practice of routinely keeping up with course material through regular study is much less common. Most students highlight or re-read material when studying rather than quizzing themselves, and many multitask or study with distractions such as texting, checking e-mails or using social media.

Evidence-based learning practices: Studies in cognitive psychology and education provide evidence to confirm the efficacy of the following learning practices: plan and manage study time, space out and repeat study, interleave (mix up) topics or methods, incorporate retrieval practice (self-quizzing, deliberative reading, or written paraphrasing), minimize distractions, leverage mistakes, and sleep at least seven hours a night.

Conclusion: Pharmacy students need to become proficient, lifelong learners. A superficial, memorization-oriented approach to learning is detrimental to professional growth. Faculty members should guide students to employ more effective evidence-based study strategies, while also exploring how curricular design, course content, academic policy or pedagogy might be predisposing students to pursue suboptimal learning practices. The issue calls for the academy to focus greater attention on how students learn.

Academic challenge facing pharmacy students

Pharmacy students are confronted with the challenge of having to learn an inordinate amount of information drawn from an ever-expanding body of knowledge, with sufficient depth of understanding such that what they have learned can be readily recalled over time and applied in a variety of circumstances.[1] If students learn in a manner that limits them to superficial short-term applicability, they might find themselves unprepared for direct patient care responsibilities. There is little question that pharmacy students must develop high levels of clinical expertise, corresponding to deeper levels of learning, which suggests that they should employ optimal learning strategies from the very beginning of pharmacy school. Long-held, less effective study habits that might have served them well during pre-pharmacy coursework might need to be shed or retooled in favor of established learning methods

* Correspondence address. Lloyd L. Gregory School of Pharmacy, Palm Beach Atlantic University, West Palm Beach, FL 33416-4708.
E-mail address: daniel_brown@pba.edu.

http://dx.doi.org/10.1016/j.cptl.2016.11.003

that have been strategically designed and scientifically validated.

Zorek et al.[1] described an alarming pattern of study among pharmacy students, termed "bulimic learning," which refers to the binge-purge pattern of cramming course material intensely during the days leading up to an exam. Cramming is a superficial approach to learning that fosters short-term memorization in order to achieve a desired exam grade. Bulimic learning patterns are not the only concern. Some pharmacy students strive to achieve long-term learning, but engage in a variety of study methods that are ineffective or inefficient.[2] Despite hard work and good intentions, their learning is not characterized by long-term retention and mastery of concepts because the manner in which they study is suboptimal. The academic performance of such students can be deceiving. They might do well on exams and receive good grades because they are skilled at short-term memorization, but demonstrate little long-term retention or ability to apply what has been memorized.

The process of learning is heavily dependent on individual effort. Knowledge cannot be transmitted from one person to another. To learn effectively, students must be actively engaged in cognitive processing. There are no shortcuts. Learning is a product of thinking—preferably critical thinking—and results from the construction of neural connections in the brain between what is being learned and what has already been learned.[3] Herbert A. Simon,[4] 1978 Nobel Laureate in Economics, captured the essence of learning rather well, stating "Learning results from what the student does and thinks and only from what the student does and thinks. The teacher can advance learning only by influencing what the student does to learn." Simon's insight suggests that students learn best when they engage in study skills that foster critical thinking. Unfortunately, old habits can be hard to break. Current literature suggests that many pharmacy students are not utilizing optimal learning practices and might be unaware of which methods are most effective.[5] In common parlance, they devote so much effort to memorizing isolated dots that they fail to gain a functional perspective of how the dots connect.

The purpose of this commentary is to identify the current study practices of pharmacy students based on published reports of student surveys and contrast those findings to the results of studies that have been conducted to determine the most effective learning practices (Table 1). By developing an increased awareness of "best practice" study strategies, pharmacy faculty will be better equipped to advise and guide students about strategies that might enable them to study (and learn) more effectively. Faculty should also realize that there are meaningful modifications to pedagogy or course design that they can implement to compel students to rely more heavily on evidence-based study practices. However, such pedagogical options are beyond the scope of this commentary. The focus shall remain limited to what students can do on their own to improve how they study and learn.

Predominant study methods employed by pharmacy students

Persky and Hudson[6] surveyed three-hundred fifty-four students at the University of North Carolina Eshelman School of Pharmacy to determine their study practices. Results showed that 91% of students re-read notes and textbooks or re-watched videos, whereas only 52% engaged in the more efficacious practice of retrieval (self-quizzing) followed by re-study. Furthermore, 59% reported having a preference for concentrated studying within two days of an exam as opposed to a more "spaced out" pattern of studying in smaller quantities over a five-day period. A total of 78% reported studying one topic during a block of time rather than breaking up their studying by interleaving (mixing) topics, and 42% reported studying with distractions such as texting, checking e-mails or engaging in some form of social media. The authors concluded that the study strategies reported by their students were mostly contrary to practices known to foster deep levels of learning.

Suda et al.[7] in surveying the study perceptions at the University of Tennessee College of Pharmacy, reported student and faculty agreement that course material should be studied regularly, but that it rarely occurs. Hagemeier and Mason[8] surveyed four-hundred twenty-five pharmacy students at Purdue University College of Pharmacy and found that 60% crammed for exams, while 88% expressed agreement that studying over several sessions is preferable to a single session. Only 17% reported that they studied according to a pre-determined schedule, whereas 70% indicated that they studied whatever was coming up next. When asked about how they study, 12% indicated that they try to recall material through self-quizzing and 40% would merely re-study it. Sansgiry et al.[9] surveyed a total of two-hundred forty-four students at two colleges of pharmacy (University of Houston and Howard

Table 1
Optimal Study Strategies Based on Evidence vs. Less Effective Study Methods Commonly Reported in Student Surveys[a].

Optimal study strategies	Common less-effective practices
Regular spaced-out studying of material in small portions[5,13,20,23,25]	Concentrated study of massed material *(Cramming)*[6,7,8,10]
Topics/subjects mixed *(Interleaved)* when studying[5,13]	One topic/subject covered extensively *(Blocked)* when studying[6]
Studying planned out in advance according to a schedule *(With Repetition)*[9,10,16,18,20]	Studying focused primarily on the next exam or assignment[7,8,10,16]
Studying via retrieval practice (Self-Quizzing) with elaboration of meaning and application, individually or in groups[10,11,13,14,16,18,22,23,24]	Studying via re-reading, highlighting or underlining notes or text, or superficial memorization[6,8,10,11]
Studying without multitasking or disruptive distractions[27]	Studying with music, TV/video, social media interruptions or other distractions[6]
Quality sleep of at least seven h a night *(especially the night before an exam)*[36,37]	Less than seven h a night of quality sleep[36,37]

[a] This table provides a listing of evidence-based, best-practice study strategies in the left column, paired with study practices in the right column that are less likely to be effective, but are commonly reported by students in published surveys. Students who rely heavily on less-effective practices should be encouraged to alter their study habits by including a greater proportion of the evidence-based methods.