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AACP CURRICULAR CHANGE SUMMIT SUPPLEMENT

Roles of Innovation in Education Delivery

Robert A. Blouin, PharmD,[a] William H. Riffee, PhD,[b] Evan T. Robinson, PhD,[c] Diane E. Beck, PharmD,[b] Charles Green, PhD,[d] Pamela U. Joyner, EdD,[a] Adam M. Persky, PhD,[a] and Gary M. Pollack, PhD[a]

[a]Eshelman School of Pharmacy, University of North Carolina
[b]College of Pharmacy, University of Florida
[c]School of Pharmacy, Western New England College
[d]The University of North Carolina at Chapel Hill

This paper reviews trends in higher education, characterizing both the current learning environments in pharmacy education as well as a vision for future learning environments, and outlines a strategy for successful implementation of innovations in educational delivery. The following 3 areas of focus are addressed: (1) rejecting the use of the majority of classroom time for the simple transmission of factual information to students; (2) challenging students to think critically, communicate lucidly, and synthesize broadly in order to solve problems; and (3) adopting a philosophy of ''evidence-based education'' as a core construct of instructional innovation and reform.

Keywords: blended learning, distance education, e-learning, learning environment, online learning

INTRODUCTION

Although many of our colleagues in the academy might protest vociferously, we contend that higher education has focused for far too long and much too closely on the wrong metric of student performance, and that this misguided focus, however practical and well-intentioned, has influenced virtually all aspects of the educational enterprise. The *raison d'être* for higher education is simple and straightforward: to prepare students, predominantly young adults, for future success. Success, of course, can be defined in many ways: the ability to pursue and advance in the career of one's choice; the ability to contribute meaningfully to one's community; the ability to pursue an ''intellectual life.'' The challenge to higher education, and where we contend that the academy has failed, is in measuring, in a meaningful way, the success of our students. This failing is particularly problematic for programs that prepare students to pursue a specific profession, such as pharmacy, as compared to those that provide a broader liberal arts experience.

Instead of attempting to assess the true impact on students, educational programs at all levels have focused on easier, and arguably more objective, metrics: course grades, aggregate grade point averages, and scores on standardized examinations. These short-term endpoints have resulted predictably in short-term thinking by all parties associated with the educational enterprise. Students, for example, often focus on what is required to achieve a particular grade in a given course. How many times have we listened to our faculty colleagues complain about students asking the question: ''Will this material be on our exam?'' (In contrast, how frequently do we hear our students ask the more intellectually satisfying question, ''How will I be able to use this material once I am in practice?'') Similarly, classroom instructors focus predominantly on content or technical aspects of application. While this is viewed as providing the necessary foundation upon which students can build in a discrete discipline, valuable opportunities to help students learn how to think, rather than simply what to remember, are lost. Moreover, entire educational systems focus on end-of-course, end-of-grade, or end-of-program performance measures to document ''good'' or ''effective'' teaching. In the view of many, this was the fatal flaw in the ''No Child Left Behind'' act: to demonstrate effectiveness, schools were, in essence, coerced to prepare their students for standardized tests for their grade level rather than for longer-term educational success – an example of the classic error of ''winning the battle but losing the war.''

The focus on content mastery by students, which by definition places content delivery as opposed to the student at the center of the educational process, has other, somewhat more insidious, implications for selecting the ''players'' in higher education. Students are recruited and ultimately admitted largely based on prior academic performance. Those of us involved in the recruitment and admissions processes of course believe we are pursuing

Corresponding Author: Robert A. Blouin, PharmD, Dean, UNC Eshelman School of Pharmacy, Beard Hall, Campus Box 7355, Chapel Hill, NC 27599-7355. Tel: 919-966-1122. Fax: 919-966-6919. E-mail: bob_blouin@unc.edu

a holistic approach that considers the full range of student attributes, from intellectual capability to communication skills to civic-mindedness. In the end, though, decisions are based predominantly on 2 factors: grade point average (from high school or a prior post-secondary program) and standardized test scores (SAT Reasoning Test, ACT, Pharmacy College Admission Test). Grade point average (GPA) and test scores are reflections of a student's ability to master content and, to some extent, utilize content in limited technical ways. As such, they are appropriate indicators of the likelihood of success in the next level of content acquisition, but do not necessarily reflect a student's capability of integrating that content, in a meaningful way, into a long-term professional career. We as an academy have made little progress in developing effective approaches to evaluating a student's critical thinking and problem-solving skills. These arguably are important characteristics that should be included in the recruitment and admission of students into a professional program. Moreover, we tend to do little to develop these skills in our students once they have matriculated into a program.

The second group of "players" in higher education of course is the faculty. Faculty selection is typically but inappropriately driven by the need to deliver specific content so that students can master that content. What happens in schools of pharmacy when the only faculty member with content expertise in physical pharmacy, for example, retires? The answer is both simple and predictable – hire another physical pharmacist! Other, competing needs of the institution are ignored; the first priority is to hire someone, *anyone*, who can effectively deliver physical pharmacy content to students. Can the selected candidate pursue a reasonable level of scholarship (an important characteristic of "faculty" in most colleges and universities)? Excite students about her or his area of expertise? Model and develop critical thinking and problem solving in these students? Attract extramural funding? Contribute to graduate education? These characteristics often tend to be viewed as "luxury items," resulting in a relative inability to make strategic decisions regarding faculty recruitment and retention.

As long as the standard practice in the academy is to focus on short-term educational outcomes measured as the lowest common denominator, simple content delivery and mastery will always drive decisions made by programs, by individual faculty members in the classroom, and by students. Given the increasingly sophisticated nature of technology as applied to content delivery, together with the ever-expanding body of content that experts in each discipline believe their students must master, the importance of the classroom (not to mention the campus) will be in question. From the students' perspective, what value is added by attending class, if the primary (or only) activity is communication of content from the faculty member? Oftentimes content can be acquired more efficiently, and sometimes even more effectively (at least in the students' view), by means other than attending lecture. If students opt to distance themselves from the classroom experience, primarily because faculty cannot demonstrate the value of that experience, what will "traditional" higher education (including pharmacy education) look like 20 years from now? Will the standard become programs offered in the manner currently utilized by online degree-granting institutions? Is that the best we can do?

We firmly contend that we can, and must, do better. As members of the academy, we have chosen to lead an "intellectual life," and aspire to inculcate our students to do the same. How do we advance that lifestyle to our young colleagues without modeling very specific behaviors in the classroom, behaviors that go well beyond the simple transmission of factual information? For those of us who practice our craft at public institutions, do we believe that the taxpayers who defray the costs of educating the young citizens of their state deserve better than what the predominant approach to classroom instruction can deliver? We believe that the public deserves our very best effort. To provide that effort, we must rethink, reengineer, and recommit to a truly scholarly approach to education, but one that is consistent with contemporary society.

Contemporary society is addicted to metrics. From baseball to the stock market to the educational enterprise, we tend to utilize quantitative measures to understand the world around us, to predict future behavior, and to support or justify decision-making. In the particular case of higher education, the nearly single-minded focus on using GPA and standardized test scores to categorize student capabilities leads to a self-fulfilling cycle. We admit students who will perform well in the classroom, and we utilize instructional approaches that ensure those students will perform well. We hire faculty who are more or less comfortable with a content-delivery-centered instructional model, and fail to help them develop as educators. When students perform well, we pat ourselves on the back and claim that we have been responsible stewards of our young charges. Because we rarely expand our horizons as educators, we propagate this model through our example even as we prepare the "next generation" of pharmacy faculty members.

As is the case with society in general, we as an academy are addicted to numbers, simply obtained and liberally applied. If we hope to do better as educators, we must first accept that our focus on traditional metrics of student performance has been misleading, and we must commit to

developing a better approach, one that focuses on the true outcome of the educational process rather than short-term, easily quantifiable results. We therefore propose 3 areas of focus, each of which is necessary, but none alone sufficient, to achieve the true potential represented by higher education in the 21st century:

(1) The predominant use of classroom time for the simple transmission of factual information to students must be rejected. The most valuable commodity possessed by an educational institution is its faculty. It is our task to teach students the *how*, and explore with them the *why*, in our various disciplines. The *what* can be provided in a variety of ways that do not consume the majority of contact time with the instructor.

(2) Students must be challenged to think critically, to communicate lucidly, and to synthesize broadly in order to solve problems within their discipline of study. Rote recitation of factual information and limited ability to perform technical tasks are educational relics of the past century. Factual information is available to virtually everyone almost instantaneously. The modern practitioner, almost regardless of discipline, must be able to discern the important from the unimportant facts, and must be able to apply those facts in effective and strategic ways.

(3) A truly scholarly approach to educational reform must be adopted. We as an academy can no longer afford to make changes to educational practice in the hope that they will be effective, and then simply discard them when they fail to deliver. We must commit to applying the same critical-thinking and problem-solving skills that we use in other areas of scholarship, and that we profess to value in our students, to evaluate and modify our approach to education. We must develop rational hypotheses, design effective approaches to evaluate those hypotheses, and communicate the results of that evaluation to our colleagues. In short, we must adopt a philosophy of ''evidence-based education'' as a core construct of instructional innovation and reform.

Curricular Change

The 2007 AACP Academic Affairs Committee identified several drivers for curricular change. We believe that, if approached appropriately, these drivers will address many of the central issues facing higher education today. The Committee suggested that pharmacy schools may not be making use of the best learning environments, and that new learning environments that optimize use of technology are needed.[1] This driver is not unique, of course, to pharmacy, but permeates throughout higher education. The Committee also noted that significant technological innovations are increasingly common; students today are technologically savvy, and want to learn by doing and through social interactions that can be facilitated or augmented by appropriate technological tools. Finally, the Committee suggested that new research on cognition and learning supports the need to develop curricular innovations based on evidence about how students learn.

To stimulate thought and discussion about future learning environments that are most appropriate for pharmacy education and optimal use of technology for curriculum delivery, we present a brief review of trends in higher education, we characterize the current learning environments and present a vision for future learning environments, and we outline strategies for successful implementation of innovations in educational delivery. Throughout this paper, we provide recommendations for addressing the critical issues facing pharmacy education in the 21st century.

TRENDS IN HIGHER EDUCATION

Human and socioeconomic forces are driving significant changes in higher education. Insight about these forces will help pharmacy educators envision how to optimally use learning environments for curriculum delivery. In recent years, much has been written about the new generation of learners. These students have grown up with interactive technologies such as computers and videogames. Of particular note is the increasing prevalence of mobile technologies in the form of such handheld devices as cell phones and iPods. These devices have created mechanisms for facile interactivity and conveyance of information.

These learners are part of the ''Net Generation,'' a group sometimes called ''Millennials'' or ''digital natives,'' and represent the majority of undergraduate students who are currently enrolled in colleges and universities.[2-4] These students read newspapers only rarely, learn by doing, and gravitate toward group or other activities that include a social component.[5,6] They engage in multi-tasking and are comfortable with multimedia entertainment; they thrive on interactivity and have little tolerance for traditional modes of information exchange exemplified by the word ''lecture.''[7] It should be noted, however, that although these generalizations may very well have validity, socioeconomic and other factors may lead to multiple subgroups within what otherwise might appear to be a relatively homogeneous group of

learners. This uneven playing field among learners must be taken into consideration when adopting technology-based solutions in the educational arena, just as a similar uneven playing field among faculty, with respect to their level of comfort in implementing such solutions, must be considered by the academic organization.

Pharmacy, as well as other science-based disciplines within higher education, faces the challenge of a continuously-increasing body of knowledge and only a finite amount of time in which to transmit that knowledge to the learner. In the next 20 years, the knowledge technology revolution will result in a demand for graduates who are equipped to make the vast amount of information coherent by assimilating information and using it to solve real-world problems often requiring collaboration among colleagues.[8] These forces are driving more focus on constructivist and collaborative approaches to teaching and learning. The importance of lifelong learning abilities, in the face of an ever-changing knowledge environment, is self-evident. Finally, with a profession such as pharmacy, professional socialization of students is crucial. However, such socialization is inconsistent, in part due to the diversity of learning environments represented by online and other distance approaches. Mentoring and interaction with role-models is essential for appropriate professional socialization,[9] regardless of the primary mode of curricular delivery, and requires a high degree of interaction between the mentor/role model and the student that includes face-to-face encounters.[10, 11] However, the effectiveness of such strategies is unclear. Nursing educators have evaluated the professional socialization of online nursing students.[12] They found that as long as online students also have experiences in the patient care setting under the supervision of practitioners, professional socialization of students in a distance-based program is comparable to that achieved in students in a traditional program.

Recommendation 1. *As new learning environments are implemented, pharmacy schools should evaluate the impact of those learning environments on all aspects of the educational mission, including professional socialization of the students as they progress across the curriculum*.

Rising costs, shrinking budgets, and the increasing attractiveness of distance education are causing colleges and universities to reexamine the way in which curricula are delivered. In response to these changes, electronic learning (e-learning) is being implemented more frequently, creating new and exciting opportunities for educational institutions and students. The advent of the Internet, coupled with other changes (decreasing costs of computer hardware, increasing computer literacy), has enabled tremendous innovation in the delivery of postsecondary education. Proponents of e-learning see these trends as enabling collaborative teaching and learning across institutional boundaries and opening the marketplace for educational services.

While providing access to potential learners is a matter of equity and justice, proponents argue that it also is a social necessity. The standard higher education model, in which individuals devote a particular, defined period of time to gaining knowledge and skills in preparation for their working lives, suited the needs of society throughout the 19th and the majority of the 20th centuries. This model is increasingly inadequate to meet the needs of a society in which the pace of change is unrelenting and requires individuals to upgrade constantly. Securing access to educational services is essential for the continued economic and social vitality of the knowledge-based society of the 21st century.

Although visionaries focus on the social ramifications of e-learning, policymakers are more interested in what many believe to be the cost-cutting potentials of Internet-based education. There is a growing consensus that educational institutions can avoid significant capital expenditures by moving courses, sections, or class meetings out of the classroom and onto the Web. Reducing per-student "seat time" should allow institutions to serve more students without expanding the physical plant. Such considerations are becoming increasingly important as states grapple with significant budget deficits and private institutions deal with the decreasing value of endowments.

The opportunities offered by e-learning do not come without challenges. What if hundreds of thousands of students suddenly demanded access? How do schools, often ill-prepared to deliver instructional material online, respond? The fact is that e-learning is expensive to develop: instructors need to be trained; material needs to be created; assessments must be developed; help desks or online support materials must be established; electronic office hours must be held. Although a variety of curricular delivery modes have been used, data comparing the cost-effectiveness of these various modes are sparse, and little is known regarding true cost-benefit ratios.

Institutions are increasingly faced with difficult decisions related to their technology investments. When costs associated with developing, delivering, and providing support services for e-learning are closely examined, the challenges become stark. It is important, however, to recognize the potential for economies of scale. E-learning materials can be reused if properly developed, repackaged, and/or re-contextualized for different audiences, and updated when appropriate. What might have once

been limited to a single class, section, or course might be made sufficiently flexible to be used by a number of different types of students (undergraduate, graduate, professional, lifelong learners) across institutions and academic calendars.

There has been rapid growth in the number of colleges and schools of pharmacy. The growth in the number of colleges and schools of pharmacy and the graying of faculty has led to a shortage of faculty that is projected to worsen during the next decade.[13-15] The faculty shortage is further complicated by a shortage of qualified preceptors for experiential training. This situation has led to discussions within the academy regarding development of collaborative models for sharing of course material, and raises such questions as: How do we deliver our curricula with a decreased number of faculty members? To what extent does the academy need faculty members who are content experts as opposed to those who can utilize readily available content information in the context of problem-based education? Furthermore, today's economic realities are causing schools and colleges to look beyond business as usual.

Recommendation 2. *Pharmacy schools must evaluate the cost-effectiveness of curricular innovations, particularly those that are technology-based. They also must implement new learning models that meet the needs of contemporary learners and are consistent with economic and other realities of the 21st century.*

LEARNING ENVIRONMENTS

Learning environments used in on-campus education have been the gold standard for curricular delivery. As defined in Appendix 1, this encompasses the traditional classroom environment in which instruction is either instructor- or student-centered. Distance education evolved as a means for meeting the needs of individuals who could not access learning environments available on-campus. As distance education began to mature, it was realized that the distance between the student and instructor was not only geographical, but also pedagogical and psychological. This distance was coined as a "transactional distance."[16] In the last 10 years, technological advances and research about how to decrease transactional distance has led to transformations in distance education. These changes are revolutionizing learning in both distance-based and traditional on-campus courses in which "online learning" are becoming common.[17] These technologies have led to a blurring of distinctions between on-campus and distance education and are leading to an end of "distance education" as a discreet educational activity.[18] With increasing frequency, delivery is referred to as either "open" or "flexible" education,[19,20] implying that the learner can exercise more control over learning than in conventional education.

Most studies in pharmacy education concerning distance or online learning have used some mode of technology to deliver instruction to a distant campus and have compared the performance of students at the distant campus to students receiving traditional instruction on the main campus.[21-27] With one exception,[25] the conclusion has been that there is no significant difference between the 2 modes of delivery. Across other disciplines in higher education, similar studies have examined the performance of distance-based students completing coursework delivered via a new mode to students completing coursework in the traditional classroom setting,[28,29] most of which demonstrated there was no significant difference between the 2 modes of delivery.

Leaders in distance and online learning have appealed to educators to stop implementing delivery modes that only replicate traditional approaches.[30,31] They further recommend that educators move beyond conducting studies comparing modes of delivery using a hypothesis that there is a difference between the 2 delivery modes with respect to student performance. Instead, studies should explore in what ways learning differs when 2 modes of delivery are compared.[30]

Recommendation 3. *Assessing the impact of changing the mode(s) of curricular delivery is an obligation of a scholarly organization. Such assessments must be designed with care, implemented prospectively, and communicated broadly to the academy. Moreover, an effort should be made to explore "in what ways" learning differs based on delivery mode.*

Converged classrooms in which both traditional and distance-based students form 1 learning community are increasingly common. As outlined in Appendix 1, options range from the traditional class utilizing information transfer by lecture to the following: (1) the traditional class using active learning; (2) technology-enhanced classes; (3) classes that use technology to off-load large sections of content; and (4) classes that are stand-alone online entities. These changes reinforce that we must evolve from thinking about learning environments simply as an "on-campus versus distance education" dichotomy.

Advances in technology have prompted the use of a blended or hybrid learning environment. Blended learning involves the deliberate combining of both face-to-face and online learning experiences.[32] A blended learning environment supports the tenet that there is not a single, perfect mode of delivery for accomplishing all types of outcomes. Effective blended learning involves restructuring of class contact hours so that face-to-face sessions engage the learners in collaborative and inquiry-based

learning. To maximize the effectiveness of blended learning, there must be a fundamental redesign of a course with thoughtful and deliberate selection of learning strategies.

As with any generation of students, it is important to recognize individual preferences in learning and that the learning environment must be designed with this in mind. While there are many theories and classifications of learning styles and preferences, it is most important for educators to develop learning activities that address multiple ways of learning and knowing. Teaching strategies can transfer some control from teacher to learner by giving students choices in the way they learn and demonstrate their learning. Once a solid factual foundation has been constructed, most students learn best by immersion; focusing on problem-solving activities that utilize immersion principles encourage learners to build on existing strengths and knowledge to master new content and skills.[33]

Successful educators focus on the intellectual—and often ethical, emotional and artistic—strengths and development of students. Indeed, rather than thinking in terms of teaching a discrete discipline, they teach students to understand, apply, analyze, synthesize, and evaluate evidence and conclusions. They stress the ability to make judgments, to weigh evidence, and to understand one's own thinking; many stress the importance of developing intellectual habits, asking the right questions, examining one's values, recognizing moral decisions, and looking at the world in novel ways. Rather than emphasizing how well students perform on examinations, they focus on ways to transform conceptual understanding, foster advanced reasoning, and develop the ability to examine one's own thinking critically.

Good instructional design promotes better learning outcomes.[34] When designing instruction, whether synchronous or asynchronous, whether utilizing technology or not, the educational underpinnings are the same. The literature in educational theory, including that of cognitive psychology, provides a framework for course design. Most significant are the seminal works describing "How People Learn"[35] and Chickering and Gamson's Seven Principles of Good Practice.[36] Table 1 summarizes the 7 principles that represent good practices which can enhance the quality of learning.

The importance of good instructional design has stimulated several initiatives in higher education in which a team of individuals collaborate in the design of a course. The National Center for Academic Transformation (NCAT) provides leadership to help colleges and their faculty use information technology to redesign learning environments that produce better learning outcomes for students and reduce the institution's costs.[37] The NCAT course redesign methodology is accomplished by a team that includes faculty members, instructional designers, technology experts, administrators, publishers, and other software vendors. To increase scalability of this institution's efforts, the NCAT is helping institutions implement this course redesign model. At most institutions, course redesign has been accomplished with large enrollment courses. However, the course redesign methodology is applicable to courses in a pharmacy curriculum.

Table 1. Chickering and Gamson's Seven Principles of Good Practice[a]

Good practice:
(1) encourages contact among students and faculty.
(2) develops reciprocity and cooperation among students.
(3) uses active learning techniques.
(4) gives prompt feedback.
(5) emphasizes time on task.
(6) communicates high expectations.
(7) respects diverse talents and ways of learning.

[a] Chickering and Gamson revised these 7 principles in the late 1990s to include the role of educational technology. From: Chickering AW, Gamson ZF. *Applying the Seven Principles for Good Practice in Undergraduate Education*. San Francisco, CA:Jossey-Bass Inc.; 1991. Reprinted with permission of John Wiley & Sons, Inc.

Other initiatives that use a team approach in integrating the use of technology within a learning environment include the Visual Knowledge Project[38] and the Open Knowledge Movement.[39] Teams participating in the Open Knowledge Movement include not only content experts, but also instructional designers, cognitive scientists, and curriculum and assessment experts.

Recommendation 4. *Course design should involve a team of experts including not only content experts, but also individuals such as instructional designers, cognitive scientists, publishers, software vendors, and curriculum and assessment experts*.

EVIDENCE-BASED EDUCATION

Adoption of innovation should be based on solid evidence of a positive influence on learning outcomes (ie, evidence-based education). The White Paper on Best Evidence Pharmacy Education (BEPE) outlined recommendations to educate the academy regarding an evidence-based approach, and included recommendations for how to foster a culture that supports evidence-based practices.[40]

A first step in developing evidence-based education is to document the effectiveness of curricular innovations. In higher education, the Virtual Knowledge Project and the Open Knowledge Movement are engaging faculty in the scholarship of teaching as they develop new technology-enhanced learning environments.[38,39]

Adopting a philosophy, model, and culture that facilitates, values, and recognizes the scholarship of teaching

and learning is not without challenges. Faculty members have indicated that a lack of adequate incentives and compensation, plus the lack of tenure and promotion guidelines that support the scholarship of teaching and learning, are barriers.[41] Perhaps the most significant hurdle, however, is that most faculty populating institutions of higher education have not been trained as educational scholars. They are quite comfortable pursuing scholarship, often in the form of traditional research, in their specific areas of expertise (among pharmacy faculty, those areas would represent various aspects of the pharmaceutical sciences and related disciplines that in the aggregate compose academic pharmacy). They almost never have experience, expertise, or confidence in developing hypotheses or applying the scientific method to issues related to teaching and learning.

Recommendation 5. *AACP should explore initiatives in higher education where faculty members are accomplishing the scholarship of teaching as new learning environments and curricular delivery models are developed (or there is course redesign) to determine the applicability of these initiatives to pharmacy education*.

A VISION FOR LEARNING ENVIRONMENTS

As technology continues to evolve, we envision a future in which there are multiple different options when selecting a learning environment for a course. We envision a time when pharmacy faculty members select the best learning environment based on thoughtful reflection about the intended learning outcomes, as well as consideration that students present with different learning preferences. Because good course design is complex, design and planning of a course will involve a multi-disciplinary, team-based approach rather than effort by only 1 or a limited group of faculty members. This team will develop a methodology so that the curricular design can become evidence-based, and that the scholarship of teaching is accomplished during the process of course design, planning, implementation, assessment, and revision.

There are many examples of institutions that have improved the quality of student learning using online learning approaches. We envision that future courses in pharmacy education will exhibit 5 key attributes that have been shown, by scholars in other disciplines, to improve student learning.[31] First, at the beginning of the course, there will be an initial assessment of each student's preferred learning style and knowledge/skill level. The assessment findings will then be used by the student to efficiently guide them through the course. These courses also will use computer-based tutorials to deliver content so that class time is focused on more active forms of student learning. Computer technologies also will be used in these courses so that faculty can provide students with individualized tracking of their progress and performance. There also will be continuous assessment imbedded within the learning activities. Computer-mediated conferencing also will be used to increase the human interaction. These attributes will reduce transactional distance or in some other way improve pedagogy.

We also envision a future in which pharmacy practice experiences benefit from innovative course approaches that include virtual patient and clinical practice environments.[42] Although such environments cannot replace actual practice experiences, they can prepare students efficiently for these experiences and reduce the teaching burden of preceptors. Courses which utilize virtual learning environments will be expensive to develop; however, when used across multiple institutions, the cost per student is reduced.

We also envision a future in which a quality framework will be used to guide development of new technology-enhanced learning environments for pharmacy students. An example of such a framework is The Sloan Consortium Quality Framework. This framework focuses on 5 pillars that promote achievement of a quality online learning environment. These 5 pillars are: learning effectiveness; cost effectiveness and institutional commitment; access; faculty satisfaction; and student satisfaction. Each pillar has an established goal, examples of best practices, metrics, and progress indices.[43] This framework can guide pharmacy educators in comparing the cost-effectiveness of various learning environments.

A well-designed course will require the fiscal, human, and physical resources previously described. To develop such high-quality courses in pharmacy education, multiple institutions will collaborate in course design. These courses then will be used by many pharmacy schools and colleges so that scalability can be achieved and the cost on a per-student basis will be decreased.

Recommendation 6. *AACP should provide programming to assist faculty and schools or colleges in understanding evolving learning environments and appropriate selection of the best learning environment for a particular curricular element. AACP should also explore curricular frameworks that have been developed by organizations such as the Sloan Consortium and identify frameworks that can guide pharmacy schools in developing quality courses*.

STRATEGIES FOR IMPLEMENTATION

Why is changing teaching practice difficult? One reason is that faculty members often feel fully occupied with their existing teaching, research, and service

obligations.[44-46] Consideration of whether or not to change an educational strategy or approach (or even to alter basic content) often is a low priority; once a decision to change is made, implementation can be slow, incomplete, and ultimately ineffective (or would be judged so if time and effort were invested in measuring efficacy). Faculty members often are resistant to adopting a learner-centered (as opposed to an instructor-centered) approach because they feel learner-centered approaches would negatively influence the content and rigor of the course or simply because they may lose some measure of control.[47] In general, change can be threatening, and therefore creates anxiety and invites resistance. Finally, faculty members have spent hundreds to thousands of hours teaching in a particular manner, which shapes their beliefs about optimum educational strategy. These beliefs can become a major force preventing change.

In a comprehensive review of the literature, Bland et al identified processes that support successful implementation of curricular innovation. These processes include building a cooperative environment, involving the institution's members as active participants, supporting faculty development, developing a mechanism for evaluating the innovation, and effective leadership. Other important factors include good communication, a structure for rewarding faculty efforts, and understanding that there will be a ''performance dip'' as the innovation is implemented.[48]

Motivational theory suggests that students and faculty alike will engage in tasks when they perceive such tasks to be of personal value and have an expectation of success, and that it is possible to create an environment in which people can motivate themselves. This environment must meet several criteria: provide positive reinforcement, convey enthusiasm, create awareness of value, maintain global awareness, cultivate personal responsibility, foster supportive interpersonal relationships, link an individual's intrinsic self-interest with the program, and structure experiences that show relevance. Although many factors contribute to the development of a positive organizational climate, a condition of trust and confidence must be present if efforts to motivate faculty members are to be successful. Without such confidence, faculty members will be reluctant to invest the time and energy required to change their teaching practice.[49] This may become increasingly important in pharmacy as we have seen an expansion in schools and colleges of pharmacy and the need for more administrators and principal change agents.

Renewing the curriculum has long been recognized as an effective means of capturing faculty interest and harnessing faculty energies in service to the institution.[49] Faculty members must understand the curriculum as a plan for learning, not merely a collection of courses for which they are charged with managing. With the increasing amount of information in health care, frequent updates to our ability-based outcomes from accreditation standards, and general changes in accreditation standards, it becomes increasingly important to build curricula with flexibility to incorporate change and faculty members should understand that curriculum evolution is necessary.

Many worthwhile changes in higher education have failed because change was introduced prematurely. As adult learners, the learning style of most faculty members requires information and a rationale for change in order to understand and accept a proposed change. The time required for investigation, questions, dialogue, and reflection is essential to facilitate this process. It is equally important that faculty members take responsibility and be prepared to implement a proposed change.

In times of faculty shortages and budget cuts, it becomes increasingly important that faculty be multitaskers, that is, address multiple aspects of the institution's broad mission. For the development of educational practices that go beyond the traditional lectures, however, the time that must be dedicated to the teaching mission could increase markedly, making it increasingly difficult for faculty members to balance the traditional 3-legged stool of service, scholarship, and teaching. Blended learning environments, or any environment in which students are responsible for a portion of their learning on their own, will require more faculty time to monitor. Sometimes this time investment may be frontloaded to design the environment and less time during the semester because students are taking increasing responsibility for their learning. In addition, these strategies are usually reusable year to year, requiring only some minor updates; thus over time, some of the time requirements will lessen.

Faculty members tend to teach the way they were taught, and most were taught with traditional lectures. Faculty members also tend to view lectures as an effective method of teaching. There is no argument that lecture is a good means to transmit information. In this information age, when information is easy to find, other teaching approaches are required to facilitate the skills students need to apply information, communicate, and reason. Lecture is a relatively poor way to develop these skills.[50] Faculty development is a key part to changing culture, including implementing instructional change. Several key principles to faculty development have been articulated;[51] building stakeholders by listening to all perspectives while maintaining a neutral posture and ensuring effective program leadership and management might be the most important of these. Research suggests that a critical

part of success in teaching development programs is having someone in a position to manage and lead the effort.

Leadership in faculty development needs to include well-respected teachers who are responsive to faculty needs. In addition, administrative commitment must be cultivated. Optimally, the administration provides the budgetary support for the program but everyone in the school must agree that teaching is important to their program's success. Faculty members also must believe that good teaching is valued by the institution. Faculty development programs must adopt guiding principles, clear goals, and assessment procedures of their efforts. During the goal development process, it is important not to raise expectations that the program will do everything, but rather will prioritize effort.

Faculty programs should offer a range of opportunities (eg, workshops, newsletters, individual consultation) but lead with their strength. As most colleges and schools of pharmacy have faculty members in different stages of their careers, it is important to address the needs of as many faculty members as possible. This may be increasingly appropriate in pharmacy, as certain areas of the field are dominated by more senior faculty members. Engaging these senior faculty members can be an important step in institutional change. Programs should encourage collegiality and community. Creating a collaborative culture is necessary and faculty members need the support of others, including faculty members within and outside their disciplines. Finally, programs should provide measures of recognition, with transparent processes that have clear criteria.

Innovation, in education or other venues, rarely waits on evidence of worth, and demonstrating worth does not guarantee adoption of the innovation. Research in innovative teaching practices relies on comparative studies in which 1 educational intervention or treatment is evaluated against another. This approach is similar to what is observed with evidence-based medicine: most ''facts'' are comparative rather than absolute. Since most assessments are comparative, they raise questions about what is similar and what is different between various situations.

There are several key points to consider when assessing innovative practices.[52] It is not always clear what should be measured. Educational innovations can produce a number of effects which may affect people in different ways. Choices have to be made about what and how to measure. Sometimes it is grades, attitudes, or even cost/resource allocation. It is not always clear who is responsible for the outcome associated with an educational intervention or treatment. Those involved in promoting or evaluating an innovation sometimes take it for granted that the intervention was directly responsible for the outcome. There is no simple relationship between the documentation of benefits and changes in educational practice. The ideal image of robust educational evaluation leading to a change in practice is the exception rather than the rule. Practices often change prior to the availability of firm evidence of efficacy (and sometimes in its absence). Similarly, practices can persist even when evidence indicates they should be abandoned. Finally, students' relationship with the educational system is not a single contact point – they are influenced by numerous factors. Students are participants in innovation; they need to perform in certain ways to make the innovation successful, and they feel (and co-create) its effects. However, they are first and foremost recipients of education; they need to submit to assessment practices in order to succeed and gain certification and they are not, of course, completely free agents.

Recommendation 7. *Pharmacy schools should use multiple strategies that have been shown to promote successful curricular change*.

CONCLUSION

Colleges and schools of pharmacy are home to a rich diversity of student learners. For the past 15 years and into the next generation, student culture has been impacted tremendously by the digital revolution. These students grew up communicating and sharing resources through the Internet. They are poised to take advantage of the digital world for learning. The question arises, are faculty members and institutions ready to take advantage? We should not jump headfirst into this potential digital cauldron without taking stock of an important detail which is shared with all technologies and instructional practices: we must not only understand their potential to impact deeper learning in students, we must also understand their limitations as a means to achieve deeper learning. It is not the lecture, cooperative learning, or the problem-based method itself that enhances student learning any more than it is the Internet, podcasts, or simulations. It is far more important to know how to use the instructional methods and technology to support learning outcomes that are integrally linked to the student learner as a critical, practical, and creative thinker. Students may know how to navigate the Internet and use other forms of digital technology for purposes of their own learning, but do they know how to take full advantage of those technologies for learning at the professional level? In today's educational climate of decreasing state support and public scrutiny of educational spending, universities can ill afford to squander important dollars on technology resources that have not been critically assessed in terms of supporting student learning.

REFERENCES

1. Bradberry JC, Droege M, Evans RL, et al. Curricula then and now—an environmental scan and recommendations since the Commission to Implement Change in Pharmaceutical Education: report of the 2006-2007 Academic Affairs Committee. *Am J Pharm Educ.* 2007;71(4):Article S10.
2. Bauerlein M. *The Dumbest Generation: How the Digital Age Stupefies Young Americans and Jeopardizes Our Future (Or, Don't Trust Anyone Under 30).* New York, NY: Jeremy P. Tarcher/Penguin; 2008.
3. Howe N, Strauss W. *Millennials Rising: The Next Great Generation.* New York, NY: Vintage Books; 2000.
4. Oblinger DG, Oblinger JL, eds. *Educating the Net Generation.* Boulder, Colo: EDUCAUSE; 2005.
5. Clayton M, Brinthaupt T, Draude B. Serving students by helping faculty: encouraging instructional technology integration. *Acad Leader.* 2008;24(3):5-6.
6. Prensky M. Digital natives, digital immigrants, part I. *On the Horizon.* 2001;9(5):1-6.
7. Prensky M. Digital natives, digital immigrants, part II: do they really think differently? *On the Horizon.* 2001;9(6):1-6.
8. Wells BG, Beck DE, Draugalis JR, et al. Report of the 2007-2008 Argus Commission: what future awaits beyond pharmaceutical care? *Am J Pharm Educ.* 2008;72(Supp):Article S8.
9. Hammer DP, Berger BA, Beardsley RS, Easton MR. Student professionalism. *Am J Pharm Educ.* 2003;67(3):Article 96.
10. Motycka C, Robertson T, St Onge E, et al. Establishing professionalism in pharmacy distance education [abstract]. Meeting Abstracts, 105th Annual Meeting, July 10-14, 2004, Salt Lake City, Utah. *Am J Pharm Educ.* 2004;68(2):Article 54.
11. Talluto B, Ineck J, Keefner K, Moore F. Fostering professional development in a multipathway pharmacy program [abstract]. Meeting Abstracts, 105th Annual Meeting, July 10-14, 2004, Salt Lake City, Utah. *Am J Pharm Educ.* 2004;68(2): Article 54.
12. Nesler M, Hanner M, Melburg V, McGowan S. Professional socialization of baccalaureate nursing students: can students in distance nursing programs become socialized? *J Nurs Educ.* 2001;40(7):293-302.
13. *Research Brief Number 8: Vacant Budgeted and Lost Faculty Positions - Academic Year 2006-07*: American Association of Colleges of Pharmacy.
14. Accreditation Statistics. Accreditation Council for Pharmacy Education. http://www.acpe-accredit.org/students/faqs.asp. Accessed November 17, 2009.
15. Beardsley R, Matzke GR, Rospond R, et al. Factors influencing the pharmacy faculty workforce. *Am J Pharm Educ.* 2008; 72(2):Article 34.
16. Moore MG. Theory of transactional distance. In: Keegan D, ed. *Theoretical Principles of Distance Education.* London, England: Routledge; 2000: 20-35.
17. Garrison R. Theoretical challenges for distance education in the 21stcentury: a shift from structural to transactional issues. *International Review of Research in Open and Distance Learning.* 2000;1(1):1-17.
18. Larreamendy-Joerns J, Leinhardt G. Going the distance with online education. *Rev Educ Res.* 2006;76(4):567-605.
19. Saba F. Distance education theory, methodology, and epistemology: a pragmatic paradigm. In: Moore MG, Anderson WG, eds. *Handbook of Distance Education.* Mahwah, NJ: Lawrence Erlbaum Associates; 2003: 3-20.
20. Witherspoon JP. *Distance Education: A Planner's Casebook.* Boulder, Colo: Western Interstate Commission for Higher Education; 1996.
21. Chisholm MA, Miller AW, Spruill WJ, et al. Influence of interactive videoconferencing on the performance of pharmacy students and instructors. *Am J Pharm Educ.* 2000;64(2):152-158.
22. MacLaughlin EJ, Supernaw RB, Howard KA. Impact of distance learning using videoconferencing technology on student performance. *Am J Pharm Educ.* 2004;68(3):Article 58.
23. Malone PM, Glynn GE, Stohs SJ. The development and structure of a web-based entry-level doctor of pharmacy pathway at Creighton University Medical Center. *Am J Pharm Educ.* 2004;68(2):Article 46.
24. Ried LD, McKenzie M. A preliminary report on the academic performance of pharmacy students in a distance education program. *Am J Pharm Educ.* 2004;68(3):Article 65.
25. Lenz TL, Monaghan MS, Wilson AF, Tilleman JA, Jones RM, Hayes MM. Using performance-based assessments to evaluate parity between a campus and distance education pathway. *Am J Pharm Educ.* 2006;70(4):90.
26. Faulkner TP, Christoff JJ, Sweeny MA, Oliver N. Pilot study of a distance-learning methodology used on campus for first professional degree pharmacy students in an integrated therapeutics module. *Am J Pharm Educ.* 2005;69(1):Article 7.
27. Moridani M. Asynchronous video streaming vs. synchronous videoconferencing for teaching a pharmacogenetic pharmacotherapy course. *Am J Pharm Educ.* 2007;71(1):16.
28. Saba F. Research in distance education: a status report. *Int Rev Res Open Distance Learning.* 2000;1(1):1-9.
29. Russell TL. *The No Significant Difference Phenomenon: A Comparative Research Annotated Bibliography on Technology for Distance Education.* 5th ed. Littleton, Colo: Arello; 1999.
30. Oblinger DG, Hawkins BL. The myth about no significant difference: "Using technology produces no significant difference". *EDUCAUSE Review.* 2006;41(6):14-15.
31. Twigg CA. *Innovations in Online Learning: Moving Beyond No Significant Difference.* Troy, NY: Center for Academic Transformation at Rensselaer Polytechnic Institute; 2001.
32. Garrison DR, Vaughan ND. *Blended Learning in Higher Education: Framework, Principles, and Guidelines.* San Francisco, Calif: Jossey-Bass; 2008.
33. Jensen EP. *Brain-Based Learning: The New Paradigm of Teaching.* 2nd ed. Thousand Oaks, Calif: Corwin Press; 2008.
34. Clark RC, Mayer RE. *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning.* 2nd ed. San Francisco, Calif: John Wiley and Sons; 2008.
35. Bransford J. National Research Council (US) Committee on Developments in the Science of Learning, National Research Council (US) Committee on Learning Research and Educational Practice. *How People Learn: Brain, Mind, Experience, and School.* Expanded ed. Washington, DC: National Academy Press; 2000.
36. Chickering AW, Gamson ZF. *Applying the Seven Principles for Good Practice in Undergraduate Education.* San Francisco, CA: Jossey-Bass Inc.; 1991.
37. The National Center for Academic Transformation. www.thencat.org. Accessed November 29, 2009.
38. Visible Knowledge Project: A collaborative investigation of learning, inquiry, and technology. Georgetown University. https://digitalcommons.georgetown.edu/blogs/vkp/. Accessed September 22, 2009.
39. Iiyoshi T, Kumar MSV, eds. *Opening Up Education: The Collective Advancement of Education through Open Technology,*

Open Content, and Open Knowledge. Cambridge, Mass: The Massachusetts Institute of Technology Press; 2008.
40. Hammer DP, Sauer KA, Fielding DW, Skau KA. White paper on Best Evidence Pharmacy Education (BEPE). *Am J Pharm Educ.* 2004;68(1):Article 24.
41. Smesny AL, Williams JS, Brazeau GA, Weber RJ, Matthews HW, Das SK. Barriers to scholarship in dentistry, medicine, nursing, and pharmacy practice faculty. *Am J Pharm Educ.* 2007;71(5):91.
42. Cook DA, Triola MM. Virtual patients: a critical literature review and proposed next steps. *Med Educ.* 2009;43(4):303-311.
43. Moore JC. *The Sloan Consortium Quality Framework and the Five Pillars.* Newburyport, Mass: The Sloan Consortium; 2005.
44. Fink LD. *Creating Significant Learning Experiences: An Integrated Approach to Designing College Courses.* San Francisco, Calif: Jossey-Bass; 2003.
45. Parry J, Mathers J, Thomas H, Lilford R, Stevens A, Spurgeon P. More students, less capacity? An assessment of the competing demands on academic medical staff. *Med Educ.* 2008;42(12):1155-1165.
46. Wright M. Always at odds? Congruence in faculty beliefs about teaching at a research university. *Journal of Higher Education.* 2005;76(3):331.
47. Blumberg P. Practical tools to help faculty use learner-centered approaches. In: Nilson LB, Miller JE, eds. *To Improve the Academy: Resources for Faculty, Instructional, and Organizational Development.* Vol 27. Boston, Mass: Anker Publishing Company; 2008.
48. Bland CJ, Starnaman S, Wersal L, Moorehead-Rosenberg L, Zonia S, Henry R. Curricular change in medical schools: how to succeed. *Acad Med.* 2000;75(6):575-594.
49. Theall M. *Motivation from Within: Approaches for Encouraging Faculty and Students to Excel.* San Francisco, Calif: Jossey-Bass; 1999.
50. Bligh DA. *What's the Use of Lectures?.* San Francisco, Calif: Jossey-Bass; 2000.
51. Wadsworth EC, Hilsen LR, Gillespie KH, eds. *A Guide to Faculty Development: Practical Advice, Examples, and Resources.* San Francisco, Calif: Anker Publishing Company, Inc.; 2002.
52. Goodyear P, Ellis RA. University students' approaches to learning: rethinking the place of technology. *Distance Educ.* 2008;29(2):141-152.
53. The TLT Group: Teaching, Learning, and Technology. www.tltgroup.org/. Accessed November 17, 2009.

Appendix 1. Types of Learning Environments Based on Level of Technology Use

Learning Environment	Primary Characteristics	Content Delivery	Student-Instructor Contact	Development Effort	Skill Development	Adaptation to Learning Styles
Traditional Instructor - Centered Environment	Traditional classroom; instructor is center of attention and students are passive receivers	Lecture	Low	Low	Foundational knowledge	Low
Traditional Student - Centered Environment	Traditional classroom; student is center of attention and instructor guides students	Active lecture; students actively engaged	Intermediate	Intermediate	Thinking and communication skills	Adapts to multiple learning styles
Synchronous Video-teleconferencing Environment	Traditional classroom (instructor- or student-centered); more students may be involved at multiple locations	Various lecture approaches (active or passive)	Low to intermediate depending on instructional approach; higher student to faculty ratio	Low to intermediate	Dependent on amount of active learning	Dependent amount of active learning
Technology-Enhanced Environment	Traditional classroom (instructor- or student-centered); technologies (eg, YouTube, animations) supplement activities	Active lecture; other approaches	Various depending on approach	Intermediate to high	Dependent on amount of active learning	High
Blended (Hybrid Learning) Environment	Traditional classroom (instructor- or student-centered); some fraction of learning occurs outside the course using various technologies	Active lecture coupled with other approaches	Various depending on approach; tends to intermediate to high	Intermediate to high	Dependent on amount of active learning	High
Online Learning Environment	Majority of the course is online with no direct face-to-face student-instructor contact; environment can be instructor- or student-centered	Part or all of course is self-paced; students actively engaged in learning	Low	High	Dependent on amount of active learning	Potential to adapt to various learning styles depending on approach