ROLES OF INNOVATION IN EDUCATION DELIVERY

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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 end points 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 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 out 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 end-of-grade exams, 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 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 two factors: grade point average (from high school or a prior post-secondary program) and standardized test scores (SAT, ACT, PCAT, etc.). 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 is, of course, the faculty. Faculty selection, we would argue, 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; priority one 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 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 into 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.

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 three 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. We must reject the predominant use of classroom time for the simple transmission of factual information to students. 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. We must challenge students 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. We must adopt a truly scholarly approach to educational reform. 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.

INTRODUCTION

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. 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 socio-economic 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. These students often are said to read newspapers only rarely; it is thought that they
learn by doing and gravitate toward group or other activities that include a social component.\textsuperscript{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”.\textsuperscript{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.\textsuperscript{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,\textsuperscript{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.\textsuperscript{10, 11} However, the effectiveness of such strategies is unclear. Nursing educators have evaluated the professional socialization of online nursing students.\textsuperscript{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 post-secondary 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 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. 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? To what extent does
the academy need faculty 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 Table 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 recent 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. With one exception, the conclusion has been that there is no significant difference between the two 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, most of which demonstrated there was no significant difference between the two modes of delivery.

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

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 one learning community are increasingly common. As outlined in Table 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. 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 has clearly been shown to promote 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”\textsuperscript{35} and Chickering and Gamson’s Seven Principles of Good Practice.\textsuperscript{36} Table 2 summarizes the seven 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 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.\textsuperscript{37} The NCAT course redesign methodology is accomplished by a team that includes faculty, instructional designers, technology experts, administrators and 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.

Other initiatives that use a team approach in integrating the use of technology within a learning environment include the Visual Knowledge Project\textsuperscript{38} and the Open Knowledge Movement.\textsuperscript{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.\textsuperscript{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.\textsuperscript{38, 39}

Adopting a philosophy, model, and culture that facilitates, values, and recognizes the scholarship of teaching and learning is not without challenges. Faculty 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.\textsuperscript{41} Perhaps the most significant hurdle, however, is the fact 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 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 one 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 five key attributes that have been shown, by scholars in other disciplines, to improve student learning. 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. 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 five pillars that promote achievement of a quality online learning environment. These five 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. 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 understand 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. 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 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. 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.

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 are to be successful. Without such confidence, faculty will be reluctant to invest the time and energy required to change their teaching practice. This may become increasingly important in pharmacy as we have seen an expansion in schools and college 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. Faculty 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 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 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 multi-taskers, that is, address multiple aspects of the institution’s broad mission. For the development of educational practices that go beyond the traditional lecture, however, the time that must be dedicated to the teaching mission could increase markedly, making it increasingly difficult for faculty to balance the traditional three-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. It should be noted that 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 some minor updates thus over time, some of the time requirements will lessen.

Faculty tend to teach the way they were taught, and most were taught with traditional lectures. Faculty 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.\textsuperscript{50} Faculty development is a key part to changing culture, including implementing instructional change. Several key principles to faculty development have been articulated.\textsuperscript{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 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 its strength. As most schools of pharmacy have faculty in different stages of their careers, it is important to address the needs as many faculty as possible. This may be increasingly appropriate in pharmacy, as certain areas of the field are dominated by more senior faculty. 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 need the support of others, including faculty 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 one 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. 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 indicate 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.
CONCLUSIONS

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 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.
Table 1: Types of learning environments based on level of technology usage.

<table>
<thead>
<tr>
<th>Learning Environment</th>
<th>Primary Characteristics</th>
<th>Content Delivery</th>
<th>Student-Instructor Contact</th>
<th>Development Effort</th>
<th>Skill Development</th>
<th>Adaptation to Learning Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Instructor Centered Environment</td>
<td>Traditional classroom; instructor is center of attention and students are passive receivers</td>
<td>Lecture</td>
<td>Low</td>
<td>Low</td>
<td>Foundational knowledge</td>
<td>Low</td>
</tr>
<tr>
<td>Traditional Student Centered Environment</td>
<td>Traditional classroom; student is center of attention and instructor guides students</td>
<td>Active lecture; students actively engaged</td>
<td>Intermediate</td>
<td>Intermediate</td>
<td>Thinking and communication skills</td>
<td>Adapts to multiple learning styles</td>
</tr>
<tr>
<td>Synchronous Video-teleconferencing Environment</td>
<td>Traditional classroom (instructor- or student-centered); more students may be involved at multiple locations</td>
<td>Various lecture approaches (active or passive)</td>
<td>Low to intermediate depending on instructional approach; higher student to faculty ratio</td>
<td>Low to intermediate</td>
<td>Dependent on amount of active learning</td>
<td>Depends on amount of active learning</td>
</tr>
<tr>
<td>Technology-Enhanced Environment</td>
<td>Traditional classroom (instructor- or student-centered); technologies (eg, YouTube, animations) supplement activities</td>
<td>Active lecture; other approaches</td>
<td>Various depending on approach</td>
<td>Intermediate to high</td>
<td>Dependent on amount of active learning</td>
<td>High</td>
</tr>
<tr>
<td>Blended (Hybrid Learning) Environment</td>
<td>Traditional classroom (instructor- or student-centered); some fraction of learning occurs outside the course using various technologies</td>
<td>Active lecture coupled with other approaches</td>
<td>Various depending on approach; tends to intermediate to high</td>
<td>Intermediate to high</td>
<td>Dependent on amount of active learning</td>
<td>High</td>
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<tr>
<td>Online Learning Environment</td>
<td>Majority of the course is online with no direct face-to-face student-instructor contact; environment can be instructor- or student-centered</td>
<td>Part or all of course is self-paced; students actively engaged in learning</td>
<td>Low</td>
<td>High</td>
<td>Dependent on amount of active learning</td>
<td>Potential to adapt to various learning styles depending on approach</td>
</tr>
</tbody>
</table>
Table 2: Chickering and Gamson’s Seven Principles of Good Practice*

<p>| | |</p>
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>1</td>
<td>Good practice encourages contact between students and faculty.</td>
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<tr>
<td>2</td>
<td>Good practice develops reciprocity and cooperation among students.</td>
</tr>
<tr>
<td>3</td>
<td>Good practice uses active learning techniques.</td>
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<tr>
<td>4</td>
<td>Good practice gives prompt feedback.</td>
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<tr>
<td>5</td>
<td>Good practice emphasizes time on task.</td>
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<tr>
<td>6</td>
<td>Good practice communicates high expectations.</td>
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<tr>
<td>7</td>
<td>Good practice respects diverse talents and ways of learning.</td>
</tr>
</tbody>
</table>

* Chickering and Gamson revised these seven principles in the late 1990s to include the role of educational technology. As stated by the Teaching Learning and Technology Group:53 “If the power of the new technologies is to be fully realized, they should be employed in ways consistent with the Seven Principles. Such technologies are tools with multiple capabilities; it is misleading to make assertions like ‘Microcomputers will empower students’ because that is only one way in which computers might be used.”
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