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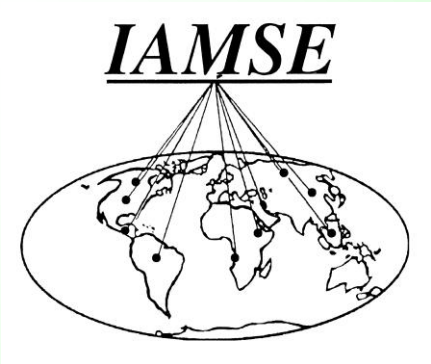

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Message from Editor-in-Chief

Uldis N. Streips, Ph.D.
Editor-in-Chief

Hello IAMSE and international reader family of JIAMSE. This is my final issue as Editor-in-Chief. As of July 1, JIAMSE will have a new editor.

Issue 20-2 represents our best effort to date. There is a variety of presentations from manuscripts to Letters to the Editor. There is a medical case on what do when a student cheats. There are monographs on medical education and research papers. I trust every one of you will find a contribution which will resonate with your own needs in medical education.

My time as editor has seen the journal grow from two issues a year with about 6-7 papers, mostly as research and commentary, to where we publish 4 times a year with an equivalent level of accepted papers, and we have developed several ways to be able to publish a peer-reviewed effort. While we have never had as extensive a volume as 20-2, our, per issue, number of contributions has steadily risen every year that I have been Editor-in-Chief. We have achieved some national listing for the journal, and our reputation as a quality journal has grown significantly. More listings are in the future and the prestige we have achieved will not fade.

I am proud of what we have achieved as an editorial board. None of this could have been achieved without the selfless and superior help of Dr. Marshall Anderson, and the superb editorial board consisting of Drs. Bolender, Crandall, Knoop, Cotter, McMahon, Seifert, May, and Lambert. Thanks to all of them for making my job easier.

So, with this Editor-in-Chief statement, my time as Editor- in-Chief ends. I have enjoyed this job, and it has been very satisfying to see so many international contributions come to fruition of publication. I hope you all will continue publishing in JIAMSE.

My very best to all of you,

Uldis N. Streips, Ph.D.
Distinguished Teaching Professor
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School of Medicine
Master Teacher, IAMSE
Editor-in-Chief, JIAMSE

LETTER TO THE EDITOR

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CAMPS (computer-assisted medical problem-solving), created in 1985 by Dr. William Schwartz, Professor of Pediatrics at the University of Pennsylvania, Medical School, was introduced at the Medical University of South Carolina (MUSC) as part of the Microbiology and Immunology course in 1988. We developed ten cases in Infectious Diseases that are an integral part of the curriculum.

In a CAMPS case, the students take a history, perform a physical examination, and order laboratory tests based on their preliminary differential diagnosis and then decide about therapy and patient disposition. They are periodically quizzed about their actions. An available feature of the simulations is the possibility to ask the students to write a SOAP note. After entering a diagnosis, they receive their grade (based on templates established by experts) with a detailed analysis of their performance and a faculty-prepared summary. The students' grades are forwarded to the teaching staff. The student is automatically requested to redo the case if the grade is below a given cut-off. At MUSC, CAMPS have been used in the basic science to add clinical context to medical microbiology. At the University of Pennsylvania, Dr. Schwartz used CAMPS to train students in the Pediatric rotations, requiring that they would write a new case as part of the rotation requirements.

In the past 5 years, a reprogramming of CAMPS was undertaken to adapt CAMPS to platform-independent Web delivery using PHP as scripting language and MySQL as the database engine. WebCAMPS has been extensively tested on a MacOSX server, but should work equally well on a Windows server and on Linux/Unix servers. Case modification and creation of new cases is extremely easy with the WebCAMPS platform, which may be used for simulation purposes in other areas besides microbiology/immunology.

Student feedback surveys have been very positive about WebCAMPS since its inception. In the fall of 2009, 80% of the students filling the course evaluation agreed with WebCAMPS' effectiveness.
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INNOVATION

Curriculum Integration: Use of Islands of Integration

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ABSTRACT

Curriculum integration can also be accomplished in smaller steps.

Many schools are undergoing major curriculum revisions to accomplish curricular integration. In some cases this involves dissolving departments, eliminating course directors, and amalgamating the courses into an integrated system. While the jury is out to see if these wholesale changes improve student learning and performance, the utility of integrating material is indisputable and was in fact already promoted by Flexner in his original report.

To accomplish partial integration in the second year of school at the University of Louisville School of Medicine, contact time (not hours) has been extended by giving the major courses, pathology, pharmacology and microbiology one extra teaching block. This modification promotes integration by overlapping all three courses for two teaching blocks. In addition, Islands of Integration have been inserted by bringing in select lectures into the curriculum of all courses. Examples include: when microbiology lectures on hypersensitivity, pharmacology presents antiasthmatic drugs; when microbiology lectures on AIDS, pathology talks about pathological changes with AIDS; when pharmacology lectures on antibiotics, microbiology talks about strategy with specific microorganisms.

By making relatively small changes to the curriculum, yet providing students with increased integration, the integrity of departmental courses is maintained and there is little danger that these changes will adversely affect the success that is currently enjoyed by our students on Step 1 of USMLE. This may provide a model for other schools contemplating curriculum integration/change.

MEDICAL EDUCATION CASE STUDY

The Case of the Cheater

Case Writer

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ABSTRACT

What do you do when faced with a student accusing another of cheating on a test?

The Case

At our medical school, we run a high-stakes examination schedule under a block type testing system. Students are tested only every few weeks and then have 4 days free before the exam, but on Friday of exam week receive a 300 question 6 part examination covering all academic subjects presented during the previous few weeks.

The test is administered in a large room where students are randomly seated with some rows vacant, but often a student can see some neighbor exam sheets. We have an Honor Code that states that any student caught cheating or observed cheating must be reported and anyone who observes cheating but does not report the incident is just as guilty.

We have a few monitors but the students are not observed constantly or even closely. We rely on the Honor Code.

After one such examination, an email came to the Chair of the testing committee that a student had been observed cheating from a neighbor and that "this was not the first case with the student and the class knew about this even last year".

The chair of the examination committee forwarded this information (the accusing student did not want to be identified) to the Dean of Student Affairs, the Education Office and Associate Dean, and to course directors who participated in the exam. The chair of the examination committee also asked for suggestions on what to do in this case.

The Dean of student affairs wrote back quickly and said the chair of the examination committee should confront the student with the accusation. However, that person was the only one who recommended direct action. All the other parties involved recommended selective seating where cheating would be impossible.

In the meantime, the chair of the examination committee determined that the accused student was a good student who had good grades and good standing. A review of examination sheets from several sections of the exam for the accused student and the possible cheating targets were compared and there was no evidence of similar wrong answers or similar scores. The chair of the examination committee felt there was no hard evidence to accuse the student because the chair had not observed this activity directly, no faculty monitor had either and this was all based on a single accusation. The chair of the examination committee decided to segregate this student into a corner of the examination room and determine how the accused student's test scores matched up to previous tests.

Questions:

1) **Should the student be directly confronted on this evidence?**
   a. **If so, by whom?**
2) **Was the decision by the chair of the examination committee correct?**
3) **What other decisions could be made?**
4) **Should the student be penalized or dismissed?**

Student Response

1) **Should the student be directly confronted on this evidence? If so, by whom?**

Yes, certainly. The responsibility presumably falls on the chair of the examination committee.

2) **Was the decision by the chair of the examination committee correct?**

Given the available information and feelings of the polled faculty members, the decision made effectively rectifies the practical concern associated with this problem, but does not appear to adequately address the ethical issue at hand.

In this case, the decision made by the chair of the examination committee reflects the common belief held by the vast majority of the committee members, and succeeds in removing the threat of future cheating by this student. Though this approach is effective at mitigating the concern of future cheating, it takes a rather ambivalent approach to the ethical conundrum at hand, sets a poor example for the student body and establishes a potentially dangerous precedent. I do not believe that simply assigning arranged seats is either prudent or sufficient given the potential recurrence of this behavior. This is almost a dismissive strategy and fails to directly engage the larger issue at hand: are the present ethics policies sufficiently strict, well known and enforced not only to identify cheating when it has occurred, but also to discourage and prevent it? Despite high standards for academic integrity and a strict honor code, numerous, often high-profile ethics violations have recently been observed at the nation's military academies, where honor and honesty are considered among the foremost principles of the institution; if such a system fails in this environment, the expectation that it is enforceable and efficacious may be unrealistic.

Though the decision made is congruent with the recommendations of the other parties entrusted with overseeing examination integrity, my personal opinion on what disciplinary action should have ensued is more along the lines of the recommendation put forth by the Dean of Student Affairs. It is my belief that there exists little harm in discussing with the student the allegation of cheating at this juncture. It is within the rights of the offending student to be informed that the infraction was reported and that he/she is likely to be monitored closely; this in and of itself may act as a deterrent for future offences, if suspicious behavior did in fact occur. The warning also provides an opportunity to observe the student specifically in future examinations and find objective evidence for his dismissal if the event recurs. A formal review of the ethics policy and reiteration of the university's zero tolerance approach to (confirmed) breaches of said policy should be made to the student body.

The collective opinion of the faculty that there is insufficient evidence based on the single complaint to justify pressing action carries some weight in the assessment of appropriateness of the incident. It is an understandable position, in the absence of a substantiated claim regarding the offence, that it would be unjust to penalize the student without proper investigation. In this respect, the committee chair's decision was prudent in protecting the rights of the student given available information at the time. It is the duty of the chair to conduct an inquiry into the validity of the claim; however this may be fraught with difficulty. A retrospective review by hand of a 300 question, multiple choice exam is unlikely to demonstrate a pattern consistent with honor code violations, unless the volume of copied material was quite substantial and copied from only one source. Additionally, any simple criteria that could be enacted in order to assess for dishonest practice would likely be somewhat arbitrary, difficult to validate, and prone to under or over-classification based on the decided threshold. To combat this, statistical approaches to assessing academic dishonesty have been proposed (http://www2.sas.com/proceedings/sugi26/p257-26.pdf) which may be useful in quantitatively determining the likelihood of cheating. It is only fair to uphold the most ethical principles in the investigation of breaches in academic dishonesty, and the most objective and impartial methods for determining guilt should be employed.

3) **What other decisions could be made?**

- Make mention of the present infraction in the student's Student Affairs records
- Review with the entire student body the existing policy on academic integrity and punishment for violations – note all students not reporting a violation of the honor code are technically culpable. This may result in increased reporting, causing the initial claim to be substantiated.
- Internally review current policies and determine if more stringent or more specifically delineated protocols need to be introduced
- Recommendation of the case for review by the university ethics board (if one exits at the institution)
- Reexamination of the student on the material to demonstrate competency/mastery

4) **Should the student be penalized or dismissed?**

This likely depends on the exact circumstance. I believe that since the consensus of the faculty involved is that the evidence put forth is insufficient to pursue formal disciplinary action, a formal penalty is not justified. If, however, the claim was somehow to be substantiated and the student deemed guilty of the offene, probation and permanent notation to the student's record is certainly justified and expulsion from the program would not be excessive, especially given the repetitive nature of the violation.

Faculty Response

1) **Should the student be directly confronted on this evidence?**
   a. **If so, by whom?**

Cheating is, of course, a serious accusation and it is understandable why the Chair of the Examination Committee would insist upon a high level of evidence before penalizing the student solely on the basis of an anonymous tip. Apart from the Dean of Student Affairs (whose high-profile might incline them to decisive action in order to avoid a "scandal" that would embarrass the organization), the lower profile Course Directors and Examination Committee Chair quickly turned to their policies regarding the security of their examinations. Clearly, there was recognition by the course directors that their examination policies were lax. Perhaps they even reviewed this accusation as an opportunity to tighten up policies that they should be changed, but had been maintained by institutional inertia.

The finding, after review of the student's academic record, that the student "had good grades and good standing" is really not relevant to the issue of cheating. If, in fact, the student had actually cheated and there was strong evidence to support that, the student should be considered for academic probation regardless of their prior level of scholarship. Therefore, prior academic performance is not appropriate grounds upon which to decide whether or not to confront the student with the accusation.

Likewise, if the student had been glancing at other students answer sheets during an examination, it is likely that this affected the answers to a small percentage of the 300 questions on the examination. It is unlikely that a statistical analysis of correct and incorrect answers from adjacent test-takers would be likely to reveal a strong enough correlation to confirm cheating. Therefore, statistical correlation with adjacent tests is not strong enough evidence to determine whether or not cheating actually occurred.

Therefore, my opinion is that the student should not be confronted on this evidence. Rather, I feel that the student should be informed of the accusation, and further informed that the available evidence is insufficient to prove or disprove whether the accusation occurred. The student should receive a letter of concern acknowledging that the evidence supporting the accusation is not strong, but that future reports of cheating will be dealt with more seriously. In addition, the letter should state that the student will have future segregation from the other students and closer monitoring during future examinations.

2) **Was the decision by the chair of the examination committee correct?**

I agree with the decision of the chair of the examination committee for the reasons mentioned above. In addition, informing (but not accusing) the student of the accusation leaves the door open for honorable behavior, and helps to cultivate the trust between students and faculty that was expressed when the faculty decided to rely on the Honor Code during examinations. In this way, the accusation creates an opportunity for professional growth and trust building.

3) **What other decisions could be made?**

The other principal options in this case are more decisive and authoritarian actions, with the most severe being the imposition of academic probation and the possibility of dismissal.

4) **Should the student be penalized or dismissed?**

On the basis of the evidence available in this case (namely an anonymous tip), I do not feel that the evidence is strong enough to support disciplinary action. In my opinion, a letter of concern followed by actions to secure testing in the future is the appropriate level of response.

As mentioned above, the examination policy for the medical school should be reviewed, and future examinations should be administered in a more secure manner.

Administrator's Response

Questions:

1) It is my opinion that a faculty member needs to observe this infraction for a student to be confronted with it. If an accusation was received, it basically gives notice to keep the accused student on radar for all classes and exams. If something is noticed by a faculty member, then the student should be confronted by the faculty member first.
2) If the question is: do you think the person was correct in forwarding the accusation? My answer is yes. I think the faculty members overseeing the course and appropriate administrators need to be made aware of the situation so that they can continue to monitor it.
3) Other decisions that need to be made are:
   a. Who gets the message with the accusation?
   b. Is the accuser a reliable source?

c. Is this a repeat occurrence that has been observed by faculty or administrators? Or are there a number of incidences and different students reporting the situation?
d. Is the accuser a bad student with a reputation of getting others in trouble who needs to be monitored?

4) No. The student should not be penalized or dismissed based on no evidence from a faculty member and very little hard evidence from one accuser.

This issue is not foreign to medical schools. There are constant accusations from students about classmates cheating or having advantages that they do not have and the mindset that other students are taking shortcuts that will help them succeed or do better. The key to this case is the fact that one student is making the accusation with no other past or present evidence to back it up.

I have not worked at an institution that relies on the Honor Code for security of examinations. The institutions I work/worked for had examination policies that included discussions about cheating. In most policies, someone at the level of faculty member or greater proctored the examinations watching students closely and constantly and ensuring that a faculty member is always present. In this case, it seems that constant supervision was not provided. If no faculty member saw the incident, the next best evidence would be a track record of problems with the accused student but that was not shown either. The student had good grades and was in good standing. In addition, the sections of the exam that were reviewed against the accuser's exam have no matching answers. The burden of proof has not been met and thus makes it hard for a dean or administrator to take the case to the next level.

In this situation, the chair of the examination committee was correct in forwarding the accusation on to appropriate faculty and administrators because a trail has to be established and the correct individuals need to take stock of the situation for future classes or examinations. However, segregating the student in a corner of the room seems unjustified based on the facts presented.

In summary, there is no reason for the accused student to be confronted with the evidence because there is no solid evidence to bring forward. Segregation of the student into a corner of the examination room without cause was unnecessary given the facts. A more appropriate set of actions could have been to make notes in both the accuser and the accused files to establish a track record and to have an administrator discuss the issue with the class in a general sense by indicating that an incident was reported, reiterating the policies on cheating, and reminding them of the Honor Code. Then, faculty could monitor both students more closely on future examinations and in future classes/clerkships.

Respondents

Student Respondent
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Faculty Respondent
Gordon Woods, MD, MPHE, College Master and Associate Professor of Medicine, Department of Medical Education, TTUHSC-Paul L. Foster School of Medicine, El Paso, TX
Administrator Respondent
Dr. Machelle Davison, Director, Office of Educational Development, Oklahoma State University Center for Health Sciences, Tulsa, OK

COMMENTARY

Using Basic Science to Develop an Innovative Program in Complementary and Alternative Medicine

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ABSTRACT

The growing interest in Complementary and Alternative Medicine (CAM) and the increasing incorporation of its modalities in the United States' healthcare system have exposed a number of problems in the field. These include a shortage of qualified CAM providers, scarcity of evidence-based research, lack of trained scientists in the field, and the ubiquitous marketing of frequently uncontrolled CAM products. Thus, the development of a comprehensive and scientifically sound educational infrastructure has become a crucial initial step in redirecting these adverse trends.

With support from the NIH-sponsored curricular CAM initiative, faculty from the department of physiology and biophysics at Georgetown University developed a M.S. program in CAM in 2003. This unique, first of its kind, science-based graduate program offers a master's degree (MS) in physiology with an emphasis on CAM. The CAM-MS degree in physiology is designed to enable students to critically assess various CAM modalities, apply scientific rigor, and carry out evidence-based CAM research. The curriculum includes core science courses and CAM-related classes. Additionally, in order to emphasize the application of academic knowledge and further strengthen problem-solving skills, the students complete an eight-week summer practicum in a professional CAM-related environment.

Here, we report on our innovative and interdisciplinary CAM graduate program where creative teaching is implemented by basic scientists and enhanced by the application of their disciplines in tandem with the clinical expertise of CAM practitioners in the community. Thus, the faculty in the Department of Physiology & Biophysics is developing emerging cross disciplinary areas of study and interest in order to prepare new generations of future physicians, health professionals, educators, and researchers capable of objectively assessing the safety and efficacy of various CAM modalities, and introducing scientific rigor to much needed research into the various aspects of CAM therapies.

INTRODUCTION

Basic science departments are facing the continued challenge to maintain their identity and are in a constant state of defending their discipline and conserving graduation programs. However, in today's era of interdisciplinary programs and translational research there may be other opportunities to use faculty expertise. The National Institutes of Health Road Map for Medical Research (http://nihroadmap.nih.gov/) delineated the importance of developing new innovative programs to promote an interdisciplinary workforce, thus encouraging the creation of interdisciplinary training programs at the undergraduate, graduate, and post-doctoral levels. In

response to this call, a group of basic scientists at Georgetown University School of Medicine launched an educational initiative focused on incorporating Complementary and Alternative Medicine (CAM) material into the medical and graduate schools curricula. As a key component of this endeavor, a CAM Master's of Science program in physiology was created and its first class enrolled in 2003.

Furthermore, it has been reported that medical students are eager to learn more about CAM during their academic training. As part of a broad survey conducted at six medical schools in the United States (Georgetown University), United Kingdom (two schools), Canada, Hong Kong, and New Zealand, the modified Integrated Medicine Attitude Questionnaire (IMAQ) was administered to first year medical students. Survey results indicated that 40.6% of students had previously used CAM, 22.5% had previously visited a CAM practitioner, and more interestingly, over two thirds (72%) expressed their eagerness to register in a special course on CAM.[1] This trend did not change throughout their four years of training.[2] Although from different cultural backgrounds, all students expressed interest in learning more about CAM. Moreover, voluntary participation in a survey by Georgetown University School of Medicine first and second year medical students revealed an overwhelmingly positive attitude towards CAM in general, personal use of CAM, experience with several CAM modalities, and a strong desire to acquire the knowledge base and training needed to effectively advise patients about CAM topics and refer them to CAM practitioners.[3] In contrast, a survey of US medical schools teaching CAM revealed that only 17.8% of the schools focus on critical evaluation of the scientific literature, which should constitute the key instruction in assessing CAM efficacy and safety.[4] These results clearly identify the need to incorporate CAM content into the curricula in order to enable the next generation of physicians and researchers to perform their duty in a responsible and competent manner.

The objective of this paper describes the development of an innovative program by basic science faculty that is anchored in multidisciplinary and collaborative academic activities. The primary focus of the CAM educational initiative is to train a new generation of students with a high level of CAM awareness and critical thinking. While some students' interest is pursing a doctorate degree with an emphasis on translational research, most of the graduates are opting for careers as healthcare professionals.

Program Description

The goal of this program is to offer an academically rigorous graduate education in CAM embedded in biomedical sciences. The program is designed to be completed in 11 months with 30 credit hours, but additional options are available to students who would like to extend their studies over three semesters or enroll on a part-time basis. However, due to the scope and interactive nature of the program, neither evening classes nor long-distance web-based learning are available.

Applications and enrollment have tripled since the program's inception in 2003 (Figure 1), and the number of students rose from 9 to 30. Due to the rapidly growing demand well beyond our current capacity, class sizes had to be capped at 25-30 students per year (Figure 2). To date, over 130 students joined our program and 98% have successfully completed the curriculum and graduated with a master's of science degree in physiology with CAM emphasis.

In the fall of 2005, the basic science faculty expanded the program to include prospective Georgetown University School of Medicine medical students. Thus, a five-year MD/MS joint program based on the one-year CAM-MS program followed by the four-year medical school curriculum was launched. This combined program has generated unprecedented interest among medical school candidates, as demonstrated by enrollment.

Fall Semester

Students are required to take core courses in the conventional biomedical disciplines and CAM-based courses as well as select from a number of electives based on personal interest (Table 1). Fall semester courses include:

1) *Cellular and Molecular Physiology*, which covers many topics relevant to cellular physiology, such as cell signaling, glycolysis, and stress metabolism.

2) *Introduction to Biostatistics*, which is a basic statistics course conveying fundamental theory and application of biostatistics. A solid grasp of this subject is a pre-requisite in the field of biomedicine, as it constitutes the basis for sound scientific study design and analysis.

3) *Survey of CAM* course, wherein students are introduced to the five domains of CAM, as defined by the National Center of Complementary and Alternative Medicine, which include alternative medical systems, mind-body-medicine interventions, biology-based therapies, manipulation and body-based methods, and energy therapies. Lectures cover the modalities most commonly used in the United States, i.e., acupuncture, chiropractic care, massage therapy, naturopathy, homeopathy, Ayurveda, Unani, biofeedback, mind-body medicine, and energy therapies. These topics are complemented by student presentations and discussion sessions. Students are exposed to the theory and principles of these various CAM modalities and are trained to evaluate evidence (or lack thereof) of their efficacy and safety.

4) *Conventional and Alternative Medicine in the USA: History of Conflicts and Commonalities* was developed to provide historical and sociological perspectives of the changing relationship between alternative and

Figure 1. Number of applications received per year for the past five years.

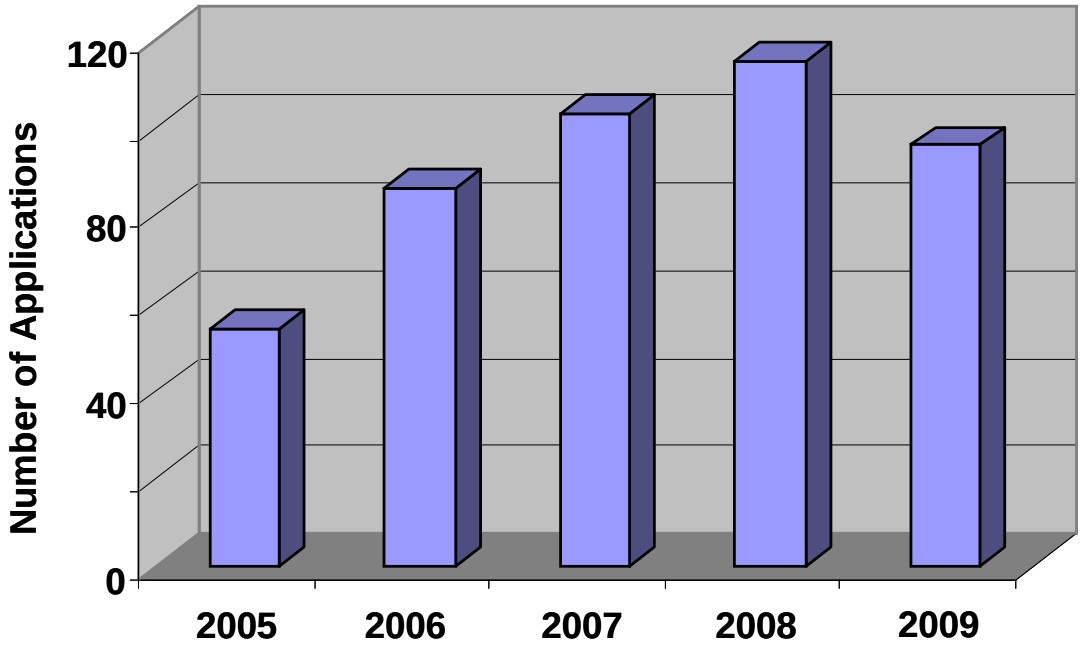
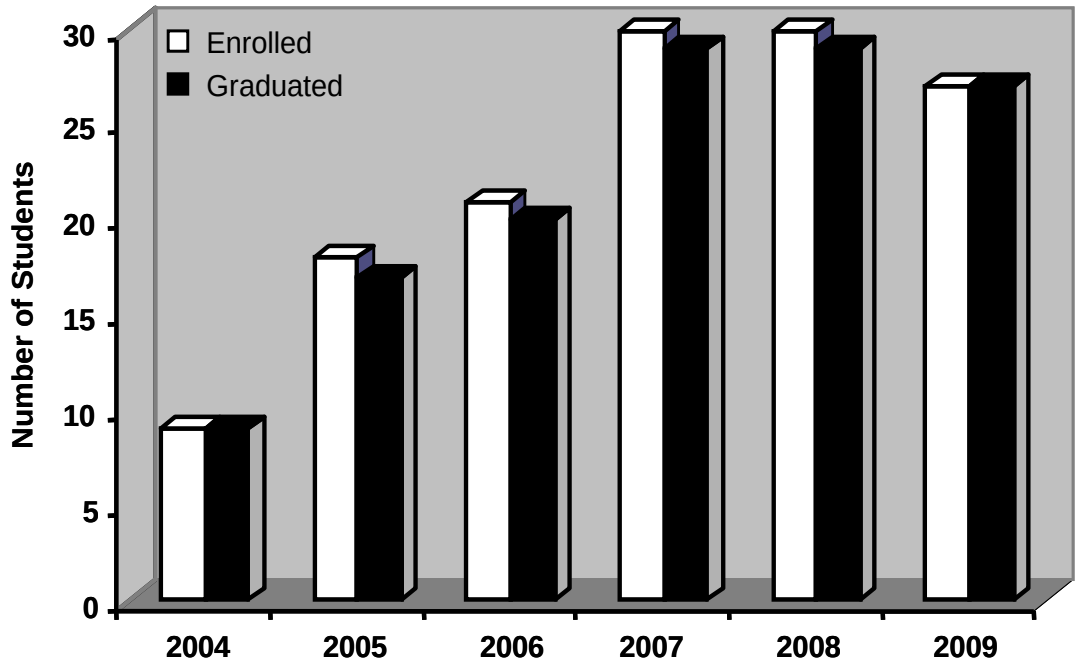


Figure 2. Number of students that enrolled and successfully completed the program.



conventional medicine in the United States. Understanding the eventful history of medicine and CAM is important in developing an objective opinion about medicine's various schools of thought.

Table 1. Summary of the CAM-Physiology MS program content.

First semester
1. Survey of Complementary and Alternative Medicine
2. Fundamentals of Biochemistry and Metabolism
3. Introduction to Biostatistics
4. Conventional and Alternative medicine in the USA: History of Conflicts and Commonalities
5. Mind-Body Medicine Skills
6. Critical Readings in CAM
7. Seminars in Physiology, Biophysics and CAM

Second semester
1. Fundamentals of Human Physiology
2. Herbal Medicine and Nutritional Supplements
3. Human Nutrition and Health
4. Physiologic Basis of Mind-Body Medicine
5. Critical Readings in CAM
6. Seminars in Physiology, Biophysics and CAM

Summer Session
1. CAM Field Practicum (Summer Internship)

Electives (selected from a longer list of elective courses)
1. Introduction to Pharmacology
2. Introduction to Physiology
3. Legal Aspects of CAM
4. Bio-ethics of Clinical Practice and Research in CAM
5. Western Practice of Eastern Medicine
6. Research Techniques Tutorial

5) *Mind-Body Skills* was designed to promote effective stress management, self-awareness, and self-care among students. Didactic and experiential learning modalities are employed to teach eleven different mind-body-medicine techniques (meditation, imagery, biofeedback, autogenics).

6) *Critical Readings in CAM* is a course that provides the opportunity to analyze, critique, and discuss key scientific publications in the field of CAM.

Spring Semester

During the second semester, students are introduced to a new set of courses spanning both conventional and CAM fields. These courses include:

1) *The Fundamentals of human Physiology* course covers the major areas of human physiology, including neurophysiology, cardiovascular, gastrointestinal, renal, and respiratory physiology, as well as endocrinology.

2) *Physiologic Basis of Mind-Body Medicine* addresses the involvement of the various psychoneuroimmulogic pathways in restoring balance and harmony and explores the physiology and mechanism of the mind-body medicine connection. The course complements the mind-body skills experiential component taught during the fall semester.

3) *Herbal Medicine and Nutritional supplements* offers an in-depth study of medicinal herbs, including their habitat, traditional use, current medical application, intentional or unintentional abuse, efficacy, and safety. Non-herbal dietary supplements are also covered in this course.

4) *Human Nutrition and Health* has been designed to emphasize the relationship between diet and health, and to introduce the concept of food as medicine.

Throughout the academic year, students attend the departmental *Seminars in Physiology, Biophysics, and CAM*, featuring invited speakers covering both conventional and CAM topics.

In addition, students have the choice of several CAM-related elective courses, such as *Bioethics of Clinical Practice and Research in CAM, Western Practice of Eastern Medicine*. In the former, basic ethical questions of

"*what treatments should be used, how should they be used,"* and *"in whom should they be used"* are discussed in order to understand how these perspectives could contribute to the right and good conduct of patient care and research. The ethical obligations to conduct effective research are also highlighted. The latter, is an overview of Western medical research studies and ancient Eastern philosophical concepts that verify the importance of the link between mind and body. In conjunction with the Georgetown University Law School, students may opt for the *Legal Aspects of CAM* course as an elective. The course features current issues and challenges pertaining to accreditation, licensing, certification, scope of practice, and litigation occurring in the field of CAM, and participants have the opportunity to directly interact with lawyers and policy makers.

This innovative educational initiative fostered a cross talk among the different Georgetown University Schools and promoted collaborative activities with the practitioners in the community. They contribute valuable insights and medical practice-based information to this program. In addition, students have an opportunity to interact and build a network with healthcare providers in the community.

Summer Session

Students are required to conclude the academic year by completing an eight-week practicum at a CAM-related workplace. The environment should contribute to the student knowledge of CAM at the clinical, basic science, educational, regulatory affairs, and policy levels. Interactions with professionals offer students the opportunity to discuss relevant issues directly with experts in the field, and reinforce their classroom learning in a manner that may be useful in their future workplace or academic setting. The practicum also provides students with a network of relevant professional contacts.

Practica have been extremely diverse and included various positions at Georgetown University and other academic institutions throughout the US, federal agencies (NIH, Federal Trade Commission [FTC], and the Smithsonian Institution), and non-profit organizations (Center for Science in the Public Interest, National Women's Health Network, Capitol Area Food Bank, Physicians for a National Health Program, and Physicians Committee for Responsible Medicine). Several students have worked at international agencies, including the Pan-American Health Organization (PAHO), and in clinical or laboratory settings in India, the United Kingdom, and the People's Republic of China (Table 2).

Students

The CAM-MS Program in Physiology is a good educational experience for students interested in (i) medicine or healthcare-related professions who also seek a solid understanding of CAM, (ii) CAM-related basic science or clinical research that might extend to a doctoral level, (iii) administrative, legislative, policy or regulatory affairs careers, and (iv) CAM-related industry. During its past seven years, the program has attracted an ethnically diverse group from excellent academic institutions across the Nation. The program has also attracted international students and the enrollment has included students and two practicing clinicians from the American University of Beirut, University of Tokyo, United Kingdom, Turkey, China, Korea, Yemen, Ghana, Vietnam, and India.

The program graduates have pursued a variety of careers. While a majority of our graduates traditionally enter medical school, others have gone on to law school, or have pursued careers in dentistry, pharmacy, veterinary medicine, and acupuncture. With over 53% of our graduates in medical training, our program's post-graduation placement rate is exceptionally high. In addition, over 30% of the program's graduates are currently in the process of applying to medical school. Those who have directly entered the workforce are now working for federal agencies, industry, non-profit organizations, and some are teaching.

Our graduates are considered uniquely qualified for CAM–related positions and have continuously secured fellowships at NCI's Office of Complementary and Alternative Medicine since 2005. Others are currently employed at the National Foundation for Alternative Medicine and the Samueli Institute (Figure 3).

The multi-disciplinary expertise of the faculty in the basic sciences, in healthcare, and in CAM was key to the launch and success of the program. Although, most faculty members are based in the Department of Physiology and Biophysics, additional faculty members from other departments and guest lecturers with exceptional skills and expertise participate in the teaching of our students and further contribute to the strength and uniqueness of this educational program.

DISCUSSION

The increasing proliferation of CAM practices is a global phenomenon that has not only been reported in the United States [5-6] but also in other countries, including the United Kingdom,[7] France,[8] Canada,[9] and Turkey.[10] The popular use of frequently unsubstantiated CAM therapies occurring in many parts of the world has lead to common concerns and calls for regulation. A nationwide survey conducted in Japan revealed a surprisingly high level of CAM use among cancer patients who had not consulted with their physicians.[11] Similar results have been reported in surveys performed in Scandinavian countries. A nationwide survey in the United States revealed the use of CAM in combination with conventional medicine in the hope for better outcomes among 54.9% of the interviewed sample population, while 50.1% had tried CAM out of curiosity [6] ignoring the notion that CAM modalities are not necessarily safe, and that complications might occur due to drug-supplement and drug-herb interactions, or as a result of inappropriate treatment by unqualified practitioners. In

Table 2. List of sites attended for the summer practica.

Category	Sites
Georgetown University	Departments of Bioethics, Family Medicine, Internal Medicine/Pediatrics, Neurology, Physiology & Biophysics, Psychiatry, Lombardi Comprehensive Cancer Center and The Arts and Humanities program.
Federal Institutions	Center for Science in the Public Interest, Federal Trade Commission in Washington, DC, National Institutes of Health: NCCAM, OCCAM, ORWH, NEI, Pain and Palliative Care Clinic.
Non-Profit Organizations	Capital Area Food Bank, DC area, Heritage Foundation, National Foundation for Alternative Medicine, Pan American Health Organization (WHO), Physicians Committee for Responsible Medicine, Physicians for National Health Plan, Samueli Institute, Smithsonian.
Other Academic Institutions and Hospitals	Beebe Medical Center, DE, Children's National Medical Center in DC, Columbia University College of Physicians & Surgeons, NYC, Harvard University-Osher Institute Johns Hopkins University, Stanford University, University of Illinois at Chicago, University of Maryland, Baltimore, Center for Integrative Medicine, University of Minnesota Center Spirituality and Healing, UCSF-Osher Center for Integrative Medicine.
Clinics	Biofeedback-Neurotherapy Centers for Washington, Center for Mind-Body Medicine, Kaplan Clinic, Lineage Natural Health, Veterinary Holistic Care.
For-Profit Organizations	HeteroGeneity, Revolution Health.
Student-initiated projects	Ethnographic Study of Herbalists in Smoky Mountain Region, Medicinal plants in Maine, Meditation for cancer patients at Lombardi Cancer Center.
Foreign Institutions	Northhampton University-UK, Research in TCM at Beijing Ji Ren-China, Waghralkar Ayurveda Hospital and Research Institute - Nagpur, India

a more recent survey, the authors also reported an increase in the use of acupuncture, deep breathing exercises and in and in meditation, massage, naturopathy, and yoga among adults between 2002-2007.[12] The lack of reliable

information regarding many CAM products and modalities combined with an insufficient CAM knowledge base leaves many physicians wondering about this emerging field. Inexperienced physicians hesitate to ask their patients about CAM, and patients frequently refrain from volunteering such information.[13-15] In addition, healthcare providers lack a standardized method to effectively document CAM use in their patient histories.[16] A recent study assessing physicians' attitudes towards CAM revealed that 61% of physicians did not feel sufficiently knowledgeable in the field, and 81% voiced the desire to receive more CAM-specific education.[17] In order to satisfy this growing need for evidence-based CAM information, and to support such information with scientific evidence, a creative model of CAM education and research based on modern technology and the scientific method has to emerge. In summary, Georgetown University's CAM-MS Program in Physiology was created in response to (i) a nation-wide consumer-driven interest in CAM, (ii) the rapidly progressing clinical integration of various CAM modalities, and (iii) the resulting demand for well-informed and properly trained healthcare providers and scientists. The development of a scientifically rigorous educational program within this field is crucial in providing the much-needed evidence-based framework and the intellectual rigor that would allow such experts and practitioners to educate, treat effectively, and distinguish facts from fiction. As research priorities at many institutions, including NIH, increasingly shift towards interdisciplinary approaches, Georgetown University's program demonstrates how faculty in basic science departments can create innovative platforms for graduate studies in emerging fields that can be solidly anchored in the scientific disciplines.

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COMMENTARY

The Development and Implementation of a Curriculum Innovation Based on Reading Published Case Studies and Biomedical Research Reports

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ABSTRACT

There is increasing recognition that experiences to help students integrate the basic sciences and clinical reasoning should be incorporated into the medical school curriculum. Many schools have adopted case study methods for this purpose in the pre-clinical years but the attempt at integration is often incomplete with failure to return to basic science after clerkships. The Medical Literature Curriculum was developed to integrate the curriculum throughout medical school by study of the medical literature as formal coursework. In the pre-clinical years, students read published case reports, while after clerkships, students read reports of clinical and translational research to return attention to the scientific basis of medicine. The program features guided independent study and large-group discussion with expert clinicians and basic scientists with the goal of modeling, from the first day of medical school, high-level clinical reasoning and the use of basic science knowledge in the discussion of clinical problems. The program has progressively grown as a feature of the required curriculum at our school. It has involved participation by faculty from nearly every clinical and basic science department and provides students with a strong message that reading the medical literature is an integral activity of the profession.

INTRODUCTION

Helping students integrate the basic sciences and clinical reasoning is an important goal for medical school curriculum planning. Introduction of case study into the pre-clerkship years is an approach used by many medical schools as a step toward this goal. The impetus for the widespread adoption of problem-based learning (PBL) is that studying clinical cases brings the basic sciences to life by highlighting their relevance in understanding disease and its management. What has been harder to achieve is a method to bring students back to a focus on the sciences after their clinical experiences in the clerkships.

In this paper, we describe a curriculum innovation that we have developed to promote integration based on the belief that a true integration of science and practice must follow from immersion in the authentic conversation of medicine represented in the medical literature. The attempt to put this into practice has led to an approach to case study in the pre-clerkship years that differs significantly from PBL[1] and to an extension of the experience beyond case study for a return to the scientific basis of medicine in the fourth year of medical school. The essence of the program is study of selected papers from the medical literature as formal coursework. We discovered early on that published

case reports provide an accessible entry into the literature for beginning students and, like case study by other methods, are a means to motivate and energize pre-clerkship students and faculty.[2] After establishing a method for studying case reports as required courses, we recognized that the approach also provides a vehicle for studying primary clinical and translational research reports later in training.[3] The method we have devised takes advantage of an unending stream of up-to-date material and utilizes large-group class sessions. These features give the program a limited cost and flexibility that allows relatively simple incorporation into most curriculum structures.

The Medical Literature Curriculum

The Medical Literature Curriculum (MLC) is a series of courses consisting of directed study of papers in mainstream medical and scientific journals. The courses run in parallel with the standard medical school curriculum throughout years one, two and four of the four-year program at SUNY Upstate College of Medicine, Syracuse, NY, and successful completion of these courses is a requirement for graduation. All three courses consist of active learning experiences comprised of: 1) independent study of assigned papers, 2) large-group class discussions of the papers with faculty experts in the areas of interest and 3) written assignments directed at specified learning objectives. Initially, during the pre-clinical years, students are directed to read published case reports to balance and promote integration of the basic science curriculum. After the clerkship experiences, students return focus to the scientific basis of medicine by studying reports of biomedical research. Throughout this extended experience, students are expected to develop increasingly sophisticated explanations and to bring ever-deepening formal analytic knowledge to their experiences.

The specifics of the methods of the program follow from the major educational goal, namely to engage students in an authentic, contemporary discussion of medicine and its supporting disciplines at the highest level possible. The assignments, the type of student-faculty interaction and the means of assessment are all designed with the intent of guiding students into that discourse. The papers themselves provide a scaffold and a target for learning. They model exemplary clinical reasoning or research approaches, showing students what a skilled physician or clinician-scientist should be capable of. The specific issues raised in the readings guide students toward filling gaps in their understanding from very basics to the edge of current understanding and into the heart of ongoing discussion of open questions. Further direction is supplied by faculty participation in discussion sessions. Using the large-group setting makes the expertise of the faculty and some uniformity of experience available to all students. The role of the faculty is to provide some additional perspective from their experience in the area of focus in the paper, oftentimes by means of some introductory comments, but ideally, the main role of faculty is to interpret and redirect the questions of students and to assure that the discussion stays on a productive course. Assessment is through "open notes" quizzes prior to class discussion directed at ensuring participation in the process. In this format, students are allowed to make use of any handwritten notes they have made while reading the paper or while doing background research either alone or in collaboration with peers. Specific objectives given to the students to help define their task while reading cases are given in Table 1 and for research reports in Table 2. The design of the quiz questions focuses on whether the students have taken adequate paths in gathering information needed to understand the specific case or research report rather than whether they have mastered some generalized body of knowledge. Question stems include phrases like "in this patient" so that even a knowledgeable physician who has not read the paper would be unable to answer them, and likewise, a student who has read the paper but has not further investigated the issues according to the stated objectives would not succeed (e.g., merely making note of the name of a drug used but not exploring the indication for its use or mechanism of action). Written assignments are submitted after the class discussion. For case studies, the assignment is to generate a conceptual "pathophysiologic hypothesis" that explains the clinical phenomena in terms of underlying disease mechanisms (an example is given in Figure 1). After submission of their hypotheses, a follow-up class session, usually led by the course director, explores a range of reasonable explanations of the phenomena in the case. Afterwards, students evaluate and grade each other's hypotheses. For research papers, the written assignments are aligned with the objectives outlined by the American Association of Medical Colleges (AAMC) Medical School Objectives Project[4] and the Liaison Committee on Medical Education (LCME) in their new standard on knowledge about research principles.[5] Our experience is that the anticipation of having to complete these written assignments drives class participation and tends to dictate the content of student questions during class sessions.

From Theory to Practice

There were initial faculty concerns that published cases such as those from the *New England Journal of Medicine* would be too complex or the discussion too specialized for medical students in the pre-clinical years. However, such misgivings about the concept of the courses are consistently undermined by direct questioning of the students. Further, the vast majority of students agree that reading published papers integrates the curriculum and is an important learning tool.

Our experience confirms Bruner's hypothesis that "any subject can be taught effectively in some intellectually honest form … at any stage in development."[6] In the past two years, we have successfully read cases of myocardial ischemia after anaphylaxis[7] and of appendicitis with an atypical presentation[8] during the first week of medical

Table 1. Objectives for study of case reports.

- Define all terms used in the case presentation and discussion.
- Make notes on the facts of the case in standard format for case write-up.
- Make a problem list. Attempt to group findings into pathophysiologic syndromes.
- Generate a differential diagnosis for each of the patient's major problems at each stage of the clinical presentation and relate the clinical data and further workup to sorting among the diagnostic possibilities.
- Determine the basis for interpretation of any special studies used in the work-up of the case or in furthering the study of the disease in question.
- Determine the mechanism of action and rationale for each drug or other therapeutic intervention used in the case.
- Summarize the prototypical features of each disease in the differential diagnosis suggested by the discussant in the case report.
- Outline the author's reasoning in discussing the diagnostic hypotheses or the results of the study.
- Construct a "pathophysiologic hypothesis" to account for the clinical findings based on the patient's underlying diseases.

Table 2. Objectives for study of biomedical research papers. These objectives are largely derived from those suggested in the AAMC Medical School Objectives Project IV[4].

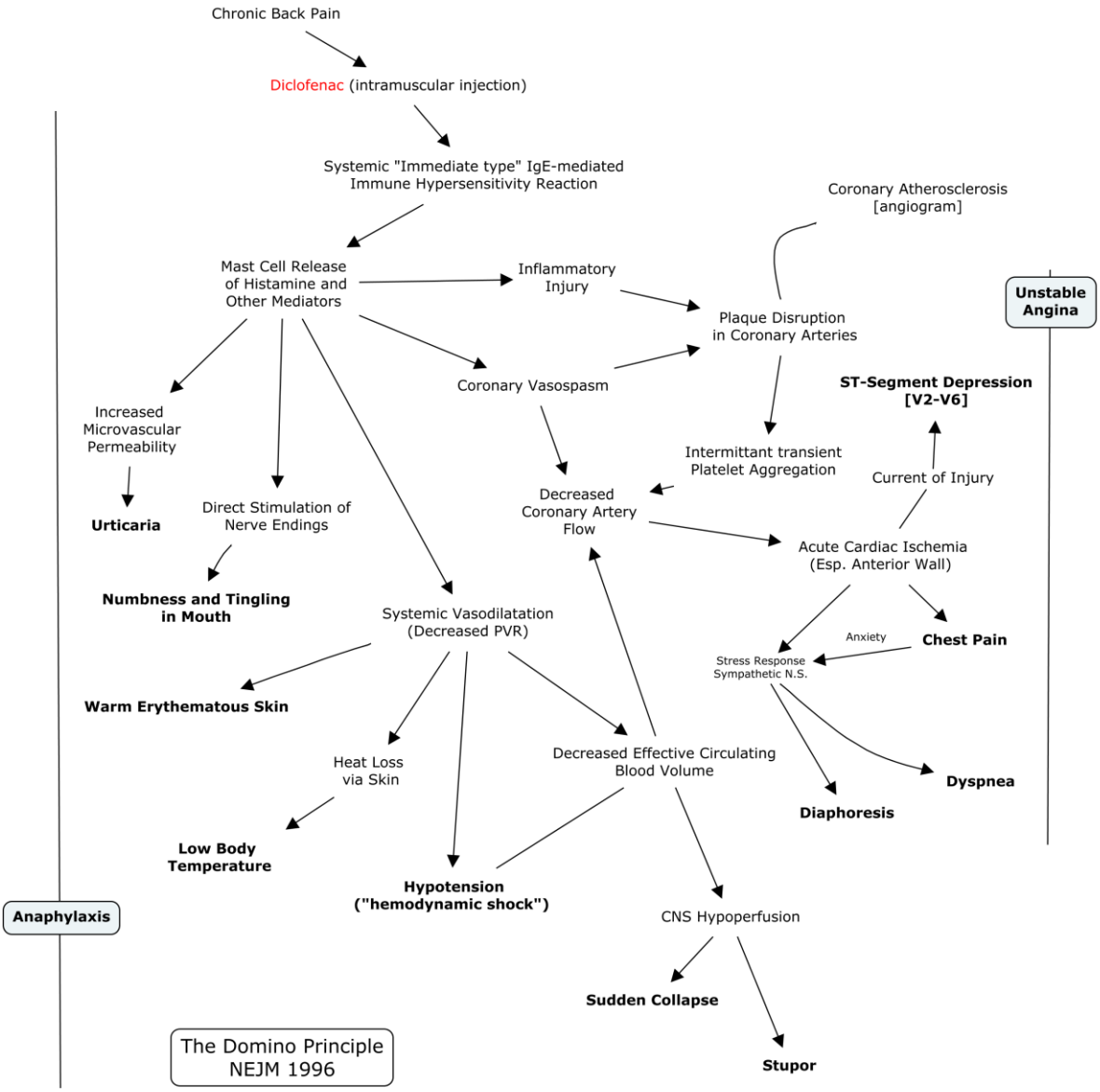
- Knowledge of the relevant background concepts in the basic sciences
- Knowledge of what is established and what the question is with respect to the clinical issue being addressed
- Ability to translate the findings of the study and the state of knowledge in the field (as represented in the editorial pieces) into lay language appropriate for communication with patients
- Ability to critically assess the information presented in terms of the conclusions drawn by the authors
- Ability to appropriately apply the findings to specific clinical problems
- Ability to suggest further research questions stemming from the study results
- Awareness of the ethical issues raised by the investigation (e.g., conflicts of interest, patient safety, informed consent, etc.)
- Attitudes of curiosity, skepticism, humility in the face of the unknown and intent to pursue a career of lifelong diligent questioning and learning.

school (chosen to loosely align with the anatomy course students were taking concurrently, thus allowing for dissections of the chest and abdomen to be coordinated with discussion of the diagnostic approaches to regional pain syndromes). Most students can relate from some past experience to the potential seriousness of allergic reactions or to the possible complexities of abdominal pain as a surgical problem. While the detailed information and formal structure of the disciplines relevant to such cases will likely be a long time coming as students progress through the curriculum, it does not preclude having a productive discussion that introduces, at least at an intuitive level, broad medical topics. Consulting a variety of recommended resources while working through these papers, the students are clearly launched into the language and ideas of medicine just a few days after arrival at medical school.

The Medical Literature Curriculum has grown to become a defining educational component of the SUNY Upstate College of Medicine curriculum. The program began as a one-credit case reading supplement encompassed within the second-year pathology course and is currently a 15-credit-hour experience (approximately 9% of the total required credits for graduation) consisting of three longitudinal courses spanning the entire curriculum (illustrated in Figure 2). This growth was gradual and largely the result of student advocacy in curriculum feedback forums in the initial phase and was later bolstered by faculty support and institutional recognition that certain desirable goals and accreditation requirements could be achieved through this mechanism.

In all then, at the present time, our students are required to participate in formal reading of the medical literature

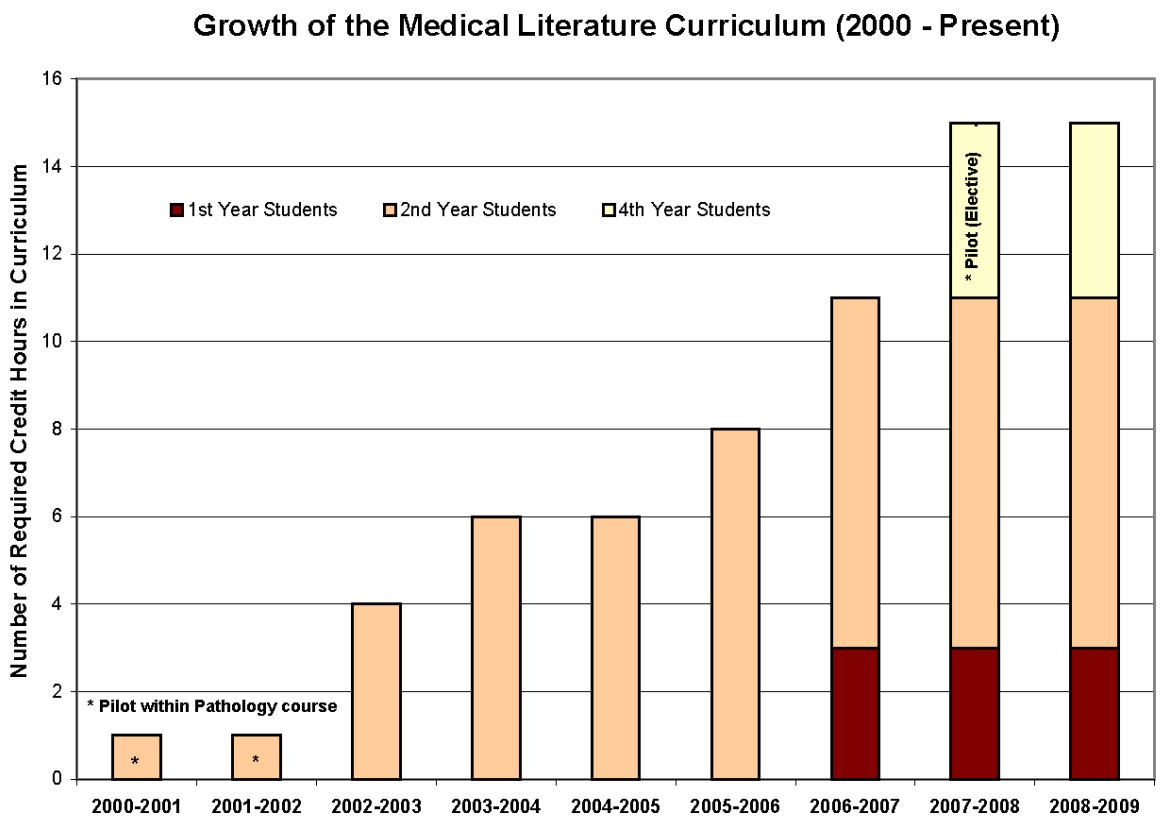
Figure 1. Sample pathophysiologic hypothesis.



The diagram shown here, created by the course director using the IHMC CmapTools (http://cmap.ihmc.us) computer software program, represents a pathophysiologic hypothesis to explain the events in a case of a patient who presents with anaphylactic shock due to a drug reaction and subsequently develops chest pain and signs of cardiac ischemia during hospitalization.[7] The goal of the exercise is to attempt an explanation of each finding in the case (bolded in the figure) with a medically and scientifically sound potential underlying mechanism. Such a conceptual representation of events is required of each student for each case along with a short written explanation of their diagram akin to a figure legend.

throughout medical school in a longitudinally planned experience that includes careful study of over 50 primary papers representing the entire spectrum of medicine (see website[9] for specific readings) and which has involved participation by faculty from virtually every clinical and basic science department in the school. The program takes

Figure 2. Growth of the medical literature curriculum from year 2000 to present.



advantage of the energizing benefits of case study to introduce beginning students to the literature. Later, it offers a mechanism for a return to basic science and for a substantive response to new accreditation standards regarding knowledge of research principles. The Medical Literature Curriculum is designed to model, from the first day of medical school, high-level clinical reasoning, use of basic science knowledge in the discussion of clinical problems and reference to the medical literature as an integral activity of the profession.

Oakeshott (as quoted in Hirst[10]) succinctly captures the overall rationale for this program. He says that we are "inheritors ... of a conversation ... [and] ... education is an initiation into the skill and partnership of this conversation." Further, this conversation consists of an "unrehearsed intellectual adventure" that is increasingly refined over generations and "which, in the end, gives place and character to every human activity and utterance." We would say that the medical literature represents the conversation of medicine in its most developed and refined form. It is the conversation that we wish our students to engage in now and throughout their careers. As such, it seems reasonable to suggest that we might best promote this by immersing the students in this literature in a formal way throughout medical school under the guidance of the faculty.

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COMMENTARY

Values, RVUs and Teaching

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ABSTRACT

Academic health centers that utilize a mission-based management system often employ metrics of faculty contributions to inform revenue distribution. These relative value unit (RVU) metrics generally omit the concept of value added to the education interaction by the faculty member's preparation and redaction. These RVU-based systems tend to incentivize functions that are part of the revenue stream at the expense of critical functions such as service to the institution on committees. Such functions go under-supported handicapping the academic environment and educational enterprise at large. Unless carefully designed, RVU systems can undervalue and inhibit collaborative interdisciplinary teaching. A larger view of duty to teaching and to the institution is advocated.

INTRODUCTION

The poet T. S. Eliot wrote the following lines for Archbishop Thomas Becket in the poem *Murder in the Cathedral*

"The last temptation is the greatest treason
To do the right deed for the wrong reason."

Faculty members in academic health centers (AHCs) are faced with increasing pressures on their time. The recent financial downturns have increased pressure on these institutions to match expenditures to revenue sources and attain the best value for each cost center. In such analyses, it follows that faculty are considered cost centers. Thus, value is often considered in terms of financial cost and choices are made for reason of cost rather than institutional goals.

On the other hand, faculty members are well aware of institutional financial pressures and likewise make choices within their degrees of freedom. Such choices include "valued," that is to say financially rewarded, activities over those that do not appear to be valued because they are not financially rewarded. The result is that many faculty functions within the AHC go under-supported. The value framework within which faculty members function needs to be reaffirmed and reset. We examine these issues in the following discussion of the value of teaching.

What is "value added" in an instructional interaction?

The concept of "value added" appears in many constructs ranging from manufacturing and processing to tax levies. To take the last as an example, the value-added tax allows the assessment of tax levies at each stage of the manufacturing process; e.g., from ore to ingot, from ingot to refined metal, from metal to instrument. Each stage of the process has made the product more able to be used as starting material for the next step and therefore more valuable and thus worthy of additional taxation.

This concept of value added also applies in the interaction that takes place between student and teacher and in the preparation that the teacher does for that interaction. Value is added to that interaction in several stages, most of which precedes the actual teacher-student interaction. We will designate these stages or phases as digestion, selection and prioritization, organization, and communication. In the digestion phase the full range of topics to be covered in a learning activity (lecture, problem-based or team-based learning session, laboratory, bed-side teaching, etc.) is digested by the teacher/facilitator. Just as the physiological digestion process means breaking down complex macromolecules to their monomeric or base units so that those units can be reassembled into appropriate structures for the body, so also the digestion phase for the teacher entails a breaking apart of the material for his/her own understanding and familiarity so that it can be presented to students in such a way as to facilitate learning. Following digestion of the material, the teacher then selects and prioritizes the content, identifying the foundational concepts that are essential for student understanding and application of the material and those that are derivative from the foundational concepts. This process permits an assessment of how much time and emphasis each component receives in order to enable the learner to reassemble the components into an ordered whole wherein each component is appropriate for both learning the material and using it in subsequent activities.

The next phase is organization. In this phase the teacher assembles the components into a framework or scaffold for the teaching interaction, ordering the material in such a way that best allows for effective presentation by the teacher so that the learner is able to acquire the information in a useful way. The teacher's organization is present in syllabus, outline, and in manner of approach.

It is not until the completion of the digestion, selection and prioritization, and organization phases are complete that the apex of the teaching interaction takes place, the communication stage. In a problem-based learning (PBL) session, for example, how the faculty facilitator helps students formulate pertinent questions assists them in identifying learning issues that will lead to solving the session's problem. In a lecture, the challenge is to enable the students to actively, rather than passively, learn the content. Thus, the use of examples, humor and analogy, as well as questions by the lecturer or learners, are critical aids in the teaching interaction in that each invites the learners' action in digestion, weighting, organization and reassembly of components into their working knowledge base.

Each of these processes adds value to the teaching interaction. Each of these is a part of the process of teaching. Each is critical to the overall process and contributes uniquely to the value added to the teaching interaction through the teacher's efforts to provide an environment in which the learners learn. The challenge, therefore, is to identify the relative value added at each stage and to assign correlative worth for each activity.

How is value added to the teaching interaction recognized?

The relative value unit (RVU) system was developed by Medicare as a guide to physician reimbursement.[1, 2] In this system, each clinical activity was assigned an RVU based on the complexity of the activity. At approximately the same time, the American Association of Medical Colleges (AAMC) began the Mission-based Management (MBM) Program to help deans and faculties of medical schools. The medical education panel of the MBM Program proposed a metric developed to create RVUs for education activities by faculty members in medical schools.[3] This system has been adapted by some AHCs or departments in AHCs to allocate resources for the various activities that serve the institutional missions.[3-6] Its use has been helpful in that it provides a method for evaluating activities and contributions from different sources and contributors. Successful use of an RVU system requires a careful analysis of the level of contribution in terms of degree of effort and relation to the overall institutional goals.

In an academic institution, three main areas of contribution are teaching, research/publication, and institutional service. In an AHC, these three areas are joined by a fourth, namely, clinical care. The utility of an RVU system depends on the ability of a system to evaluate appropriately the various contributions made across the different areas of expected (and therefore rewarded) activities and on the use of the system for all areas of activity. In AHCs, teaching takes place both outside of and within the clinical setting. Non-clinical teaching occurs during lectures and grand rounds, in laboratories, in small groups including problem-based learning, team-based learning and conference/recitation sessions, and while mentoring the research of students and trainees. Teaching occurs on clinical services during rounds, outpatient clinics, clinical conferences and case-based sessions, and in surgical or special clinical procedure rooms. How these differing teaching interactions are assigned RVUs is critically important to the reliability of the RVU-based system of accounting for faculty time and for its acceptability to the faculty.

While the AAMC suggested a mechanism for developing an RVU metrics system for teaching, the ways that various institutions or departments have calculated them are myriad. They range from a simple time-based system[7] to a sophisticated metric that measures overall academic productivity by including publishing, teaching, administration and research.[2] Most metrics start with the number of contact hours for each educational activity and include some factor for the complexity of the activity, which may include the number of students. Some systems may employ endpoint measures such as section test grades or student evaluations in the calculation. Such inclusions introduce variables into the calculation that are beyond the

faculty members' role. Moreover, questions arise as to how to equate different types of teaching. For example, how does preparing and presenting a lecture to a large classroom of 200 students compare to the bedside teaching given to 5 students during a 40-hour week clinical rotation? The product of hours times number of students is equivalent but 1 hour is far less than 40 hours in the weekly schedule. Is 3 hours of clinical bedside instruction for 5 students equivalent to 3 hours of "tankside" instruction in the gross anatomy laboratory? How are overlapping duties evaluated? For example, how much of clinical rounds is teaching vs. clinical care and how much of graduate student research training is research vs. teaching?

While these questions may seem to be fine points or details, they nonetheless markedly influence faculty satisfaction or dissatisfaction with an RVU-based system from the standpoint of the fairness of the system. The degree of dissatisfaction increases markedly when RVUs are utilized in the calculation for distribution of funds to individual departments. Dissatisfaction increases even more when RVUs are used to calculate individual salaries, particularly when these calculations lead to a decrease in remuneration. Faculty dissatisfaction with RVU systems is a significant cause for revisions of systems in order to address equivalencies.

Where RVU systems have greatest difficulty, however, seems to be in the area of universality of application. This difficulty arises from the well known observation that an institution or an individual will receive more of whatever behavior is incentivized. For the case in point, if more RVUs are available for teaching there will likely be a greater willingness to teach on the part of the faculty. Similarly, if incentives are offered for new grants, an increased number of applications will be sent to funding agencies. These are desirable results for an AHC, but if certain functions are not incentivized, the danger lies in the inability to retain active participants.

Unfortunately, adoption of the RVU system may lead to disincentivizing collaborative efforts. Instruction that involves the collaboration of faculty from different departments or disciplines can often result in disparate apportionment of RVUs, especially when RVUs are the basis for distributing educational funds to departments. Inequities can arise ranging from awarding RVUs only to the team leader/course director to too few RVUs for participant faculty whose role may be critical yet subordinate. Some departments award RVUs for departmental courses only to departmental faculty and not to faculty of other departments who teach in the course. Inequities such as these have led to some faculty members refusing to participate in interdepartmental courses because of inadequate amounts of RVU recognition in the face of their department chair's demand for high RVU per unit time. In essence, the RVU system has incentivized these faculties to place their efforts elsewhere. Thus, lack of universality of awarding and/or recognizing RVUs for teaching is a multi-headed problem for AHCs.

In addition to teaching, research and clinical care, an AHC has critical responsibilities that require the efforts of faculty as committee members, task force leaders and coordinators. These "volunteer" efforts are necessary in the normal operation of the AHC in functions such as student admissions, faculty promotion and tenure reviews, internal review boards and animal welfare committees to name only a few. These "volunteer" efforts are also critical for periodic site visits and certification reviews such as those of the Liaison Committee on Medical Education (LCME), academic accreditation agencies, hospital certification reviews and others. This latter group of external reviews requires extra concentrated effort in preparation for the actual site visit ranging from 2 years prior to site visit in order to prepare the self studies and data bases required for the visit. These efforts are not recognized by RVUs in the vast majority of institutions, although they are institutional functions. These efforts have always been assumed to be part of the "other duties not specified but part of the faculty role" and recognized as not specifically delegated but required. This lack of universality of assigning RVUs to all functions seems to us to be greater than the disparities in distribution of teaching RVUs.

DISCUSSION

Did the concept of the RVU or the RVU system as employed cause the problems described above? The answer to this seems to us to be no. Neither the RVU concept nor the RVU system causes the problems; they just lay bare the underlying issues. The real question for AHCs, and for that matter universities and colleges, is what does it mean for an institution to have a teaching mission?

To help answer that question, we would like to introduce the concept of *magisterium*. While the word magisterium has ecclesial roots, specifically in the Roman Catholic Church and other liturgical traditions, it applies to academic institutions as well. Magisterium denotes both the **authority to teach** as well as the **duty to teach**. The magisterium resides in the institution as is illustrated by the fact that the right to award degrees is given to the academic institution by the state through various licensing and review processes. Teaching in the institution is authoritative in that it is accomplished by learned degree-holding faculty. Thus the authority exercised by the institution is a corporate authority dependent on the collected expertise of the whole faculty. Licensure and certification of academic institutions is also corporate in that these processes are dependent upon review by degree-holding academicians outside the institution.

The magisterium of the institution is authoritative (knowledge-based) but not authoritarian. Rather, it is inviting, challenging and encouraging of learning and

contributing new ideas. Since the teaching authority lies in the faculty it follows that the duty to teach also lies in the faculty. This duty to teach includes responsibilities to students, the field of study and to the environment of the academic institution. Duty to students focuses on presenting the material in such fashions that students learn, recognizing that students learn in differing ways. Thus, the teacher repeatedly checks the progress of student learning through questions, conversations and tests. Duty to the field of study requires that the teacher keep current with both advances in the field and advances in teaching strategies and subsequently to adjust teaching strategies to meet the changing needs of the student population. It also requires that the faculty member contribute to the field in any of a variety of ways including publication, poster presentations, lectures, seminars on research topics, etc. Duty to the environment of the institution, it seems to us, includes by definition participation in collaborative interdepartmental/interdisciplinary teaching as well as committee work and faculty governance, which is required for the orderly functioning of the department, division, school, and institution. Since the teaching authority is corporate, faculty participation on committees and other ancillary functions is also necessary to the proper execution of the magisterium of the academic institution.

RVU systems that inform revenue distribution are accounting constructs that are useful for the maintenance of the university and for faculty remuneration. However, we suggest that RVU systems, if not well-designed or misapplied, challenge traditional values in teaching and the magisterium of the AHC. This is because RVU systems introduce a hierarchy of duties that is dependent on revenue streams. By their very nature, RVUs incentivize and prioritize duties that generate income for the institution, and therefore for the faculty member, to the detriment of those that do not.

Most academic institutions prepare budgets on the basis that every activity has an income stream. Faculty teaching effort is financed through institutional resources such as tuition, endowments, and state allocations for state institutions. Faculty research time is financed through grants, contracts, or endowment sources. For AHCs, faculty clinical time compensation is covered by clinical income. Since many of the responsibilities inherent in the magisterium of the AHC are not within the revenue stream (e.g., counseling or mentoring students or other faculty members, teaching in pre-matriculation courses, committee work, faculty governance, etc.), RVUs can be applied in such a way that faculty members are inhibited from properly executing those responsibilities.

We propose that if AHCs are going to utilize RVU systems to inform revenue distribution in a mission-based management plan, they carefully design and apply those systems in such a way that they recognize the importance of all the duties inherent in the magisterium. The faculty needs to be assured that the RVU system is equitable and reflects the importance of the faculty responsibilities to promote student education, their field of study, their patients, and the institution regardless of whether these duties are directly captured in a revenue stream.

However, it also seems to us that the privilege and duty of teaching transcends whatever construct is utilized by the institution for revenue distribution. Since the magisterium resides in the faculty, its members must take seriously their duties that come with being part of the magisterium. A faculty member's decision about whether to participate in a course should be based on expertise, interest and available time, not on the number of RVUs awarded. Faculty members also have a responsibility to advocate for teaching, for students and for the various constituencies of the institution by participation in institutional committees and faculty governance. The voice of the faculty is critical to the well-being of the institution in matters of academic policy, procedures, and standards, as well as in implementation of current curricular content. Without the voice of the faculty, the institutional magisterium falters in its pursuit of excellence.

Likewise, the administration of AHCs also has duties derivative from the institutional magisterium. High in the rank of duties would be the duty to recognize and value the contributions of all constituencies of the AHC on whose efforts the success of the AHC depends. While this certainly includes providing appropriate remuneration for all the various contributions, it is especially critical that the AHC ensure that each contributor knows, believes and can articulate the role his/her contribution makes to the institution. In a sense, this effort gives ownership of the aims, goals and success of the institution to each constituent, such that each member of the AHC becomes a valued contributor rather than just a paid employee.

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SHORT COMMUNICATION

Assessing First Year Medical Student Attitudes of Effectiveness of Team-Based Learning™

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ABSTRACT

This study explores medical student attitudes on the effectiveness of Team-Based Learning (TBL) after completing their first year in a TBL curriculum. While individual attitudes toward many aspects of TBL varied, our data suggest that TBL is seen as an effective tool for use in supplementing medical education.

Large class sizes, compromised faculty time, and an ever-expanding knowledge base have made didactic lectures the instrument of choice for many medical educators.[1] However, medical school faculty have long recognized the importance of clinical application, group problem solving, and active learning in preparing first and second year medical students for national board examinations and clinical clerkships. Indeed, since the American Association of Medical Colleges (AAMC) first recommended that a problem-based, student-centered curriculum emphasizing the integration of basic and clinical sciences should be an essential component of pre-clinical medical education,[2] medical educators have struggled to find effective teaching methods which actively engage students in the learning process. While numerous strategies have evolved to supplement didactic lectures with active learning, a paucity of information exists within the literature regarding medical student attitudes toward the effectiveness of such active learning methods.

Team-Based Learning (TBL)[3,4] is a well-defined instructional strategy, first developed for large business school classes, that is being increasingly employed in medical education.[5] It requires small groups to work together to solve problems in an instructor-led but learner-centered environment with well-structured processes of individual and group accountability (Table 1).[6] In 2002, TBL was introduced as a supplemental educational strategy into Wright State University Boonshoft School of Medicine's (WSU BSOM) predominately lecture-based preclinical curriculum. Since then, the school has been at the forefront in utilizing this innovative form of authentic assessment along with discipline- (year 1) and system-based (year 2) didactic lectures. It has created an active learning environment that promotes both mastery of the facts of course content as well as application of course concepts to solving complex clinical problems. In distinct contrast to Problem-Based Learning (PBL), the strategy

Table 1.

Components of WSU BSOM Team-Based Learning*	
Timeline	**Components**
Start of Academic Year	1) *Team Formation*: Instructor randomly assigns students to teams of 5-7. Students remain in assigned team for duration of school year (2 academic terms).
Prior to TBL Module	2) *Advance Preparation:* Students receive study materials and TBL objectives.
During TBL Module	3) *Readiness Assurance* a) IRAT - instructor administers a test composed of MCQs to be taken by each student individually. b) GRAT - all teams take same IRAT MCQ test as a group. 4) *Group Application Excercise:* Instructor has teams work on a set of very challenging, clinically-based MCQs requiring extensive problem solving / critical reasoning. 5) *Class Discussion*: Instructor moderates extensive, whole class discussion on application exercise with inter-team debate on answer choices.
End of Academic Term	6) *Peer Evaluation*: Twice each academic year students must evaluate each team member on his/her contribution to the team's productivity. Evaluations are incorporated into term grade.

* Adapted from Parmelee et al., 2009[6]
IRAT = Individual Readiness Assurance Test; GRAT = Group Readiness Assurance Test
MCQ = Multiple Choice Question

involves one to three faculty for a session conducted entirely in one room.

Numerous studies have shown that TBL incorporates effective small-group learning into large group lecture-oriented classes, thereby increasing student participation, preparedness, communication, teamwork skills, and knowledge outcomes.[1,5,7-9] However, it is critical that one not underestimate the importance of student confidence in judging the worthiness of any active learning experience.[10] Pre-clinical students frequently feel overwhelmed by the amount of information they must acquire through individual study, sometimes resulting in skepticism toward active learning exercises that require large investments of time in exchange for questionable gains in factual knowledge.[1] Often, in spite of the fact that active learning methods incorporate and/or prepare students for course specific summative testing (ex: IRAT/GRAT, Final Examinations), students instead prefer the safety and assurance inherent in an efficiently taught lecture covering only information pertinent for national board examinations and "real life" medical situations. The specific aims of the current study were to ascertain student perspectives regarding the effectiveness of TBL compared to other active learning strategies in fostering critical reasoning and clinical problem solving skills and determine which aspects of TBL are particularly effective or ineffective at promoting retention of course material as indicated by subjective student experience on exam performance.

With institutional review board approval, the 2008-2009 first year class at the Wright State University Boonshoft School of Medicine participated in this study. In a classroom setting at the end of their first year in a medical school curriculum supplemented by TBL, laboratory exercises, case discussions, and "audience response"

lectures, students anonymously completed a 20-item Likert Questionnaire (1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree) with 2 "write-in" prompts to assess attitudes toward different aspects of TBL compared with other active learning educational strategies. The survey, developed after a thorough literature review to assess intended outcomes of TBL, was approved by WSU BSOM course directors and TBL moderators. The questionnaire took approximately 15 minutes to complete. Response rates were 100% (n=94) for Likert questions, 38.3% (n=36) for write-in prompt 1 and 48.9% (n=46) for write-in prompt 2.

The preponderance of student responses in the "neutral" range of the Likert scale indicates there is a great deal of variability among student attitudes regarding various aspects of TBL. However, several trends are apparent within the data. Of students polled, 82.9% reported that they "agree" or "strongly agree" with the statement that readiness assurance testing creates manageable deadlines between course examinations (Table 2 Question 14; Table 3). By fostering advanced preparation, TBL helps students who may be less intrinsically motivated to properly structure their study time. Accordingly, 65.9% of students reported they "agree" or "strongly agree" that preparing for TBL is an effective use of study time (Table 2 Question 5; Table 3). It further appears that intellectual gains fostered through TBL extend beyond the mere act of preparing for and taking readiness assurance tests. Our data suggest that a majority of students view the time spent in TBL as a worthwhile learning experience (Table 2 Question 6). Indeed, if this were not the case, periodic individual multiple choice quizzes could replace TBL. It should be noted, however, that data from written responses indicate the process may be more effective with an increased basis on conceptual lecture materials as well as making the clinical cases more applicable to the daily practice of medicine (Table 3).

By allowing for directed small group discussion among peers, 77.7% of students reported they "agree" or "strongly agree" that concepts covered during TBL are more effectively learned than through independent study alone (Table 2 Question 2; Table 3). It is within group discussion that many have postulated the benefits of TBL are uncovered.[1,9] Particularly for struggling students, it may be that the mutual consensus of ideas amongst team members necessary to reach a unified response on Group Readiness Assurance Tests and Application Exercise problems provides productive feedback[1] as well as better retention of knowledge.[9] In concordance with such posits, 84.0% of students responded that they "agree" or "strongly agree" that TBL fosters the use of critical reasoning and clinical problem solving more so than other active methods of teaching and learning (Table 2 Question 3). Further evidence suggesting the importance of team discussion can be found in the written responses, where some students indicated that too much discussion by the instructor can become counterproductive (Table 3). However, when presented with the option of time limits during team discussion, student opinion varied, indicating that group discussion is of paramount importance (Table 2 Question 18). The acquisition and gradual mastery of such skills within a group promotes healthy team dynamics and a strong sense of team unity, as evidenced by the 71.3% of students who reported that they "disagree" or "strongly disagree" that a mid-year change in TBL team assignments would help people further build teamwork skills (Table 2 Question 8; Table 3).

TBL is an education strategy designed to develop higher order cognitive skills students can apply to real world, clinical problems. By creating a learning environment that depends upon productive group interaction and individual accountability of team members, it prepares students for the clinical experiences which rely heavily on teamwork skills, critical thinking, and problem solving. While individual attitudes toward many aspects of TBL may vary, our data suggest that first year medical students see TBL as a more effective opportunity to foster critical reasoning and clinical problem solving skills than other non-lecture, active methods of teaching and learning (ex: labs and case discussions), as well as allowing for enhanced learning of core concepts through student to student interaction. It is our opinion that, because students view this authentic assessment strategy not merely as assessment, but as learning, it can be applied effectively in a medical school setting. Findings should be interpreted, however, in light of the study's limitation that responses are from one class of medical school students. Future studies should include the progression of student attitudes toward TBL over a prolonged time period.

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Table 2.

Question	Mean	SD
1) TBL facilitates long-term retention of information covered in a TBL exercise.	2.6	1.0
2) I feel student-to-student discussions help me to learn concepts covered during TBL exercises better than if studied independently.	2.0	0.9
3) TBL sessions foster the use of critical reasoning and clinical problem solving skills more so than other non-lecture, active methods of teaching and learning (e.g. histology labs, anatomy labs, case discussions, etc.).	1.7	0.9
4) How often do you leave a TBL session feeling confused about the topics discussed? (1 = 0-5%, 2 = 6-10%, 3 = 11-24%, 4 = 25-50%, 5 = >50%)	2.3	1.3
5) I feel that the amount of material that I learn while preparing for TBL is worth the time investment.	2.2	0.9
6) I feel that the amount of material that I learn during TBL is worth the time investment.	2.4	0.9
7) I feel that the grade-weighted peer evaluation is an important aspect of TBL.	2.7	1.3
8) I would like to change TBL team assignments midyear to give me a better opportunity to practice my communication and learning skills with a broader spectrum of my classmates.	4.2	1.1
9) I would attend the TBL group application exercises even if that portion of the TBL were neither graded nor required (i.e.: not incorporated into any portion of the course grade or term grade).	2.8	1.3
10) If grades for TBL group application exercises were based on attendance only rather than answers produced, this would improve my learning experience.	3.2	1.1
11) Alternative answers should be accepted by TBL moderator either during TBL or after review of a submitted written appeal to the TBL moderator.	2.0	1.2
12) Alternative answers should only be accepted after review of a submitted written appeal to the TBL moderator.	3.2	1.2
13) Alternative answers should not be accepted.	4.6	0.9
14) IRATs/GRATs are helpful in making sure that I "keep up" with course material by creating deadlines between exams.	1.9	1.0
15) Group Application Exercises are helpful in making sure that I "keep up" with course material by creating deadlines between exams.	2.7	1.2
16) I think the academic playing field is more level when faculty do not answer questions from individual students during the IRAT.	2.9	1.2
17) Making TBL team performance and ranking public information would create healthy competitive mindset between TBL groups.	3.5	1.4
18) I think discussions between groups and the moderator during GRAT and group application questions should be limited to a set time limit.	2.7	1.2
19) More frustrations during TBL modules result from the discussion and debate between teams about the best answer than from the quality of the questions and cases themselves.	2.8	1.1
20) I think that access to online resources would make group application exercise learning activities better.	2.9	1.0

1 = Strongly Agree, 2 = Agree, 3 = Neutral, 4 = Disagree, 5 = Strongly Disagree

Table 3.

Prompt 1: The most important thing about TBL is:	
Factor	**Representative Items**
Readiness Assurance	1) "Keeping up with material and providing clinical application to the basic science material we are learning." 2) "Keeping us on task for exam studying and providing informative clinical application to our material."
Group Discussion	1) "A good team dynamic that helps foster learning. You like the people you're with and want to contribute, be a team player, not disappoint, have fun, etc." 2) "Discussing concepts with a group aids my studying better than by myself."
Prompt 2: The most important thing that would improve TBL is:	
Factor	**Representative Items**
Readiness Assurance	1) "Questions should focus more on concepts than tiny detail." 2) "Make sure TBL material correlates with lecture material covered on exam."
Group Discussion	1) "Make the cases more applicable to what we will experience once we practice medicine. Sometimes the cases are very rare." 2) "Less dense discussion by the instructors. Some facilitators talked a lot about miscellaneous info." 3) "Less discussion time if all groups get answers correct."

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SHORT COMMUNICATION

Implementation of Curriculum to Teach and Assess Surgical Skills for Surgical Residents

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Abstract

Surgical skills training plays an important role in residency training. The training and development of technical skills have largely been confined to the operating room. Although most institutions in the West have implemented surgical skills training programs for surgical residents, few such programs exist in India. A basic surgical skills course was conducted for surgical residents in liaison with ETHICON Institute of Surgical Education. Sixteen students were enrolled in the course. The course consisted of a short lecture followed by hands on instruction and practice. The students were allowed to spend additional time practicing and refining the skills that were taught. The course was divided into six sessions: 1) overview of suture material, 2) handling of surgical instruments, 3) sutures and needles, 4) basic suturing techniques and 5) opening and closing of abdomen. The students were provided with the surgical instruments, suture material, knot tying board and a suturing pad to practice knot tying. A pre course versus post course survey of the students' perceived self assessment score for all the skills combined rose from 2.97+0.6 to 3.96+0.3 (p value<0.0001).The students thought the course was highly relevant to their current level of training (mean rating 4.8+0.5) and comfort levels performing the skills taught compared with before the course was markedly improved (4.5+0.6).

Since knowledge of surgical skills is becoming increasingly important, these results are presented to the curriculum committee to consider integrating the surgical skills course into the first year of postgraduate curriculum. The earlier in one's career that proper suturing and knot tying technique is learned, the more opportunity there will be for practice and development of the speed, efficiency and precision that is characteristic of expert performers.

There is good evidence that procedural simulation improves operational performance in actual clinical settings [1]. The training and development of technical skills has largely been performed in the operating room. Although most institutions in the West and Tanzania under low resource settings [2] have implemented surgical skills training program for surgical residents, few such programs exist in India. In the current model of surgical training, based primarily on apprenticeship, the opportunities for deliberate practice are rare. Operations are complex, and it is difficult to focus on one small component of the procedure [3]. A needs assessment survey of advanced surgical trainees at this hospital demonstrated that skills were usually acquired during sessions in the operating theatre often in an ad hoc manner. They felt the need of more practical training by the faculty in a form of workshop. We report our experience in establishing a workshop-based skills course which was conducted for first year surgical residents in liaison with ETHICON Institute of Surgical Education.

Sixteen post graduate students were enrolled in the course. The course consisted of a short lecture followed by hands on instruction and practice. The course was divided into five sessions: 1) overview of suture material, 2) handling of surgical instruments, 3) sutures and needles, 4) basic suturing techniques and 5) opening and closing of abdomen. Students were provided with the instruments, suture material, knot tying board and a suturing pad to practice trying knots. Students were allowed to spend additional time practicing and refining the skills that were taught. The students completed pre- and post-training questionnaires to measure self-perceived confidence in performing select surgical procedures. Students rated their confidence on a five-point Likert scale, (1) "Very unconfident" to (5) "Very confident". The post-training survey also included qualitative questions on how the training changed student perception of practicing surgery as well as recommendations for improvement of the training. Descriptive statistics for the items on the survey including percentages, means and standard deviations were calculated. Matched paired t-tests were used to compare pre course to post course confidence levels of students using SPSS version 17 software.

The study was approved by Kamineni Institute of Medical Sciences Institutional Research Committee.

The pre-course versus post -course survey of student-generated self assessment score for all the skills combined rose from 2.97$\pm$0.6 to 3.96$\pm$0.3(p value<0.0001). [Table 1] The students thought the course was highly relevant to their current level of training (mean rating 4.8$\pm$0.5) and comfort levels for performing the skills taught, when compared to before the course, was markedly improved (4.5$\pm$0.6). There was overall satisfaction with the manner in which the skills were taught (hands-on apprenticeship with oral guidance) and the individual attention each

Table 1: Pre and Post course confidence levels in various surgical skills

Task	Pre course	Post course	P value
1 Scrubbing and gowning	3.69	4.25	0.003
2Recognize and name basic surgical instruments	3.31	4.19	0.001
3 Know common types of suture material	3.88	4.38	0.056
4 Know common needle sizes	3.31	4.13	0.027
5 Perform two-handed ties	3.06	4.19	0.001
6 Perform one-handed ties	2.13	4.00	<0.0001
7 Perform an instrument tie	3.69	4.38	0.003
8 Perform a simple interrupted closure	3.81	4.44	0.055
9 Place a horizontal mattress suture	3.63	4.19	0.045
10 Perform a vertical mattress suture	2.94	4.25	<0.0001
11 Perform a running deep dermal closure	2.19	3.63	0.003
12 Perform a fascial wound closure	2.50	3.63	0.006
13 Perform Abdominal closure	3.19	4.13	<0.0001
14 Take a skin incision	3.69	4.38	<0.0001
15 Combined overall score	2.97	3.96	<0.0001

P value <0.05 was statistically significant

student received to learn the skills. The simulation for abdominal opening and closure included a balloon placed beneath the abdominal wall and the participant should be able to open and close abdomen without bursting the balloon. All the participants could not perform the procedure initially but after the session on abdominal closure, thirteen out of sixteen participants could do the procedure. Ninety one percent of the respondents strongly agreed that the training was a valuable use of their break time, believed it would help them provide better patient care and would recommend the training to their juniors. Students reported an increase in willingness and preparedness to carry out surgery after the training. Comments from participants included: 'Improvement themes related to wanting longer duration of training and broadening of the skills covered to include procedures such as endotracheal intubation and chest tube insertion'. One participant felt 'I could learn how to hold the knife in a proper way today'. Participants also requested for the suturing pad and other materials to be taken home so that they can practice.

A major advantage of a course of this nature for relative surgical "novices" is that the skills are taught by experts in a low-key, non pressurized environment rather than in the operating room, where time pressures and patient safety are paramount. Since there was no formal surgical skill training being offered for the surgical residents, we tried to see if the residents would benefit from such training. The participants were initially not able to perform the skills taught in a methodical manner: for example one of the participants was touching the gown with bare hands when putting on the gown and one participant was touching the fingers of the gloves while donning the gloves. All the participants were asked to perform the skills taught before teaching and were then shown the proper way to be followed on a one to one basis, since we had time in a low key, non pressurized environment. It would not be possible to teach the suturing in the theatre on the patient while the patient anesthesia time keeps on increasing. Six out of sixteen participants felt the need for more time in teaching deep dermal closure. Ericsson [4] and others [5] have pointed out that learning is enhanced in low-tension environments, but high-level tension, such as is often found in the operating room, inhibits learning of motor skills because of associated anxiety.

Surgical skills are becoming increasingly important in surgical education. The findings of the study have been reported to the curriculum committee for them to consider integrating the surgical skills course into the first year of postgraduate curriculum beginning with the next academic year. In the future, the improvement in the time taken and the precision of performing the suturing will be assessed. The earlier in one's career that proper suturing and knot tying technique are learned, the more the opportunity will be for practice and development of the speed, efficiency and precision that is characteristic of expert performers. The major advantage of the course is that skills are being taught by experts in a low-key, non pressurized environment rather than in the operating room. Medical colleges and universities should consider integrating a surgical skills course into the first year postgraduate curriculum.

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SHORT COMMUNICATION

Interprofessional Education: Development of an Interdisciplinary Health Care Team Project at a Midwestern U.S. University

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ABSTRACT

In recent years, there has been an increased emphasis on interprofessional education (IPE) in universities that offer health professions programs. The body of knowledge about the importance of student participation in IPE is well developed. This descriptive narrative from a multidisciplinary college in the Midwest region of the United States explores the development of an IPE experience that includes medical, nursing and social work students. Benefits and barriers to implementation, as well as strategies for incorporating IPE experiences into curricula are described. The development of an IPE experience for health professional students may provide a unique solution to improving patient safety in the health care setting.

Introduction

For at least 20 years, national and international organizations and task forces have called for reform in health professions education and have urged that health professions students no longer be taught in isolation from one another.[1] In 2000, the United States (U.S.) Institute of Medicine (IOM) released "*To Err is Human: Building a Safer Health System",* which called for the development of interdisciplinary teams as a way to increase health care quality and safety.[2] In 2003, the IOM reiterated the link between interdisciplinary teamwork and health care quality and urged health professions educators to incorporate interprofessional education (IPE) routinely into the curriculum. [3] After reviewing 89 studies, the Cochrane Collaboration concluded that IPE should begin early in the curriculum for health professions students as a way to promote role understanding, better communication, and ultimately improve the well being of patients.[4]

In the growing body of literature on the importance of IPE across health professions programs and the development and implementation of various types of IPE programs for health professions students, different pedagogy have been described in the literature. One example of different pedagogy implemented to support the development of IPE for health professions students is to have them working together in problem-based learning (PBL).[5] Other authors identify clinical experiences as an ideal way to develop and implement IPE programs that utilize teams interacting with patients. Clinical learning is central to IPE in health profession programs.[6] An additional variation in theme from the literature focuses on how programs use a

combination of both clinical and didactic learning as pedagogy for interprofessional learning.[7] Chan and coworkersl.,[5] describe the formation of interdisciplinary teams with nursing and social work students. The students participate in problem-based learning (PBL) case studies during four cross-disciplinary sessions. Data collected relate to the students' awareness of each other's values, recognition of disciplinary knowledge, an appreciation for each other and discussion between the disciplines about further collaboration. The researchers report that discussion between the nursing and social work student teams "enhanced their understanding of their decision making process in their assessment and management of a patient".[5] Swisher, and coworkers[6] describe both centralized and decentralized organization models for interprofessional education of students from physical therapy and medicine. When first implementing the IPE experience with these two groups of students in 2005, a centralized model was used in which there was scheduling of shared core courses. In the second and third year of implementation, IPE was changed to a decentralized model in which the interprofessional curriculum contained IPE learning experiences but not actual courses. Although the program continues with the first year utilizing the centralized model and the second and third years utilizing the decentralized model, some issues have developed regarding interprofessional education such as organizational commitment and culture change for the long-term sustainability of IPE. The authors identify certain steps to take with the implementation of the centralized/decentralized model to increase interprofessional communication. These steps include the development of interprofessional competencies to facilitate constructive discussion among professions.

The delivery of a designated interprofessional curriculum in college and university programs in both the U.S. and abroad has been accomplished using a variety of modalities. Hoffman and Harnish[8] report using self-directed independent research, problem-based learning, and collaborative group discussions to promote IPE among health profession students in Ontario, Canada. Pollard[9] describes the use of case studies for IPE in the United Kingdom but concluded that in order to develop interprofessional competency, the students who utilized case studies for IPE needed additional face-to-face interprofessional engagement. In Stockholm, Sweden, Hylin and coworkers[10] describe the use of a clinical practice course for interprofessional training. This course was a two week mandatory course in which medical, nursing, physiotherapy, and occupational therapy students gained an "enhanced understanding of the roles of other professions and the importance of good communication to teamwork and patient care". [9] Conway[11] reports the development in Australia of a department designated Multidisciplinary Learning Unit (MLU) in order to facilitate interprofessional clinical experiences. Select students from medicine and nursing participate in the care of patients on the Multidisciplinary Learning Unit (MLU). Continued support of the Multidisciplinary Learning Unit (MLU) with involvement of all health professions students is recommended by the authors. In 2003, Morison and coworkers.,[7] compared IPE done in a classroom versus a clinical setting for medical and nursing students in Belfast, Northern Ireland. Classroom learning involved the use of team work and case studies. The results indicated that learning occurred equally well in both settings and that each possessed merit for IPE. The authors suggest that pedagogies that provide an opportunity for interaction and active learning are most effective. Jacobsen and coworkers.,[12] conduct a longitudinal study on an Interprofessional Training Unit (ITU) in Denmark in which medicine, nursing, physiotherapy and occupational therapy students were partnered in the clinical setting to care for patients. The results of the three year study were that students who participated were able to achieve the faculty-determined goals of IPE. The students felt that they had learned from the other professions, gained a better understanding of their own role, and worked better together as professionals. Faculty felt that new methods of coordinating and integrating clinical and didactic learning were discovered with the development and implementation of the Interprofessional Training Unit (ITU). In order to develop and implement a novel approach to interprofessional health care education, researchers and students at the University of Minnesota devised a student-run organization called Clinician Administrator Relationship Improvement Organization (CLARION).[11]The mission statement of CLARION is to further interprofessional education for health professions students. CLARION was created under the "premise that interprofessional experiences will facilitate the development of future leaders who will make the changes needed to provide high-quality, safe and effective health care".[13] These experiences include simulations, small group discussions, large group presentations, seminars, tours of units with integrated interprofessional care models, and an interprofessional case competition. The organization credits its many accomplishments to the development of the interprofessional case completion, a capstone course in which students compete in conducting and presenting root cause analysis of a fictitious sentinel event. Johnson and coworkers[13] report the completion of this capstone course promotes interprofessional equality among the health professions students.

Although there is increasing interest in implementing Interprofessional Education (IPE), there can be daunting logistical problems to overcome. Differing curricula, time constraints, geographic distance, and faculty buy-in can all make authentic, interactive IPE experiences difficult to create and sustain. [1] The purpose of this demonstration project was to attempt IPE integration across curricula in a College of Health and Human Services (CHHS) at a Midwestern U.S. university.

There is no doubt that the application of IPE to health professions curricula is imperative, and the literature reflects many different approaches to the development of IPE. Successes have been reported using didactic methods

of engagement, traditional clinical learning, or a combination of the pedagogies. In this article, we report on one college's attempt to breakdown the traditional silos that occur in academia, particularly in the health professions programs, through the implementation of a longitudinal IPE curriculum. With the implementation of this curriculum, we became the only university in a large regional area of the Midwestern U.S. where future health care professionals can engage in patient care-focused service learning activities in collaboration with students from other health care disciplines. The students who participate in these IPE Health Care Teams (HCTs) work together in classroom, lab, and field activities to facilitate the development of medical knowledge, technical expertise, and valuable understanding about what it takes to deliver safe, high quality patient care. Here we report on both success and challenges encountered in implementing this unique experience.

METHODS

Our campus is a regional campus of a large Midwestern university system in the US, a university system with the only medical school in the state. As part of the statewide medical education system, the medical school offers program sites at eight locations around the state; our campus is the only regional campus of the university to have one of these sites located on campus. Previously, the school of medicine branch was housed in a separate building and was only peripherally involved in the regional campus, as it primarily reported to the Statewide System School of Medicine and not the campus. However, in 2004 a new Medical Professional Building was built on our campus, bringing together programs in medicine, nursing, social work, and other health professions programs. In 2007-2008, a College of Health and Human Services (CHHS) was formed bringing together all the health professions programs under one administration and with the School of Medicine branch as an informal partner. Subsequently, the Assistant Dean and Director of the School of Medicine branch became the dean of the CHHS, with dual reporting to the Dean of the System School of Medicine, and the Academic Vice Chancellor of the regional campus. This new physical proximity of the health programs and the involvement of the School of Medicine created a "perfect storm" of events that served as the impetus for the development of an IPE program.

The evolution of IPE built upon an existing School of Medicine program termed the "Chronic Patient Project" (CPP). This project traditionally included a medical student following the care of patient over a period of two years. The IPE Health Care Team (HCT) pilot was developed from the CPP in Spring 2007. Two HCTs were formed, each consisting of a community residing patient, a graduate student in social work (MSW), an undergraduate nursing student and an undergraduate medical student (second year). These teams interacted over one semester with only loosely defined goals and objectives. At the end of the semester the teams presented their patient to faculty from the three programs. The Health Insurance Portability and Accountability Act of 1996 (HIPPA) guidelines were followed by all HCT participants in the presentations in order to protect the identity of the patients.

Although feedback from students indicated this had been a valuable experience, it also alerted us to some of the many logistical barriers we would face in expanding the program. Feedback from students included expected issues such as conflicting schedules, but also indicated that students were having difficulty actually having access to the patient since patients were relatively well, mobile adults living in the community. After much deliberation with faculty from all of the programs, it was decided that the Chronic Patient Project (CPP) model would be used, but that patients would be assigned from local extended care facilities (ECFs). This allowed access to many more patients and also created a "captive audience" of patients who would be available to students. Institution Review Board (IRB) approval for the qualitative research design was obtained.

The first full Health Care Team (HCT) cohort began in the spring semester of 2008 and included 18 teams. A second, expanded cohort began in spring 2009 and the third in spring 2010. The specific objectives of the HCT included to: 1) develop the skills needed to understand the physical, emotional, and financial impact of illness on a patient's life; 2) develop a deeper understanding of the impact of disease on the patient and their family, and how cultural values and socio-economic conditions impact adherence to medical treatment and advice; 3) practice and improve skills related to obtaining a detailed health history and performing a physical examination; 4) develop communication skills necessary for receiving and relaying information to other members of the healthcare team, and 5) develop a better understanding of how each member of the healthcare team contributes to the care, well-being, and quality of life of a chronically ill patient. Each HCT includes a first year medical student, junior nursing student, and graduate social work student and the HCT works together and follows an assigned patient for three consecutive semesters starting in the spring, then fall, and finally spring of the following year.

The HCT contracts with the patient and asks them to sign consent for inclusion in the program. Patients are informed in writing what to expect in terms of visits from students, that the regular care they receive from their primary physician will not be changed in any way, and that it is the patient's regular physician or health care provider who should be contacted for health issues. In other words, it is made clear to patients that the students are not there to substitute for the care they receive from their regular providers.

Assignments for the HCT are discipline specific; however, near the end of the third semester team members prepare and present a team presentation to peers and faculty from all three disciplines. Assignments otherwise occur on a semester-by-semester basis. The medical students, in year

one semester one, complete and present a patient history, and in semester two of year one complete and present a complete physical exam. The nursing students complete an Elder Reminiscence Paper in the first semester and a comprehensive nursing care plan in the second semester. The social work students complete a biopsychosocial assessment in the first semester and progress notes in the second semester. Although the students can meet with the patient individually, HCTs are required to meet together a minimum of two times during the semester and to document communication using a modified "Situation, Background, Assessment and Recommendation" (SBAR) format. Each discipline is responsible for submitting typical discipline related paperwork to their respective faculty, and each student receives individualized discipline specific credit or clinical time for their involvement in the project. Additionally, students share a course management site (Oncourse ®) that allows for e-discussions, communication with their professors, and electronic submission of assignments.

RESULTS

After the first cohort completed all three semesters, the students were asked to evaluate the experience. Feedback received from the first cohort primarily concerned communication issues. Students struggled with communicating with students from different disciplines, mostly because of varying and busy schedule. Students involved in the Health Care Team (HCT) stated their preferred forms of communication were email and texting, and when they did not receive rapid responses from their team members they were quite frustrated. Another issue was patient turnover. In an effort to create a captive audience of patients, faculty failed to take into consideration how frequently patients were lost from the Extended Care Facilities (ECFs) due to death, discharge, or hospitalization. Several teams dealt with patient loss in the middle of their three semester experience; however, most indicated that the loss of their patient, while difficult, was a professionally meaningful event. The ECFs were asked to identify patients who were communicative and medically stable; however, as can be expected, some patients deteriorated over the project term
.
Many students stated that the roles of the professional disciplines represented within the HCTs were confusing for them, and that it created a sort of role confusion for them as they attempted to internalize their own professional role, while attempting to understand the roles of the other disciplines within the team. Some suggestions from the HCT members for future cohorts included requiring more frequent mandatory team meetings and providing permanent liaisons for the students to contact at the ECF.

Student group presentations of their three semester experience are very revealing. It is very common to hear comments indicating that while the worth of the project was not evident at the beginning (and that some students even resented having to participate), there is almost universal agreement that the project is worthwhile and should be continued. Inclusion in the project is required for the medical students, the social work students participate on a voluntary basis, and the nursing students are nominated by faculty to participate. Students present the patient case from their own disciplinary perspective, and comments such as "I really didn't know what nurses (physicians, social workers) did for the patient" are very common.

DISCUSSION

Recommendations for future HCT cohorts based on student evaluation include, among other things, the necessity of having a formal explanation and presentation of the professional roles represented by each member of the HCT. This should be done at the beginning of the project when teams are being formed. Development of a new clinical setting with an assigned agency liaison will assist in meeting the needs of the HCT students, by giving them a point person for contact when issues arise. A minimum number of face-to-face mandatory meetings are expected of students, and an evolving HCT handbook has been developed based on ongoing feedback and refinement of the program. Additionally permanent faculty advisors for each discipline are now in place to allow for better coordination of the project and in order to model the interdisciplinary behaviors that are expected from students. Another way we will be promoting better communication and collaboration among HCT students is by implementing TeamSTEPPS ® (http://teamstepps.ahrq.gov/ accessed March 2009) training**,** a patient safety initiative from the Department of Defense (DoD) and the Agency for Healthcare and Research Quality (AHRQ). TeamSTEPPS ® training promotes communication between health care professions by creating a common language that all HCT members can use and understand.

CONCLUSIONS

It is hoped that this brief description of our first attempts at IPE will be informative to those who are just beginning on the journey. We continue to collect data as the cohort's progress in order to track trends related communication and collaboration among disciplines. The current expansion of IPE programs allows health care professionals to enter the workforce having an education in interdisciplinary collaboration and communication. As the body of knowledge accumulates about IPE, implementing and assessing the effectiveness of IPE interventions is vital to the continued success of the program.

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OPINION

What Is Most Important In Pathology Training?

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ABSTRACT

At a time of financial austerity in training programmes in many parts of the world, it is important ensure that the training offered efficiently meets the needs, and where possible, the preferences of both trainees and the healthcare systems they are training within. The time available for educational activities in postgraduate medical education is limited, and it would be useful to those providing training programmes to know which educational activities are considered most important by the trainees and trainers, and to know if there is discordance between the two groups on this issue.

This paper reflects on the findings of a recent survey of the relative importance placed by cellular pathology trainees and trainers in Great Britain.

Cellular pathology (histopathology and cytopathology) has traditionally had an apprenticeship model, in which trainees gradually build up their experience through exposure to an increasing range and volume of diagnostic cases. In the earlier years of training, and when examining rarer cases later in professional life, the typical strategy used will be to assess a case using a hypothetico-deductive model. This is an important bridge between being a complete novice, a time when what is seen under the microscope doesn't fit into any recognised pattern (particularly for graduates of undergraduate curricula in which exposure to histology is sparse), to the later stage in which most cases are diagnosed using a rapid pattern recognition strategy. In my opinion the experience gained by attempting to diagnose increasing numbers of cases, with subsequent feedback (preferably in person) from an expert pathologist, is central to the development of the trainee from novice to independent practitioner.

I was interested to find out whether trainee pathologists and their trainers shared this view, and to see how other aspects of training programmes were valued by both groups. In order to explore this, I conducted a survey examining the importance placed by consultants and trainees on a variety of educational activities that may be present as components of a post-graduate cellular pathology training programme. The results confirm the continued perceived importance of double-headed reporting by both trainees and consultants.

This study surveyed trainee and consultant cellular pathologists, as part of a study with local National Health Service research ethics committee and Royal Free

Hampstead NHS Trust Research and Development Department approval, relating to post-graduate pathology education. The survey was conducted predominantly online. Email invitations to take part in the survey were sent out to all trainees and consultants at the Royal Free Hospital, to personal contacts who are trainee or consultant cellular pathologists practicing in Great Britain, and a link to the survey was also included in the email newsletter of the Royal College of Pathologists. A small number of paper copies of the survey were completed in private and returned anonymously. These responses were added by the author to the online survey. It is acknowledged that this method of sampling could introduce some bias, and that it is not possible with this methodology to reliably ascertain a survey response rate, however I would consider an estimate of approximately 10% to be plausible. Fifty seven cellular pathology consultants and 25 trainees responded to the section of the survey described in this report.

Respondents were asked to rate the importance for training of the following activities on a scale of 1-5 (1 – unimportant, 2 – slightly important, 3 – moderately important, 4 – important, 5 – very important): double headed reporting, autopsies, independent reading, black box sessions (meetings at which trainees are asked to discuss the diagnosis of educational cases), small group tutorials, teaching performed by the trainee, independent review of archival slides, inquest attendance, conference attendance, research activities, lectures, and journal clubs.

Both consultants and trainees reported very similar levels of perceived importance for the various activities (figure 1 and tables 1, 2, and 3). Both trainees and consultants rated double-headed microscopy reporting as the most important activity (both groups giving a mean score of 4.84/5). No consultant and only one trainee gave double-headed reporting a score of less than 4/5, demonstrating the consistency of the perceived value of the activity within and between the groups.

Independent reading, black box sessions, and autopsies were also considered very important by both groups, although autopsies were given a slightly higher importance rating by trainees than consultants (4.36 vs. 3.93/5). Both groups gave a mean importance rating of between 3 and 4 for small group tutorials, independent review of archival slides, teaching performed by the trainee, conference attendance, lectures, and inquest attendance.

Both trainees and consultants gave relatively low importance ratings to journal clubs and research activities, although the trainees gave a higher importance rating to research than did the consultants. Trainees were not subdivided into those with academic and those with non-academic career aspirations, and it is likely that the relative importance of research for an individual would depend on their career aspirations.

It is of interest that both trainees and consultants considered double-headed reporting to be more important than lectures, which may support the importance of the apprenticeship model of pathology education, in which supervised exposure to increasing numbers of cases is the core component of educational activity. The Royal College of Pathologists 'Curriculum for speciality training in histopathology and related subspecialties' document states that the majority of the curriculum (for histopathology postgraduate training) will be delivered through 'work-based experiential learning'.[1] Similarly, the 'Future Doctors Policy Statement' published by the Postgraduate Medical Education and Training Board has also emphasised the importance of trainee doctors developing their skills in front-line settings that provide them with relevant experience.[2] While acknowledging the importance of other learning opportunities, the survey reported here demonstrates that double-headed reporting of cases, a core component of experiential learning in cellular pathology, is considered educationally very important by both trainees and consultants.

In my opinion, although additional learning tools can make an important contribution to cellular pathology training, the core activity of supervised reporting of cases is still vital to the development of the diagnostic skills required to become a consultant cellular pathologist.

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Figure 1.

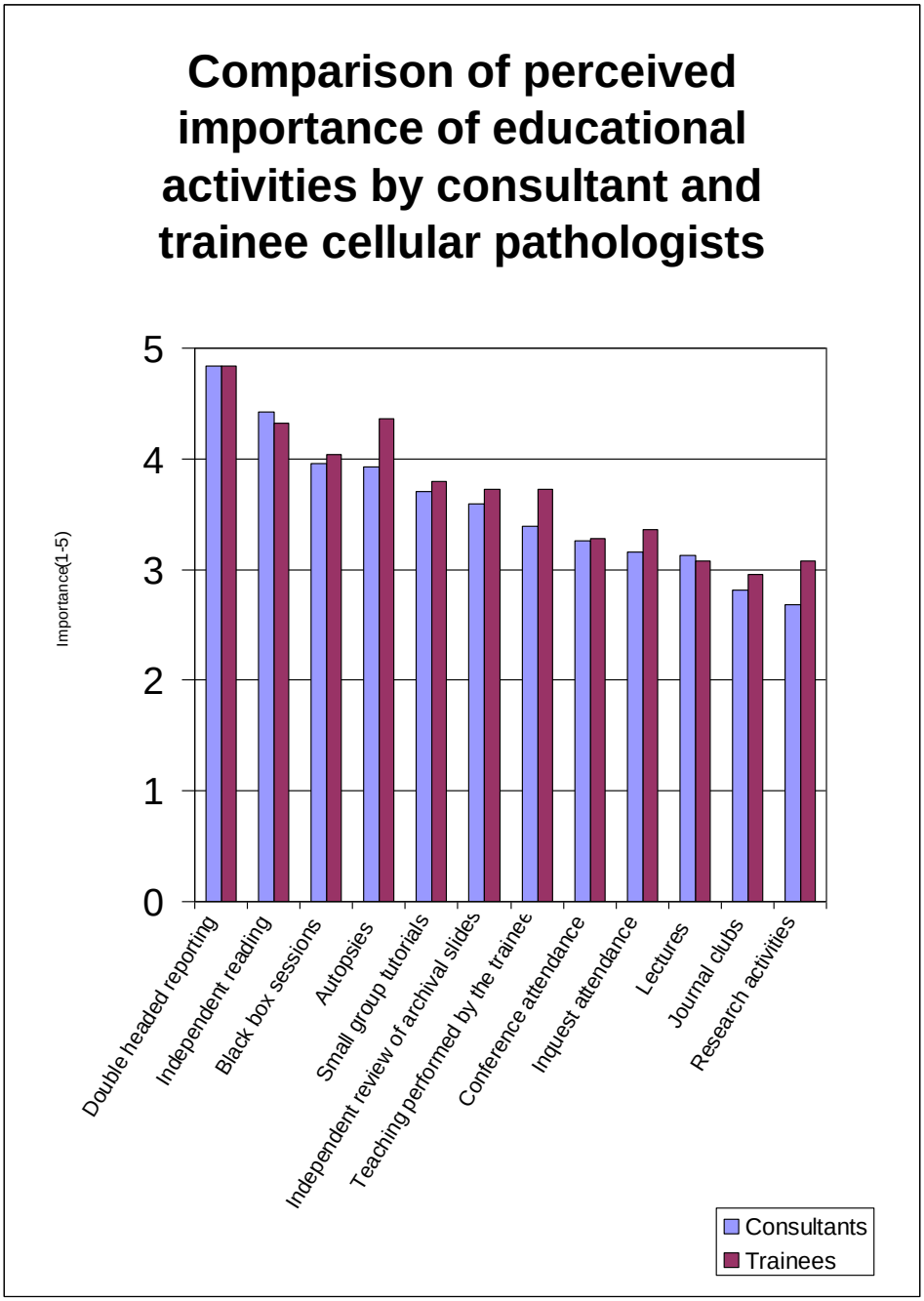
Comparison of perceived importance of educational activities by consultant and trainee cellular pathologists
Importance(1-5)
5
4
3
2
1
0
Double headed reporting
Independent reading
Black box sessions
Autopsies
Small group tutorials
Independent review of archival slides
Teaching performed by the trainee
Conference attendance
Inquest attendance
Lectures
Journal clubs
Research activities
Consultants
Trainees

Table 1.

Mean Importance Ratings and Ranking - Consultants	
Activity	**Mean Importance Rating (1-5)**
Double headed reporting	4.84
Independent reading	4.42
Black box sessions	3.96
Autopsies	3.93
Small group tutorials	3.7
Independent review of archival slides	3.59
Teaching performed by the trainee	3.39
Conference attendance	3.26
Inquest attendance	3.16
Lectures	3.13
Journal clubs	2.81
Research activities	2.68

Table 2.

Mean Importance Ratings and Ranking – Trainees	
Activity	**Mean Importance Rating (1-5)**
Double headed reporting	4.84
Autopsies	4.36
Independent reading	4.32
Black box sessions	4.04
Small group tutorials	3.8
Teaching performed by the trainee	3.72
Independent review of archival slides	3.68
Inquest attendance	3.36
Conference attendance	3.28
Research activities	3.08
Lectures	3.08
Journal clubs	2.96

Table 3.

Mean Importance Rankings – Consultants and Trainees		
Ranking (highest to lowest)	Consultants	Trainees
1	Double headed reporting	Double headed reporting
2	Independent reading	Autopsies
3	Black box sessions	Independent reading
4	Autopsies	Black box sessions
5	Small group tutorials	Small group tutorials
6	Independent review of archival slides	Teaching performed by the trainee
7	Teaching performed by the trainee	Independent review of archival slides
8	Conference attendance	Inquest attendance
9	Inquest attendance	Conference attendance
10	Lectures	Research activities
11	Journal clubs	Lectures
12	Research activities	Journal clubs

MONOGRAPH

Curriculum Mapping: Knowing Where You are Going and How You are Going to Get There

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ABSTRACT

Institutional Goals and Objectives define and inform the curriculum of medical schools. However, an understanding of the curriculum is not complete without understanding what specific educational experiences contribute to the learning and behaviors that the goals and objectives define. The University of Illinois College of Medicine has developed Curriculum Maps to determine the vertical and horizontal threads of learning that build knowledge for students beginning in the basic sciences, as foundational materials, and then build into the clinical curriculum, defining learning from matriculation to graduation. These foundations of knowledge are linked to the Graduation Competencies of the University of Illinois' Institutional Goals and Objectives and are defined by the educational methods used to present the content and the evaluation methods employed to assess student learning. The process of developing Curriculum Maps, for a complex four-campus medical school, is described along with examples of each step.

INTRODUCTION

In the late 1990's, the University of Illinois College of Medicine faculty began developing competency-based institutional goals and objectives. These came to be known as the 'Graduation Competencies.' Through this work, and developing means to assess the curriculum, it became clear that the relationship of the curricular elements (each required course and clerkship) would need to be linked to the Graduation Competencies in a formal, documented way. Since the professional educators in the College made the argument that developing curriculum maps would aid in developing curricular transparency by providing a system to demonstrate how, where, and when the competencies are met and how competencies are assessed within the curriculum, a discussion of mapping began.

The faculty first explored the advantages and prominence of developing curriculum maps within medicine. The literature revealed that several medical and veterinary schools throughout the world looked to curriculum mapping to manage and provide transparency to their curricula[1-6] Willet and coworkers argues that the integrated curricula found in medical schools are so complex that it is easy to lose sight of the 'student learning process' and encourages the use of a mapping system developed within their College for indexing medical topics.[1] At the University of Edinburough, UK, faculty developed curriculum maps within the Veterinary College to "…facilitate curriculum review, improve integration and clarity across the curriculum, and provide a transparent method of demonstrating outcomes for quality-assurance purposes."[2] Wong and Roberts worked to map the internal medicine residency curriculum at the University of British Columbia and found their efforts in providing information without duplication resulted in residents satisfied with the curricular presentations and lack of duplication.[3] At the University of New South Wales, after developing a new curriculum, the faculty employed curriculum maps as one

of several tools to manage the new curriculum.[4] Harden at the Centre for Medical Education and Education Development Unit, Dundee, UK, developed a guide published by Association for Medical Education in Europe (AMEE) that encourages medical faculty to develop curriculum maps to "…communicate about the curriculum…"[6]

Providing leadership and encouraging electronic curricular mapping at the national (United States and Canada) level, the American Association of Medical Colleges (AAMC) has for several years offered a curriculum management tool, CurrMIT[7, 8] designed to aid in the management of curricular elements within a medical school, determine curricular gaps and innovations, as well as identify faculty responsible for various elements within a school's curriculum.[8]

As early as 1997, the Urbana campus of the University of Illinois College of Medicine began mapping their course and clerkship offerings to the competencies. But not until the Liaison Committee on Medical Education (LCME) review of 2001 did it become clear that the identification of required clinical cases for each clerkship discipline and the identification of required procedures and formal curricular maps would need to be developed to track the curriculum. This was done to assure that the competencies were being met, redundancies were planned, gaps were eliminated and each of the four campuses presented comparable training to students.

Throughout the early 2000's, the Graduation Competencies were refined by the faculty at the four campuses of the medical school during college-wide retreats. Eventually, they were adopted and revised, most recently in 2007. Simultaneously, the clinical departments adopted cases and procedures for each discipline that students must master in order to pass the corresponding clerkship.

Conceptualizing the Maps

As faculty discussed the information to include in the mapping process, it was clear that linking all required curricular elements to the competencies' learning objectives was important to evaluate the curriculum. In addition, providing both the educational method employed to present the content and the evaluation method or means with which students were evaluated was necessary. Further, a second set of maps developed to link each of the required curricular elements to the required clinical departments' cases was made. Both educational methods and evaluation methods were included within these maps. It is important to note that educational methods and evaluation methods* were chosen based on those utilized by the University of Illinois College of Medicine within the Association of American Medical College Curriculum Management Information Tool, CurrMIT[7] software database.

Although the literature suggests several commercial products[1, 2, 4, 6, 8, 9] that aid in the mapping process, *Microsoft Office Excel* [10]was chosen as the spreadsheet of choice because of convenience, familiarity and no additional cost. Staff and faculty computers are equipped with the *Microsoft Office* software package[10] and are fully trained on using the software.

The Process of Mapping

The following is purposefully very detailed, so readers may understand the process employed in developing the curriculum maps for the large and complex curriculum of the University of Illinois College of Medicine. For more information, including additional curricular maps, readers are directed to the web pages of the University of Illinois' College of Medicine: http://www.medicine.uic.edu/ Also there are two Appendices that provide an example of the output of this process. The process consisted of three major areas: Drawing up the Mapping Form; Collecting Data; and, Constructing the Maps.

1) Drawing up the Mapping Form

In order to collect the data from faculty, templates were designed that would simplify the completion of course/clerkship information. Spreadsheets were designed with multiple pages, one for each Graduation Competency. On every sheet each competency was defined and the corresponding learning objectives were placed along the left hand margin. A legend of Educational Methods and Evaluation Methods was placed at the top of the sheet for ease of use. Templates were developed in a similar fashion for each competency.

2) Collecting Data

Every course and clerkship director was invited to a meeting to submit data by completing template forms. Faculty members were directed to identify objectives from each competency that related to their course, identifying the educational method and the evaluation method employed. For example, basic science course directors were instructed to consider if their course provided fundamental information that supported the attainment of the learning objective; if so they were asked to provide the educational method employed in presenting the materials and the evaluation method used to evaluate the students' learning. Course directors were encouraged to be inclusive, rather than exclusive, in linking their materials to the learning objectives.

3) Constructing the Maps

The curricular offerings were organized by academic year, i.e., all first year offerings were combined and assembled onto one map. Thus, Year One, Year Two, Year Three, and Year Four maps were constructed. Appendix 1 is an example of the Year One curriculum map for the Patient Care Competency as delivered in Urbana.

Case Maps

The same process, as described above was followed for Case Maps. Each required curricular offering was mapped to the required cases. This process was repeated at the medical school locations in Chicago, Peoria and Rockford. Appendix 2 Lists the cases by clinical discipline and maps the curriculum to the cases.

CONCLUSION

Curricular Maps were developed for a number of reasons, but the primary one was to provide guides to aid in formal evaluation of the curriculum. The maps were proven to be very useful when matching content to competencies, informing the faculty and students of content flow, and analyzing the curriculum for gaps and redundancies. In addition to that, faculty in the geographically separated Urbana-Peoria-Rockford (UPR) Track found the maps helpful in understanding when particular information was presented in Urbana and how it was evaluated.

Although the LCME site visitors in November 2009 expressed some concern about the comparability of the first year curriculum in Urbana with the first year curriculum in Chicago, the curriculum maps were valuable in demonstrating similarity of the curriculum at different site locations.

One of the challenges in developing the curriculum maps is keeping them current. The maps must change and be updated as the curriculum evolves. This will be an ongoing priority of the faculty and is intended to be built into the curricular evaluation practices of the various curriculum committees.

Employing the *Microsoft Office* product *Excel*[10] does have limitations. The variety of consumer software products for this specific task of mapping is wide. Features not found in maps built in *Excel* include flexible reporting tools specific to curricular mapping and other detailed attributes (such as indexing content.) However, the faculty members who utilized the maps feel the instruments currently built are sufficient for basic uses described above.

*The Department of Pediatrics insisted on using specialized evaluation methods that were employed during the Pediatrics Clerkship. They are listed along side the other evaluation methods on the Clerkship Maps.

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Appendix 1.

The competent graduate must be able to:

	Course Name	Educational Methods	Evaluation Methods
• Obtain a full appropriate medical history	Be,G,I,Im,P	1,3,5,6,8,9,11	1,2,4,8,9
• Perform a skillful physical examination	A,Be,I,Im,N,P	1,3,5,6,8,9,10,11	1,2,4,8,9
• Formulate a differential diagnosis and problem list	Be,Bc,E,G,H,I,Im,N,S	1,3,5,6,8,9,10,11	1,2,4,8,9
• Perform competently all medical and invasive procedures required for graduation	A,Bc	1,2,9,10	1,2
• Perform, order and interpret diagnostic investigations that result in accurate diagnosis and treatment	A,Be,Bc,E,H,I,Im,P,S	1,3,5,6,8,9,10	1,2,4,8,9,10
• Utilize data to reason and solve problems	Bc,E,G,H,I,Im,P,S	1,3,5,6,8,9,10,11	1,2,4,8,9,10
• Develop management plans	E,Im,N	1,8,9,10	1,8,9
• Consider cultural and socioeconomic factors in management options	Be,E,I	1,8,9	1,9
• Form an effective therapeutic relationship	A,Be,Bc,E,G,I,Im	1,8,9,10,11	1,3,4,9
• Recognize life threatening health problems and institute appropriate initial therapy	Be,Bc,E,G	1,10,11	1
• Construct a therapeutic plan for relieving pain, ameliorating suffering and directed toward specific resolution of health problems	G	1,11	1
• Counsel and educate patients and their families	Bc,H,I	1,3,8,9,10	1,2,9
• Apply the principles of epidemiology and evidence-based medicine	Bc,I,Im,N,P,S	1,8,9,10	1,4,8,9

The asterisk on Preceptor Evaluation for Psychiatry refers to a broad definition of Preceptor. In Psychiatry, the Clerkship Director directly observes all students in the clinical setting in addition to teaching didactic sessions, discussing cases, and doing an oral exam

Appendix 2. Curriculum Map of Required Cases

M-1 Course Legend	M-2 Course Legend	Educational Methods	Evaluation Methods
A=Anatomy	E= Epidemiology	1. Lecture	1. Mult Choice ?'s
Be=Behavioral Sciences	F=Fundamental Clinical Problems	2. Lab Skills	2. Lab Skills
Bc=Biochemistry	H=History/Phys/Diag	3. Small Group	3. Sm grp presentations
E=Embryology	I=Imaging	4. OSCE	4. Quiz
G=Genetics	M-Clinical Microbiology	5.Clin Correlations	5.Practice Exam
H=Histology	P=Pathology	6. Demo	6. OSCE
I=Intro to Human Disease	Ph=Pharmacology	7. Web-based	7. NBME Subject Exam
Im=Immuno-Micro	Ps=Psychiatry	8. Case Presentations	8. Precp Eval of Skill
N=Neuroscience	T=Tutorials	9. Patient Work-up	
P=Physiology		10. Independent Learning	
S=Statistics		11. POPs	

Core Department - **FAMILY MEDICINE**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
GI (Pain/Diarrhea)	A,Be,Bc,E,G,H,I,Im, P	1,2,3,5,8,10	1,2,3,5	F,H,I,M,P,Ph,Ps,T	1-3,5,7,8-12	1,5
GU (STD/UTI)	A,E,H,I,Im	1,2,3,5,8,10	1,2,3,5	F,H,I,M,P,Ph,Ps,T	1-3,5,7-11	1,
Neuro (Acute-chronic HA/Demential)	Be,E,G,H,N,S	1,2,8,10	1,2,3	F,M,Ph,Ps	1,5,7,8,10,12	1,6,9
Derm (Acute)	H,Im,S	1,2,3	1,2,4	F,H,M,P,Ph	1,5,8	1,5,7
ENT/Pulm (URI/LRTI/Otitis)	A, Bc,E,G,H,S	1,2,3,5,8,10	1,2,5	F,I,M,P,Ph,T	1,3,5,7-11	1,7
Musculoskeletal (Sprain/Strain/						

Musculoskeletal (Sprain/Strain/ LoBack Pain)	A,E,G,H,I,Im,P,S	1,2,8,10	1,2,	F,H,I ,Ph,T	1,3,5,7-10	1,5
CV (HTN/Vascular Disease/CHR/ Stroke)	E	1,2,3,5,8,10	1,2,3,5	F,H,I,P,Ph,Ps,T	1-3,5,7-10	1,5,7
Endocrine (DM/Thyroid/ Osteoporosis)	EH	1,2,3,5,8,10	1,2,3,5	F,I,P,Ph,Ps,T	1,3,5,7-11	1,7
Derm (Chronic)		1,2	1,2	F,H,P,Ph	1,5,8,10	1,5,7
Musculoskeletal (RA/OA/Chronic LoBack Pain)	Be,Bc,E,G	1,2,3,8,10	1,2	F,H,I,P,Ph,T	1,2,3,5,7-10	1,5,7
Pulmonary (Asthma/COPD)	S	1,3,5,8,10	1,2,3,5	F,H,I,Ph,Ps,T	1,3,5,7-10	1,5
Well-child	Be,G	1,	1,	F	1,5	1
Adult Prevention (Family Planning/Gyne)	Be,G,S	1,2	1,2	F,H,	1,5	1,5
Geriatric Assessment	Be			F,Ps	1,5,7,8,10	1,9
Substance Abuse (Tobacco/drugs/ alcohol)	H,Im,S	1,3,8,10	1,	F,H,Ph	1,5	1,5
Weight Loss	A, Bc,E,G,H,S	1,	1,	F,I,Ph,Ps	1,5,8,11	1
Depression	A,E,G,H,I,Im,P,S	1,8,10	1,	F,Ph,Ps	1,5,7,8,10,11,12	1,9,
Anxiety	E	1,8,10	1,	F,Ph,Ps	1,5,7,8,10,11,12	1,9
Pediatric Psychosocial	EH	1,	1,	F	1,5	1

Core Department – **INTERNAL MEDICINE**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
Abdominal Pain	A,E,G,H,I	1,2,3,5,8,10	1,2,3,5	F,H,I,P,Ph,T	1,2,3,5,7-10	1,3,5,6,7
Acute Blood Loss	A,Bc,P	1,2,3	1,2	F,I,P,Ph	1,2,3,5,10	1,7
Altered Mental Status	E,N	1,8,10	1,3	F,I,Ph,Ps,T	1,3,5,7-10,12	1,3,5,6,9
Asthma	H,Im,P	1,2	1,2	F,H,I,P,Ph,T	1,2,3,5,7-10	1,3,5,6,7
Coronary Artery Disease (CAD)	A,Bc,E,G,H,I,P,S	1,2,3,5,8,10	1,2,3,5	F,H,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Chest Pain	Bc,H,I	1,2,3,5,8,10	1,2,3,5	F,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Congestive Heart Failure	A,E,H,P	1,2	1,2	F,H,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
COPD	A,E,H,I,P	1,2,3,5,8,10	1,2,3,5	F,H,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Deep Vein Thrombosis	Bc,G,H,S	1,2,3,8,10	1,2	F,I,P,Ph	1,2,3,5,10,	1,7,
Diabetes (Cellulitis/Wound Care/Ulcers)	Bc,E,H,I,Im,N,P	1,2,3,5,8,10	1,2,3,5	F,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Dyspnea	Bc,I,Im	1,3,5,8,10	1,3,5	F,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Electrolyte and Acid Base Disorders	E,I,Im,P	1,3,5,8,10	1,3,5	F,P,Ph	1,2,3,5,10,	1,7,
Fever	Im	1	1	F,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Headache	N	1,8,10	1,3	F,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Hyper-cholesterolemia	Bc,E,G,H,I	1,2,3,5,8,10	1,2,3,5	F,P,Ph	1,2,3,5,10,	1,7,
Hypertension	A,Be,Bc,E,I,P	1,2,3,5,8,10	1,2,3,5	F,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7

Joint Pain (DJD/RA/SLE/gout)	A,H,Im	1,2	1,2	F,I,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Pain Management	Be	1	1	F,Ph	1,5,	1,
Pneumonia (CAP/VAP/HAP)	E,Im	1,2	1,2	F,I,M,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Renal Failure (Fluid overld/infecti/line access)	A,E,H,I,Im,P	1,2,3,5,8,10	1,2,3,5	F,P,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Substance Abuse	Be,E	1	1	F,Ph	1,5,	1,
Syncope				F,Ph	1,5,	1,
Urinary Tract Infections	A,H,Im	1,2	1,2	F,I,M,Ph,T	1,2,3,5,7-10,	1,3,5,6,7
Preventive Care				F,P,Ph	1,2,3,5,10	1,7

Core Department – **OB/GYN**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
Menstrual Irregularity	E,H	1,2	1,2	F,H,P,Ph	1,2,3,5,10,	1,7,
Dysmenorrhea	G,H	1,2,8,10	1,2	F,P,Ph	1,2,3,5,10,	1,7,
First Trimester Bleeding	E,H	1,2	1,2	P	1,2,3,5,10,	1,7,
Acute Pelvic Pain	A,E,H	1,2	1,2	F,I,P,Ph	1,2,3,5,10,	1,7,
Chronic Pelvic Pain	A,E,H	1,2	1,2	F,I,P,Ph	1,2,3,5,10,	1,7,
Abdominal Pain	A,E,H,I	1,2,3,5,8,10	1,2,3,5	F,I,P,Ph	1,2,3,5,10,	1,7,
Vaginal Discharge	E,H	1,2	1,2	F,I,M,P	1,2,3,5,10,	1,7,
Dysuria	H	1,2	1,2	F,I,P,Ph	1,2,3,5,10,	1,7,

Abnormal PAP Smear	G,H,Im	1,2,8,10	1,2	F,P	1,2,3,5,10,	1,7,
Contraception Choice	E,H	1,2	1,2	F,Ph	1,5,	1,
Urinary Incontinence	A,E,H	1,2	1,2	F,Ph	1,5,	1,
Postmenopausal Symptomology	E,H	1,2	1,2	F,P,Ph,Ps	1,2,3,5,7,8,10	1,7
POS (obesity/infert/ hirsutism)				F,I,Ph	1,5,	1,
Uncomplicated Prenatal Care	G	1,8,10	1	F	1,5,	1,
Uncomplicated Labor	E	1	1	F	1,5,	1,
Post Partum Recovery				F	1,5,	1,
Multiple Gestations	E	1	1	F	1,5,	1,
Gestational Hypertension	E	1	1	F,Ph	1,5,	1,
Abnormal Glucose Tolerance	Bc,E	1,3	1	F,P,Ph	1,2,3,5,10	1,7
Third Trimester Bleeding	E	1	1	F,P	1,3,5	1,7
Premature Rupture of Membranes	E	1	1	F	1,5,	1,
Abnormal Fetal Heart Rate	E	1	1	F	1,5,	1,
Preterm Labor	E	1	1	F	1,5,	1,
Post Partum Fever				F,Ph	1,5,	1,
Size Less than Dates	G	1,8,10	1	F	1,5,	1,
Abnorm Labor (Failure to Progress)	E	1	1	F	1,5,	1,
Post Partum Hemorrhage	Bc,E	1,3	1	F,Ph	1,5,	1,

Core Department – **PEDIATRICS**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
Respiratory	Bc,E,G,H,I,S	1,2,3,5,8,10	1,2,3,5	F,H,M,Ph	1,5,	1,5
Gastrointestinal	Bc,E,H	1,2,3	1,2	F,H,M	1,5,	1,5
Cardiovascular	Bc,E,G,H,S	1,2,3,8,10	1,2	F,H	1,5,	1,5
Endocrine	Bc,E,H	1,2,3	1,2	F,Ph	1,5,	1,
Infectious Disease	E,H,I,IM	1,2,3,5,8,10	1,2,4,5	F,M,Ph	1,5,	1,
Orthopedic	A,H	1,2	1,2	F	1,5,	1,
Hematology/ Oncology	Bc,E,G,H,Im,S	1,2,3,8,10	1,2	F,Ph	1,5,	1,
Neurologic	Be,E,G,H,N,S	1,2,8,10	1,2,3	F,M,Ph,Ps	1,5,7,8,10,12	1,6,9

Core Department – **PEDIATRICS**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
Disorder with Psychotic Features	Be,G	1,8,10	1	F,Ph,Ps	1,5,7,8,10,12	1,9
Mood Disorder	Be,G	1,8,10	1	F,Ph,Ps	1,5,7,8,10,12,	1,9
Anxiety Disorder	Be,G,S	1,8,10	1	F,Ph,Ps	1,5,7,8,10,12,	1,9
Mental Disorder (1st or 2nd Sub Problem)	Be,E,G	1,8,10	1	F,Ph,Ps	1,5,7,8,10,12,	1,9
Mental Status Exam	Be,N,S	1,8,9,10	1,3	F,Ps,T	1,3,5,7-12,	1,3,5,6,9
Cognitive Assessment	Be,E,N	1,8,9,10	1,3	F,Ps	1,5,7,8,10,11,12,	1,6,9

Assessment of Suicidality and Homicidality	Be	1	1	F,Ps	1,5,7,8,10,11,12,	1,6,9
Psychiatric Write-Up				F,Ps	1,5,7,8,10,12	1,9
Oral Presentation				F,Ps	1,5,7,8,10,12	1,9
Screen - Substance Use				F,Ps	1,5,	1
Screen - Domestic Violence				F,Ps	1,5,	1
Screen - Eating Disorders				F,Ps	1,5,	1
Screen - Sleep Disorder	Be	1	1	F,Ps	1,5,	1
Screen - Sexual Dysfunction	E	1	1	F,Ps	1,5,	1
Assess - Acutely Ill Psychiatric Patient	Be	1	1	F,Ps	1,5,7,8,10,12	1
Assess - Serious Medical or Substance Condition	E	1	1	F,Ps	1,5,7,8,10,11,12	1
Assess - Capacity to Care for One's Self				F,Ps	1,5,7,8,10,11,12	1
Interview – Child				F,Ps	1,5	1
Interview – Elderly Person				F,Ps	1,5	1

Core Department – **SURGERY**

Patient Case Presentation	M-1 Course Experience	M-1 Educational Method	M-1 Eval Method	M-2 Course Experience	M-2 Educational Method	M-2 Eval Method
GI	A,E,G,H,I,P	1,2,3,5,8,10	1,2,3,5	F,I,P	1,2,3,5,10	1,7
Breast	A,G,H	1,2,8,10	1,2,	F,H,I,P	1,2,3,5,10	1,5,7
Hernia	A,E,H	1,2,	1,2,	F,H,I	1,5,	1,5
Vascular	A,E,H,P	1,2,	1,2,	F,I	1,5,	1
Laparoscopy	A,E,I	1,2,3,5,6,8	1,2,3	F,I	1,5,	1
Miscellaneous				F,I,Ps	1,5,7,8,10	1

MONOGRAPH

Creation of an Online Curriculum to Introduce and Supplement the Learning of Pharmacology in a Problem-based Learning/Lecture Hybrid Curriculum

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ABSTRACT

Problem-based learning (PBL) curricula for medical education present unique challenges for longitudinal disciplines such as pharmacology. The time and attention that is required to introduce students to fundamental principles of pharmacology may be overlooked in deference to other content learning goals that are taught in a more concentrated fashion. The solution chosen for the Western Reserve2 Curriculum was to create an online pharmacology supplement to the existing curriculum, in order to introduce pharmacology early in the curriculum and increase student pharmacology knowledge, engagement with the material, and self-efficacy in learning pharmacology topics. The process of choosing a method of delivery and obtaining buy-in from stakeholders, as well as details about the creation, integration, and

implementation of this supplemental curriculum is described. Student participation was higher than expected, with positive initial feedback and significant learning gains for regular users. Important lessons in managing timelines and obtaining institutional approval for initiating a new supplemental curriculum are also discussed.

INTRODUCTION

Utilization of Problem-Based Learning (PBL) during the basic science years has become increasingly prevalent at medical schools both in the United States and internationally, as advances in cognitive and learning sciences theories continue to influence medical education.[1-3] While there are many potential benefits to having medical information presented in an integrated fashion in the context of case studies,[4,5] this curricular format presents particular challenges to the teaching of many longitudinal disciplines, including pharmacology.[6-8] If the curriculum is also organ-systems based, this presents additional complications, as subjects such as pharmacology can be difficult to integrate within a single organ system, and require a great deal of interdisciplinary coordination.[5]

Many PBL curricula allot a discrete period of time for the teaching of pharmacology, expecting that students will learn pharmacology largely on their own over the course of the curriculum.[9] If the teaching of pharmacology does not begin early in the curriculum, students may fail to pay attention to faculty-intended self-directed learning goals and may later find that they have fallen behind.[10] Additionally, students are often confused as to how much time and effort they should devote to studying pharmacology; it is easy to ignore this field altogether, with the competing demands of other disciplines that are more explicitly covered in the curriculum.[10] Discrete periods of pharmacology didactics also lend themselves to increased student "cramming," or massed learning, immediately before a curriculum exam or before medical board exams, when distributed learning (*i.e.*, learning pharmacology in smaller units along the way) would lead to improved retention of such material.[11-13] These difficulties are somewhat paradoxical, because pharmacology naturally synthesizes fundamental principles from the foundations in biochemistry, physiology, and pathology in order to provide the basis for therapeutic intervention.[8] However, online interventions can help increase distributed learning habits; Magid and Schindler found that weekly open-book, computer-based quizzes increased student performance on final examinations and resulted in positive student feedback in general pathology,[14] another longitudinal discipline at our institution.

Intervention Goals and Objectives

Within the Western Reserve2 Curriculum of Case Western Reserve University School of Medicine, the basic science curriculum spans 18 months and is organized into six "blocks" (Figure 1). Each block is approximately 12 weeks long, with the exception of the first block.[15] The curriculum is systems-based, with PBL-style cases accounting for approximately half of student contact time. The remaining six hours of student contact within the systems-based block is utilized for lectures and other smaller group sessions that are led by content specialists. The Western Reserve2 Curriculum was introduced two years prior to the pharmacology learning intervention described herein.

Within this systems-based teaching structure, fundamental principles of pharmacology are officially presented within the "Homeostasis" curricular block at the end of the first year. Although therapeutic agents are encountered within the PBL-style cases and briefly mentioned in lecture from the start of the curriculum, we were concerned that students failed to recognize the opportunities for learning pharmacology prior to the official didactic sessions scheduled near the end of their first year. Though they were presented with therapeutic agents in PBL-style cases throughout the curriculum, it was repeatedly observed by faculty facilitators that students often did not devote as much time to the pharmacology learning objectives during discussion groups as the other basic science disciplines. Many students provided feedback that they felt they had minimal exposure to pharmacology prior to the "Homeostasis" block, and that they were unhappy or uncomfortable with their pharmacology knowledge prior to studying for their medical board examinations. The following comment from an end-of-block survey was typical: "I feel, as do most of my peers, that I am completely inept when it comes to pharmacology." Students stated that they did not feel confident that they had the means to study pharmacology on their own, and expressed trepidation in doing so: "Pharm is hard for some of us to understand, and reading everything out of a book to learn for that subject just does not work very well," and "Please teach pharmacology to the students." Consistent with international medical students, students at our institution requested additional educational support regarding solving pharmacology problems and increased clinical integration.[16]

To facilitate learning of pharmacology earlier in the first year, we chose to create a supplement to the curriculum that could augment pharmacology learning without requiring any additional lecture or PBL time. Our objectives were as follows:

Objectives

- Supplement the curriculum with online, self-paced modules that align with topics students are currently studying throughout the systems-based blocks
- Increase student familiarity with fundamental principles of pharmacology and therapeutic agents
- Increase the amount of time students spend on learning pharmacology (increase student engagement)
- Improve student self-efficacy so that students feel they have the tools to learn pharmacology

The main outcomes we hoped to achieve with our supplemental curriculum were as follows:

Outcomes

- Increase student pharmacology knowledge
- Increase student time spent working on pharmacology
- Increase student self-efficacy in learning pharmacology

In summary, we wished to increase formal learning opportunities in pharmacology, while creating a flexible method for students to access the material, working at their own pace and at times that were convenient for them. We hoped that they would gain additional pharmacology knowledge, spend more time engaged with the material, and feel more confident in their ability to learn the subject matter.

Building an Improved Pharmacology Curriculum

Many steps were taken to create the new, supplemental pharmacology curriculum. A focus group comprised of second-year students was conducted to obtain insights into what students felt were strengths and weaknesses of the pharmacology curriculum, and what they thought could be done to improve it. Students expressed the desire for more explicit pharmacology didactics earlier in the curriculum, as well as a more integrated approach; students reported that they did not know what they should be learning with regard to pharmacology, or useful methods for learning about therapeutic agents. With the new changes to the curriculum, didactic time had been decreased considerably, including time dedicated to pharmacology. As with any new curriculum, optimal means of presenting the information within the constraints of decreased contact time were in the process of being identified and implemented. Faculty had also expressed frustration with the reduction in contact hours, and student satisfaction with regard to pharmacology teaching had significantly decreased, when it had previously received outstanding marks in the pre-Western Reserve2 curriculum.

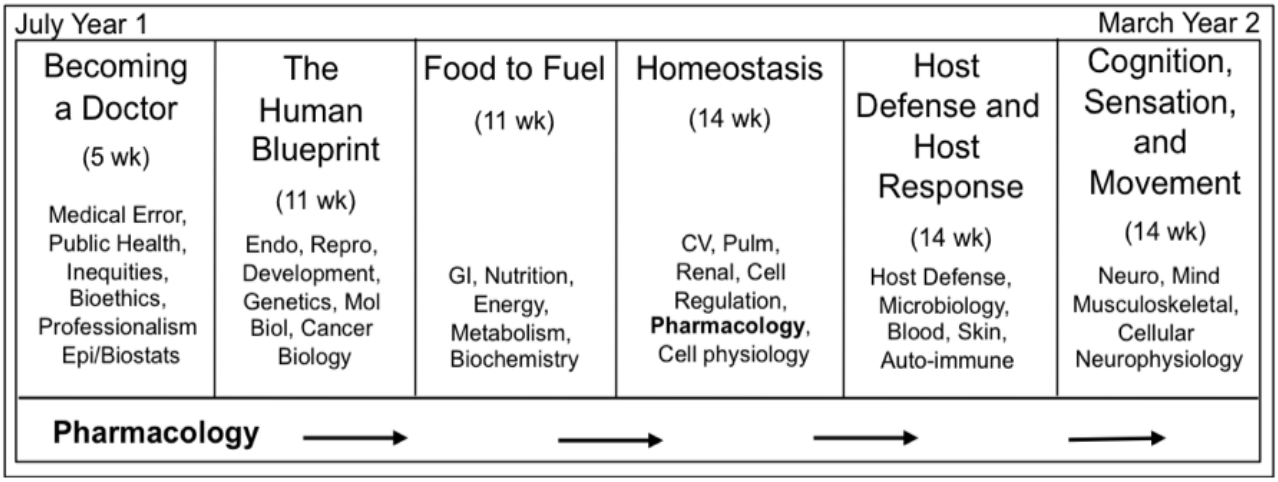

Figure 1. Pharmacology Teaching and Learning within the Pre-clerkship Blocks of the Western Reserve2 Curriculum. The teaching and learning of pharmacology within the Western Reserve2 Curriculum occurs both longitudinally throughout the first 18 months of the curriculum and also in a more focused fashion near the end of the first year, when fundamental principles of pharmacology are introduced to the students through lecture, team-based learning and PBL-style cases.

Given this impetus for augmenting the pharmacology curriculum from both students and faculty, we conducted a review of the literature to determine how others had solved this problem in their curricula. We found that other medical schools struggled with similar difficulties, *i.e.*, students were treating pharmacology learning objectives within PBL cases too superficially.[10] However, an online curriculum that was focused on use of herbs and dietary supplements showed significant knowledge improvements and retention at the long-term follow up assessment, six to ten months later.[17] Results from another online pharmacology curriculum indicated that students (nurse prescribers) reported substantial increases in their perceived knowledge and satisfaction with pharmacology, further suggesting that an online supplemental curriculum might be efficacious at our institution.[18] The University of Melbourne found a combination of multiple-choice questions (MCQs) and PBL-style questions with case vignettes to be useful methods for assessing a PBL curriculum.[19] Students at our institution already had essay examinations as a part of the existing curriculum, including pharmacology questions, so we did not focus on augmenting such assessment strategies. However, we did include short MCQs in the weekly self-assessment quizzes in our supplemental curriculum, to provide the students an avenue for assessing their learning.

Weighing the different options, we decided to use an online supplement, as this could be completed by students at their convenience, in any location. Previous research has shown that students will use digital content to learn basic science topics.[20-21] This supplemental material is not an effective substitution for the core curriculum, as students who used online lectures as a replacement for live lecture attendance in pharmacology performed more poorly on summative assessments.[21] However, students in another study were found to have a positive subjective response to online content, and the majority felt that online lectures were at least as effective as live class lectures.[20] At our institution, although online lectures from the previous iteration of the curriculum are available to students, the ongoing live lectures are not available online. Student feedback indicated that these lectures, while useful, did not appropriately address their introductory pharmacology learning needs. Hence, the decision was made to create supplemental online modules. All students were required to purchase a laptop computer upon matriculation, so access to online modules was not a concern. In addition, this approach did not require additional didactic time, a commodity that is decidedly difficult to obtain within a curriculum of limited student contact time.

At other institutions, pharmacology modules appear to have been created professionally or with significant computer programming support.[18,23] The University of Cincinnati College of Medicine chose to create their instructional technology and online modules for their basic science curriculum in-house, in order to maintain the integrity of the finished product, but their annual costs were $96,000, on average.[24] While we eventually intend to seek funding, with the goal of broadening our modules' appeal and usefulness in order to share them with other schools, we felt that we could initiate this task creatively, largely taking advantage of existing resources instead of requesting additional support. We were able to create our supplemental curriculum with one medical student's summer support and "volunteer" time from faculty, making it unnecessary to involve outside computer professionals to create the modules, thereby retaining more control over the final product. In this manner, students, faculty, and staff were able to work collaboratively without the further complications of working with outside vendors.

Deciding upon the computer method of delivery required significant investigation. Pachyderm, a flash-based modular program with pre-fabricated templates that could be used for creation of modules with limited computer expertise, was initially considered. However, since we wished to assess the efficacy of the intervention, this program did not prove suitable, as it did not include the ability to capture quiz and survey data.

Since students expressed a desire to have pharmacology presented on a more longitudinal basis, and doing so had the potential to increase learning and retention by providing distributed as opposed to massed learning, we decided to create nearly weekly modules that would complement the existing didactics and case studies presented during the formally scheduled curriculum. In this way, students' pharmacology learning could be integrated with their other learning and potentially placed within a more meaningful context. In addition, frequent modules would increase student awareness of pharmacology learning opportunities much earlier in the curriculum, further facilitating distributed learning rather than massed learning right before examinations, as suggested by the literature.[14]

Getting Stakeholder Support

We worked with our medical school's Academic Computing office to develop a plan for inclusion of the online pharmacology supplement within the existing infrastructure of the current curriculum online portal. Utilization of this electronic framework permitted us to track student participation and assessment outcomes in a de-identified manner.

The supplemental pharmacology curriculum also required support from additional medical school committees that monitor curriculum changes and student evaluations. Multiple meetings and presentations to these committees were necessary to obtain support. In addition, changes were made by these bodies, such as the wording, length, and frequency of our program evaluation questionnaires, due to concern for student survey response burden. We also met with various members of the administration, including the vice dean for medical education, the curricular affairs dean, and the director of program

evaluation, to obtain their support. Ultimately, approval to offer the supplemental online pharmacology curriculum to students on an optional basis was attained. Since this supplemental pharmacology curriculum was not required, a limited number of students chose to utilize the resource initially, making the interpretation of results somewhat more complex.

Overview of Supplemental Pharmacology Curriculum

Given the feedback we received from students and faculty, we wished to provide a longitudinal supplement to the existing curriculum. In this manner, we could introduce pharmacology principles much earlier, and more formally highlight pharmacology-related learning objectives. Some of these pharmacology learning opportunities were already present in the existing PBL-style cases in the curriculum, but we anticipated that the supplement would increase awareness of these opportunities. As stated above, fundamental principles of pharmacology are formally presented during the "Homeostasis" block that occurs at the end of the first year of the curriculum. As a means of achieving remote contact with the students, the web-based pharmacology supplemental curriculum was initiated near the start of the students' first year, during the "Human Blueprint" block that includes the disciplines of molecular biology, genetics, development, reproduction, endocrine systems, and cancer biology. Though student participation was optional, students were informed of the supplement *via* an in-person introductory session, flyers distributed during PBL-style groups, and existing institutional online student portals.

The general format of the web-based supplement consisted of short "modules," which were comprised of: 1) a brief topic introduction and didactic information, pointing out applications to the existing curriculum, when possible; 2) a short reading assignment/resource suggestions (generally one to three pages of reading); 3) a short (three question) quiz used for student self-assessment and to solidify learning; and 4) brief explanations of the basis for the correct answers and the problems with the incorrect answers. Each module was intended to take no more than 20-30 minutes to complete, including the brief textbook or literature-based reading assignment and quiz. The formats of each module differed slightly, including more traditional didactic presentations, case studies, and even a "choose your own adventure"-type format, where students chose which therapeutic option to administer to the "patient," with explanations of the rationale for each treatment. Students had access to new modules on a weekly basis, mirroring the existing weeks of the curriculum. Students were encouraged to keep up with the weekly modules, as they were more relevant to the existing curriculum when done concurrently, but all modules were permanently available to students after they were released. The modules were written by faculty members, with input from medical students. A unique feature of these modules included a mascot, affectionately named "PharmFriend," who highlighted key points and take-home messages for students. PharmFriend's comments were largely written by a medical student. We felt that this student voice was important, to optimally engage students and convey the material at a level that was accessible to most beginning medical students.

To assess the effectiveness of the supplement, a number of means of curricular assessment were instituted:
1) *Pre- and post-tests for each curricular block*. To assess increases in pharmacology knowledge, a pre-test was included at the beginning of each curricular block, prior to the release of any supplemental modules. Similarly, each series of modules associated with a systems-based curricular block was concluded with a post-test. These post-tests contained the same questions from the pre-test, providing a means to measure an increase in knowledge, as well as additional related questions designed to assess the transfer and application of knowledge. All students were encouraged to take the pre- and post-tests, regardless of whether or not they completed the online supplement.
2) *NBME-style examinations.* A formative but mandatory NBME-style exam at the end of each curricular block, consisting of retired NBME questions selected by faculty members, was an existing part of the curriculum. Pharmacology questions included within these NBME-style exams were also used to assess increases in pharmacology knowledge.
3) *End-of-block essay examinations.* All students were required by the existing curriculum to take an integrated essay exam covering material from that curricular block. Scores for pharmacology-related sub-questions were separated from non-pharmacology essay sub-questions, and compared.

Additional goals of the online supplement included increasing student engagement with the material, measured by a self-reported increase of time spent studying and discussing pharmacology. Another goal of these modules was to increase student self-efficacy in pharmacology; the goal was for students to feel more confident about their ability to learn the material and approach pharmacology problems on their own. Student satisfaction with pharmacology as a discipline was also an important goal, as we expected that the supplement would help students learn and feel as if they had more support at an earlier point in the curriculum. These goals were assessed by optional surveys at the beginning and end of curricular blocks, usually presented in the context of existing curricular assessment surveys. The collaboration with our Academic Computing office provided an avenue to track the number of times each student accessed the online supplemental modules, as well as the number of completed self-assessment quizzes and pre- and post-tests. We used this information as an additional proxy for engagement with pharmacology, as increased "hits" to the modules and quiz completions would likely correlate with increased interest and/or effort spent learning pharmacology.

Design of Pharmacology Supplements Aligned with Curricular Blocks

"The Human Blueprint" is the second block of the Western Reserve2 Curriculum, but is the first block to deal extensively with molecular and organ-based medical sciences, including molecular biology, genetics, development, reproduction, endocrine systems, and cancer biology. It was during this block that the pharmacology supplement was initiated. The PBL-style cases early in "The Human Blueprint" block largely focus on developmental/chromosomal defects and genetics, in which drugs and therapeutic agents do not play a large role in treatment. Thus, while every effort was made to present materials in the pharmacology supplement that were relevant to students' weekly PBL-style cases, it was not always possible to do so directly. During lectures, however, students were presented the topics of cellular receptors and tyrosine kinase inhibitors. Thus, we drew from lecture topics as an additional source of linkage with the existing curriculum.

The pharmacology supplement for "The Human Blueprint" block consisted of eight modules, with the following topics:

- What is Pharmacology?
- Drug Delivery
- Drug-Receptor Interactions
- Receptor Regulation
- Chronic Myelogenous Leukemia & Tyrosine Kinase Inhibitors
- Introduction to Endocrine and Reproductive Drugs
- Pharmacogenetics: Focus on Erlotinib
- Breast Cancer: Focus on HER-2 Inhibitors

We provided a brief introduction in the first module of the supplement ("What is Pharmacology?") to the discipline of Pharmacology, as well as an introduction to the online supplement itself. In the second module, "Drug Delivery," the topics of bioavailability, routes of drug administration, steady-state, and half-life were introduced, as these were viewed to be basic pharmacology concepts that would be useful for the students to learn as they began considering individual drugs. The third module, "Drug-Receptor Interactions," encompassed the subjects of receptors, agonists/antagonists (competitive and non-competitive), drug-receptor interactions, and graded log dose-response curves (including concepts of potency and efficacy). During the first two weeks of the existing curriculum, intracellular signaling pathways and receptors were presented, providing a foundation for the discussion of drug-receptor interactions. The fourth module, "Receptor Regulation," discussed ligands and receptors, including androgen ablation therapy (relevant to topics of reproductive and endocrine systems more formally covered during the curriculum).

The fifth module, "Chronic Myelogenous Leukemia & Tyrosine Kinase Inhibitors," involved a departure from the other modules; a patient scenario from a PBL-style case that had been presented during the primary curricular block was presented and expanded within the pharmacology module. The original author of the PBL-style case, a hematologist/oncologist, collaborated with the pharmacology supplement authors to select the actual therapeutic treatments that would be considered as options with such a patient. The physician was also very helpful in providing clinical explanations as to why a particular option was the first-line treatment and what patient characteristics might lead one to consider various alternative treatments. Students were presented with an extension of the PBL-style case, after the patient had failed her initial drug therapy, and asked which treatment they would select next. Students could select one of three different treatment modalities for the "patient," with explanations for the role of each treatment in the management of chronic myelogenous leukemia. Students were also encouraged to view the explanations for the other treatments they did not select as their first choice in treating the "patient."

In the sixth module, "Introduction to Endocrine and Reproductive Drugs," students were provided guidelines regarding how to approach and assimilate information for individual drugs as they progressed through the curriculum. Lists of clinically significant drugs were provided to students, with tips on how to think about therapeutic agents and what were the most important features they should understand. The actual details pertaining to each drug were not provided to students, because we felt that there would be educational value in having students create their own drug "flashcards" or lists to suit their needs. In the seventh module, "Pharmacogenetics: Focus on Erlotinib," patient variability in responding to drugs, including concepts of pharmacogenetics, was discussed. This module used a patient from one of the PBL-style cases occurring concurrently in the curriculum to further reinforce the material. In the eighth and last module for the curricular block, "Breast Cancer: Focus on HER-2 Inhibitors," alignment with one of the PBL-style cases from the week was achieved as the topic of monoclonal antibodies and cellular receptors in the treatment of breast cancer was covered and the module expanded what the students had learned from the original case.

During the third curricular block, "Food to Fuel," which focuses on the topics of biochemistry, metabolism, nutrition, and the gastrointestinal system, the online pharmacology supplements focused on various pharmacokinetic topics. The following nine modules were designed to align with the existing curriculum where possible:

- Vitamins
- Drug Absorption

- Drug Distribution I
- Drug Distribution II
- Drug Absorption: Clinical Case Example
- Drug Distribution: Clinical Case Example
- Introduction to Drug Metabolism
- Drug Metabolism: Focus on Pharmacogenetics
- Introduction to Gastrointestinal System Drugs

Early in the "Food to Fuel" curricular block, students are exposed to concepts in biochemistry and nutrition. The topic of "Vitamins" was therefore chosen as an introductory topic for the pharmacology supplement. Subsequent modules took advantage of the concomitant formal teaching and learning of the gastrointestinal system that takes place during this curricular block and introduced the concepts of drug absorption, distribution and metabolism. Introductions and case-based examples were provided for each of these topics.

Formal teaching of pharmacological principles occurs during the final curricular block of the first year. This "Homeostasis" block includes a focus on cell physiology, cardiovascular physiology, renal physiology, pulmonary physiology, and principles of pharmacology. No online supplements were provided during this block because formalized contact time relating to pharmacology occurs during this curricular block, reinforcing the content from the online modules.

RESULTS: IF YOU BUILD IT, WILL THEY COME?

Since this fledgling supplement to the curriculum was optional, we had significant concerns that few students would peruse the modules. However, for the pharmacology supplement modules that took place during "The Human Blueprint" curricular block, 84% of students (139 students) visited the supplement at least once, and 20% (33 students) completed at least 86% of the available weekly self-assessment quizzes. Significant effort was made to inform the students about the modules, including an in-person presentation that featured students from the previous year who explained that this supplement was a result of their feedback for additional educational support in pharmacology. Student word of mouth was also important; several students reported to the authors that they had heard that Pharmacology was a difficult subject to learn on your own before it was "officially" presented within the "Homeostasis" curricular block, and that they would benefit from some additional support.

Some students completed the online pharmacology supplement modules paced with the required system-based block curriculum as the modules were intended to be approached. Others who had not kept up at this pace completed the modules immediately prior to the start of the "Homeostasis" block, the curricular block in which formal presentation of principles of pharmacology occurs. Anecdotally, students who completed the modules indicated that they did not take more than the expected 20-30 minutes to complete, that the modules helped them to become familiar with pharmacology prior to more formally encountering the material during the "Homeostasis" curricular block, that completion of the modules helped them to feel more comfortable in learning the dense pharmacology formally presented during the "Homeostasis" block, and that they were able to help teach their friends who had not completed the modules and who felt "very confused" and "lost."

Although a complete discussion of the results of our investigation is beyond the scope of this report, preliminary results suggest that students who regularly used the online pharmacology supplement made significant gains in pharmacology knowledge. There is also an indication that first-year medical students, who had access to the supplement, were more satisfied with their pharmacology learning and knowledge than their counterparts from the previous year, who did not have access to the supplement.

Student perceptions of the curriculum are surveyed at the end of each block. The survey at the end of the "Homeostasis" block for the Class of 2011 (for whom the online pharmacology supplement had not yet been available) revealed a great deal of dissatisfaction with the integration of pharmacology concepts in the curriculum. In contrast to the other four topics surveyed, the mean rating for pharmacology was below the midpoint on a six-point scale (Figure 2). For the Class of 2012, the ratings of pharmacology concept integration were markedly higher than the previous year, although still the lowest of the five concepts surveyed. The pharmacology rating increase of nearly a full point on a six-point scale represents a medium effect size (Cohen's d = 0.65) and was statistically significant: t (304) = 5.72, $p < 0.001$. This change appears to be specific to pharmacology; there was no general trend for increased ratings for the other four topics, with two increasing slightly (Cohen's d = 0.24 and 0.09) and two decreasing slightly (Cohen's d = -0.23 and -0.11), and no differences significant at an alpha level of 0.01 (all ts < 2.1, all ps > 0.04).

DISCUSSION/LESSONS LEARNED

Based on feedback from students, there was a need to supplement the pharmacology teaching in the existing curriculum at CWRU. Faculty members were also interested in increasing the presence of pharmacology early in the curriculum. With virtually no budget beyond "volunteer" faculty time, one student's summer support, and a willingness of our Academic Computing office to facilitate our use of the existing electronic curriculum infrastructure, we successfully created supplemental online modules that appeared to increase pharmacology learning. Even though the modules were completely voluntary, a reasonable number of students used the modules and appeared to find them useful. Though they represented a self-selected group, students who used the modules regularly showed significant increases in pharmacology

knowledge. Preliminary results and student feedback suggest that the students who had access to the supplement were more satisfied with their pharmacology learning than students from the previous year, who completed the curriculum before the supplement was created.

During this project, the authors learned some valuable lessons about creating a new supplemental curriculum. We were surprised to find that a significant number of students would use the supplement on a purely voluntary basis. Communication with the students was key; though we used several different methods to announce the existence of the supplement to the students, there were students who were upset and claimed that they did not know about the existence of the supplement until partway through the last curricular block of the first year. Increased administrative efforts to enhance student awareness may be necessary, given the diverse commitments that entering medical students have in their schedules. Anecdotally, student word of mouth appeared to be one of the best means of advertisement and reinforcement of the utility of completing the modules.

Creating content for the weekly modules was time-consuming. Even though the modules were generally very brief, the content had to be established, *de novo*, often in collaboration with multiple faculty members. Even formatting the modules with pictures and graphs into the available electronic curriculum system required considerable effort, and the learning curve was initially steep. For the first block of the supplement, modules were not completed until the morning the module was to be released. Now that the modules have been created, much less time is required for maintaining/updating content. In the future, additional modules will be designed to further supplement learning of therapeutic agents that occurs in the second year of the curriculum.

Obtaining organizational buy-in and approval from stakeholders was also more time consuming than anticipated. The effort required for engaging various faculty committees, the pharmacology faculty, and the

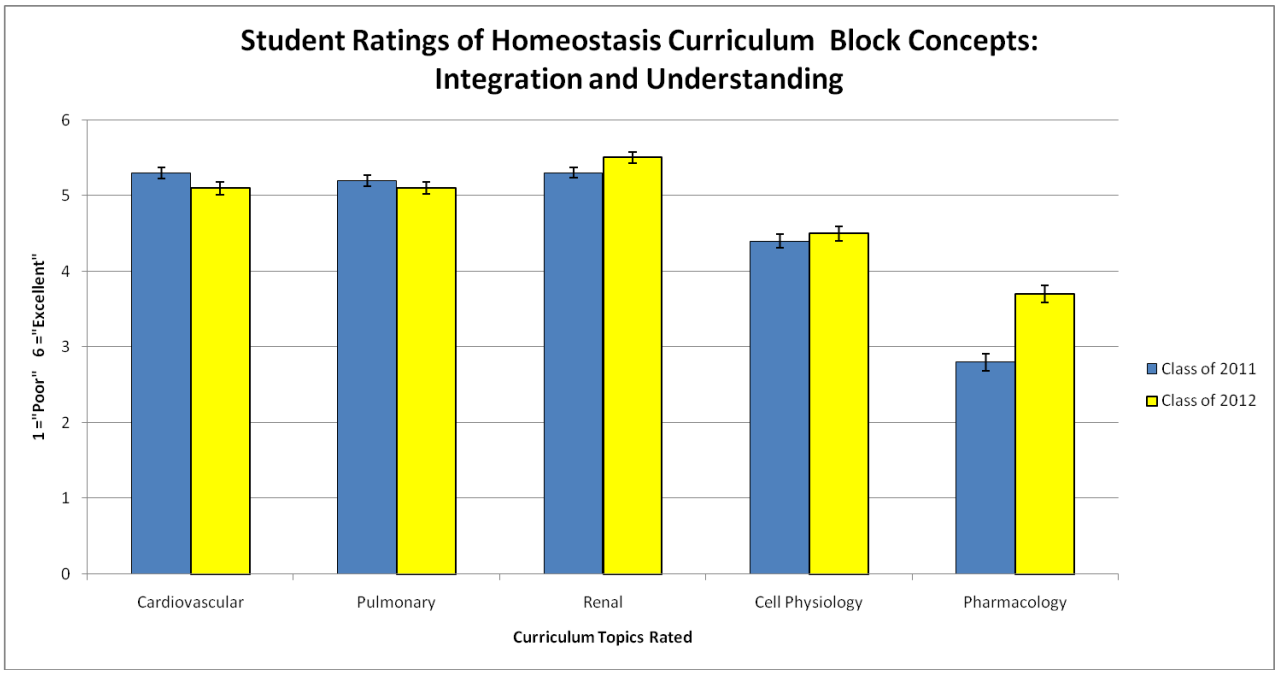

Figure 2. Student Ratings of Integration and Understanding for Curriculum Topics before and after Introduction of Online Pharmacology Supplement. Student ratings for pharmacology after the introduction of the online pharmacology supplement for the class of 2012 were markedly higher than the previous year (Class of 2011, before the introduction of the supplement), while no consistent trend for improvement was evident in the ratings of the other curriculum topics surveyed.

administration is not to be underestimated. Ultimately, however, reactions have been positive and preliminary results suggest that this supplement increases student learning and satisfaction. We continue to work toward further integrating this longitudinal pharmacology supplement into the existing curriculum and enhancing student learning of fundamental principles of pharmacology and the appropriate utilization of therapeutic agents.

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METHODS

Generating Multiple-Choice Questions from an Existing Short-Answer Radiology Examination

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INTRODUCTION

Multiple-choice exams are used frequently in medical education. They are reliable and allow for rapid marking and immediate feedback for students.[1] However, creating and writing effective multiple-choice questions is a time-intensive process that involves 3 steps: writing clear objectives, defining levels of learning and following basic test writing rules. The three basic levels of learning are *knowledge, combined comprehension and application,* and *problem solving*.[2]

The National Board of Medical Examiners and the Medical Council of Canada have both published guides to aid in constructing effective test questions.[3,4] These guidelines demonstrate how to generate clear questions and appropriate answers. At the University of Ottawa, medical students are taught basic radiology as a component of a broad Foundations course. Short-answer radiology questions have traditionally been incorporated into a practical Foundations exam, in which examinees are tested on anatomy and microbiology as well. Examinees rotate through 12 radiology stations. The anatomy and histology components of the exam are tested in the multiple-choice format. Thus, marking the radiology component of the exam has been more difficult than marking the other components of the exam. This article describes the process of converting the previously existing short-answer questions to multiple-choice questions.

METHODS

After reviewing the existing short-answer questions, the exam writer formulated an educational objective for each question. The objective helped define the level of learning of each question. Several of the previously existing questions examined the *knowledge* level of learning, and some of these questions were omitted. After determining which level of learning was to be examined the exam writer formulated the question, ensuring that the question was related to the educational objective. The exam writer also ensured that the stem was a clear, direct question. Then, the exam writer generated -distracters by incorporating common learner errors into the options. An example of this process is found in Appendix. The exam was then reviewed and approved by members of the Faculty of Medicine.

DISCUSSION

Writing effective multiple-choice examinations is time-intensive, and it can be a difficult process. Several steps are involved in writing just one effective multiple-choice question. Writing clear objectives and determining the level of learning examined by individual questions are important steps that should be done prior to writing multiple-choice questions. Objectives should focus on important, relevant topics rather than on trivia and should be measurable. Vague statements, which use such words as

understand and *learn*, result in unclear, immeasurable objectives.[2]

Multiple-choice questions can be used to examine higher levels of learning.[2] Adding clinical stems is one way to examine application of knowledge rather than simple recall of isolated trivia .[4] When testing radiology, higher level questions require examinees to identify structures or findings correctly, interpret the image, and then use that information to answer questions correctly. Questions that require examinees to identify structures are examining at the *knowledge* learning level rather than at the *application of knowledge* learning level. However, when a learning objective states that recall or recognition is the task required of the examinee, questions that examine the *knowledge* level of learning are appropriate.[2]

Basic rules should be followed when one writes multiple-choice exams. Questions should be clear, and if possible, students should be able to answer the question without looking at the options.[4] All information necessary to answer the question should be provided[2] and options, including the distracters should be homogenous.[4] For example, if the question asks which structures are involved in inflammatory arthritis, all answers should be anatomical structures. Generally, negatively worded questions that include *not* or *except* should be avoided.[2]

A criticism of multiple-choice exams is that of a cueing effect which can aid students in identifying the right answer.[5] Scores have been shown to be higher on multiple-choice exams than on open-ended exams, but this effect seems to diminish with a higher level of expertise on the part of the examinee.[5] Questions related to identification of a diagnosis have demonstrated a more prominent cueing effect than questions related to management of patients and interpretation of data.[6]

This article demonstrates the process of converting short answer questions to multiple-choice questions. Multiple-choice questions are a reliable form of assessment that allow for rapid marking .[1,2] Following established and well- published guidelines can aid in the development of effective multiple-choice questions that examine high levels of learning.[4]

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Appendix

The original short answer question:

Using the radiographs answer the following questions:

- *What is the arrow pointing to?*
- *In what pattern(s) of arthritis is this seen?*
- *What is the typical target site?*

The multiple choice question generated:

A 40 year old woman presents to her family doctor with increasing fatigue over the last several months. She has pain, swelling and stiffness in her hands and feet. The following radiographs of her feet are obtained:

Q1: To what radiological findings are the arrows pointing?

A. Erosions
B. Sclerosis
C. Osteophytes
D. Soft tissue tophi

Q2: What is the primary target site in this type of arthritis?

A. Articular cartilage
B. Synovium
C. Peri-articular bone
D. Ligaments

Do Accompanying Clinical Vignettes Improve Student Scores on Multiple Choice Questions (MCQs) Testing Factual Knowledge?

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ABSTRACT

We assessed the impact of using clinical vignettes in single best option multiple choice questions (MCQs) on recall of factual pharmacology knowledge. We tested the same knowledge of isolated facts using two sets of MCQs using in-term quizzes administered to second year medical students. The MCQs used by the intervention cohort were context-rich with accompanying clinical vignettes; the MCQs used by the control cohort were context-free requiring recall of identical knowledge. The intervention cohort students correctly answered fewer MCQs (context-rich MCQs) than the control cohort (context-free MCQs). A similar difference was detected between the two cohort answers on the common MCQs . Later we retested the same knowledge on the mid-term and final examinations using the same context-free MCQs for the entire class. The students in both cohorts performed better on the retested MCQs than on newly created MCQs, but there was no significant difference between the two cohorts.

Responses on a five-item "closed response" questionnaire indicated that the majority of students are favorably inclined to context-rich MCQs but some have reservations about this format. We conclude that facilitating recall of knowledge is not a compelling reason for using MCQs with accompanying clinical vignettes.

INTRODUCTION

Among the wide variety of written methods of assessment, multiple choice questions (MCQs), especially the single best option variety, remain the steady staple of examinations administered to undergraduate medical students. Despite the criticism that they promote regurgitation of facts rather than exploring higher order reasoning [1] MCQs continue to be extensively used not only by medical schools but also in the initial steps of

examinations by licensing bodies [2]. Their logistical advantage of allowing testing of large numbers of students and broad sampling of topics in a relatively short time remains unchallenged by any other formats of written examinations.

The validity of MCQs is sometimes questioned because they test factual knowledge rather than professional competence that integrates knowledge, problem solving, communication skills and attitudes. Nevertheless, it has been convincingly shown that knowledge of a domain is the single best determinant of expertise [3]. Thus, this form of written test continues to be regarded as a valid method of testing competence [1;4].

The format and wording of the stem of a MCQ, (what the question asks), play an essential role in determining what is being assessed. In its simplest form a MCQ can ask about an isolated fact. Such a "context-free" MCQ tests rote knowledge only. Higher order skills, such as interpretation and problem solving are best tested using a "context rich" stem, in which the question is embedded in a meaningful context [5]. In biomedical subjects, context enrichment most often takes the form of a clinical vignette [2]. The putative advantages of enriching the stem with a clinical vignette are two-fold. First, it presumably allows for the assessment of higher order cognitive skills. Second, information is thought to be better recalled when the learning context is similar to the retrieval context [6]. For this reason, the universal use of clinical vignettes is strongly encouraged even with MCQs testing factual knowledge.

The goal of the present study was to test the validity of the second conjecture by exploring the differences between context-rich and context-free MCQs. The context-rich MCQs were embedded in clinical vignettes; the context-free were not. The subjects of this study, second year medical students in an integrated basic medical science course, were tested on the pharmacology and therapeutics component of the course. The content was taught, for the most part, in a clinical context. Our study addresses the following questions: (1) When testing the same factual knowledge, do students perform differently on context-rich compared to context-free MCQs? (2) Is recall of factual information influenced by whether previous evaluation was with context-rich or context-free MCQs ?

MATERIALS AND METHODS

We conducted this experimental, prospective, cluster-randomized study during a three month interdisciplinary course at the beginning of the second year of the four-year undergraduate medical curriculum at McGill University. Diverse teaching modalities were used in the course: didactic lectures, interactive whole class formats, and small group sessions. The small group sessions in the pharmacology component of the course employed case-based learning, providing opportunities to discuss important pharmacological principles on the background of a clinical case.

Single best option MCQs are the major component of the multidimensional assessment of the students. In addition to the midterm and final examinations, we used MCQs in the in-term quizzes, two of which were before the midterm examination and two of which were before the final examination. We administered the in-term quizzes at the end of the pharmacology small group sessions then, as learning activity, we discussed the questions and provided the correct answers.

Our study design is outlined in Table 1. The Dean's office randomly assigned the students to 13 small groups of 13 or 14 students each. For the purpose of this investigation, we divided the class into two cohorts. The intervention cohort comprised 109 students in small groups 1, 3, 5, 7, 9, 11 and 13; the control cohort included 93 students in groups 2, 4, 6, 8, 10, and 12. To verify that the intervention cohort and the control cohort were academically equivalent, we calculated the average grade and the Z-score of the students in the two cohorts in all seven preceding basic science course units of the first year medical curriculum. The average grade and average Z score of the students in the intervention cohort was 81.4% and 0.015; for those in the control cohort the averages were 81.1% and -0.018. Thus we were assured of reasonable randomization.

We then prepared two sets of in-term quizzes. Each quiz consisted of 12 MCQs. In one set of quizzes (used for the intervention cohort) there were 4 MCQs that were context-rich with clinical vignettes, and in the other set (used for the control cohort) there were 4 identical, but context-free, MCQs designed to test the same knowledge (Table 2). The remaining 8 MCQs ("common MCQs") were the same for both cohorts. The authors, two clinicians and two basic scientists, wrote the MCQs with assistance from two experienced pharmacology lecturers. We later reused the context-free MCQs in the midterm and final examinations with slight modifications (usually by changing the sequence of the answer options).

Testing student knowledge recall in quizzes

The students in intervention cohort completed in-term quizzes containing a total of 16 context-rich MCQs with clinical vignettes and 32 common MCQs. The control cohort students completed in-term quizzes containing a total of 16 context-free MCQs and the same 32 common MCQs. We carefully matched the context-rich and context-free MCQs to ensure that they tested the same knowledge.

Testing student knowledge recall in the midterm and final examinations.

In the midterm and final examinations, we retested the same knowledge tested in the in-term quizzes. For this we

used 16 (8 in midterm and 8 in final examinations) modified context-free MCQs that had been used in the in-term quizzes. All MCQs in both examinations were the same for the entire class.

Table 1. Study design.

Random assignment of students to small groups

September — Cluster randomization of small groups to intervention and control cohorts

Verification of academic equivalence of the students in the two cohorts

	Intervention cohort		**Control cohort**	
	Study MCQs	Common MCQs	Study MCQs	Common MCQs
	Quiz 1			
	4 context-rich MCQs	8	4 context-free MCQs	8
October	**Quiz 2**			
	4 context-rich MCQs	8	4 context-free MCQs	8
	Midterm examination			
	8 context-free MCQs (retested)	28	8 context-free MCQs (retested)	28
November	**Quiz 3**			
	4 context-rich MCQs	8	4 context-free MCQs	8
	Quiz 4			
	4 context-rich MCQs	8	4 context-free MCQs	8
December	**Final examination**			
	8 context-free MCQs (retested)	33	8 context-free MCQs (retested)	33
Total MCQs on quizzes	16	32	16	32
Total MCQs on exams	16	61	16	61

Statistical indicators of MCQs

For each MCQ on the midterm and final examination, four statistical indicators are routinely provided by the McGill computing centre [7]: (1) MCQ difficulty is the proportion of students who answered correctly of the total who attempted to answer. The MCQ ability to differentiate between those who achieved a high or low score on the examination is presented as (2) the biserial correlation coefficient and (3) the point biserial correlation coefficient. (4) MCQ reliability is a coefficient measuring, for each MCQ, the proportion of true variation with respect to errors of measurement. These statistical indicators for the various MCQs were compared (Table 3).

Student questionnaire

We administered an anonymous five item questionnaire exploring the student attitudes towards context-rich and context-free MCQs using a forced choice 5-point Likert scale anchored by "strongly agree (5)" and "strongly disagree (1)" (Table 4). The same questionnaire requested elementary demographic data and invited optional narrative comments.

Ethical considerations

Prior to the study, we informed all students that some of the MCQs in the quizzes would be used for research

purposes only. The study was approved by the Research Ethics Board of the McGill University.

Table 2. Examples of pairs of matching MCQs testing the same factual knowledge: a context-rich MCQ with a clinical vignette and a context free MCQ.

Ms. S. R. is 44 years old homemaker with a long history of alcoholism. After several incidents that caused her embarrassment among relatives, she agreed to seek professional help. She entered a residential program that emphasizes group therapy but also uses pharmacological agents. She was given a drug that decreases craving for alcohol, possibly through an action involving the endogenous opioid system. The drug she received is likely:

1. disulfiram
2. naltrexone
3. diazepam
4. nalbuphine
5. buproprion

Answ. 2

Which of the following drugs can decrease craving for alcohol presumably through an action involving the endogenous opioid system?

1. disulfiram
2. naltrexone
3. diazepam
4. nalbuphine
5. buproprion

Answ. 2

Ms. A. W., a 72 old homemaker, complained of difficulty sleeping, fatigue and shortness of breath upon reclining. Physical examination revealed swollen ankles and pulmonary rales (crackles). You prescribed captopril (an ACE inhibitor). A day later, her husband brought her to the emergency room because she could hardly breathe after going to bed. Her symptoms, especially those of pulmonary congestion got much worse. You conclude she has acute pulmonary edema due to left ventricular failure. Which of the following drugs would most likely be effective in treating her condition acutely?

1. Amiloride (a potassium-sparing diuretic)
2. Mannitol (an osmotic diuretic)
3. Hydrochlorothiazide (a thiazide diuretic)
4. Furosemide (a loop diuretic)
5. Losartan (an angiotensin receptor antagonist)

Answ. 4

Which of the following drugs is most effective in controlling acute pulmonary edema associated with left ventricular failure?

1. Amiloride (a potassium-sparing diuretic)
2. Mannitol (an osmotic diuretic)
3. Hydrochlorothiazide (a thiazide diuretic)
4. Furosemide (a loop diuretic)
5. Losartan (an angiotensin receptor antagonist)

Answ. 4

Mr. S.A., 60 year old CEO, is about to undergo abdominal surgery. He is anesthetized with an inhalation anesthetic and given a single intravenous dose of pancuronium. Power is lost in the operating room and the surgeon decides to stop the procedure. Which of the following drugs is suitable to reverse the effect of pancuronium?

1. Atracurium
2. Bethanechol
3. Neostigmine
4. Physostigmine
5. Pralidoxime

Answ. **3**

2. The effects of pancuronium can be safely reversed by:
    1. atracurium
    2. bethanechol
    3. neostigmine
    4. physostigmine
    5. pralidoxime

Answ. **3**

Statistics

We used conventional descriptive statistics, Bonferroni t-test and Spearman correlation coefficient for comparison of the measured values.

RESULTS

Performance on the in-term quizzes

The control cohort students performed better than those in the intervention cohort on the 16 in-term MCQs which tested the same knowledge. The average grade on the context-free MCQs was 66.7 for the control cohort and on the context-rich MCQs 60.0 for the intervention cohort ($p < 0.05$, Fig. 1A). The control cohort students also performed better on the 32 common MCQs, i.e. the same context-free MCQs done by both cohorts (75.6% vs. 68.6%, $p < 0.05$, Fig. 1B).

Performance on midterm and final examinations

The intervention and control cohort students performed almost identically on the 16 retested MCQs (84.9% vs. 83.4%, $p>0.05$, Fig.2A) as well as on the balance of 61 new-MCQs (78.7% vs. 76.0%, $p>0.05$, Fig 2B). Both cohorts performed better on the 16 retested MCQs than on the 61 new MCQs (intervention cohort 84.9% vs. 78.7%, $p<0.05$; control cohort 83.4% vs. 76.0%, $p<0.05$) regardless of whether the material had been previously tested using context-rich or context free MCQs.

Statistical indicators

There were three categories of MCQs in the final and midterm examinations: context free MCQs tested before (retested); context-free MCQs not tested before (new); and context rich MCQs not tested before (new). The mean of the difficulty indicators of the retested MCQs was statistically insignificantly higher than that of the other MCQ categories. This reflected the improved performance of the students on the retested MCQs. The indicators of discrimination and reliability of all three categories of MCQs were comparable (Table 3).

Table 3. Statistical indicators of the MCQs on midterm and final examinations: means (±SEM) and number of MCQs.

	N	Item Difficuly	Biserial Correlation	Pt. Biserial Correlation	Reliability Index
Context-rich new MCQs	11	0.72 ± 0.06	0.33 ± 0.05	0.24 ± 0.03	0.13 ± 0.02
Context-free new MCQs	50	0.77 ± 0.02	0.39 ± 0.02	0.28 ± 0.01	0.15 ± 0.01
Context-free retested MCQs	16	0.85 ± 0.03	0.36 ± 0.05	0.25 ± 0.03	0.13 ± 0.02

Table 4. Student preference questionnaire: means (±SD) and number of completed questionnaires

Question	Mean±SD N
5=Strongly agree; 4=Agree; 3=Undecided; 2=Disagree; 1=Strongly disagree	
1. Context-rich MCQs help me understand the clinical relevance of the tested factual knowledge.	**4.12±0.95** 126
2. Context-rich MCQs help me to recall the factual knowledge required for the correct answer.	**3.59±1.1** 126
3. Context-rich MCQs help me to remember the tested factual knowledge for longer time than the context-free questions.	**3.55±1.06** 126
4. Context-rich MCQs delay my answer and distract my attention to the tested factual knowledge.	**3.55±1.06** 125
5. Overall, I prefer context-rich MCQs to context-free MCQs.	**3.41±1.20** 126

Questionnaire responses.

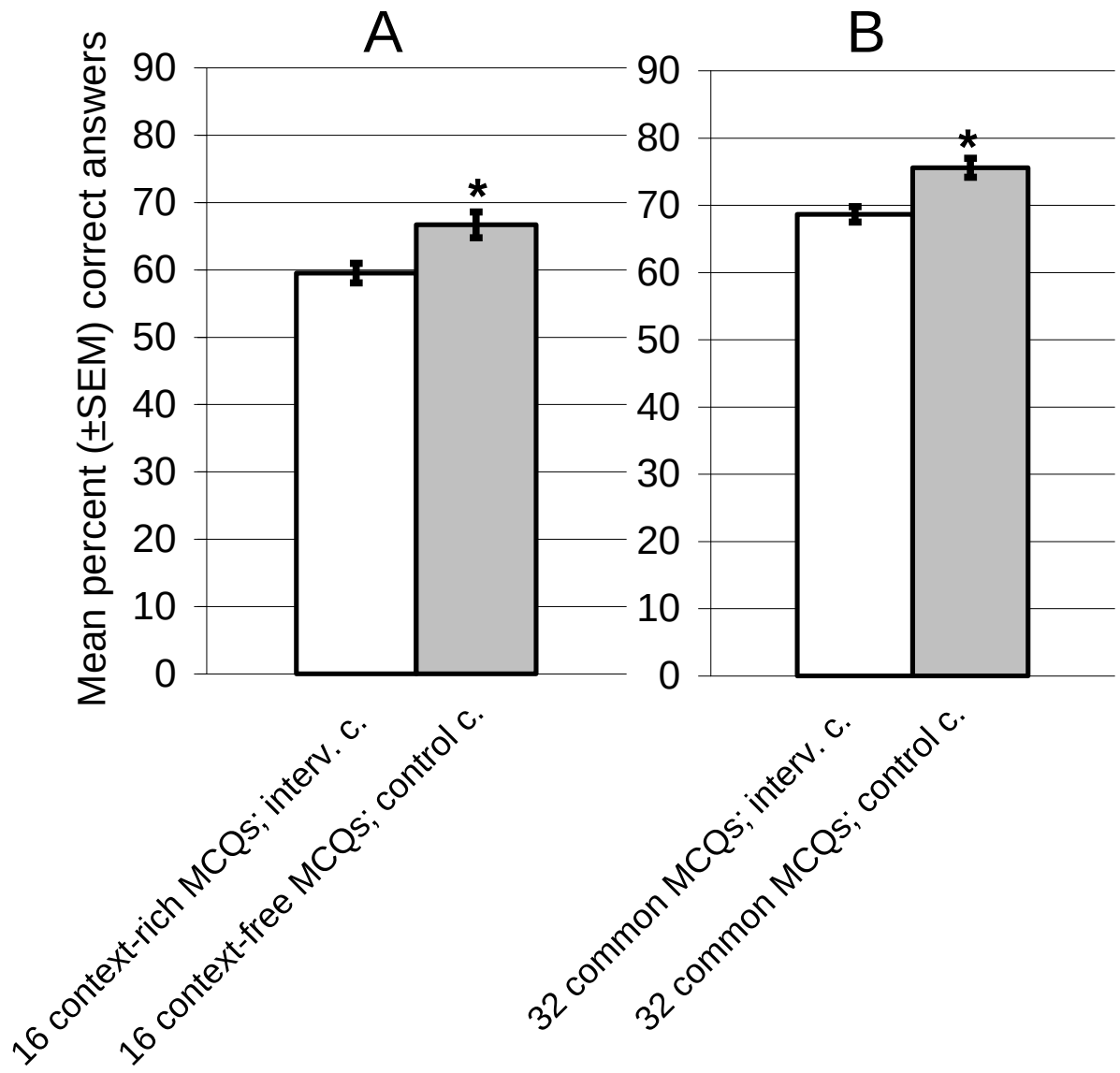
Of the 202 students in the class, 126 (62%) completed the questionnaire. Their answers are summarized in Table 4. The responses to statements 1, 2, 3, and 5 indicate that the majority of students were favorably inclined to the use of context-rich MCQs. The responses to statement 4 revealed that a sizeable minority of students had reservations about this MCQ format. The mean values of responses of students with different levels of education before admission to medicine to statements 1, 2, 3 and 5 were not different. However, the mean values of the responses to statements 4 were negatively correlated with three categories of the level of education (premed, undergraduate, and graduate or professional degree) before admission to medical studies (Spearman rank correlation coefficient=-0.31, $p<0.05$, N=125), indicating a lesser degree of preference for the context rich MCQs of the students with less advanced education.

Many of the 28 narrative comments received were favorable, such as: "*Context-rich is the way to go. Yes, more time consuming but if done appropriately then better as teaching tool. Also USMLE-like"*. The most frequent positive comments related to the idea that use of the context-rich format is helpful in preparation for the licensing examinations which use that format. Some were negative, such as: *"At the basic, first time learning stage, the info should be tested (i.e., quizzes) in a more basic, less complicated context-free way".*

DISCUSSION

In recognition of the generally accepted notion that medical education should be integrated and that basic sciences should be taught in a clinical context [8], clinical relevance has been the leitmotif of teaching pharmacology at McGill University for many years. The relevance of basic science in clinical medicine is emphasized in didactic lectures and further reinforced in small group sessions and other interactive teaching modalities by presenting pharmacological principles in a context of clinical cases. In view of this, we were surprised that the clinical vignettes used in our study did not give the intervention cohort students a selective advantage in recalling the factual knowledge required for correctly answering the context-rich MCQs in the in-term quizzes. In fact, the intervention group students performed less well than the control cohort students on MCQs testing the same factual knowledge. All students had had some experience with context-rich MCQs with clinical vignettes from previous courses therefore unfamiliarity with this format cannot readily explain this difference. The same difference between the two cohorts emerged in answering the "common" MCQs that were the same for the entire class. Thus, the poorer performance by the intervention cohort students may reflect a difference in knowledge of the material tested in the in-term quizzes rather than increased difficulty in answering the context-rich questions. There also is a possibility that the reading of the longer stems of the context-rich MCQs distracted the students and had negative influence on the overall performance in the

Figure 1. Comparison of correct answers by students of the intervention and control cohorts in four in-term quizzes. (A) 16 context-rich MCQs, intervention cohort and 16 context-free MCQs, control cohort; (B) 32 "common" MCQs, intervention and control cohorts: * $p<0.05$.

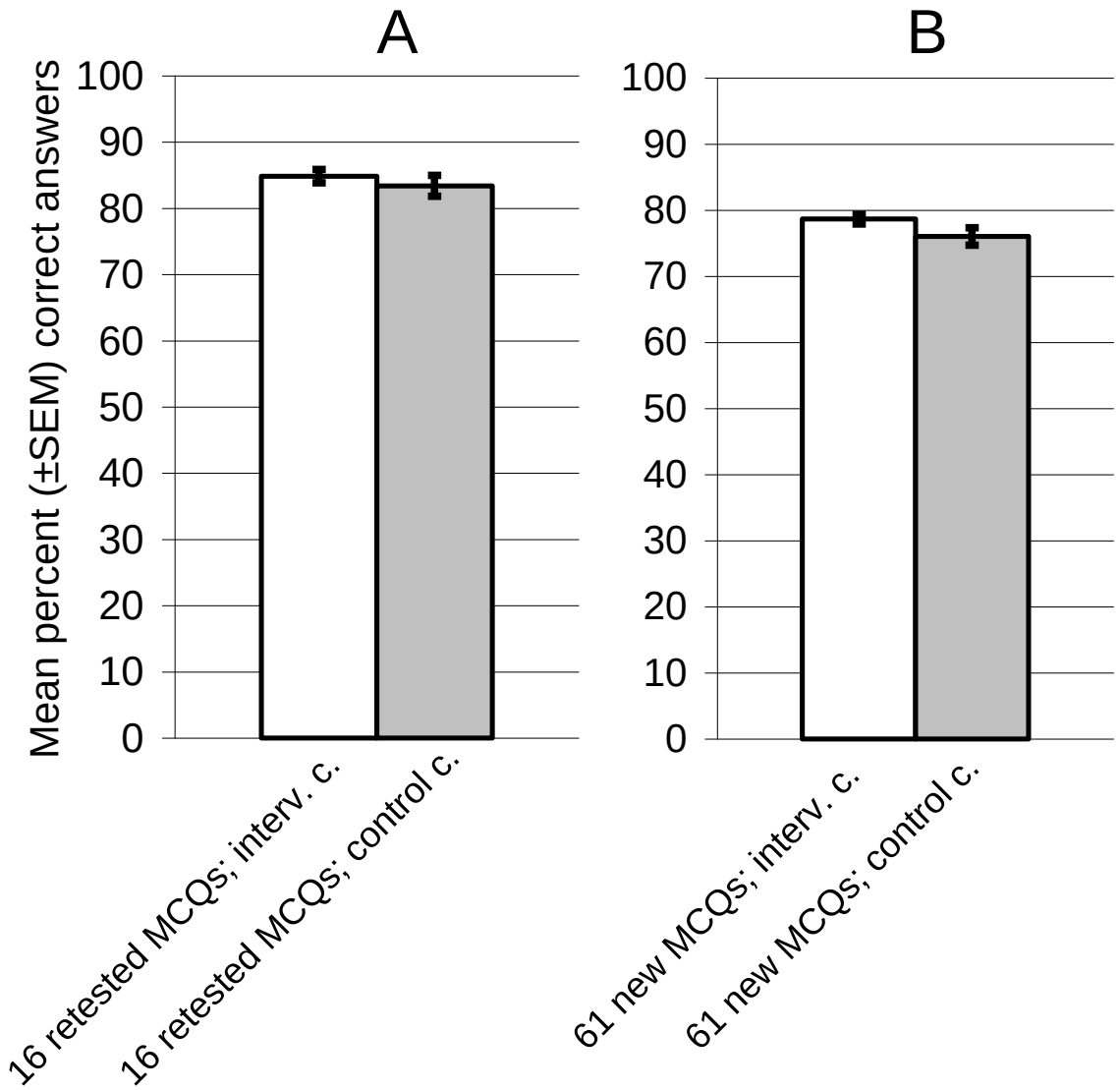


quizzes. Uneven matching of the two cohorts is unlikely to account for this difference since their performances in the seven interdisciplinary basic science courses of the first year medical curriculum were equivalent (see Methods) as were those in the subsequent pharmacology component of the midterm and final examinations (Fig. 2).

Although the in-term quizzes were used minimally as a component of summative assessment, their main purpose was formative by providing a learning experience, especially in preparation for the midterm and final examinations. Quite predictably, they accomplished this goal. In the midterm and final examinations, students in both cohorts correctly answered more retested MCQs (context-free MCQs that retested the knowledge previously tested in the in-term quizzes) than new MCQs. However, there was no overall performance difference between the two cohorts suggesting that previous exposure to either, context-rich MCQs or context-free MCQs in in-term quizzes improved equally the formative outcomes in the midterm and final examinations.

Our study has limitations. First, because of the scheduling of the small group sessions and the examinations, the test-retest time interval (between the quizzes and the examinations) varied from 4 to 32 days Second, we have

Figure 2. Comparison of correct answers by students of the intervention and control cohorts in the midterm and final examinations. (A) 16 retested MCQs, intervention and control cohorts; (B) 61 new MCQs, intervention and control cohorts



no objective verification that the two versions, context-free and context-rich, of a MCQ tested identical factual knowledge exclusively. We relied on the judgment of five experienced medical teachers that the same factual knowledge was sufficient to correctly answer both versions of the given MCQ and that reading the longer stem of the context-rich MCQ was the only additional task facing the intervention cohort students.

The student responses on the questionnaire imply that an overall positive attitude to the context-rich MCQs prevailed among them. From the narrative comments submitted it appears that the main reason for this attitude was purely pragmatic, namely "practice" with context-rich MCQs is useful preparation for the licensing examinations. Nevertheless, a substantial number of students had reservations about this format; as the correlation suggested, this attitude was more prevalent in students with fewer years of university education before they began medical school. The presumably older and more mature students, with more advanced education before admission to medicine, were apparently better able to recognize the value of clinical context for their learning, or simply were less influenced by the longer stem of the context-rich MCQs.

The basic tenet of learning in context is that recall is facilitated when the new knowledge is acquired in an authentic context [9]. This notion has been put into practice in problem based learning where basic science and clinical knowledge are learned in the context of clinical problems relevant to medical practice. The evidence that recall is facilitated when the context in which learning occurs resembles the context in which the knowledge is tested, is well documented [10]. However, Koens et al. [11;12] failed to confirm the same context advantage in an environment relevant to medical education, the classroom and the bedside, suggesting that the context of physical surroundings does not contribute to the same context advantage in medical education. Obviously, the concept of context in education is more encompassing than physical surroundings [12].

Although it is commonly assumed that the clinical context increases commitment to acquire and retain basic biomedical science knowledge, our results failed to support this notion. The context of clinical vignettes in the stem of the MCQs affected neither the summative outcome of the MCQs, the recall in the quizzes, nor the formative outcome, the later recall tested in the examinations. The additional clinical context of the MCQ in the quizzes was not sufficiently significant or authentic to provide any cognitive advantage measurable by the assessment in the examinations.

CONCLUSION

Our study suggests that facilitation of both learning and recall of factual knowledge is not a compelling reason for using context-rich MCQs.

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Designing Clinical Pamphlets in a Physiology Course Facilitates Learning in Chiropractic Students

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ABSTRACT

In this manuscript we have demonstrated the effective use of pamphlet design by students taking the physiology course at a chiropractic school. The activity helped students to hone their skills by working in groups, develop creativity and apply physiological concepts to real life situations. A rubric was adopted to grade the pamphlets. At the end of the course, the students had the opportunity to present their work during a lab session and communicate with colleagues on their projects. The students benefited immensely from this unique learning experience and encouraging feedback was received on this learning activity.

INTRODUCTION

In observing healthcare institutions, clinics use brochures, leaflets or pamphlets as helpful resources to educate patients. In recent years, more emphasis has been given in designing pamphlets, including the implementation of cognitive psychology to augment the effectiveness of their use [1]. These educational tools are designed and distributed for a number of reasons, including tools to address general health education material, educating patients on the safety and use of a pharmaceutical agent, addressing important health issues, when advertising and recruiting teaching faculty and/or for research purposes.[2,3,4,5,6,7] Moreover, at Northwestern Health Sciences University, physiology students enrolled in the chiropractic program are required to develop a brochure or pamphlet that amalgamates physiology course work with chiropractic medicine. The learning activity constitutes about 10% of the student's final grade. As a summative assessment, the designing pamphlet assignment motivates students to learn, work in a team and apply basic science principles to both clinical sciences and common clinical presentations. The learning objectives for designing a pamphlet were as follows:

- Students will understand and use online programs to design a pamphlet
- Students will perform retrieval of references from online resources with assistance from the university library
- Students will develop and demonstrate the ability to work in a group
- Students will appreciate their communication and presentation skills
- Students will apply principles of physiology to a clinical or a real life scenario

Details of the Pamphlet/Brochure as a Summative Assessment:

Based on an outlined assessment rubric (see Table 1.0), a total of 25 points was allocated for the research and design of the pamphlet. These pamphlets would cover information relative to a physiology topic of study correlated to and pertinent to patient education. Students worked in groups of two with the working partner assigned from the same lab section. Although strongly discouraged

and pending individual circumstances, a student had the option to work independently. Students were to refrain from choosing a partner from another lab section to avoid unnecessary confusion and logistic work for instructors. In the introductory lab session, students were made aware that pamphlets would be graded based on the rubric in Table 1.0. Before starting the project, students were given the following guidelines:

1. All topics are approved by the professor before a given deadline and are submitted on index cards with title and names of the group members. The index cards are provided by the instructor (different colored cards were chosen for different lab sections) and 5 points were awarded for timely submission.
2. All pamphlets are due by a given date to receive 20 points based on the rubric. Points are deducted for late submission.
3. Pamphlets are accepted as a single page, bifold or in a trifold format.
4. The font size should be appropriate with no double spacing.
5. All pamphlets are properly documented with at least 3 sources (2005 or later) and written with proper grammar and spelling.
6. Any student caught plagiarizing will be subjected to academic review.
7. Students who decide to use this pamphlet as a resource for patient education are suggested to have copyright approval for any material, pictures or diagrams they have used in their brochures.
8. The students are required to initial and sign for record that they understood the aforementioned guidelines.

Sharing Knowledge:

Towards the end of the term, one of the lab sessions was dedicated to student presentations. Prior to this presentation, students distributed copies of their pamphlet, both to their instructor and to students in their lab section. Ten (10) points were allocated solely to their presentation, independent from the developmental phase of the pamphlet. The following aspects were considered when evaluating the students.

- Students made a 5 minute presentation to discuss content of the pamphlet and share acquired knowledge with lab members
- Each presentation was followed by a 5 minute question and answer session
- Students were assessed on the clarity of their presentation, team work and their ability to answer questions on their topic
- An independent faculty member could also be invited to evaluate the students

DISCUSSION

Student perspective on this learning activity:

The clinical physiology pamphlet exercised a multitude of dimensions: application of basic physiology to common clinical presentations, integration from other course work, effective patient communication, and critical thinking.

Applying our physiology course work in this particular assignment was an effective way to summarize important course-related details that may otherwise have been forgotten. At times, it is easy to get lost in the plethora of material presented in the classroom. If not provided the opportunity to exercise and apply the principles presented, students may fail to fully grasp and understand the course's fundamental objectives. Because of the activity, basic concepts of which may be pertinent for chiropractors, such as the role of basic sciences in the development of an accurate diagnosis and other future clinical applications are subsequently lost and underappreciated. This project aimed to substantiate the learning objectives.

Additionally, this assignment provided students with the opportunity to apply basic physiology principles to common clinical presentations: diabetes, rheumatoid arthritis, and hypertension, to name a few. The assignment encouraged students to think critically about the role of human physiology in these commonly diagnosed conditions. As a result, group members challenged one another on their knowledge regarding the topic, researched the topic, incorporated course work from other areas, for example histology, and radiology, and even went as far as to discuss how we as future chiropractors could care for patients with similar presentations. This integrative experience contributed to a thorough understanding of the fundamental principles, their clinical applications, and available treatment options for the chosen topic.

Furthermore, students quickly learned to appreciate the importance of effective patient communication. One challenge of particular relevance involved taking a wealth of information pertaining to the chosen topic and summarizing it into a clear and concise document that encompassed the topic's clinically relevant information and in such a way a patient would understand. Students become accustomed to using medical vernacular throughout their chiropractic training and get away from using common, everyday language. While working on this assignment, students quickly learned to appreciate the difficulty of this task as well as the preparation and practice required to convey information about a particular subject. The use of plain language in brochures has been previously highlighted in the literature.[8]

Table 1.0: Sample rubric for grading the pamphlets:

Requirements	4 pts	3pts	2pts	1pt	Total
Proper documentation of resources with rubric attached	**All 3 references are documented correctly**	**Improper documentation of one reference**	**Improper documentation of two references**	**Improper documentation of all references**	
3 current resources from 2005-2010	**All 3 references are current**	**Two references are current**	**One reference is current**	**No current references listed**	
Detailed topic description including what, how, signs, symptoms, treatment	**Detailed topic description with what, how signs, symptoms, treatment**	**Pamphlet did not include one of the following: what, how, sign, symptoms, treatment**	**Pamphlet did not include two of the following: what, how, sign, symptoms, treatment**	**Pamphlet did not include three + of the following: what, how, sign, symptoms, treatment**	
Professional appearance, spelling, grammar, and full sentence format	**Professional appearance with no spelling or grammatical mistakes. Full sentences.**	**One appearance, spelling or grammatical mistakes.**	**Two appearances, spelling or grammatical mistakes.**	**Three appearances, spelling, or grammatical mistakes.**	
Pamphlet is correlated to physiology and chiropractic	**Pamphlet strongly correlates the topic with chiropractic and physiology**	**Pamphlet moderately correlates the topic with chiropractic and physiology**	**Pamphlet somewhat correlates the topic with chiropractic and physiology**	**Pamphlet does not correlate with physiology and chiropractic**	
Late submission after 5pm _____(date)					**-20**
				Total/20	

Finally, this assignment capitalized on a number of different learning styles: visual, auditory, and kinesthetic. Visual learners prospered while gathering and presenting relevant diagrams to explain the underlying physiological principles and their relation to the medical condition. Auditory learners benefited greatly during group discussions and as spectators during the in-lab presentations, and the kinesthetic learners excelled while organizing the information and constructing the pamphlet. This interactive assessment provided students with the opportunity to utilize and apply their own unique learning style to accomplish the outlined objectives and gain insight into the role basic science education has in the clinical aspects of their chiropractic education.

Teacher perspective on this learning activity:

Educators in the medical discipline have shown concern on the basic science instruction model and whether it can meet the future challenges in medical education.[9] Basic sciences are a strong component in medical education [10, 11] and innovative assessments to test and increase student knowledge should be periodically added to a course such as medical physiology. Introducing activities such as designing a brochure, pamphlet or poster within a medical curriculum can make basic science subjects more attractive and fascinating to learn. To reinforce, introducing brochure or pamphlet design in early part of the medical curriculum can bridge gap between clinical and basic science knowledge.

Students learn to apply basic science concepts to clinical scenarios that can spark their interest to investigate about patho-physiological concepts.

Henceforth, in early part of the chiropractic curriculum this activity gives students the opportunity to enhance their critical thinking and simultaneously hone their pamphlet designing skills. More importantly, the activity was designed to familiarize students to latest research articles and introduce them to the concept of evidence based medicine. The students in the course practiced to retrieve peer reviewed references via the library or internet. The intention was to make students appreciate the clinical applications in physiology. As chiropractors or any clinician, this exercise will be useful to design pamphlets for patient education in their future clinics and could have tremendous impact on their practice.[12] As shown previously, brochures complement strong physician-patient interaction.[13]

To conclude, the students took great pride in their brochures and developed a mutual understanding and team spirit to complete the project. Taken together, since the activity was being conducted in the basic sciences department it was important to make students realize that basic sciences are an important core of the chiropractic curriculum. To reiterate, sound understanding of basic science principles is required to excel in a chiropractic or medical program and subsequently as a clinician.

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Societies Program at the University of Arizona College of Medicine Design, Implementation and Lessons Learned

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ABSTRACT

Learning community models for medical student education are becoming an increasingly popular method to teach students clinical skills, provide appropriate mentorship, and foster medical professionalism. This paper describes the conception and implementation of such a model, called the Societies Program, at the University of Arizona College of Medicine. Incoming students are assigned to one of a highly selected group of experienced clinical educators in groups of 5 to 6 students, who remain together throughout medical school. The Societies Program introduces medical students to clinical medicine starting on the first day of medical school. Subsequently the groups meet for one afternoon per week in years 1 and 2 for a variety of clinical experiences including clinical labs, bedside teaching sessions, and personal and professional development sessions. These activities are closely linked to and integrated with the material being taught in the basic science blocks to facilitate integration of clinical and basic sciences. Within these sessions student clinical and professional skills are evaluated with a variety of competency-based formative and summative tools. All student work and reflections are compiled in an electronic portfolio designed to encourage self-reflection and student-driven learning.

Two years of data show that the Societies Program is highly valued by students and Society Mentors. This paper describes the challenges and successes encountered as the program started. More work is needed to evaluate the outcomes of this and similar programs. We hope this paper provides insight to those schools that are planning to develop or modify similar programs.

INTRODUCTION

Many medical colleges frequently assess and evaluate their curricula to determine what changes may be needed to better prepare medical students during their undergraduate years. However, schools typically focus on changing a single aspect of the curriculum until it is determined another curricular change is necessary.[1-5] In 2005, the Dean of the University Of Arizona College Of Medicine (U of A COM) started an initiative to update and revise the entire four-year curriculum, starting with years 1 and 2. Literature searches reveal few US medical schools have implemented such a total transformation[6, 7]. Major changes occurred at every level of the curriculum, inclusive of but not limited to changing to a block format schedule, integrating basic science and clinical content into an organ systems approach, changing teaching and student performance assessment methodologies, increasing the number of basic science and clinical faculty for teaching and facilitating, and restructuring the clinical training in

years 1 and 2. Curricular change is ongoing and the new clinical curriculum for years 3 and 4 recently began in July 2009. This paper reviews the design, implementation and lessons learned from one unique curricular aspect added to the new curriculum, the Societies Program. The Societies Program is based on the learning community model and is responsible for clinical training in years 1 and 2 and mentoring for all four years of medical school.

Review of the literature

Goldstein et al review the status of clinical skills education and the design and implementation of their Colleges Program at the University of Washington in their manuscript.[8] The Learning Communities Institute at the University Of Iowa Carver College Of Medicine provides an updated listing of all of the learning communities at medical schools[9]. There are currently sixteen learning communities at US medical schools included in this listing. The first began at the University of Iowa in 1999 with medical schools continuously adding new learning communities. All receive funding through their Dean offices and state budgets with one being funded by a private foundation. Some have dedicated physical space, while others share existing teaching space in the medical school. In addition to clinical skills instruction, there are mentoring activities, career advising, service-learning projects and discussions of the humanities, cultural competency, professionalism and the social sciences. Nearly half of them have a formal evaluation plan in place. One common theme is that faculty involvement is reserved for those faculty members with a reputation for excellence in education. Learning communities, including an on-line learning community[10], have also been used in nursing education[11-13].

MATERIALS AND METHODS

a. Background information

After a thorough evaluation of the strengths and weaknesses of the medical school curriculum, in 2005 the Dean of the COM initiated complete revision of the pre-clinical curriculum at the COM, which had not changed substantially since the COM opened in 1967. The Dean cited many reasons for the change, including well documented and publicized reports on medical error such as those from the Institute of Medicine[14, 15], changing societal needs, continually advancing and expanding medical knowledge, educational advancements and the increasing role of interprofessional collaboration in the care of patients. Along with changing from traditional longitudinal courses to a quasi-organ systems based approach, it was decided to revise the clinical training that COM students received during years 1 and 2. The COM previously relied on volunteer community and university-based preceptors for clinical training in the first two years. As such, there was great heterogeneity among the clinical experiences the students experienced. Citing the lack of a standardized clinical experience in years 1 and 2, the nation-wide decline in bedside teaching and longitudinal mentoring for students[16, 17] and the need to better integrate basic science and clinical science principles in the curriculum, the Dean proposed a learning community model to introduce students to concepts of professionalism and clinical competence early in their training. The goals of this learning community were: 1) longitudinal professional and clinical mentoring; 2) increased experiences in bedside teaching; 3) greater development of physical exam and medical interview skills; 4) greater development of clinical thinking and medical communication skills; 5) clinical application of basic sciences principles; and 6) consistent and structured exposure to modern concepts of medical professionalism.

b. Brief overview of the change from discipline to systems approach

A Steering Committee appointed by the Dean was charged with forming and staffing committees to design and transition the new basic science curriculum. The traditional longitudinal content (Year 1: Anatomy, Histology, Neurosciences, Physiology, Biochemistry, Medical & Molecular Genetics, Medical Interview & Physical Exam; and Year 2: Pathology, Pharmacology, Microbiology, Clinical Correlations with Pathology, Clinical Preceptorship) was redesigned into an integrated block structure. The Blocks are: Prologue (1 week); Foundations; Nervous System; Musculoskeletal System; Cardiac, Pulmonary and Renal Systems; Digestion, Metabolism and Hormones; Life Cycle; Infection and Immunity; Cancer; and Advanced Topics. In addition to traditional content, curricular threads were woven throughout the blocks (Aging, Evidence-Based Decision Making, Gender-specific Medicine, Health and Society, Humanism, and Interprofessional Education). New teaching modalities introduced include interactive lectures, case-based instruction, team-based learning, and interprofessional exercises shared with the Colleges of Law, Nursing, Pharmacy and Public Health and the School of Social Work.

c. Planning for Society program

After the Dean confirmed that a learning community model was financially viable, he sent a faculty member to the University of Washington, a nearby school with an established learning community identified to have similar goals as those to which the COM aspired. Soon after, the Dean appointed the Director of the learning communities (0.75 FTE, also functions as Assistant Dean for Clinical Education), which was named the Societies Program. The director continued with a literature search, another visit to the University of Washington, and (with the Dean, the Vice-Dean for Academic Affairs, and the Senior Associate Dean for Medical Student Education) appointed three other Society Heads (0.50 FTE each). The Director also functions as a Society Head, for a total of four. The Society Heads continued work on the structure of the Societies Curriculum while accepting applications for the

remaining Society Mentor positions. The faculty and student structure of the Societies Program was decided on: The Societies Program is comprised of four Societies (named after indigenous Arizona flora – Agave, Acacia, Cholla and Manzanita). Each Society has five clinical Mentors (including the Head) for a total of 20 Society Mentors. Each Society Mentor teaches and mentors a group of five to six students in each year of medical school. Although the group stays together for all four years, currently almost all the activities occur in years 1 and 2; Societies activities in years 3 and 4 are in evolution as the year 3 and 4 curriculum is being revised.

d. Selection of mentors

The Societies Director sent invitations to clinician educators to apply for the 19 open Mentor positions. The Societies Director also functioned as a Mentor and there are two additional back-up Mentors for the Program. The four Society Heads selected the remaining Mentors. It was a very competitive process and the most outstanding educators in the College were chosen to be Mentors. A formal application and interview process was utilized to select the Mentors. Applicants were asked to: (i) list medical student and resident teaching experiences, along with relevant educational, academic and employment background, including any teaching awards or honors; (ii) describe their philosophy of medical education as it pertains to the concept of the Societies Program; (iii) submit a letter of recommendation from a colleague attesting to the applicant's skill and enthusiasm for medical education; and (iv) submit a form signed by the applicant's department head expressing support for the application. The position of Society Mentor is 30% (0.3 FTE) of the physicians' time; this includes two afternoons each week for teaching year 1 and year 2 students and one afternoon each week for faculty development. Each Mentor's home department receives remuneration for the Mentor's time. Clinician-educators in all disciplines were encouraged to apply; the initial group of Mentors included four general internists, nine family physicians, two pediatricians, two surgeons and three emergency medicine physicians.

e. Faculty development of mentors

The selection process was completed by January 2006. At that time the group began a series of weekly Friday afternoon meetings (four hours each) during the remaining six and one-half months until the start of the academic year. During these mandatory sessions the group developed, discussed, and reviewed all aspects of the new Societies' curriculum. Faculty development for Society Mentors is an ongoing process and the Mentors meet each Friday afternoon for this purpose. Topics for discussion include debriefing of previously completed sessions, continued curricular development, basic science reviews and clinical topic reviews. The Societies Faculty has become a learning community as well and time is spent discussing both the educational and personal successes and the challenges and mistakes that Mentors have experienced during their teaching sessions.

f. Society curriculum and The Doctor & Patient Course

Students meet with their Society Mentor and group for one afternoon each week. During the Foundations Block, the first full block, the curriculum is unique. In this nine-week block the Society Mentor teaches the medical student group the basic elements of the medical history and the normal physical exam. These sessions are split into two, two-hour sections, one focusing on the basic medical history (using hospitalized patients) and one focusing on the normal physical exam (using students under Mentor supervision). In the old curriculum the physical examination was taught to the first year students by fourth year medical students. Additionally, the high risk behaviors interview and delivering bad news are taught using standardized patients (SPs) during this block. With the anticipation of weekly four-hour bedside sessions, we were able to teach a more basic medical interview and physical examination segment. Students must complete an observed full history and physical at the end of the block. In subsequent blocks, the activities include Clinical Labs using standardized patients, Bedside Teaching Sessions, and Professional Development sessions (Tables 1 & 2).
Clinical Labs occur once or twice within each basic science block. The objectives of the labs are to 1) teach advanced elements of the history and physical exam related to the basic science block the students are studying; and 2) to help students begin to understand which elements of the history and physical are most important for various complaints and the rationale for each of those elements. Students are assigned a clinical topic that is related to the block they are studying (Table 1). Each clinical topic includes reading sets on the appropriate medical history[18] and a relevant chapter from *Up To Date*. Students perform a focused history and physical on a standardized patient with a complaint related to the clinical topic they were assigned while the mentor observes and grades the encounter using a mini-clinical evaluation (mini-CEX) checklist. (**See Appendix 1**) There are usually three different clinical cases utilized for each lab. After performing the focused H&P, the students present the case and their findings to the mentor and teach the remaining students in the group (who were assigned different cases) the most important elements of their reading sets (Tierney text and Up To Date). Finally, the Mentor distributes and goes over the key clinical teaching points that were developed for each case. (**See Appendix 2**)

Bedside Teaching Sessions are the core of Societies activities. Patients for these sessions are recruited the morning of the sessions by program Patient Coordinators at our teaching hospitals. Care is taken to recruit patients with diagnoses that relate (when possible) to the basic science the students are studying to maximize basic and clinical science integration. During year 1, one student per group per session is assigned to evaluate a patient and perform a history and physical examination (H&P),

Table 1: Society Activities First Two Years

Year I	Foundations	Musculoskeletal	Nervous System	Cardiology, Pulmonary & Renal	Digestion & Metabolism I
# Clinical Labs	None	1	1	2	None
Clinical Lab Topics	9 Weeks of Introductory Physical Exam & Medical Interviewing	1. Neck Pain 2. Arm & Hand Pain 3. Low Back Pain 4. Hip/Buttock Pain	1. Tremor 2. Diplopia 3. Headache 4. Muscle Weakness	Cardiology: 1. Chest Pain 2. Palpitations 3. Edema Pulmonary: 1. Cough 2. Dyspnea 3. Hemoptysis	Non Applicable
# Bedside Teaching Sessions	None	2	5	8	1
Professional Development Topics	1. Exposure to the Cadaver 2. Balance vs. Perfection	1. Stress, Anger & Authority in the Medical Profession	1. Behaving as a Professional 2. The Measure of Competence	1. Altruism 2. Meaning of Medicine	None
1-3pm Activities	None	1. Evidence Based Medicine	1. Evidence Based Medicine	1. Evidence Based Medicine 2. ECG Reading 3. Cardiac Physical Exam	1. Evidence Based Medicine 2. ECG Reading 3. Cardiac Physical Exam

Year II	Digestion & Metabolism II	Life Cycle	Immunity & Infection	Cancer	Advanced Topics
# Clinical Labs	1	4	None	1	1
Clinical Lab Topics	1. Abdominal Pain 2. Acute Diarrhea 3. Diabetes	1. Breast / Pelvic 2. Male GU 3. Pediatric 4. Geriatric	Non Applicable	1. Breast Lump	1. Complete Physical Exam
# Bedside Teaching Sessions	6	2	5	2	None
Professional Development Topics	1. Physicians and Substance Abuse	1. Medical Ethics	1. Integrity	1. Facing Death	None
1-3pm Activities	None		1. Evidence Based Medicine 2. ECG Reading 3. Cardiac Physical Exam 4. HIV Clinic 5. Urgent Care 6. Cardiac Arrest Lab		

directly observed by his or her Mentor; another student in the group serves as a peer observer and evaluator. While

Table 2: Society'Activities & Objectives

	Objectives
Clinical Labs	1. Practice specific history-taking and physical exam techniques correlating to the basic science block you are studying. 2. Using the assigned readings, decide which elements of the history and physical are important for the patient problem/disease to which you are assigned. 3. Using the assigned readings, understand the rationale for each of the items in the history and physical exam that you believe are important for the presenting problem. 4. Learn and understand the *Key Teaching Points* provided after each session and integrate this clinical knowledge with the basic science you are studying.
Bedside Teaching Sessions	1. Practice performing a history and physical on a patient with a disease or complaint correlating with the basic science block you are studying. 2. Practice performing oral presentations. 3. Learn how to write a History and Physical. 4. Attain familiarity in interacting with patients and health care professionals in the hospital setting. 5. Correlate the basic science material that you are learning with clinical knowledge obtained through the medical history, physical exam and subsequent discussion. 6. Begin to understand and practice how physicians use clinical thinking to develop an assessment of the patient's medical condition.
Professional Development	1. Recognize the major elements of medical professionalism. 2. Become aware of the personal factors that help or impede professional behavior. 3. Through open discussion in confidential (and unevaluated) group meetings with peers and a faculty leader, explore and learn from others about professional behavior. 4. Give support to others and accept it when needed. 5. Realize that there is more to professionalism than a list of do's and don'ts and understand variations of behavior consistent with professionalism. 6. In fulfilling the above, explore such themes as balance, collegiality, authority, and altruism.
1-3pm Activities	**Evidenced Based Medicine:** 1. Raise awareness of information resources that support clinical research and decision-making. 2. Train students on database-specific searching techniques. **ECG Readings:** 1. Students will learn the basics of clinical ECG reading. **Cardiac Physical Exam:** 1. Students will practice the basic and advanced cardiac exam with a cardiologist. **HIV Clinic**: **Urgent Care:** 1. Students will perform a focused evaluation on an undifferentiated patient in the ED or UC and present to an ED attending. 2. Students will write a SOAP note which will be revised by their Society Mentor **Cardiac Arrest Lab:** 1. Recognize a patient who is in cardiac arrest and know how to call for help. 2. Differentiate shockable (ventricular fibrillation) from non-shockable (asystole and pulseless electrical activity) rhythms on the ECG monitor for patients in cardiac arrest. 3. Perform adequate chest compressions. 4. Demonstrate airway management during simulated cardiac arrest with bag-valve mask and endotracheal intubation. 5. Demonstrate the use of a defibrillator during a simulated cardiac arrest, both AED and manual defibrillator. 6. Demonstrate the ability to work productively as part of a resuscitation team.

this is occurring, the remainder of the group is assigned research relating to the patient's diagnosis, assigned to practice a history and physical on a standardized patient in the teaching clinic, assigned to a formal ophthalmology lab, or assigned to another clinical activity. (See Table 1; section "1-3pm Activities") After the student completes the H&P, the whole group reconvenes at the bedside to hear an informal oral presentation by the examining student and talk to and examine the patient. The group then proceeds to a small group teaching room, where

further discussion about the case ensues, incorporating the research done by other group members. Mentors are responsible for integrating basic science and psychosocial issues as appropriate. Formal timed oral presentations are then given for patient(s) seen the week before, and Mentors review write-ups that were turned in the previous week. Formative feedback is given to the students at each session by both their Mentor and their peers in the group. During year 2, two students from each group perform a history and physical exam, with the mentor splitting direct observation time between the two students. In year 2, peer observers/evaluators are not used: Year 2 students who are not performing the H&P participate in the following activities on a rotating basis while waiting for the group to reconvene at the bedside: ECG tutorial, the advanced cardiac examination lab, an urgent care experience, pelvic exam lab, evidence-based decision making tutorial, HIV clinic, cardiac arrest lab (using a simulator) and other activities. (See Table 1; section "1-3pm Activities") Case discussions during year 2 incorporate clinical thinking exercises whenever possible.

Personal and Professional Development (PPD) Sessions (previously called Professional Development sessions) focus on issues related to medical professionalism, ethics, death and dying, student well-being, and related topics (Table 2) in order to broaden student knowledge of the intricacies involved in doctoring and self-care during the educational process. These sessions occur periodically through the year, often on exam weeks, as these sessions take less time than the regular Societies activities and require no student preparation. Each session is introduced by a 30-minute talk on the chosen topic. Following this, students break into their groups to discuss these issues with their PPD Mentor as it relates to them professionally and/or personally. Student support and personal disclosure are optional components of these sessions. To assure separation of counseling and evaluative functions and to encourage free discussion, the students' PPD Mentor is different from their regular Society Mentor. All PPD Mentors are Societies faculty and remain with the same group for the two-year period. If a PPD Mentor senses a student is having emotional or academic issues, he or she refers the student to the appropriate COM resources.

The Doctor and Patient Course is a longitudinal clinical skills course that spans the first two years of medical school. The course is the objective part of the Societies Program and is administered by the Society Mentors. The specific components include those that are woven into the sessions described above plus other activities. Formal interactive lectures are given for the following topics: writing SOAP notes and H&Ps, oral presentations, and clinical thinking. Materials developed by Society Mentors specifically for these sessions are used. During the Clinical Labs, students are graded on their overall performance using a mini-CEX checklist that contains the elements of the history and physical that the students should be asking or performing for each clinical problem in the labs. During the Bedside Teaching Sessions, the students' interactions with the patients are critiqued using the Bedside Evaluation form. The students' formal oral presentations are critiqued with another form designed specifically for this activity. Finally, the written H&Ps are graded in two ways: 1) the Mentors critique the actual content of the H&P electronically using Microsoft Word and "Track Changes/Insert Comment" tool; and 2) with an overall global H&P evaluation form. All of these evaluations and H&Ps are kept in an electronic portfolio (called the Society Portfolio) that is accessible to Mentors and students at any time. (**See Appendix 3 for a sample Evaluation Form**) Additionally, students are responsible for one reflective exercise per year, and these also are housed in the Society Portfolio. Each student's overall performance is documented using a four-semester set of competency-based, developmental benchmarks (Table 3). Students and faculty independently fill out the benchmark form (the responses are then combined into a single electronic document) and compare results during Portfolio Reviews. Portfolio Reviews occur every semester; during these sessions students meet individually with their Society Mentors to go over their Benchmarks evaluation and the general progression of their clinical work. Based on this discussion, the Mentors help the students formulate specific goals and objectives for the coming semester. These goals are also documented in the Society Portfolio. Finally, OSCEs (Objective Structured Clinical Examinations) (described below) at the end of year 1 and year 2 serve as final examinations for each year of the Doctor & Patient Course.

Implementation

Implementation of the Societies Program would not have been possible without the steady support of the Dean of the COM and other key educational administrators. State funds earmarked for medical student education were used to fund the program, including the Society Director, Society Heads, Society Mentors, Program Coordinators, Patient Coordinators, and infrastructure. After the previously described initial six month faculty development, the Societies Program began in the fall of 2006 with the incoming class of 2010.

In the old curriculum, there was a 200-hour course entitled Preparation for Clinical Medicine (PCM). One of the Society Heads had been the Director of that course. Much of the material from PCM including the medical interview, physical examination, note writing, and clinical thinking was re-written and integrated into the Societies' curriculum.

On the afternoon of the first day of medical school, the students meet their mentors and begin a short discussion about the structure of the Societies Program. After this brief introduction, the students accompany their Mentors to the hospital where the Mentors conduct an interview with patients while the students observe. In this interview the Mentors encourage the patients to discuss their experiences as patients, rather than a standard hospitalized patient interview. The only student objective for this

session is for the "students to conduct themselves appropriately and professionally during an interview with a patient." After this interview, the Mentors also encourage the students to converse with the patients. The group then adjourns to their small group room for a debriefing session during which the Mentors engage the students in a discussion of their experiences and reactions to the patient comments. The students begin their weekly patient encounters the following week with the start of the Foundations Block.

Our former curriculum included an extensive Patient

Table 3a. Developmental Benchmarks

	End of First Semester Year I	End of Second Semester Year I	End of First Semester Year 2	End of Second Semester Year 2
Medical Knowledge	Applies basic science knowledge of musculoskeletal and nervous systems to discussions, presentations and /or write-ups	Applies and integrates basic science knowledge of musculoskeletal, nervous, cardiac, pulmonary, and renal to discussions, presentations and write-ups	Applies and integrates knowledge of year one studies along with digestion, metabolism, endocrine and life cycle to discussions, presentations and write-ups	Applies and integrates basic science knowledge from Years 1 and 2 studies in clinical work Independently investigates basic science and clinical issues related to patient's medical problems and incorporates findings into discussions, presentations and write-ups
Professionalism	Demonstrates the demeanor, dress, and behavior of a physician Maintains confidentiality in the health care setting Displays respect for patients, peers, faculty and staff Understands and practices the roles and responsibilities of a first-year medical student such as timeliness, preparedness and collegiality	Consistently demonstrates the demeanor, dress, and behavior of a physician Consistently maintains confidentiality in the health care setting Consistently displays respect for patients, peers, faculty and staff	Consistently demonstrates the demeanor, dress, and behavior of a physician Consistently maintains confidentiality in the health care setting Consistently displays respect for patients, peers, faculty and staff Demonstrates knowledge of patient advocacy and needs such as patient/family education, and recognizing medical errors	Consistently demonstrates the demeanor, dress, and behavior of a physician Consistently maintains confidentiality in the health care setting Consistently displays respect for patients, peers, faculty and staff Presents practical approaches to patient advocacy in the context of discussions, presentations and /or write-ups

Table 3b. Developmental Benchmarks

	End of First Semester Year I	End of Second Semester Year I	End of First Semester Year 2	End of Second Semester Year 2
Patient Care	Learns sequential components of medical history and physical examination Begins integration of history and physical exam information in patient discussions	Improves skill with medical terminology Increases level of detail in patient's histories and physical examinations Performs complete history and physical examination in an appropriate time frame Develops patient problem list Becomes familiar with basic laboratory, diagnostic tests and radiology tests in context of patient discussions / encounters	Emphasizes significant findings in patient's history and physical examination Generates a differential diagnosis based on patient's problem list Collects and integrates lab and radiology results into patient discussions, presentations and write-ups Suggests possible diagnostic modalities in patient discussions Explains basic science behind treatment plan as appropriate for level of education	Performs accurate and complete history and physical examination with minimal supervision Refines differential diagnosis by including pertinent positives and negatives from history and physical Independently integrates laboratory and radiological data into patient discussions, presentations and / or write-ups Suggests appropriate diagnostic tests in patient discussions, presentations and / or write-ups Explains basic and clinical science concepts behind treatment plan

Instructor and Standardized Patient program. We were fortunate to be able to continue using this outstanding resource. The SPs are broadly involved with the Societies/Doctor and Patient medical interview and physical examination segments. During the medical interview component, they assist with the interview and patient communication sessions designed to teach students how to inquire about patients' high risk behaviors and how to deliver bad news; they also assist with the final sessions during which students' conduct complete medical interviews. Additionally, they assist in the final examination for the physical examination segment. As described above, we have Clinical Labs in each block; SPs are trained to portray the patients for these labs as well. Finally, throughout the blocks during the bedside teaching sessions, some of the students who are not assigned to perform an H&P that week use this opportunity to practice the interview and physical exam with the SPs.

The University of Arizona COM has administered a high-stakes OSCE for over twenty years. Administered at the end of Year 3, passing this OSCE is a graduation requirement. With the advent of the new curriculum we added an end-of-Year 1 and end-of-Year 2 OSCE. These exams are shorter and less comprehensive than the original end-of-Year 3 OSCE. They have four stations and focus on the clinical cases that were presented during the Societies labs in each block. After the first administration of the Year 2 OSCE we redesigned it to allow for greater standardization in the evaluation system and to ensure that

Table 3c. Developmental Benchmarks

	End of First Semester Year I	End of Second Semester Year I	End of First Semester Year 2	End of Second Semester Year 2
Practice-Based Learning and Improvement	Identifies and utilizes sources for evidence-based medical literature for discussions, presentations and / or write-ups Demonstrates knowledge learned from assigned reading in discussions, presentations, write-ups and / or standardized patient labs Demonstrates ability to self-assess and incorporate feedback, showing improvement in history/physical examinations, patient write-ups and presentations	Cites evidence-based resources in discussions, presentations and write-ups Demonstrates self-directed learning by going beyond assigned reading for Society labs, discussions, presentations and write-ups Demonstrates ability to self-assess, incorporate feedback and shows improvement in areas of weakness	Demonstrates ability to perform evidence-based literature search for patient discussion, presentation and / or write-ups Able to self-assess knowledge, incorporating feedback to show improvement in areas of weakness	Demonstrates ability to perform evidence-based literature search using Medline or similar search engine Independently self-assesses performance in discussions, presentations and write-ups to determine what aspects performed well and what aspects require improvement
Systems-Based Practice and Population Health	Elicits and reports demographic, socio-cultural, and economic information on patients	Demonstrates awareness of how demographic, socio-cultural, and economic factors impact on patient's health and treatment in discussions, presentations, and write-ups	Integrates the impact of patient's demographic, socio-cultural, economic, and health system issues on their health and treatment as evidenced in patient discussion, presentations and / or write-ups	Independently integrates the impact of patient's demographic, socio-cultural, economic, and health system issues on their health and treatment as evidenced in patient discussions, presentations and / or write-ups

each of the students is prepared to begin their third-year clerkships. Our Year 2 OSCE now combines standardized patient cases with direct observation by a mentor and an oral examination administered by a mentor. With this new OSCE, each student sees two patients portraying a scenario with one of five common symptoms. The students perform a focused history and physical examination while a mentor (not their regular mentor) observes the interaction on a monitor in a separate room. After the student has a few minutes to collect his/her thoughts, the student and mentor meet in a separate room where the student makes an oral presentation of the patient followed by an oral examination aimed at assessing the student clinical thinking skills. The focus of this oral examination is not to assess content knowledge but rather the students' diagnostic reasoning. All of the mentors spent at least four hours of faculty development sessions in order to standardize this oral examination. All of the cases portray

Table 3d. Developmental Benchmarks

	End of First Semester Year I	End of Second Semester Year I	End of First Semester Year 2	End of Second Semester Year 2
Interpersonal and Communication Skills	Develops effective listening skills, elicits information from patients in a reassuring, compassionate manner Accurate reporting of patient narrative and accurate documentation of patient's history and physical examination findings Develops appropriate communication style for medical discussions with peers such as active listening, appropriate participation and constructive peer-review Patient presentations and write-ups organized according to standard components with data in appropriate sections	Demonstrates increased use of medical terminology in formal presentations and write-ups Accurate description of physical exam findings using descriptive terminology rather than presumptive diagnosis Formal presentations and write-ups are accurate, complete and well organized Effective listening skills for peer presentations, contributes to patient discussions	Continued improvement in developing comfortable environment for patient-physician interaction Effective listening skills for peer presentations, contributes to patient discussions	Formal presentations are well organized and concise Patient write-ups are well organized and utilize precise medical terminology as well as convey thoughtful analysis of patient's major medical problem(s) Effective listening skills for peer presentations, contributes to patient discussions

a common symptom with multiple possible diagnoses. To be successful, the student must perform a focused, yet thorough examination. The mentors target the oral examination not specifically on the diagnoses but rather on the signs and symptoms that would help lead to the diagnoses and the relative importance of those signs and symptoms in arriving at a diagnosis. Through this year 2 OSCE we achieve standardization of evaluation and assure that each student is ready to start clinical clerkships.

RESULTS

The Program Evaluation Team in the Office of Medical Student Evaluation administered multiple surveys to our students. The surveys questioned students about the bedside teaching, standardized patient labs and professional development sessions. Results of surveys collected at different times during the year are shown for the Classes of 2010 (first cohort) and 2011 (second cohort) in Table 4.

The Societies Program as a whole has received consistently high marks from students, who consider the program to be an instrumental part of their medical education. The first eight rows of Table 4 refer to core Societies clinical and mentoring activities. The average score for all these activities is above 4.5 on a 1 to 5 scale (5 being best). Rows 9 – 11 refer to the Personal and

Table 4. Student Survey (selected items)

	6 months		12 months		18 months		24 months	
Class	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**	**2010**	**2011**
Response rate	**94%**	**72%**	**53%**	**60%**	**83%**	**86%**	**50%**	**85%**
	Mean Score							
The bedside teaching integrates basic & clinical practice	4.43	4.46	4.32	4.40	4.07	4.08	4.14	4.15
The labs are a valuable experience	n/a	n/a	4.21	n/a	4.28	n/a	4.14	n/a
While in the hospital with my mentor, he/she demonstrates respect towards patients & staff	4.92	4.89	4.88	4.91	4.92	4.61	4.89	4.90
While in the hospital, he/she demonstrates ethical behavior	4.89	4.90	4.87	4.90	4.94	4.86	4.90	4.93
My Society group contributes to my medical education	4.72	4.69	4.68	4.69	4.51	4.60	4.59	4.62
I am satisfied with my Society mentor	4.78	4.73	4.89	4.72	4.79	4.71	4.80	4.77
My mentor provides constructive feedback	4.72	4.72	4.80	4.76	4.69	4.50	4.61	4.55
My mentor provides consistent feedback	4.70	4.71	4.80	4.56	4.68	4.43	4.64	4.52
I am satisfied with my Professional Development Mentor	n/a	3.68	4.38	3.87	4.57	3.76	4.49	4.31
I believe the PD group contributes to my medical education	4.08	2.79	3.23	3.17	3.52	2.85	3.47	3.01
I feel comfortable speaking about personal issues with my PD mentor	4.33	3.42	3.47	3.52	3.48	n/a	4.02	n/a

Scale is 1-5; Strongly disagree to Strongly agree
n/a indicates the question was not administered to the group

Professional Development Program that is housed within the Societies Program as described above. While acceptable, the average score for some of these items is noticeably lower than the core clinical activities. Core aspects of Society Mentor satisfaction surveys are presented in Table 5. The results confirm that all the Mentors enjoy their work in the program and feel they are contributing significantly to student education.

The COM has traditionally held focus groups with year 3 students to determine how prepared students felt as they started the clinical clerkships. In 2007, 21 members of the class of 2009 participated in the focus group; in 2008, 43 members of the class of 2010 (the first cohort to participate in the Societies Program) participated in the focus group. While none of the focus group participants from the Class of 2009 felt prepared to begin year 3 clerkships, 20% of the focus group participants from the Class of 2010 felt prepared. Likewise, the focus group participants from the Class of 2010 felt much more prepared to perform medical histories and physical exams, to present patients orally, to interpret objective clinical data (labs, ECGs), and to generate differential diagnoses (Table 6). While these focus group data are not conclusive, they provide preliminary evidence that the Societies Program prepares students for the year 3 clerkships more so than the previous community-based program.

DISCUSSION AND LESSONS LEARNED

While we believe the Societies Program has been very successful thus far, there have been many challenges during the implementation of the program.

- *Identifying the appropriate level to teach the students.* All of our Society Mentors are experienced clinical educators. However, while some had participated in previous clinical activities in years 1 and 2, most of

Table 5. Society Mentor Survey (selected items)

	6 months	18 months
Response rate	**86%**	**80%**
I enjoy my work as a Mentor	5.0	5.0
How confident do you feel discussing the basic and clinical aspects that arise in group	3.8	3.9
How much do you think students gain academically from you	4.0*	4.4*
I am satisfied with the Society faculty development sessions	4.1	3.8

Scale is 1-5; Strongly disagree to Strongly agree
*1-5; Not too much gain to An extreme gain

Table 6. Focus Group Data (selected items)

	Class of 2010 (N = 43)	Class of 2009 (N = 21)
Felt well prepared for year 3	20%	0%
Wanted more practice performing H&Ps in years 1 and 2	0%	14%
Wanted more practice with oral presentations in years 1 and 2	0%	20%
Felt unprepared to interpret clinical labs	2%	20%
Not confident in ECG interpretation	1%	20%
Not confident in basic radiology interpretation	12%	20%
Not confident in generating differential diagnoses	1%	33%

Notes: Class of 2010 was the first group to go through the Societies Program and are our current year 3 students. Focus Group for Class of 2010 conducted 9/2008; for Class of 2009 conducted 3/2007.

the group's educational expertise was in teaching clinical medicine to year 3 and year 4 students and residents. As such it was easy for Mentors to teach at a level higher than that for which the year 1 and 2 students were prepared, especially when integrating clinical and basic science in discussions. With student feedback, faculty development sessions and experience, Society Mentors feel they have greatly improved their ability to teach at the appropriate level, increasing the complexity as student knowledge and experience grows.

- *Heterogeneity within the groups.* While the Society leadership and mentors worked hard to standardize the activities as described above, it is not surprising that there are significant differences among the mentoring groups in how the sessions are run. These differences relate to several factors: Mentor specialty, Mentor personality, student/group personality, and Mentor organization/time management skills. Specifically, differences related to:

  - Time. Although most sessions are scheduled from 1 to 5 PM, some groups end significantly earlier on a regular basis. This causes student angst on several levels: some students whose sessions end early feel they are missing out on potentially richer educational experiences while conversely some students whose groups always end at 5 PM feel they are being worked too hard.

  - Student feedback. While all students receive feedback, some groups provide more peer and/or faculty feedback than others. Not surprisingly, some students feel there is too much feedback while others feel there is not enough. As an example, an internal review of students' H&Ps

finds great variability in how many comments Mentors make when reviewing them.

- Integration of basic science material. While all Mentors are encouraged to review the curriculum weekly for both year 1 and 2 and integrate this material into the sessions when applicable, some Mentors do this more than others. Additionally, some Mentors feel more comfortable with basic science concepts than others.

- Integration of "thread" material (described above). Again, all Mentors are aware of the curricular "threads" and attempt to integrate these concepts into sessions when appropriate, but the extent to which each Mentor does this varies. Additionally, because there are multiple activities and goals for each session, little time is left to address "thread" concepts.

- Settings. Mentors with easy access to the Emergency Department, the operating room or an ambulatory clinic will at times use these settings for their groups. While adding welcome diversity to the experience for those students, students in other groups may feel left out. This is somewhat mitigated by the fact that most Mentors have access to at least one other clinical setting to use other than the hospital.

The Mentors addressed these issues related to heterogeneity through our faculty development sessions. We had open discussions regarding the pros and cons of the varied approaches and were able to build consensus, although this is an ongoing process.

- *Competition with basic science effort.* Although most students enjoy the clinical sessions and understand the importance of the sessions for their education, the stress of studying vast amounts of material for the basic science blocks can dull students' enthusiasm for the Societies sessions. At times, Mentors feel that their students are not taking the time to prepare for the sessions. This perhaps is exacerbated by the fact that Societies sessions and the Doctor & Patient course are Pass/Fail, whereas the basic science blocks report final percentage grades for the Dean's Letter.

- *Maintaining interest and furthering student development.* Because the first- and second-year Societies Program curriculum are similar with the primary difference being increased patient encounters in the second year, some students feel they have learned how to take an H&P by the end of year 1 and see little value in continuing to practice these essential skills. Assuring that students continue to advance their clinical and diagnostic skills necessitates students and Mentors to be equally aware of those areas in which students need improvement and to explicitly target those areas together.

- *Problems with the Professional Development curriculum.* Medical professionalism is known to be difficult to teach and discuss with pre-clinical medical students[19, 20]. We placed these interactive sessions during exam weeks, because the professional development sessions are significantly shorter than other Societies activities (two hours versus -four hours) and the sessions can be completed in one day scheduled early in the week rather than the two days required to complete regular Societies activities. In this way, all students have a smaller time commitment for Societies, which is completed early in the week allows more time to prepare for block examinations. None the less, some students complained about even this minimal commitment during exam weeks, and the overall student satisfaction for these sessions is lower than for other Societies activities (Table 4). Some students also objected to the content and the support function that is an optional part of these sessions. Still most students understand the purpose of the sessions and enjoy getting to know another Mentor. We will continue to develop this part of the curriculum with the hope of making the important topics covered in these sessions more aligned with the students' current stage of professional development and thus more meaningful.

There have been many benefits that were not originally planned:

- Society Mentors forming their own learning community. Meeting for faculty development activities one afternoon almost every week has formed a learning community for the Mentors as well. Designing and participating in medical education-based faculty development and sharing our educational encounters have proven to be rich experiences for the Mentors. The Mentors previously knew of each other but never had the opportunity or the time to share meaningful educational experiences and ideas with each other. The educational experience and wisdom of the collective group is astounding and each Mentor feels privileged to be a part of this community.

- Identification of problem students early in training. Medical students with problems in professionalism or ability to interact appropriately with peers and patients usually do not come to the attention of the school until the clinical years, when it may be more difficult to remediate the student. Since one Mentor works with the same group of students every week for two years, he or she is able to observe their students in a variety of circumstances, some quite stressful. Issues relating to professionalism and aberrant interpersonal behaviors are usually apparent to the Mentors. As such the student can receive needed help early in their medical education.

- Students becoming comfortable with taking risks, being wrong, and participating in feedback. Although most groups start off tentatively, we have found that trust is soon established. As medical students are traditionally embarrassed to make mistakes and not comfortable giving meaningful feedback to peers, it is very gratifying to see students relax and freely learn from and give feedback to each other.

We chose to begin our students' clinical exposure on the first day of Year 1 as described above. We also were aware of both the inherent appeal to students of participating clinical activities early in their education and the risks of engaging students in clinical work so early in medical school. The basic sciences curriculum is extensive and detailed. Although many believe a retreat to the hospital to be an important reprieve for the students deeply engaged in their basic science studies, we also recognized its potential peril. To address these concerns, we work closely with the basic science block directors to design the Societies Program to be as closely aligned to the block curriculum as possible. Our clinical labs work in parallel with the materials being learned in the classroom and whenever possible, the patients seen by the students each week had a diagnosis being studied in the classroom. As discussed above, the Year 1 students are assigned to perform H&Ps approximately half as often as the Year 2 students; we worked to make the curriculum developmentally appropriate by increasing our expectations of student clinical work each semester with both formative feedback and objectively with our Developmental Benchmarks. (See Table 3) As we noted above, this early initiation of clinical activity was well received by our students. Nonetheless, we are aware of the 'hallway chatter' and continuously elicit feedback from the students in an attempt to maintain an acceptable balance between the excitement of early clinical work and the potential distraction from student basic science studies.

We are confident that our group of twenty Mentors provides a learning experience that is significantly more standardized than that provided by our former greater–than-one-hundred group of clinical preceptors. However, even with our weekly faculty development, we are aware that teaching and feedback to the students varies from group to group. As discussed above, the revised end of Year 2 OSCE created the standardization of evaluation we sought.

CONCLUSIONS

We have shown that an intensive learning community model for clinical education and mentoring of 1st and 2nd medical students is feasible and acceptable to both students and faculty. The student evaluations place the Societies Program among the most highly rated components of our new curriculum and faculty evaluations demonstrate a high level of satisfaction with participation in the program. Aligning the program as closely as possible with the basic science blocks enhances relevance for students and encourages integration of basic and clinical science concepts. Preliminary data suggest that the Societies Program is more successful at preparing students for year 3 than our previous curriculum. The program is in continual development to enhance the applicability and developmental nature of the curriculum. Future study is needed to establish the value of such learning community models based on more objective outcomes.

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APPENDIX 1: ACUTE ABDOMEN MINI-CEX

Doctor and Patient: Integrating the Art and Science of Medicine
Mini CEX – DMH Block

CC: Acute abdominal pain
HPI:
Age of patient (very important in evaluation of acute abdominal pain):

1. O = Onset
    a. When did the pain first start?
    b. Onset sudden or gradual?
2. P = Position, Pattern, Location
    a. Diffuse vs. localized?
3. Q = Quality (type of pain)
    a. Dull, sharp, colicky, waxing and waning, etc.
4. R = Radiation
    a. Back
    b. Flank and groin
    c. Shoulder
5. S = Severity (1-10)
6. T = Timing -- high risk features include:
    a. Sudden onset?
    b. Maximal at onset?
    c. Pain with subsequent vomiting?
    d. Constant pain for < 48 hours?
7. A = Aggravating
    a. Increased or decrease after eating?
    b. Increased or decreased after BM?
8. D = Duration
    a. Hours vs. weeks
9. A = Associated Symptoms
    a. Fever, chills
    b. Vomiting
    c. Diarrhea
    d. Blood in stools
    e. Vaginal discharge
    f. Dysuria
    g. Shortness of breath
    h. Previous evaluation and treatment

Allergies / Adverse Drug Events:

Past Medical & Past Surgical History

1. prior abdominal surgery
2. cardiovascular disease
3. history of HIV infection
4. Obstetric history

Medications:

1. NSAID's

Family History:

1. Cholelithiasis? nephrolithiasis?

Social History / High Risk Behaviors:

1. Alcohol consumption
2. Recent travel

Physical Examination:

Key Knowledge:
In the evaluation of acute abdominal pain is different from that of chronic abdominal pain, and includes several potentially life-threatening diagnoses. This session focuses on acute abdominal pain.

In evaluating acute abdominal pain, it is important to search for and exclude:

- abdominal aortic aneurysm
- mesenteric ischemia
- bowel perforation
- acute bowel obstruction
- volvulus
- myocardial infarction

In women of childbearing age, pregnancy status must be determined.

Three classes of abdominal pain:

- **Visceral pain:** innervation bilaterally at multiple levels; dull, poorly localized, felt in midline. Caused by ischemia, inflammation, or distention of hollow organs or capsular stretching of solid organs.
- **Parietal pain:** innervated on same side and dermatomal level; more distinct and localized. Caused by ischemia, inflammation, or stretching of the parietal peritoneum.
- **Referred pain:** felt far from the diseased organ; due to shared central pathways for afferent neurons from different locations.

Key knowledge:
Vital signs are particularly important, and must be accurately measured.
Bowel sounds: normally 2-12 gurgles per minute. No bowel sounds over 2 min suggests peritonitis. Hyperactive bowel sounds suggest blood or inflammation within the gut. Periodic rushes of high-pitched "tinkling" bowel sounds with distention, suggests obstruction.

Rigidity is involuntary spasm of muscles, due to peritoneal

1. General appearance
    a. patients age
    b. level of discomfort
    c. motionless vs. changing position
2. Vital signs
    a. orthostatic symptoms
    b. tachycardia
    c. fever
3. Eye exam
    a. scleral icterus
4. Skin exam
    a. jaundice
    b. Abdominal or flank ecchymosis
5. Cardiac and vascular exam
    a. atrial fibrillation
    b. cardiac murmurs
    c. abdominal bruits
6. Pulmonary exam
    a. Consolidation at lung base
7. Abdominal exam
    a. Observation
        i. Distension
        ii. Visible peristalsis
    b. Two minute auscultation
        i. Bowel sounds
        ii. Aortic and femoral bruits
    c. Palpation
        i. Lightly for rigidity
        ii. Deeply for localized tend.
        iii. Palpation of aorta (older ♂)
        iv. Carnett's sign
        v. Murphy's sigh
        vi. Psoas sign
        vii. Obturator sign
        viii. Rovsing's sign
8. Pelvic exam
    a. "I need to perform a pelvic exam."
9. Testicular exam
    a. "I need to perform a testicular exam."
10. Rectal exam
    a. "I need to perform a rectal exam."
11. Extremities
    a. Peripheral vascular disease?

Professionalism

1. Present
2. On time
3. Prepared
4. Engaged and participatory
5. Respectful

irritation.

Voluntary guarding: tensing of the abdominal muscles due to apprehension or discomfort.

Rebound tenderness: increase in pain after quick removal of palpating hand (poor SN & SP).

Carnett's sign: increased tenderness when the abdominal wall muscles are contracted (95 percent accurate at distinguishing abdominal wall pain from visceral pain).

Murphy's sign: patient abruptly stops deep inspiration during palpation of the RUQ. Can be useful with suspected cholecystitis.

Psoas sign: with patient on their left side, pain when the right hip is extended (suggests retrocecal appendicitis).

Obturator sign: pain elicited with passive internal rotation of the flexed right thigh (suggests a pelvic appendicitis).

Rovsing's sign: pain in the RLQ with palpation of the left lower quadrant.

Psoas, obturator, and Rovsing signs have low SN but good SP for acute appendicitis.

Geriatric patients: accuracy of exam findings is decreased in the elderly. Abdominal tenderness may not localize, and peritonitis may not cause rigidity.

APPENDIX 2: KEY TEACHING POINTS

Key Teaching Points – Abdominal Pain

1. abdominal pain is common – although frequently benign, it can herald serious pathology
2. triage is important – separate those with possible surgical abdomen and hemodynamic instability
3. history & physical examination are critically important
4. alarm features include:
    a. Fever/chills
    b. Orthostatic symptoms
    c. Alcoholic stools
    d. Black stools
    e. Bloody stools
    f. Change in appearance/character of stools
    g. Weight loss or gain
    h. Jaundice
    i. Pain change with menses
5. differentiate acute from chronic; intervals are arbitrary, but think whether it is an accelerating process, one that has reached a plateau, or one that is long standing but intermittent
6. surgical abdomen – condition with a rapidly worsening prognosis in the absence of surgical intervention (e.g., intraperitoneal hemorrhage, acute appendicitis or viscus perforation)
7. can approach other diagnoses by location: right upper quadrant, epigastric, lower abdominal
8. right upper quadrant pain etiologies include: liver or biliary pathology
9. epigastric pain etiologies include: pancreatitis, peptic ulcer disease, non-ulcer dyspepsia
10. lower abdominal etiologies include: diarrheal diseases including infection, ileal pathology such as inflammatory bowel disease, left lower quadrant disease including diverticulitis (can also have pain on the right), and pelvic pathology including menstrual disorders, pelvic inflammatory disease, ovarian disease, endometritis and ectopic pregnancy
11. other causes include functional bowel disease and irritable bowel syndrome

APPENDIX 3: EVALUATION FORM FOR STUDENT WRITE-UP

Doctor and Patient Course: Integrating the Art and Science of Medicine
Written H&P Evaluation Form

		Needs Remediation		Appropriate for Level of Training & Meets Expectations		Excellent	
1.	Date and time, patient identifier, source of information, student name	1	2	3	4	5	N/A
2.	HPI: Framing sentence; OPQRST-ADA as appropriate; pertinent positives and negatives; previous evaluation/treatment	1	2	3	4	5	N/A
3.	ROS (appropriate for presenting problem)	1	2	3	4	5	N/A
4.	Physical Exam: "normal" not used frequently; description of finding rather than diagnosis/assessment	1	2	3	4	5	N/A
5.	Summary statement	1	2	3	4	5	N/A
6.	Clinical thinking problem list	1	2	3	4	5	N/A
7.	Differential diagnosis	1	2	3	4	5	N/A
8.	Prioritizes differential diagnosis based on pertinent positives and negatives; demonstrates clinical reasoning skills	1	2	3	4	5	N/A
9.	Plan: Appropriateness; justifiable based on Assessment/discussion; includes elements of diagnosis, treatment and patient education as appropriate	1	2	3	4	5	N/A
10.	Comments (Strong points, areas to focus on in order to improve)	1	2	3	4	5	N/A

_____
Mentor Signature

_____
Date

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Managing Growth in Medical Education

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ABSTRACT

In response to concerns about future physician shortage, urgent calls have been issued in the USA and Canada to increase medical student positions by 20-30% from current numbers. Yet very little information has been published on how to successfully plan for and manage medical school expansions.

Between 2000 and 2008, the University of Manitoba gradually managed a 53% expansion in Undergraduate Medical Education (UGME) class-size. The latest installment of UGME expansion occurred in 2008-09, amidst concurrent growth in Postgraduate Medical Education. In the same year, a program to evaluate and educate international medical graduates expanded 58% and, a new Physician Assistant Education Program was implemented. To meet the challenge of maintaining quality education for all learners and to appropriately plan for resource development, a systematic inventory of teaching responsibilities and an analysis of the gap between teaching capacity in 2007-08 and future demands were done. Using a combination of qualitative and quantitative methods, pre-clinical teaching was expressed in instructor-hours while clinical teaching was expressed as learner-weeks in clinical teaching units.

The methodology and the guiding principle that data should be expressed numerically using common units across all departments and programs, aided in unequivocally identifying scarce resources and competing needs. The results, allowing for a Faculty-wide accounting of future commitments, set in motion a teaching-based pro-rating system to allocate funding across departments in a transparent manner. Our methodological approach and experience will be of interest to faculty and administration involved in expansion of health professionals' education.

INTRODUCTION

A shortage in the physician workforce in the future has been predicted for the United States and Canada.[1,2] Urgent calls have been issued in both countries to increase medical student positions by 20-30% from current numbers.[2,3] Between 2002-03 and 2011-12, total first-year enrolment at existing medical schools in the United States will likely increase by 2,558 (15.5%) students.[4] In Canada, it is recommended that medical school positions should increase from approximately 2,500 to 3,000 as quickly as possible.[2]

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Increasing medical school class size by even 15% increases the need for resources (space, clinical training sites, faculty time, expertise, support staff) and adversely impacts quality of education.[5,6] The rapidity with which expansion is expected to occur may be the most challenging aspect of growth for some schools. Only a handful of publications give advice on how best to successfully plan for medical school expansions,[7] and even less discussion has revolved around increasing medical class size amidst simultaneous growth in the training of international medical graduates (IMGs) and other health professionals. Yet all of these learners will compete for similar resources during their training and education.

An analysis of challenges and strategies, faced by six institutions in the US that had recently expanded or planned to expand their medical student class size by at least 10%, identified lack of experience among medical educators and administrative leaders as a major challenge.[8] This was in part due to the essentially stable enrollment in US and Canadian medical schools over the previous quarter century.[8]

In less than a decade, the Faculty of Medicine, University of Manitoba, experienced an unprecedented 53% increase in undergraduate medical education (UGME) as incoming medical class size grew from 72 students in 2000-01 to 110 in the fall of 2008-09. An average year-over-year growth of 5.9% was sustained during this period. However, between 2007-08 and 2008-09 alone, the Faculty accommodated almost a 10% growth when incoming class size was increased from 101 students to 110 students. As growth in UGME necessitates a one-on-one growth in linearly-connected postgraduate medical education (PGME) positions, demands on our medical education system will not reach a steady state until the year 2016 (Figure 1). Independent of this anticipated future growth in PGME, in 2008, a unique provincial program was introduced to increase family medicine residencies with a rural/remote (northern) stream by 10 positions.[9] Additionally, in 2008 the Faculty of Medicine implemented Canada's first graduate-level, civilian Physician Assistant Education Program (PAEP). Finally, the IMG program that evaluates and trains IMGs for medical licensure as primary-care physicians in Manitoba and, the nurse-practitioner (NP) program were also expanded, by 58% and 40%, respectively, during the same year. While the IMG program is traditionally overseen by the Faculty of Medicine, the NP program, offered and administered through the Faculty of Nursing, requires resources available within specific clinical sites affiliated with the Faculty of Medicine.

Such multi-level growth (Figure 1) was likely to stress the medical education system of the Province of Manitoba. In order to effectively manage growth, the Faculty adopted a comprehensive and integrated approach to planning curricular and resource needs across all programs. In the summer of 2008, just prior to the start of the academic year 2008-09, we conducted an analysis of the gap between historic teaching capacity and future responsibilities for delivery of curriculum requirements. We considered the year 2007-08 to be representative of our historic teaching commitment and we chose the year 2012-13 to represent our future because enrollment in all UGME classes will have reached 110 that year as will the number in the graduating class. A guiding principle for the gap analysis was that all data summaries and presentations should be expressed in common units across all programs and departments. In this paper we present how we assessed and planned for the impact of growth on the Faculty's teaching responsibility. Our methodology and experience will be of interest to faculty and administration planning for and managing growth in health professionals' education.

MATERIALS AND METHODS

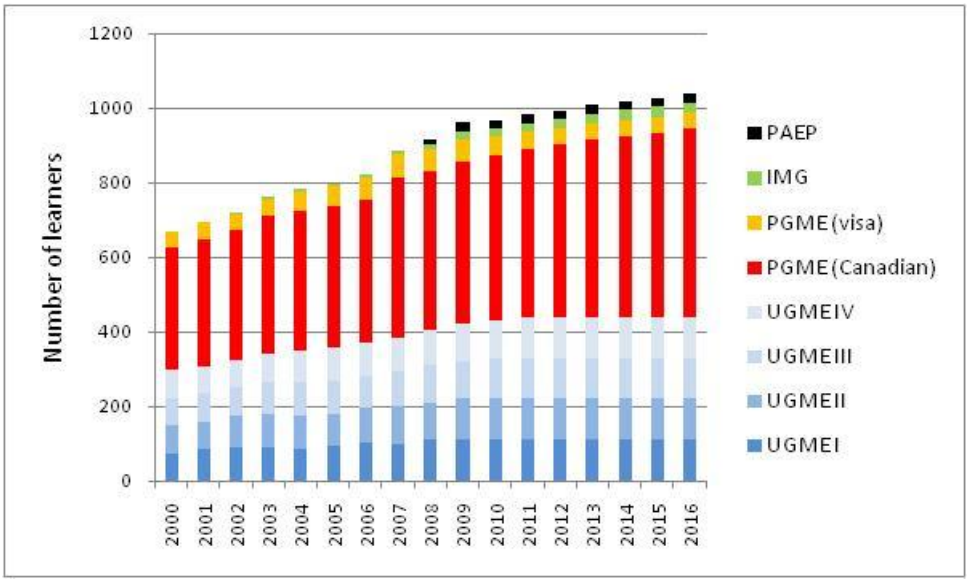
We used a combination of quantitative and qualitative methods to create preliminary summaries of historic teaching commitments across all departments. The sources of quantitative data were centralized department- or program-specific records and electronic databases (Table 1). Program administrators, directors, and coordinators individually verified or updated these numbers and then provided us with qualitative data, in the form of semi-structured interviews, on program-specific distinctions, needs and concerns, if any, for the future. We made particular note of all areas and units of instruction customarily functioning at maximum capacity, plans toward immediate curriculum reform, development of new teaching units, and changes to program logistics.

We created a list of critical factors that were thought to determine the Faculty's teaching capacity. In general, this list includes not only the number and type of learners, the number of preceptors (instructors, tutors), and the number of hours of instruction specified in the program curriculum but also the format of instruction (Table 2). Small-group learning sessions such as tutorials, labs, and clinical skills sessions require more physical and human resources for teaching compared with lecture-sessions. The number of small-group sessions is theoretically determined by the ideal ratio of preceptor to students. An ideal ratio, however, is often altered by limitations of physical infrastructure and availability of human resources.

Analysis of the gap in pre-clinical instruction

We defined teaching commitments in pre-clinical years as the sum total of individual instructors' direct contact hours with students for all curriculum sessions at all levels of UGME and PAEP, and expressed these commitments in instructor-hours. Instructor-hours were different from student curricular contact hours. For example, a 2-hour small-group tutorial session stipulated in the student curriculum required the Faculty to offer 8 small-group instructional sessions (totaling 16 instructor-hours) for 110 students in all. We presented the gap as the difference between the number of sessions (and hours) offered in the year 2007-08 and the number needed in the year 2012-13.

Figure 1. Cumulative impact of increased enrolment in all health professional education programs at the University of Manitoba's Faculty of Medicine.



PAEP – Physician Assistant Education Program; IMG – International Medical Graduates; PGME–Postgraduate Medical Education; UGME – Undergraduate Medical Education.

Analysis of the gap in clinical instruction

Capacity for clinical teaching is a function of clinical teaching units (CTUs). We defined a CTU as a specialty-specific clinical environment such as an inpatient ward or outpatient (ambulatory) clinic with a predetermined maximum limit on the number and type of learners that could be accommodated at any given time. CTUs could be further classified into tertiary-care vs. primary-care; urban vs. rural; teaching hospital vs. community-practice settings. Since the definition and capacity per unit per week of a CTU was site- and discipline-specific, getting input from preceptors and educational coordinators from each department was especially important.

We identified four major groups of factors as limiting our Faculty's annual capacity for clinical teaching commitments towards learners. These factors include not only human resource issues such as the number of preceptors, but also the physical concepts of time and space (Table 3). Specifically, the academic year is a fixed and pre-defined unit of time, necessitating the accommodation of each successive cohort of learners within this stipulated unit of time. The catchment area of a teaching hospital establishes the number or prevalence of cases seen in a year. While the size of a discrete clinical spatial unit, such as a ward or clinic, determines the clinical care capacity of the CTU, the number and total capacity of all such spatial units available for teaching purposes influence the overall ratio of student to cases. The fourth factor grouping, patient volume, is not unrelated to the other sets of factors but, in some instances, it may be significant enough to be deliberated on its own during planning.

We defined the gap in clinical teaching capacity as the difference between annual fixed capacity of the Faculty to provide clinical training to its learners and the sum total of cumulative clinical training requirements for learners across all programs in the year 2012-13 (Figure 2). We established the annual (maximum) fixed capacity of the Faculty by determining the product of space, time and the capacity per spatial unit per unit of time (assuming equal capacity across all spatial and temporal units). We expressed this fixed capacity in learner-weeks. One learner-week can be described as one week of clinical training offered to one learner. We then calculated cumulative clinical training requirements for learners in each program as the product of the annual number of learners per program and duration, in weeks, of clinical rotation required per learner. The grand total of these products, also expressed in learner-weeks, indicates clinical training requirements for all learners in a given year.

Table 1. Data sources used for preliminary summaries of historic teaching commitments at the University of Manitoba's Faculty of Medicine

	Data source	Description of data source
Pre-clinical instruction		
Undergraduate Medical Education	Centralized, electronic pre-clerkship database	Includes names, departmental affiliation and hour-by-hour direct teaching commitments of faculty members, by course.
Physician Assistant Education Program	Program requirements	Program syllabus
Clinical instruction		
Undergraduate Medical Education	Centralized, electronic clerkship rotation database	Historic and current clerkship rotation requests and placements, including elective placements
Physician Assistant Education Program	Program requirements	Program syllabus
Postgraduate Medical Education	Standard questionnaire-surveys designed by the Royal College for program accreditation and completed in 2007 by directors of specialty and subspecialty postgraduate medical education programs at University of Manitoba	Contains, in detail, program core and elective requirements, resident placements, and faculty commitments.
International Medical Graduate Program	Program requirements and program database	Historic and current clinical rotation requests and placements
Nurse Practitioner Program	Program requirements and program database	Historic and current clinical rotation requests by nurse-practitioner learners at sites affiliated with the Faculty of Medicine

We further divided learner-week requirements into ambulatory care experience vs. inpatient-ward experience; tertiary care setting vs. community practice; rural vs. urban. We examined units that provided sub-specialty experiences for learners to help identify major "bottle-necks" or limiting factors within each department or discipline.

We distributed final Faculty-level and department-specific summaries for validation to heads of departments and to program directors, administrators and coordinators within all programs and departments and other administrative units. Departments of primary appointment of preceptors and instructors, and course coordinators when applicable, were used to create department-specific summaries.

RESULTS

In 2007-08, over 1,500 individual faculty members, including preceptors, tutors, instructors, carried out the teaching responsibilities of the Faculty of Medicine. In addition to university-based teaching sites, learners were placed across 200 urban, rural and remote community-physician practice sites. A total of 9,073 instructor-hours were committed to the 5,058 pre-clinical instructional sessions in UGME; 29,067 clinical learner-weeks were offered collectively to UGME, PGME, IMG and NP programs.

Based on the level of growth in different programs in 2008, the Faculty will gradually be required, over the next five years, to provide up to 10,906 instructor-hours per year for pre-clinical training in UGME and PAEP, and

Table 2. Factors that determine a medical faculty's capacity for teaching

Factor
Number and type of students Number of preceptors Appropriate ratio of preceptor to students Curricular requirements • Number of direct contact hours with preceptor Format of instruction • Whole class lecture, small-group tutorials, teaching in clinical units Physical infrastructure • Availability of small-group learning environments

31,761 learner-weeks per year for clinical training in UGME, PAEP, PGME, IMG programs. Specifically, in 2012-13, the Faculty should be prepared to deliver 890 instructional sessions, 1,833 instructor-hours, and 2,769 clinical learner-weeks in addition to those delivered in the baseline year 2007-08 (Figure 3). Department-specific gap analyses illustrated that Internal Medicine and Family Medicine will absorb the biggest fraction of increased teaching responsibility at the pre-clinical and clinical level, respectively (data not shown).

Discipline-based differences in definition and capacity of CTUs notwithstanding, the Faculty was able to identify critical situations and prioritize planning and development. For example, pediatrics ranked first among the departments/disciplines urgently in need of additional community-based, ambulatory- or outpatient-CTUs. We estimated that thirty additional pediatric ambulatory CTUs were required to accommodate growth in UGME alone, assuming that each such CTU will train one UGME clerk for 3 weeks per year (Table 4). Since community-based pediatric CTUs were in demand across all programs (with differing curricular requirements), 96 additional outpatient units will be needed to accommodate growth in UGME, PAEP, PGME, IMG and NP programs, assuming each unit functioned as a CTU for about 3 to 4 weeks a year. Like Pediatrics, Family Medicine too required the development of additional community-based CTUs for all programs. For UGME alone, 14 additional rural practice sites were needed, assuming each site accommodated one UGME clerk for 5 weeks in a year. Internal Medicine, on the other hand, was a representative example of disciplines in need of inpatient-CTUs. At least 1 additional Internal Medicine inpatient ward in a teaching hospital setting was required, at current training capacity, to meet growth at the Faculty level. In general, Pediatrics, Obstetrics & Gynecology, and Family Medicine were most at risk of being overcrowded by the different learner groups. Specific departmental subunits that were identified as potential "bottlenecks" included trauma ward in surgery, outpatient gynecology, pediatric anesthesiology, rural family practice, and northern/remote medicine.

DISCUSSION

The process of identifying the Faculty of Medicine's historic teaching capacity and future teaching responsibilities has allowed for Faculty-wide accounting of future commitments; identification of scarce resources, competing needs, duplicated efforts; and development of a teaching-based pro-rating system for allocation of funds in a transparent manner. Departmental heads assumed responsibility for translating our gap analysis into human resource planning. A process to review, renew, and update the accounting on an annual basis has also been set in motion.

Benefits of the quantitative, analytical approach

The quantitative approach supported assertions that while some departments were already functioning at maximum capacity (e.g., pediatrics, obstetrics/gynecology), a few other departments had room for growth (e.g., psychiatry, general anesthesia). The ability to bring together all departments and communicate, using numbers and common units, the need to rank and prioritize resource development in critical areas, was the ultimate strength of the described methodology. Departments used the

Table 3. Factors that determine a medical faculty's capacity for clinical teaching

Factor grouping	Specific factors	Comment
Human resources	Number of clinical preceptors available in a CTU Ratio of clinical preceptors to learners accommodated in a hierarchical manner in a CTU	May be related to concepts of space and patient volume General hierarchy of learners accommodated in a CTU ▪ Number ▪ Type o Pseudo-attending physicians (usually residents in the last few months of training in certain specialties) o Senior learners (usually PGY2s – PGY4s, subspecialty learners) o Junior learners (UGME clerks, PAEP clerks, NP students, IMGs, PGY1s)
Time	Number of weeks in a year a CTU is available for the training of learners • For UGME, PAEP clerkship years: 48 weeks • For PGME, IMG years: 52 weeks	Fixed physical quantity
Space	Geography • Catchment area of teaching hospital Clinical spatial unit • Number of discrete clinical spatial units, such as wards and clinics, available for teaching • Size of discrete CTUs (Determines clinical care capacity of CTU**)**	Fixed physical quantities
Patient volume	Cases seen • Annual prevalence	May be related to other factors such as human resources and space

UGME – Undergraduate Medical Education; PAEP – Physician Assistant Education Program; PGME – Postgraduate Medical Education; IMG – International Medical Graduates; NP—Nurse Practitioner; PGY—Postgraduate Year.

projected needs to streamline existing resources, to fast-track plans for developing new CTUs, or to pinpoint the critical juncture in the future at which the development of new CTUs will become inevitable and essential. Quantitative analysis also put to rest the unwarranted fear that implementation of the PAEP will overcrowd our

Figure 2. Gap analysis for clinical training capacity in clinical teaching units (CTUs): general principle and methodology

Annual fixed capacity of CTUs* to train learners	Vs.	Learner needs per annum
Number of CTUs available for clinical training of learners X Number of weeks per year available for clinical training of learners X Maximum number of learners that can be accommodated per CTU per week		(Number of UGME clerks X Number of weeks of clinical training required per UGME clerk) + (Number of PAEP clerks X Number of weeks of clinical training required per PAEP clerk) + (Number of IMGs X Number of weeks of clinical training required per IMG) + (Number of PGME resident X Number of weeks of clinical training required per PGME residents) + (Number of NPs X Number of weeks of clinical training required per NP learner)

* Assuming equal clinical care capacity across all discrete CTUs.

UGME – Undergraduate Medical Education; PAEP – Physician Assistant Education Program; IMG – International Medical Graduates; PGME – Postgraduate Medical Education; NP—Nurse Practitioner.

CTUs. The results clearly indicated that there will be only one physician assistant student, on average, in a ward or clinic at any given time. Equally important was the visual impact that within some disciplines/specialties such as family medicine, outpatient gynecology and pediatric emergency care, the NP and UGME programs can potentially compete with each other for clerkship placements.

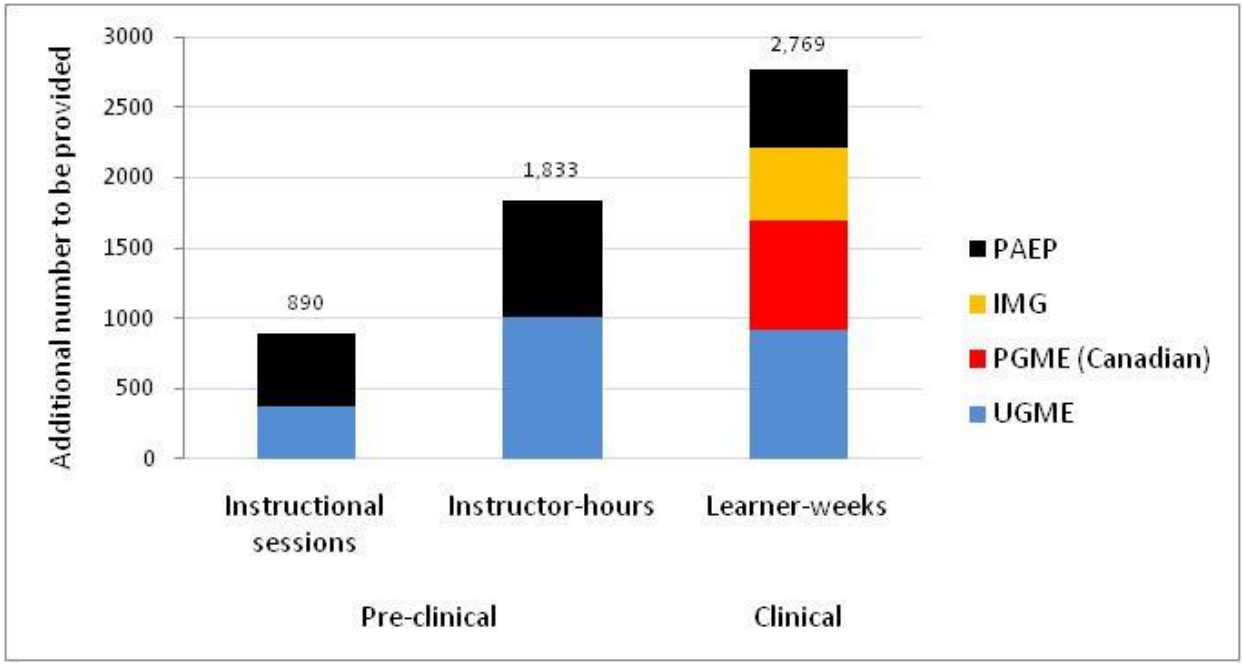
Lessons learned

The experience of creating an inventory of teaching commitments was made smoother by the availability of centralized course-level or program-level electronic database of teaching commitments. For example, instructors' departmental affiliations were available in a Microsoft ACCESS database on UGME pre-clinical teaching commitments as were data on curriculum requirements, time and room scheduling, and instructor availability. Such a database allowed for department-specific summaries of our integrated organ/system-based course commitments in an efficient and timely manner. Courses without centralized databases required more labor-intensive and time-consuming accounting methods.

Future directions

One major limitation with the unit 'learner-week' is the lack of further refinement to the level of teaching hours and direct contact time between preceptors and students. Our methodology in this phase of the study did not discriminate between the time spent by a learner in clinics with a patient, with or without a physician, and the time spent in other educational activities, namely, didactic hours spent discussing a case, attending academic half-days and using computer simulations and related educational technology. We are planning a subsequent study in which learner-weeks will be systematically categorized into smaller subunits of time. Several smaller, specialized courses (e.g., Advanced Cardiac Life Support), exam refresher courses (e.g., preparation course for Medical Council of Canada Qualifying Examinations), extra-

Figure 3. Faculty-level gap analysis in pre-clinical and clinical teaching, in academic year 2012-13 compared with baseline year 2007-08, by program.



PAEP – Physician Assistant Education Program; IMG – International medical Graduate; PGME – Postgraduate Medical Education; UGME – Undergraduate Medical Education

curricular opportunities (e.g., early exposure programs) that were not included in the planning and methodology of this paper will also be analyzed in the future study.

To address projected shortages in health professional workforce in the United States and Canada, plans are underway in both countries to establish new, and expand existing, educational programs.[1,10] The task of accommodating all such growth can seem daunting. This manuscript documents the systematic methodological approach we used to address and plan for one of the challenges faced in the expansion process, namely the impact of growth on the teaching capacity of our medical faculty. The precise magnitude of our growth and future commitments may not be universally relevant but our methodological approach and experience will be of interest to faculty and administration involved in the expansion of health professionals' education.

Table 4. Comparative use of gap analysis across discipline-specific CTUs—selected examples from UGME clerkship

Type and site (CTU) of UGME core clerkship training requirement	Historic capacity for clerkship training (Capacity before growth)			Clerkship training needs after growth		
	Number of available CTUs A	Annual functional capacity per CTU B	Cumulative annual functional capacity of all CTUs C = AxB	Cumulative annual training needs D*	Gap between needs and capacity E = D-C	Additional number of CTUs needed to meet gap F† = E/B
		Learner-weeks	Learner-weeks	Learner-weeks	Learner-weeks	
Internal Medicine						
General						
CTU: Internal ward in teaching hospital	6	96	576	660	84	1
Family Medicine						
Rural						
CTU: Rural practitioner's site	96	5	480	550	70	14‡
Pediatrics						
Outpatient care				330		
CTU: Ambulatory pediatric clinic in a teaching hospital	2	96	192	192	N/A	N/A
CTU: Ambulatory pediatric clinic in a community setting	16	3	48	138	90	30‡
Inpatient care						
CTU: Pediatric inpatient ward at teaching hospital	3	96	288	330	42	0.5‡

* Determined by curricular requirements for clerkship training and class-size.
† Rounded up
‡ These numbers do not reflect the increase in need arising from growth in PAEP, PGME, IMG, and NP programs.

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Student Perceptions of Preclerkship Pelvic Examinations

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ABSTRACT

This study tested the hypothesis that practice pelvic examinations on teaching patients within the second year medical school curriculum improve student perceptions of competency and preparedness for clinical rotations. After IRB approval, 260 second year medical students were asked to complete two voluntary, anonymous electronic surveys: one prior to their practice exam and one afterwards. Eighty-eight students (34%) completed the pre-exam survey; 76 students (90%) indicated they never had performed a pelvic exam. Seventy-one students (27%) completed the post-exam survey. Before the activity, 39 (45%) students did not know how to use a speculum; 57 (67%) could not bi-manually locate the cervix; 69 (81%) could not bi-manually locate the uterus; 72 (85%) could not bi-manually locate the ovaries; 74 (87%) could not assess pubococcygeus muscle tone; and 31 (36%) students were not familiar with the appearance of a cervix. Following the experience, 71 (100%) students knew how to use a speculum; 70 (99%) could bimanually locate the cervix; 66 (93%) could bimanually locate the uterus; 57 (80%) could bi-manually locate the ovaries; 44 (62%) could assess pubococcygeus muscle tone; and 70 (99%) students knew what a cervix looked like. Students indicated that the practice pelvic exam improved their perception of preparedness (n=70, 99%) and confidence (n=64, 90%) for performing the pelvic exam and 64 (90%) students reported that the experience helped reduce their anxiety about performing pelvic exams. The practice pelvic exam activity considerably improved student self-perceived competency and preparedness for clinical rotations, which may help their future performance.

INTRODUCTION

Physical examination and communication skills are important components of medical education that are typically taught throughout all four years of medical school. However, the female pelvic exam is a component of the physical exam that is often not adequately addressed in the curriculum; this exam is especially challenging to teach and to learn because of its sensitive nature.[1] Medical students often have limited or no opportunity to practice the pelvic exam during the first two years of medical school. Furthermore, opportunities to practice this exam during clinical rotations may be limited due to patient preference, student or preceptor gender, and practice type.[2,3] The exam can be uncomfortable for both the patient and the medical student. There are also ethical concerns as to whether students should perform their first pelvic exam on a clinical patient.[4] Several studies suggest that in some clinical circumstances, students do not receive the necessary degree of clinical exposure for them to be able to enhance their knowledge and gain competency in specific skills.[5] There is no consensus about the number of pelvic exams required to be competent; however, it is often assumed that increased experience correlates with increased competency and confidence.[1]

It is important for students to learn clinical skills in an environment in which they are able to receive instructions, ask questions, integrate their medical knowledge with clinical skills, and practice communicating with patients. Standardized Patients (SP) and Teaching Patients (TP) have become an increasingly integral component of

medical education; they play a role in both the teaching and assessment of student clinical skills.[6] SP are paid to simulate a clinical scenario, in order for students to practice taking medical histories, performing physical exams, and treating the patient. The TP role is to guide the student through specific clinical and communication skills, rather than simply role play. Some medical programs use SP and/or TP, who actively participate as teachers, to assist students in developing their clinical and communication skills for performing pelvic examinations.[7] There is limited research on the effect and outcome of using SP and/or TP to facilitate this type of clinical learning experience. In addition, the timing of the SP and/or TP experience in relation to student medical school year varies; some programs take place immediately before obstetrics and gynecology clinical clerkship, while others begin earlier in the students' medical education.[4,7]

Currently, practice pelvic examinations involve use of the speculum, components of the bimanual examination, and appropriate physician-patient communication. Unlike physical examination components, the sensitive nature of this examination can make medical students unnecessarily nervous and therefore it can be difficult for them to communicate and work effectively. The use of SP throughout the first 2 years of medical school is quite common, considering the assumption that increased experience correlates with increased competency and confidence.[1] However, the underutilization of practice pelvic examinations within the first 2 years of medical school leaves students vulnerable. Therefore, the purpose of this study was to examine the effectiveness of practice pelvic examinations by evaluating student- reported clinical and communication competency before and after the experience. We hypothesized that practice pelvic examinations on teaching patients, within the second year medical school curriculum, would improve students' perceptions of competency and preparedness for clinical rotations.

MATERIALS AND METHODS

Sample

The 260 second year students at Kansas City University of Medicine and Biosciences (KCUMB) were asked to complete voluntary pre- and post-exam questionnaires regarding their experience during a practice pelvic exam activity. Students were required to practice the pelvic exam in a controlled teaching environment during the Reproductive section of their second year medical education. This section lasted six weeks, and it was the last academic section before students began their clinical clerkships. During the first week of the reproductive section, students were instructed how to perform the pelvic exam and what to expect during the practice exam experience; students were required to participate in the simulation once.

Survey questionnaire

The electronic questionnaires were released during the second week of the Reproductive section, before the simulated experiences began. The questionnaires were validated by a small sample of individuals before being released. Students were informed verbally and electronically via email about the voluntary survey. The survey was posted to the Blackboard online student forum and students were responsible for completing the surveys before and after their simulated experience, within the time frame of the six week section. The survey was completely voluntary and student responses were anonymous.

To protect the identity of our students, minimal questions were asked concerning demographic information. The pre-examination (pre-exam) questionnaire included eighteen questions regarding gender, perceptions of the pelvic exam experience, previous pelvic and breast exam experience, what skills the students already had for the pelvic examination, and self-assigned code number. The post-exam questionnaire consisted of forty-one questions; ten of the pre-exam questions were repeated in order to determine whether the pelvic exam simulation had an impact on student self-perceived ability to perform the pelvic exam during a clinical rotation. Additional questions concerning the organization of the pelvic exam experience, and perceptions regarding how the simulated pelvic exam experience prepares them for future clinical rotations were added to the post-exam survey. The participant's response option was based on the following 5 point Likert scale: strongly agree, agree, neither, disagree and strongly disagree.

Statistical Analyses

Due to lack of student recall of their self-assigned code number, pre-exam to post-exam comparison was not plausible. Therefore, pooled descriptive statistics are reported for each survey.

RESULTS

There were 260 students in the second year medical class. Of the 260 students, 88 (33%) completed the pre-exam survey (36 male, 51 female); of those, seventy-six students (90%) had not performed a pelvic exam previously. Seventy-one (27%) second year medical students completed the post-exam survey (32 male, 34 female).

Summary data indicates that the simulated pelvic exam significantly improved student preparedness (n=70, 98%) (Figure 1) and confidence (n=64, 90%) to perform the pelvic exam in the clinical situation (Figure 2). In addition, 64 (90%) students reported that the simulation helped to reduce their anxiety about performing the pelvic exam (Figure 3).

Figure 1.

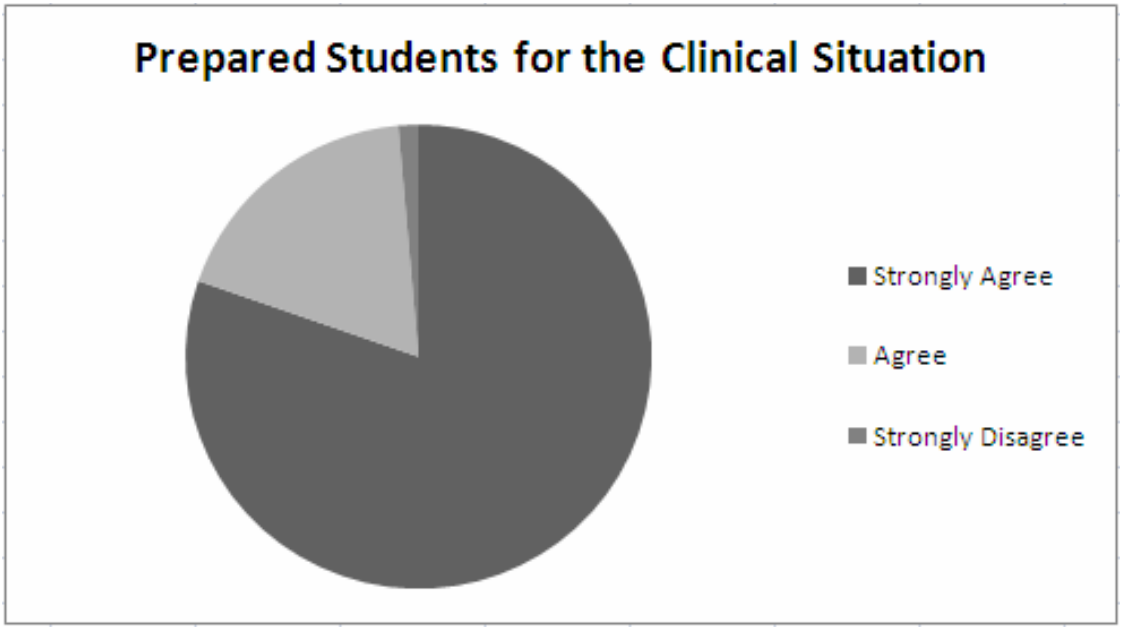
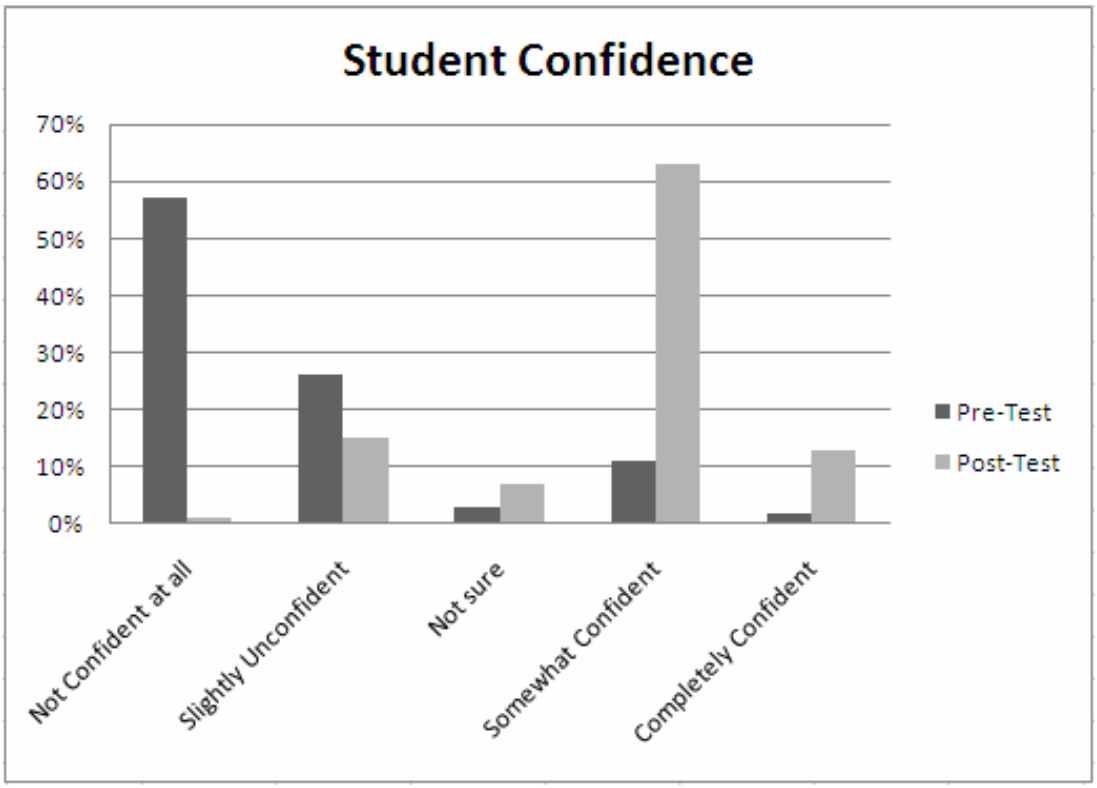
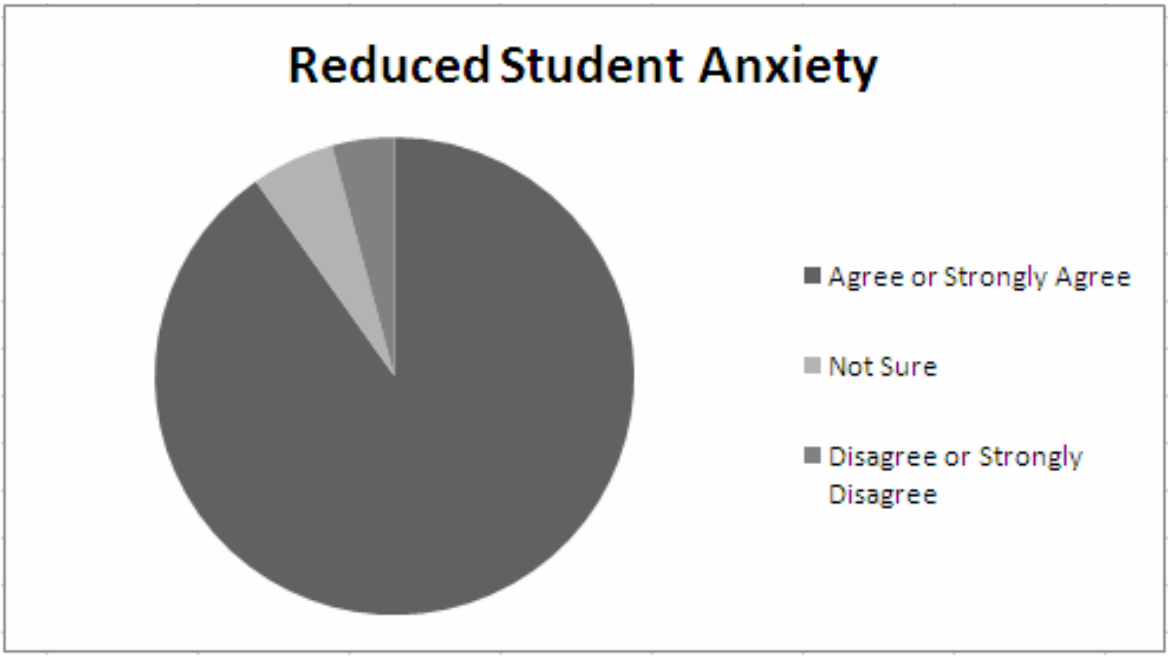


Figure 2.



Before the practice examination experience, 39 (45%) students did not know how to use a speculum; 57 (67%) could not bi-manually locate the cervix; 69 (81%) could not bi-manually locate the uterus; 72 (85%) could not bi-manually locate the ovaries; 74 (87%) could not assess

Figure 3.



pubococcygeus muscle tone; and 31 (36%) students did not know what a real-life cervix looked like.

Following the pelvic exam simulated experience, 71 (100%) students knew how to use a speculum; 70 (99%) could bi-manually locate the cervix; 66 (93%) could bi-manually locate the uterus; 57 (80%) could bi-manually locate the ovaries; 44 (62%) could assess pubococcygeus muscle tone; and 70 (99%) students knew what a real-life cervix looked like (Figure 4).

The student ability to communicate with the patient about the pelvic exam procedure was also assessed in the pre- and post-exam surveys. Before the practice experience, 30 (34%) and 27 (31%) students indicated that they were not sure how to explain and what to tell the patient concerning the exam procedures, respectively. However, after the practice pelvic exam experience, 62 (87%) and 65 (92%) students agreed or strongly agreed that they knew how to explain and what to tell the patient concerning the exam procedures, respectively (Figure 5).

Sixty-nine (97%) students indicated that the pelvic exam activity was well organized. Seventy (98%) believed the experience was a useful way of teaching the pelvic exam. Fifty-nine (70%) students believed this method of teaching promoted teamwork. Fifty-seven (81%) students reported receiving appropriate feedback about their performance of the pelvic exam.

DISCUSSION

Overall, the students indicated very positive feelings about the effectiveness of the practice pelvic exam experience. The physicians and teaching patients provided the students with an appropriate level of instruction necessary for the students to gain the skills required to perform this type of exam. As a result, the students felt more prepared, more confident, and less anxious about performing a pelvic exam in the clinical setting.

The survey results support our hypothesis that the practice pelvic exam activity utilizing Teaching Patients at KCUMB improves second year medical student perceived competency and confidence in performing a female pelvic exam. The TP helped to facilitate a safe environment in which students were able to ask questions, practice skills, and gain exposure to potentially uncomfortable clinical situations. The TP and physician also provided the students with formative feedback regarding appropriate clinical and communication skills.

As a result, the students were able to learn how to perform specific exam skills, such as locating the cervix and ovaries, using a speculum, and assessing pubococcygeus muscle tone. After this experience, the students felt more prepared and confident to communicate appropriately with the patient during the exam.

Figure 4.

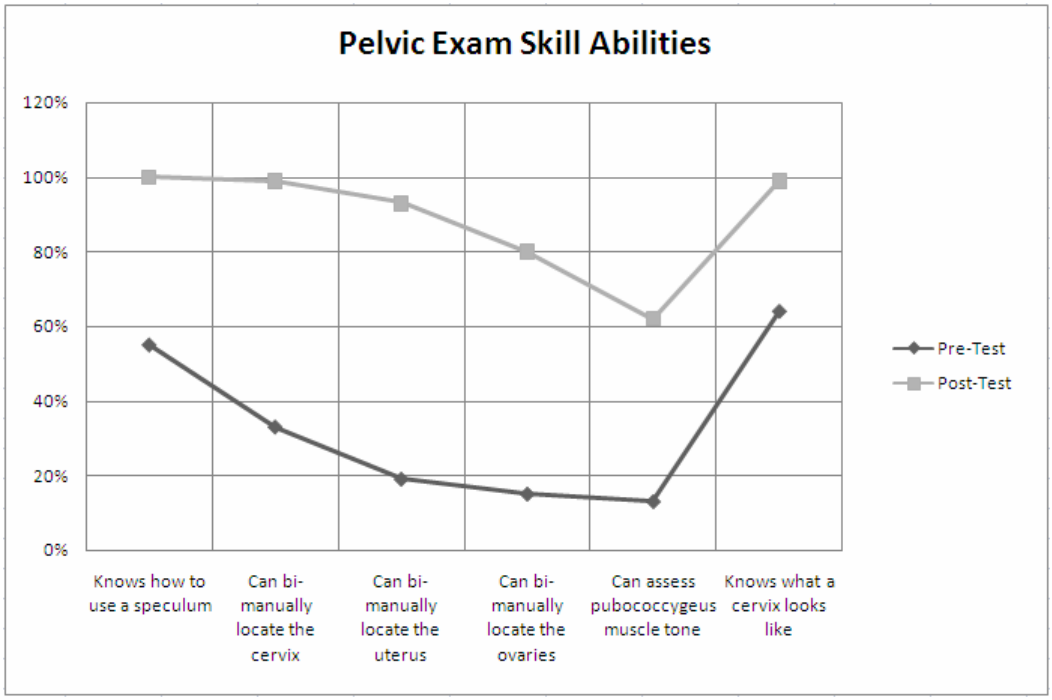
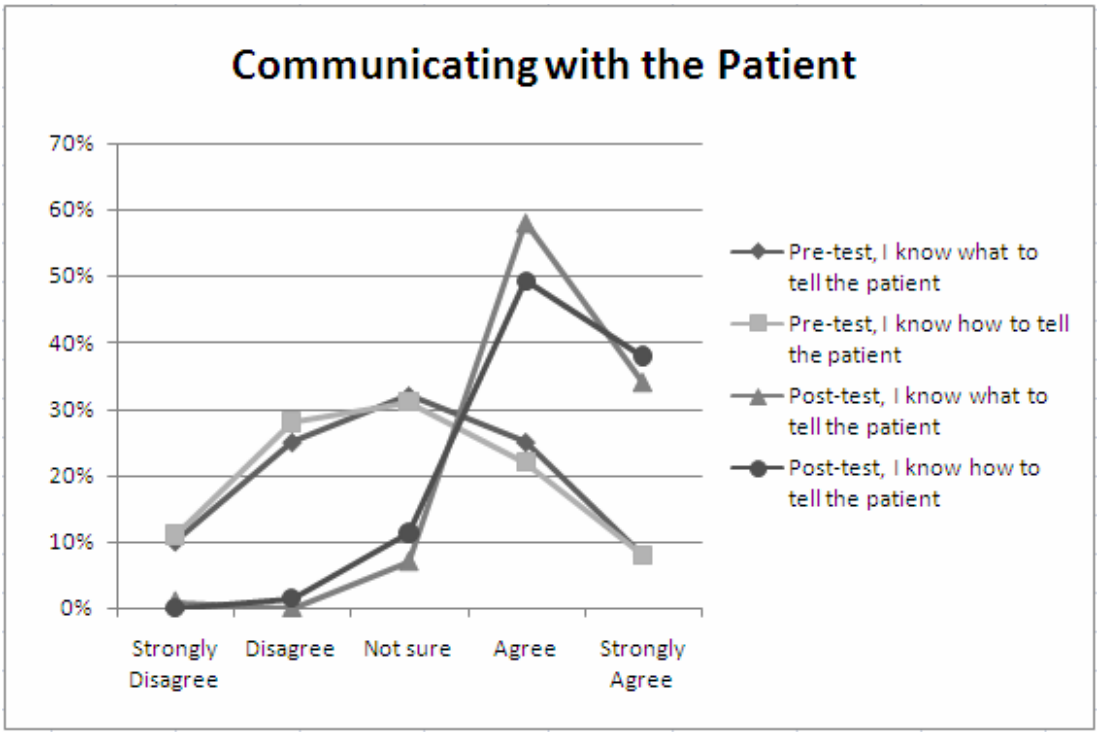


Figure 5.



Several other studies have demonstrated the importance of providing students with hands-on clinical experiences in order to improve their level of confidence and competence. These studies have determined that this type of practice

experience is a significant independent predictor of student confidence.[5] Our results support this conclusion. However, the relationship between self-perceived clinical competence and actual clinical competence or performance cannot be determined from this study. Although students reported that they felt prepared for and confident in performing a pelvic exam during clinical rotations, there was no direct assessment of their preparedness in rotations. Because the students did not receive a grade following the practice experience, no correlation can be made between their performance during the practice exam and their performance during clerkships.

Previous studies suggest that there is no correlation between clinical experience or confidence and measured performance assessment, including both clinical and written examination grades.[5] However, the explanation for this result is still unclear. Research by Morgan and Cleave-Hogg suggests that the lack of correlation could be due to several factors, including the quality of the learning experience, the quality of the feedback received during skill acquisition, or how important learning this skill was perceived by the student.[5] Our students, however, reported that activity was well organized, was a useful way of teaching the pelvic exam, that this method of teaching promoted teamwork, and that they received appropriate feedback about their performance of the pelvic exam. In addition, students found the teaching patient to be a good teacher and believed the experience provided a supportive learning environment.

Based on our results, we believe that further investigation between clinical experience or confidence and measured performance assessment is warranted. Because the students only received hands-on experience with performing pelvic exams, a correlation using their obstetrics and gynecology clerkship grade, may not provide an accurate point of comparison; students would need to be specifically graded on their pelvic exam performance, in order to have a point of equal comparison. Currently, these data suggest practicing a sensitive type of examination utilizing live teaching patients is beneficial to the students' feeling prepared for clinical rotations. These data may apply to other sensitive nature exam, such as the male prostate examination.

Limitations

This study had several weaknesses. Due to lack of recall of their code number, we were unable to perform statistical comparisons between surveys. Because the surveys were posted individually, participation on one was not required for the other and without code numbers to match the survey respondents, the pre- and post-survey respondent groups may have consisted of different individuals from the class. Thirdly, since we did not assess student interest in this subject, this factor may have influenced the students' motivation to participate in the survey and interest in the pelvic examination experience overall. The lack of response may be due to lack of interest or lack of time. This questionnaire took place during the last section of the second year curriculum when most students have the least amount of time due to regular course work, preparing for rotations, and studying for their upcoming board examinations. Lastly, the students who participated in the pre-survey and post-survey, respectively, may not accurately reflect the experiences of all 260 second year medical students who participated in the practice experience or medical students in general.

CONCLUSIONS

Despite these limitations, our study strongly suggests that teaching the pelvic exam during the second year of medical school curriculum helps students to adequately learn the necessary skills needed to perform pelvic exams in the clinical setting. The opportunity to learn the components of this exam in a controlled, supportive learning environment helps students to feel more comfortable and confident in their ability to perform the pelvic exam. Ultimately, the researchers believe that this opportunity, during the second year of medical school, serves as a foundation upon which students can begin to acquire the skills necessary for competency in performing the female pelvic exam.

Future studies

Since the survey was conducted prior to clinical clerkships, it was not possible to determine the degree to which the practice experience actually prepared students for the clinical setting. In order to assess the degree to which the experience actually prepared students for clinical rotations, a follow-up questionnaire is being conducted of all third and fourth year students who have performed at least one pelvic exam during clinical rotations.

ACKNOWLEDGEMENTS

This research information has been presented in poster form at the 2008 American Osteopathic Association Annual Conference, and in oral form at the 2009 KCUMB Research Symposium. The abstract of this manuscript has been published in the Journal of the American Osteopathic Association (JAOA).

This research involved the use of human participants. Exempt status IRB approval from Kansas City University of Medicine and Biosciences was granted for this project before surveys were distributed to participants.

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