Learner-Directed Clinical Case Tutorials: An Approach that Focuses on the Integration of Patient-Physician Interaction and Basic Science Information to Diagnose Patient Complaints

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An imperative of medical education is to provide for students early in their training the opportunity to integrate basic science information into the clinical experience. We suggest this approach would improve clinical competencies as well as instill in the future physician the mindset that integration of basic science knowledge with acquired patient data is critical in the construction of an assessment, diagnosis and plan for the best patient outcome. Initial instruction to our medical students includes the anatomical sciences (anatomy, histology, development and radiology) as well as basic history taking and physical examination skills. In an effort to create a clinical experience in parallel with that of the classroom, a series of on-line accessible, case based tutorials has been developed for the first term of our pre-clinical curriculum in which basic science and clinical skills information is seamlessly integrated. The focus of the tutorials is to benefit student success in first term courses as well as their success as practicing physicians.

The tutorials are constructed using a self-directed guided inquiry process to engage and challenge the student to explain relevant anatomical facts in relation to reported patient complaints and patient evaluations. Cases are designed to integrate knowledge that is covered in the lecture and/or laboratory aspects of either or both courses. Explanations augmented with images are linked to interrogative prompts. Videos accompany each tutorial to help students visualize 1) the acquisition of "data" in the history and physical, 2) methods of patient communication and 3) appropriate physician/patient interactions. Two short videos of the patient-physician interaction are created for each case in which a physician 1) takes a patient history and 2) performs a physical examination. The videos expose students to the level of professionalism that is expected and provide the novice medical student a frame of reference for their own interactions with standardized patients. The tutorials were not mandatory. Despite student advocacy for a more clinically oriented focus in their early medical training, course site tracking data indicated that student access of these optional learning aids was minimal. Approaches to encourage self-selection of the tutorials and obtain outcomes data are being evaluated.

Masters of Science in Patient Safety Leadership: Responding to the Demands for a Safer Health System

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The Institute of Medicine's (IOM) report To Err is Human; Building a Safer Health System estimated that as many as 98,000 patients die every year in hospitals from preventable medical errors. Health care providers, both clinical and administrative, have a tremendous need to develop expertise in the fields of healthcare quality and patient safety. Competencies for optimal patient care outcomes in the clinical environment include knowledge, skills, and attitudes in critical disciplines. These competencies, however, are not traditionally taught in traditional health science education. In response to this gap in health science education, the University Of Illinois College Of Medicine developed an online Master of Science in Patient Safety Leadership (PSL) program. The PSL program was designed for both clinical and non-clinical health care professionals interested in taking health care quality and patient care services to a higher level of excellence.

The MS in Patient Safety Leadership is offered primarily online through the UI Global Campus, with one 5 day intensive on-site requirement. The curriculum of the PSL program consists of nine (9) 4-credit hour courses for a total of 36 credit hours. Three core domains are embedded within the curriculum: Patient Safety and Quality Care; Leadership and Organizational/Systems Management; and Professional and Interprofessional Development. Course content includes: patient safety and health care quality, leadership, interprofessional collaboration, organizational management, communication, global health, legal/policy, error science, simulation, information technology and health services research. Each course has been designed and developed by interprofessional teams across multiple health science disciplines at the University of Illinois, and by nationally recognized experts in the field of patient safety.

The PSL program is important to the health care community in its continued efforts to break the cycle of medical error and improve the safety of patients who participate in the health care system. This degree program provides comprehensive education and training, enabling learners to become leaders in the critical aspects of safe and effective healthcare, from bedside care to facility design, including administration, academia, government, accreditation and clinical associations.

Use of Portfolios in a First Year Medical School Course

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Self reflection is an important skill for physicians; training students in the art of self reflection is an important goal. Our new Patient Centered Medicine (PCM) course has afforded the opportunity for students to maintain a portfolio of reflections. Students meet in small groups almost weekly with a faculty facilitator/mentor. Portfolio entries are read by each student's facilitator who comments on every entry. This creates a mechanism for "conversation", and serves as an extension of the small group meetings. Students reflect on experiences before beginning medical school ("Describe a personal experience with the health care system; Describe your feelings in anticipation of seeing patients.") Throughout the year students reflect on patient-physician encounters ("Reflect on an ethical dilemma; Discuss a patient interaction which has impacted you"), on service learning activities ("Describe the teacher/learner interaction; "Describe negative and positive attributes of your site/population"), and on chronic illness and end-of-life community site visits ("What can physicians offer when curative treatment is not available; Discuss experiences with chronic or terminal illness which you have had with family members and friends.")

Students are required to make one entry per month. They write their portfolio entries online using our course management system (WebCT). Entries contain personal observations and thoughts, raise challenges, pose questions, and are expected to reflect empathy, respect for others, honesty, motivation, professionalism, and cultural competence. Student entries are graded on quantity and quality (0 = not regularly recorded; 1 = entry completed; 2 = entry reflects thoughtful and thorough comments.) The portfolio grade accounts for 25% of the PCM course grade.

Student feedback has been both positive and negative. Some students enjoyed writing about their personal experiences and tracking their activities and thoughts during medical school. Others found this type of reflection more difficult, especially "on top of the work required for other classes." Faculty feedback was mostly positive. Portfolio writing will continue into the second year of PCM and become a longitudinal document that will provide evidence of personal and professional growth in the skill of self-reflection, and in learning to be a doctor.

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Assessing Ethical Expertise

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Clinical Applications: Problem Solving and Integration of Basic Science Concepts using Team-Based Learning

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The first-year curriculum at The University of Texas Medical School at Houston is comprised of traditional discipline-based basic science courses and an Introduction to Clinical Medicine course where students learn the basics of the patient interview and physical exam. Integration of material between courses can be problematic within traditional curriculums, particularly due to division of materials between courses in consecutive semesters. The first-year course directors developed a method to allow students to cross the boundaries of concurrent courses, and establish connections between materials presented in successive semesters. These methods also incorporated associated content from the basic science courses with skills learned in the Introduction to Clinical Medicine course. In order to accomplish these goals, seven integrative problem-solving sessions were introduced into the first-year curriculum, four in the first semester and three in the second. These Clinical Applications sessions utilized a team-based learning approach to present scenarios of patient problems that integrated content from three or more of the first-year courses. Particular efforts were made to incorporate concepts from first-semester courses into sessions in the second semester to promote vertical integration. Clinical scenarios have included infertility, premature birth, sickle cell anemia, HIV infection, diabetes mellitus, renal failure, cardiovascular disease, cancer and pain, and travel medicine.

The first-year class is divided into 40 teams of six students, corresponding to the Gross Anatomy tank groups. Students prepare for sessions by completing pre-assigned reading and review of targeted lectures. Their material mastery is then assessed by readiness assurance quizzes that are first administered individually, followed by group team analysis. Following the readiness assurance process, teams are presented clinical scenarios. Additional problem sets are presented within scenarios, and teams are directed to find solutions to posed questions. Teams compose a one-page written justification for their solution for one of the problems within the set, which is submitted for grading. Faculty members facilitate the inter-team discussion of the solutions the teams present. The facilitation of the session is best accomplished with participation of all first year course directors present, thus allowing for sufficient horizontal and vertical integration. An overwhelming majority of students indicated the sessions helped them better apply their basic science knowledge to clinical problems.

A Professional Development Module to Optimize Interactions between Teachers and Learners

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Each medical university strives to have an optimal learning environment. Inevitably lapses do occur, often attributable to miscommunication between teachers and learners. At our institution, it was noted by both the Association of American Medical Colleges Graduation Questionnaire and individual clerkship evaluations from 1998-2004 that there were numerous negative comments regarding the learning environments of the surgery and obstetrics/gynecology clerkships, and that both of these clerkships were ranked lowest in overall quality, mainly due to the perceived poor quality of the learning environment.

In an effort to improve the learning environment of these two clerkships, a professional development module was created to help faculty and residents identify their own personality preferences, recognize behavioral cues in others, and optimize teacher-learner interactions. Based on the Myers-Briggs Type Indicator (MBTI) and the Flex Care methodology of Allen and Brock,[1] the module was designed to teach clinical faculty members how to adjust (or "flex") their preferred communication styles to accommodate the learners' preferences for receiving information.

The module is a 54-slide PowerPoint presentation with embedded video clips. Before presenting the module, it is assumed that the presenters are experienced MBTI facilitators and that each member of the audience has taken the MBTI and has participated in an interpretation session about his/her type. The authors report that these sessions were received well by the clinical faculty.

This is an innovative way to help improve the teaching and communication skills of clinical faculty members and residents. We look forward to seeing if measurable improvements in the learning environment result from this professional development module. The module is available for review from the authors (ltorbeck@iupui.edu).

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Pathology Image of the Day: a Tool for Augmenting Visual Learning in a Problem-Based Curriculum

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We use an integrated, problem-based curriculum to teach basic science and pathology. The curriculum is organized by organ system and divided into "phases." At the end of each phase, a multi-disciplinary, USMLE-style examination is administered. Many questions are vignette-style. One third of pathology questions are image-based.

Students receive reading assignments and objectives for pathology topics. Much discussion of pathology takes place in small groups facilitated by faculty whose backgrounds vary. To aid interpretation of visual information, we instituted an email-based supplement inspired by the "Image Challenge" series of the *New England Journal of Medicine*. We call ours the "Pathology Image of the Day" (IoD).

One faculty member assumes responsibility for each phase and sends out electronically a series of multiple-choice, vignette-style questions, each with an attached image(s). The questions are of the same difficulty as the examination. The answer and a discussion justifying the answer and explaining the foils follow separately.

The initial "production" of an IoD is time consuming. Once it has been produced, however, it can be updated and used yearly. Since adding IoDs, we have had fewer requests for remedial help. Thus, time invested may be compensated by time saved from other pedagogical interactions.

Our examinations contain many vignette questions, a style new to many beginning students. IoDs offer opportunities for familiarization with this style before the first exam. IoDs also give faculty the chance to "field test" interdisciplinary questions. The IoD concept can be adapted to other basic sciences. Less visual disciplines could create a "Problem of the Day."

Establishing a Student Tutoring Program

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It is common for a small number of medical students to encounter academic difficulty in the first two years of medical school for a variety of reasons. In 2006, VCU SOM established a Student Tutoring Program to expand our academic resources available to at-risk first and second year medical students.

Through academic counseling, at-risk students were referred to the tutoring program based on course performance. Fourth year and dual degree students were invited to provide tutoring in both small group and individual sessions. Hourly payment was provided.

Tutors and tutees completed a survey providing feedback on the pilot program. Tutees generally responded very positively to the tutoring program. Specifically, the tutors taught students how to organize the large amount of course material effectively and provided more individualized attention in a setting where the tutees felt comfortable to ask questions. For many students, the additional review of material in a small group boosted their self confidence.

Tutor evaluations overwhelmingly emphasized how much they enjoyed tutoring. Many became vested in the progress of their tutees and felt tutee performance reflected their teaching success. Students indicated they volunteered to tutor for the opportunity to teach, to meet first and second year medical students, to give back to the medical school, and to review material. Their feedback highlighted the significant time required to prepare for each session. Lastly, many tutors indicated they would like more direction and formative feedback throughout the year.

We specifically analyzed the Gross Anatomy course because there were multiple examinations and the largest number of tutees. Data collected were compared to a historical control group of at-risk students from a previous year that did not receive tutoring. Paired t test analysis indicates that the tutees improved their average standard score on their third test compared to the first test in the course while the control group did not.

After a successful pilot year, we will continue the program offering additional tutor support and training while encouraging collaboration of tutors and course directors which can help tutors prepare for sessions to be most effective for the tutees.

MONOGRAPH

An Overview on Educating Future Physicians Concerning Professionalism

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Introduction

Medical professionalism is currently a widely discussed topic within health professions training programs, teaching hospitals and physician specialty societies. In medical education circles, a host of organizations have issued statements on professionalism in the last five years[1-5] ,with increasing calls for greater emphasis on this topic. There are several factors that appear to be "driving" this emphasis: increased scrutiny of the medical profession by society; publicized lapses in ethical judgment on the part of health care professionals; the patient safety movement; and increasing calls for a more centralized health care system that provides a minimum level of coverage for all Americans.[6] There is also limited evidence that poor professionalism by medical students is predictive of future problem behaviors regarding medical licensure and related issues.[7-8]

Additionally, the educational process for physicians has undergone a dramatic shift in the past decade. This shift is described as one that features more emphasis on an outcomes-oriented approach to both medical education and the continued certification of practicing physicians.[9-10] Early leadership in this regard was provided by the Accreditation Council for Graduate Medical Education (ACGME), the national accrediting organization for all residency training programs in the USA. The ACGME's revision of accreditation standards to require curricula within a framework of "six general competencies" (patient care, medical knowledge, practice-based learning & improvement, interpersonal & communication skills, professionalism, systems-based practice) was a major paradigm shift in residency training, and included much emphasis on professionalism.[2] This trend is also now reflected in accreditation standards for undergraduate medical education, along with a demand for formal education and assessment of professionalism and the learning environment for medical students.[11] A recent search of the Association of American Medical College (AAMC) national curriculum database (CurrMIT) revealed that 55 North American schools list "professionalism" as a component of training in their curricula for the 2006-2007 academic year. It is very likely that nearly all medical schools are addressing this topic in one way or another.

While much has been written on the topic of professionalism in medicine, it is our belief that there remains a lack of clarity about four issues arising from the continuing emphasis of this topic:

1) The definition of professionalism; what is the precise subject matter that should be taught to medical students and/or resident physicians in training?
2) The teaching of professionalism; how should this topic be taught, by what methods or processes?
3) The assessment of professionalism; how should we evaluate our learners to be assured that they have learned the material and, as a consequence, are behaving professionally?
4) The broader application of professionalism; what are the implications of this emphasis for academic health care institutions as a whole?

While a detailed examination of these four questions is beyond the scope of a single paper, we provide an overview

of these issues within this monograph so that medical educators may better understand the current emphasis on professionalism and further consider what role they should play in addressing them. Our institution recently appointed a multidisciplinary task force that worked for approximately a year on these issues, resulting in a plan of action for teaching and assessing medical professionalism across all levels of physician training within our medical center. Accordingly, this monograph will briefly address each of these four issues, explain the recommendations reached by our task force and subsequently endorsed by our school and, finally, outline our plan to implement this new program at our institution.

What is the Definition of Professionalism?

> "Our youth love luxury. They have bad manners, contempt for authority; they show disrespect for their elders and love chatter in place of exercise; they no longer rise when elders enter the room; they contradict their parents; chatter before company; gobble up their food and tyrannize their teachers"
>
> *Socrates, 9th century B*

> "The most common criticism made at present by older practitioners is that young graduates have been taught a great deal about the mechanism of disease, but very little about the practice of medicine; or, to put it more bluntly, they are too 'scientific' and do not know how to take care of patients".
>
> *Sir Francis Peabody, noted English physician, 1927*

In whatever way we may choose to define the concept of medical professionalism, it seems likely that there has been controversy about what it means for quite some time! If medical schools and residency training programs are to be expected to teach and/or assess student professionalism, they must arrive at a "working definition" to guide their educational efforts.

Professionalism is a broad and multi-faceted construct in the current health professions education literature. Our review of the literature revealed far more information regarding how to define professionalism, compared with material concerning how it may be taught and assessed. The classic definition of professionalism consists of three separate but related concepts: an advanced level of training or expertise in a particular field, a commitment to service, and a high degree of autonomy in practice and self-regulation.

One of the most frequently cited definitions comes from the joint effort of three groups: the American College of Physicians, the American Board of Internal Medicine, and the European Federation of Internal Medicine. This group issued its "Charter on Medical Professionalism" in 2002, and defines professionalism using ten responsibilities (competency, honesty, patient confidentiality, appropriate relationships with patients, improving care quality, improving access to care, just distribution of finite resources, commitment to scientific knowledge, maintaining trust by managing conflicts of interest and commitment to professional responsibilities) based on three broad principles (the primacy of patient welfare, patient autonomy and social justice). This document is mentioned in nearly all current references to professionalism, and is widely acknowledged to be influential due to its adoption by many physician groups. However, it has also been criticized as being too paternalistically-oriented. [12]

The ACGME,[2] through its Outcomes of Medical Education project, has defined professionalism as "a commitment to carrying out professional responsibilities, adherence to ethical principles and sensitivity to a diverse patient population". All resident physicians, regardless of specialty choice, are expected to be taught these principles; and, teaching faculty are expected to assess resident understanding and application of them in some manner. Each medical specialty, through its own Residency Review Committee, reviews the efforts made by residency programs to develop curricula in professionalism and offers advice about possible assessment methods.

The AAMC has also published a review document that examines the education of physician trainees on professionalism.[1] This document lists characteristics of professionalism as defined by the AAMC's Medical School Objectives Project: physicians are expected to be knowledgeable (scientific method, biomedicine), skillful (clinical skills, reasoning, condition management, communications), altruistic (respect, compassion, ethical probity, honesty, avoidance of conflicts of interest) and dutiful (population health, advocacy and outreach to improve non-biologic determinants of health, prevention, information management, health systems management). The report references numerous efforts by a variety of other groups to define the core concepts of professionalism.

What about the accrediting body for medical schools, the Liaison Committee on Medical Education (LCME)? While past versions of LCME standards discussed this subject only indirectly, this approach is changing. Effective July 1 2008, a new LCME standard (MS-31A) will require that accredited schools "ensure that the learning environment for medical students promotes the development of explicit and appropriate professional attributes (attitudes, behaviors and identity) in their medical students".[11] This new standard is discussed in its annotation section in greater detail. Schools are expected to "define the professional attributes it wishes students to develop in the context of the school's mission and the community in which it operates", and to ensure that these attributes are also "promulgated among the faculty and staff associated with the school". The standard requires schools to "regularly assess the learning environment to identify positive and negative influences on the maintenance of professional standards and conduct, and develop appropriate strategies to enhance the positive and mitigate the negative influences". Clearly, the LCME now expects medical schools to have a more formal approach to the

teaching and assessment of professionalism, and to actively monitor the learning environment as a whole.

At least one attempt to define professionalism involved a qualitative inquiry approach using carefully-constructed focus groups that gathered input from a variety of constituents about how professionalism should be taught and assessed. [13] This interesting study found common themes related to knowledge and technical skills, good relationships with patients and individual virtues; but also noted differences between constituent groups regarding how professionalism should be defined. The authors note that these differences "reflect the inherent challenges to teaching professionalism successfully".

Indeed, even a casual examination of the various documents purporting to define professionalism reveals that these definitions have both commonality and differences. A major delineation in the literature pertains to whether the concept of medical professionalism should more narrowly focus on the physician-patient relationship or whether a broader definition should be used, including the concept of civic professionalism where, it is argued, physicians have a moral obligation for involvement in society.[14] This delineation turned out to be a key area of discussion for our task force.

The responsibility of medical educators to actively address the teaching and assessment of professionalism is well stated by one prominent author: "given that doctors hone their professional attitudes during their formative years as students and residents, medical educators have a critical role to play in ensuring that future doctors are prepared to fulfill their obligation to be trustworthy."[15] Our task force was charged to form our own definition of professionalism for the purpose of determining how it should be taught and assessed at our school, not only because of the perceived importance of the issue within medical education but in anticipation of the new requirement from LCME. In addition to a review of the literature, we also reviewed policy-oriented documents from approximately 10-12 other medical schools to gain insight into how professionalism was defined elsewhere. For example, Menna and coworkers (2005) described efforts at one medical school to design and implement a new program whereby students are taught a set of professionalism expectations and evaluated across all four years on these criteria[16].

We also reviewed several existing documents in use at our school, which were regarded to be relevant to defining professionalism. These documents included school-wide exit objectives adopted in 2000 concerning professional attributes of our students; policy and procedures taken from the faculty manual of our parent university (East Carolina University, or ECU) on academic integrity; a formal code of conduct for all employees of our parent university (ECU); a specific code of conduct for our medical school faculty; the student honor code for our medical school; and a code of ethical behavior promulgated by our primary affiliated teaching hospital, Pitt County Memorial Hospital (PCMH). Copies of these documents can be furnished upon request.

All of these external and internal documents served as useful background and helped inform the eventual adoption of a new medical school policy which explicitly defined "Teaching & Assessing Medical Professionalism". This new policy defines eight core elements of medical professionalism as follows:

1. **Integrity & Trustworthiness**: displays honesty and forthrightness; adheres to ethical standards; truthful in all communications; maintains confidentiality; reports inappropriate behavior by colleagues.
2. **Compassion & Respect for Others**: considerate; cooperative; displays empathy; respectful of different socioeconomic backgrounds & cultural traditions; sensitive; respects authority.
3. **Teamwork & Professional Demeanor**: works well with others; maintains composure in difficult circumstances; inspires trust; avoids inappropriate remarks; adheres to local dress codes.
4. **Responsibility & Sense of Duty**: completes assigned duties; sets & achieves realistic goals; follows policies; responds promptly when called; detail-oriented; places patient needs first.
5. **Accountability & Initiative**: flexible; delegates effectively; accepts personal responsibility for mistakes; asks for help when needed; discloses medical error when appropriate.
6. **Scholarship & Commitment to Learning**: punctual; attends classes, clinics, other required events; seeks additional knowledge and skills; seeks feedback; willing to assist other learners; is self aware of areas for improvement.
7. **Concern for the Welfare of Patients**: treats patients & families with dignity; respects patient privacy & cultural values; maintains accurate information in patient records; advocates for patients.
8. **Self-Care & Self-Growth**: maintains personal health & hygiene; cares for self; seeks advice, counsel or tutoring when needed; avoids harmful behaviors.

The definition of professionalism reflected in this policy was based primarily on the fact that our school and our parent university were already "on the record" with official statements related to professionalism. While our task force did not think the more global, socially-oriented aspects of professionalism were unimportant, we decided to recommend a policy including a definition that focused more narrowly on the role of students within the learning process, and on the patient-physician relationship. We felt that such an approach was justified primarily by the fact that our charge was to relate professionalism to the teaching process within medical school and residency training. There was agreement among the task force members that emphasizing the role of the physician in larger society was not as germane to our immediate task (although we felt that such issues were adequately addressed within the formal curriculum of our medical school).

The resulting policy also requires professionalism to be "taught formally, emphasized informally and assessed by the faculty of the school". In regard to assessment, the policy states that "all health professions trainees as well as teaching faculty should be assessed concerning medical

professionalism, within the guidelines and procedures of each specific training program and department". Also, regarding teaching and assessment of medical students, the policy empowers the school's Executive Curriculum Committee or an appointed sub-committee thereof to monitor all aspects of this program consistent with the school's governance code.

In summary, our group spent much time examining the medical education literature and other sources to arrive at a definition of professionalism that we felt was workable for our institution, reflected key components identified by various groups, focused primarily on student roles and responsibilities for learning and patient care and avoided long debates about the various aspects of how to define such a broad construct. In so doing, we felt it likely that an observation from the AAMC report previously cited about the various descriptions found in the literature concerning professionalism was correct:

> "All explications of professionalism then devolve into descriptions of the general qualities of a virtuous *person*, one who works in the field of medicine, and how such a virtuous person would act. While the processes of coming to these various descriptions of professionalism differ and may have had formative value in their respective organizational domains, in the end and at a deeper level, the final accounts are all the same".[1]

What likely matters most is not so much whether all medical educators or practicing physicians agree on a precise definition of professionalism. Rather, we agreed that the concept itself must be addressed in a more explicit manner than we had previously accomplished in our curriculum and our institution; and that such emphasis has the potential for great benefit not only to our students, but to the entire academic medical center.

How Should Professionalism Be Taught During Medical School?

The literature on how professionalism should be taught to medical students and resident physicians is mostly descriptive and anecdotal in nature, likely due to the relative newness of this area of formal emphasis within medical education. Teaching professionalism involves both formal, planned curricular offerings and activities that fall into the category of the "hidden" or "informal" curriculum, where students learn from both positive and negative role models observed during teaching experiences. In particular, this informal teaching/role modeling is felt to be a powerful influence on student behavior and learning.

The present trend appears to be the provision of more formal, explicit teaching on professionalism by adding lectures and other activities to the first two years of the curriculum. Many medical schools, including ours, have courses involving clinical activities early in the curriculum and these courses provide obvious opportunities to address professionalism issues. However, for the most part, medical students spend the majority of their time in lectures during years one and two. What can be done during basic science courses to address professionalism? In an excellent series of articles published in 2006 in the journal Clinical Anatomy, several basic scientists describe efforts made to address professionalism in a variety of ways. Activities discussed include team building, reflective exercises, preparation of a clinical anatomy chart and progress notes, peer teaching and review, commemorative services, and interaction with body donor relatives.[17-18] Several authors in this series argue powerfully for the lasting impact that early exposure to professional attitudes, behaviors and practices has on medical students in the "proto-professional" (or early in training) stage, with one author stating emphatically that "how students approach the cadaver, whether with respect, empathy and sensitivity, or with callous disregard, can predict their later approach to patients".[19]

We examined our four year medical student curriculum and discovered that we were addressing various aspects of professionalism in the following activities:

- During a required session as part of our *Personal & Professional Leadership* (PPL) experience for year one students. This experience is a series of structured meetings in small groups whereby students discuss a wide range of subjects and are prepared for the experience of medical school. Our group recommended expansion of this concept beyond the first year of medical school, with the hope of linking the experiences to both mentoring activities and preparation of some type of reflective exercise by students (e.g., portfolio).
- As part of the "white coat ceremony" experience wherein year one students take an oath of affirmation to the medical profession and receive their white coats. It was noted that some schools do not award the white coat until later in the curriculum (e.g., at the beginning of year three); or supplement the year one white coat ceremony with another ceremony when students begin core clinical training.
- During our year one and year two *Social & Ethical Issues in Medicine* courses. Students receive lectures and participate in case-based small group experiences focused on issues related to professionalism.
- During our year one *Doctoring* course. *Doctoring* is a longitudinal, two semester course that provides an introduction to the medical profession as well as biostatistics, training in standard interviewing and physical exam techniques.
- During our year two *Clinical Skills* course, an extension of the year one *Doctoring* course that delves further into special types of physical examination techniques and other clinical issues.
- During the orientation session for year three students (immediately prior to the beginning of the core clerkship year). Our group recommended a new panel presentation/discussion session on professionalism from the perspective of an attending physician, a nurse educator and our senior associate dean for academic affairs. We also recently added a session where year four students (i.e., those who just completed the core clerkship year) meet with the rising year three students

and reflect on their experiences and insights into how medical students make a valuable contribution to the clinical team.

- During our year four *Transition to Residency* course, where senior students spend two weeks revisiting key topics and learning about medico-legal issues as well as other residency-oriented and health system subjects. Activities include discussion of residency training issues (e.g., duty hours, patient safety & care quality, community service) and input from a panel of resident physicians from our teaching hospital. Also, the six general competencies (patient care, medical knowledge, practice-based learning & improvement, interpersonal & communication skills, professionalism, systems-based practice) are introduced as a framework for students' further training in their chosen disciplines. The professionalism competency, in particular, is presented in an interactive format by two senior physicians who have previously dealt with medical staff issues & concerns within our teaching hospital.

Two additional ideas were put forward by the group, both regarding didactic experiences during the third year of medical school. It was proposed that each of the six core clerkships develop one lecture each on the meaning of professionalism within the context of their particular discipline. It was also suggested that we create a system of focus groups within the third year, whereby students would have a "safe haven" to discuss and reflect upon both positive and negative aspects of their clinical training experiences, with emphasis on issues related to ethical issues and professionalism.

We feel that our overall approach to the formal teaching of professionalism is consistent with recommendations found in the literature such as those offered by a fourth year medical student who stated that "while didactics are certainly an important part of the process, they alone are not sufficient….it was largely through observation, mentoring and role modeling that the concepts were finally solidified and internalized".[20] This raises the issue of the informal curriculum and its impact on student learning of professionalism. The literature is ripe with examples, both positive and negative, of the impact made on young physicians in training by older, more seasoned faculty members who set examples for them in the clinical setting. The opportunity to both experience and reflect upon these examples is of great importance to the learning of clinical medicine.[21] Yet, as one seasoned educator well states, "physicians-in-training are not exposed routinely to the knowledge, skills and attitudes necessary for the practice of self-reflection nor does medical training provide them with the structural opportunities to do so".[22] We are continuing to explore ways to impact the informal curriculum, recognizing that this presents a far greater challenge.

It was also recognized that students and residents learn a great deal about professionalism by spending time outside the walls of the academic medical center itself. Opportunities to experience rotations in underserved communities, in other countries or in one's own community with private practitioners afford the learner greater insight into what it means to be a medical professional in various contexts. Our curriculum currently provides this opportunity, and our institutional culture reinforces it by encouraging students and residents to volunteer their time to local causes such as free clinics and fund raising activities for health-related research. These learning experiences, some within and some outside the formal curriculum, are valuable and reinforce the unique obligations associated with the profession of medicine.

In summary, our group reviewed our current teaching on professionalism and made recommendations to further emphasize formal teaching during all four years of the medical student curriculum. Less obvious was how to significantly impact informal teaching/role modeling during the clinical years. And, we also felt that addressing the teaching of professionalism to residents would be challenging, due primarily to the de-centralized nature of residency training and the need to structure educational activities around discipline-specific requirements.

How Should Medical Student Learning and/or Students' Professionalism Be Assessed?

The formal assessment of professionalism is a relatively new idea. Medical student education is often very grade-oriented, and this fact can contribute to a very competitive learning environment for students. In spite of previous factors mentioned that are "driving" the current emphasis on professionalism, most medical schools have hesitated to embark on a formal system of assessing student professionalism, either because of lack of resources or for fear of litigation in the event of dismissals on the basis of non-professional behaviors. A key concern only now beginning to be reflected in the literature regards how data gathered about student learning of professionalism should be summarized, for example in the Medical Student Performance Evaluation or "Dean's letter". Related to this issue, one must also determine what types of data concerning the professional behaviors of students will be collected; who should have access to those data; and how the data should or should not be used.

Our task force review found that there was little formal assessment of student professionalism in our medical school curriculum. A single core clerkship in year three included a professionalism item on the form used by faculty to rate overall student clerkship performance; few if any comments are received from faculty in this regard. It would appear that, when a given student is having issues with professionalism, it must rise to an extremely high level of concern before any formal review takes place; emphasis is upon handling issues of this nature more informally wherever possible, or ignoring them altogether. It is therefore possible that many incidents of unprofessional behavior go unreported in our school. This approach could have resulted in the graduation of some students (likely a

very small number) despite faculty concerns about these students' professionalism. At the time of our review, there was no real mechanism in place to allow for systematic formal assessment of students in this regard.

With the advent of the six competencies of graduate medical education (i.e., patient care, medical knowledge, practice-based learning & improvement, interpersonal & communication skills, professionalism, systems-based practice), it is likely that more assessment effort regarding professionalism has begun within the GME realm than in the medical school curriculum. Residency directors are now required to assess the professionalism of their trainees in some manner. Our institution is participating in a national pilot project conducted by the National Board of Medical Examiners wherein a new instrument for assessing resident professionalism in selected disciplines is being field tested. However, GME educators in our group stated that no uniform efforts were present within our institution's residency training programs to assess professionalism; efforts being made were very program-specific. Our task force was challenged to consider whether to recommend an institution-wide system of assessing the professionalism of our learners.

A variety of assessment methods are represented in the medical education literature, depending on which particular aspects of professionalism one might wish to assess. The task force examined several descriptive articles on this issue, including two literature review articles [23-24] and several recent descriptive and research-oriented articles.[7-8, 25-28] A proposed ratings instrument for pilot testing was created based on our definition of professionalism (previously described) and on our review of the literature. The instrument consists of eight items and uses a three point rating scale (3=no issues whatsoever; 2=some concern about this issue; 1=definitely a problem area). A suggestion to add a 4th rating scale point reflecting high achievement in a particular realm was not supported by the group as a whole. Further, the task force recommended that an online assessment system be developed to implement the data collection process.

The task force extensively discussed when to collect data. Some schools collect data on student professionalism only in very narrow, well-described "incident only" circumstances, i.e., when there is a noticeable lapse in professional behavior. Other schools work more proactively to assess student professionalism "across the board". Our task force favored the latter approach; but recognized that doing so would create significant challenges in terms of data collection and analysis. It was ultimately recommended that all students be assessed during all required courses/clerkships in all four curricular years via a secure, online data collection system. In particular, the need to base ratings of professionalism during the clinical years and within residency training on direct observation of clinical performance was felt to be of critical importance to the data collection procedures established.[29]

By using a carefully designed computerized system, it was felt that the burden on course directors and other faculty would be minimized to some extent. And, after establishing baseline use of the instrument, it may be possible to scale back data collection efforts to a less frequent schedule based on the results of data analyses.

Two other issues were discussed related to assessment. One, it was strongly recommended that the same ratings instrument be used across all courses within the medical school curriculum; and across GME training programs in our medical center, an idea that has been previously endorsed by at least one national medical education group.[30] It was hoped that this common assessment platform would facilitate the development of a reliable measurement, and enable efficient "tracking" of individual students over time. Two, it was recommended that a parallel system of peer ratings be implemented at some future point, whereby medical students and residents would be asked to provide peer review of the professionalism of their colleagues in training. The medical education literature indicates that peer review is effective in determining where professionalism issues exist among trainees, and educationally desirable in that students as well as residents will be subject to peer ratings throughout the course of their careers and should be prepared for these experiences. [31-32] Peer-review of professional behavior within some type of small group setting is one method which we will likely pursue in the future.

Another important issue centers on how to use the data collected as a result of this new assessment program. The task force spent a considerable amount of time on this issue. Key conclusions of this discussion were:

- Medical students who are strong academically but who exhibit profound difficulties with professional behavior should not be allowed to graduate from our school.
- Students who are identified early as having difficulties with professionalism should receive the opportunity to learn from their mistakes via mentoring, counseling or other forms of assistance, so that they may proceed through the curriculum.
- Decisions made about individual student professionalism and whether difficulties would prevent graduation should be based on a pattern of behavior observed over time (rather than on a single incident, unless egregious). Some schools have undertaken a "three strikes and out" policy. Our group supported this approach as consistent with the need to teach professionalism, remediate students who experience difficulty and prevent graduation only in a small number of cases where such issues cannot be resolved in spite of the best faith efforts of all involved.
- Systematic monitoring of the assessment program and review of resulting data should take place through the auspices of a "Professionalism Committee" appointed by the Dean. This Committee would be charged with a variety of educational tasks related to professionalism, including its primary duty of reviewing assessment data

concerning student professionalism and making recommendations to the appropriate administrative Review & Promotion Committees. There are several existing models of this approach that our group reviewed during its deliberations, and the experiences of other schools should prove valuable as part of our development of this program. Graduate students, medical students and residents should be represented on the Professionalism Committee and student input is considered vital to its success.

The Broad Application of Professionalism to Academic Health Centers

A final issue concerned the implications of a renewed emphasis on professionalism for our academic medical center as a whole. Our group felt that the overall teaching environment at our institution could benefit from the positive cultural change that could take place as a result of our recommendations to implement further teaching and assessment of professionalism in medicine. In order for a high degree of professionalism to be maintained, it was felt that we needed an institution-level emphasis whereby all affected constituents would be included in learning about this topic and participating in assessment procedures appropriate to their specific work contexts. This approach would result in learning and employment environments where high levels of professionalism are taught, role modeled, assessed and generally valued at all levels (i.e., not just by trainees but also by faculty, staff and administration). Related to this more broad application of professionalism to the institution, we felt strongly that there was a need for targeted staff and faculty development on this issue for such culture change to occur. Instituting a formal assessment program whereby medical students and residents are systematically reviewed concerning their levels of professionalism was felt to be a necessary, but not sufficient, component of culture change. Discussion was held concerning:

- Whether the existing course and/or faculty evaluation systems (i.e., student ratings of instruction) should be modified to allow students opportunities to provide feedback on professionalism-related items. We determined that such activity was happening during some courses/clerkships but not consistently across the medical student curriculum or residency programs. It was recommended that a more standardized approach be implemented in this regard.
- Whether faculty should be formally reviewed on "citizenship" or similar concerns related to professionalism at the time of the annual performance review by the Department Chair. We ultimately recommended that this activity be instituted, ensuring that such efforts would coincide with ongoing efforts by other groups within our medical center (e.g., Dean's Executive Council, Vice Chairs of Diversity, PCMH Committee on Physician Health).
- Whether resident physicians and/or fellows should also be rated by medical students on their overall teaching activities and, specifically, on professionalism-related items. Since approximately 50% of all teaching of medical students is performed by residents (according to our AAMC annual graduation survey), we felt that gathering this feedback would likely prove useful.

The task force recommended that these actions take place, while recognizing that policy changes would be required to accomplish these goals.

What are the implications of emphasis on professionalism for academic medical centers and medicine as a whole? While beyond the scope of our group's charge, we wish to make a few informed observations. First, there is evidence that both physicians and the general public value the ongoing professional involvement by physicians in social advocacy roles (e.g., community health, patient advocacy, health literacy, health system reform, political involvement, public safety).[6, 33] Second, it seems apparent that the connection between professionalism and such topics as patient safety, quality of care and the so-called "problem doctors" phenomenon is a matter of wide scrutiny and therefore critically important at this time in the history of medicine. If physicians are to be afforded the continued opportunity for self-regulation, the medical profession must assume leadership roles and act quickly to address health care quality, patient safety and physician performance issues.[34-35] Third, our rhetoric on this issue must be equaled by our willingness to act constructively to bring about organizational change where needed. As an example, we should consider efforts made as part of an appreciative inquiry-based program at the University of Indiana School of Medicine, whereby a deliberate and sustained campaign of positive culture change based on concepts of professionalism have been ongoing for several years.[36] Our school recently participated in a development conference offered by faculty and staff at IUSOM, and returned enriched for the experience of learning more about this campaign. Fourth, it is apparent that professionalism has achieved increased importance in continuing medical education and in the process applied to the credentialing and re-credentialing of physicians to the medical staff of hospitals. For example, The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) has revised its policies and procedures to reflect a new emphasis on the evaluation of physician practice behaviors (including professionalism) as a required part of credentialing procedures.[37] In our view, this trend will continue to receive the detailed attention of a wide variety of accrediting and physician licensing organizations within our state,[38] and within the health care system as a whole.

Subsequent to our own task force work on the issue of professionalism, our institution has undergone significant leadership changes and other organizational issues that have further demonstrated (at least to us) the need for vigilance concerning the powerful effect of what the LCME labels as "the learning environment" on all who work and train here. A recent report from a different ad hoc committee which analyzed our organizational culture resulted in strikingly

similar findings to that of our professionalism task force, and we are presently exploring ways to implement many of the recommendations of both groups.

CONCLUSIONS

> "The third year of medical school has been the most degrading experience of my life. I can certainly see why some physicians are unhappy and bitter individuals, with the beginning of this frustration starting in medical school".
>
> *Third year medical student, Class of 2002, anonymous medical school, USA*

The current emphasis on professionalism in medicine and medical training is likely to continue. Our school is fortunate to have had an opportunity to explore this topic in some depth through the work of an appointed task force. By considering the definition of professionalism, how it may best be taught and assessed and the broader implications of professionalism for academic medical centers, perhaps the time may come when we no longer hear of observations like the one made by a graduating medical student above. Our duty as medical professionals demands that we work toward such a time.

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MONOGRAPH

Developing Computer-Aided Instruction within a Medical College

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ABSTRACT

The Instructional Technology Center (ITC) at the University of Cincinnati College of Medicine is a cost-effective model for developing computer-aided instruction (CAI). This monograph outlines the benefits realized by the College as a co-administrator of the ITC together with Academic Information Technology & Libraries (AITL). Many of the benefits stem from the fact that the ITC offers in-house production of CAI, as opposed to outsourced production. The ITC's successes in creating CAI depend on effective methods of: communication with medical faculty content experts, organization of projects, design process for CAI, and dissemination of both CAI products and research results. These methods can easily be reproduced at other schools of medicine. Once medical schools have created quality CAI products, it is of great value for them to follow the ITC model by submitting their work to established peer-reviewed repositories for digital scholarship in the Health Sciences (MedEdPortal and HEAL). In so doing, the academic medical community can create a rich, freely accessible, multimedia curriculum that is both indexed and searchable. The ITC measures the success of its products through summative evaluation (randomized controlled trials on student performance), formative evaluation (reactions from medical students), peer review, and informal reviews from the academic medical community at large. Next steps for the ITC include studies that will assess specific CAI design features that are in development, and dissemination of these results.

Introduction

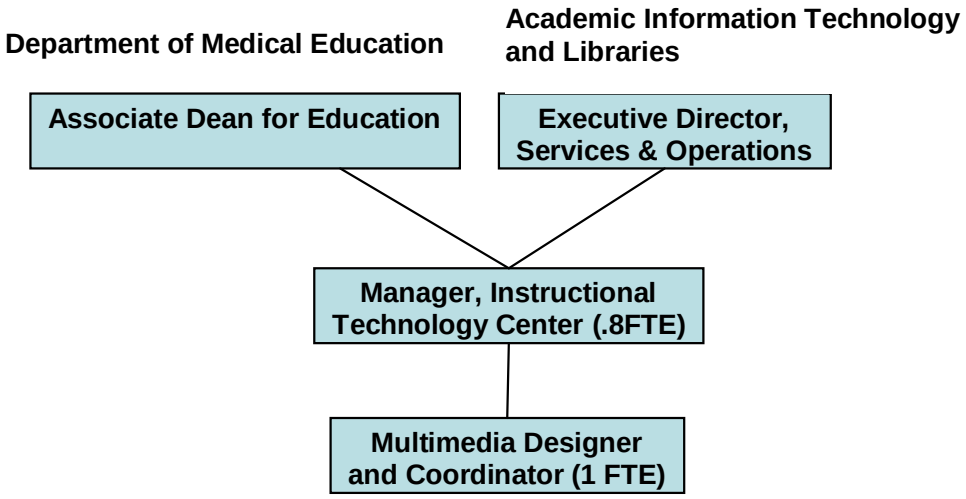
Medical schools are finding their way as developers in the burgeoning field of instructional technology for medical education. Most schools, and many independent faculty members, are either producing Computer-Aided Instruction (CAI) in-house or contracting with outside agencies to produce it. The Instructional Technology Center (ITC) at the University of Cincinnati College of Medicine (COM) specializes in developing computer-aided instruction via a cost-effective development plan. The ITC leverages the ideas of faculty members and students, so that good ideas for CAI development can become professional-grade, distributable products that are worthy of peer review.

Given the choice of contracting with an outside agency or creating instructional technology in-house, what should a medical school do? The University of Cincinnati COM chose the latter option, founding the ITC in 1999 to provide faculty with digital design support to optimize production of CAI. In-house production offers advantages over outsourcing that show up both in the educational integrity of the finished product and in the ability to continue producing creative, novel works. After all, many of the best content ideas come from those who teach and learn at the medical school. The ITC fosters ongoing communication with both faculty and students, and hence ongoing submission of new ideas. As the name "Center" implies, the ITC centralizes ideas, connecting faculty whose ideas overlap; it facilitates communication across departments and reduces redundant efforts. An in-house staff has continuous access to the content experts as needed through the various stages of project development. Such input is invaluable for defining project direction and uncovering flaws or shortcomings that

arise in the digital presentation of a faculty member's teaching materials.

The mission of the ITC is "to promote and facilitate the effective use of instructional technology in the teaching of students at the College of Medicine." This charge encompasses more than creation of CAI. Once ITC staff become aware of a need, through communications with faculty and students, the next step is to search through existing resources to locate materials that meet the need and, if no suitable solution is found, to focus on creating a product that is unique and thorough. The ITC resides in both the Department of Medical Education and the Academic Information Technology and Libraries units (see Figure 1), so ITC staff members stay informed about several key facts: curricular developments; those persons who will have a vested interest in a project; those who might be recruited to participate; and specialists in related areas of multimedia development and processing.

Figure 1. Section of Organizational Chart



From 2003 through 2006, the ITC produced 65 web-based CAI modules for medical students that were successful in the peer review process at MedEdPortal. All but one of the ITC's peer-reviewed modules make up a reproductive physiology series that has been honored with the 2006 Pirelli INTERNETional Award (cash award of €15,000), the 2005 Slice of Life Student Software Award (cash award of $1,000) and the 2003 APGO/Pfizer Women's Health Curriculum Development Award (cash award of $15,000).

While many projects are based on student and faculty member ideas, this is not to say that all ideas come to light without some effort on the part of the ITC. As will be described below, one of the first steps is to secure and maintain a base of content experts from the faculty. Once the experts are in place, the next steps provide a framework for designing and developing projects, assessing and revising projects, and disseminating the finished products and research results. Institutions that undertake this process should understand both the nature of the required investment and the potential benefits.

Investment and Ongoing Costs

At the University of Cincinnati College of Medicine, the ITC startup costs were approximately $7,805 (Table 1). Personnel, operating and maintenance costs average $96,600 per year (Table 2), which includes the cost of the content expert contribution, figured in at an average rate of .1FTE. The ITC has also been successful in securing funding for special projects through in-house seed grant money earmarked for medical education projects, and has applications pending for funding through the HASTAC Digital Media and Learning Competition. Award money is used largely to cover salary for digital design co-op students who can be hired on a short-term basis (minimum of a ten-week academic quarter) to lend their creative talents to ITC projects.

Actual ITC staffing is 1.8 FTE – a full-time multimedia coordinator and designer position and a part-time (.8 FTE) ITC manager position. Completion time for the first complete version of a stand-alone module is generally about a year, though it varies depending on the scope of the project. In the case of the 65 reproductive physiology modules that make up a unified series, there were a number of elements that repeated themselves throughout, so that programming elements could be reused. As such, the 65 modules took about four years to produce. Digital design co-op students contributed to that process.

Table 1. Startup Costs

	Cost
Hardware	
3 CPUs (Windows OS)	$6000
Digital video recorder	$300
Software	
Adobe Flash	$150
Adobe Dreamweaver	$125
Adobe Illustrator	$125
Adobe Photoshop	$175
Cinema 4D	$500
Sony Sound Forge	$400
Quicktime Pro	$30
Windows Office	University license
Total Startup Costs	
	$7805

Table 2. Ongoing Costs

Personnel	Skill Base	Cost
Content Experts (.1 FTE)	Expertise in a biomedical specialty	13,600.00
Multimedia Designer and Coordinator (1 FTE)	BA in digital design program; high level programming skills in Flash ActionScript and Cinema 4D; general skills in supporting software programs	35,000.00
ITC Manager (.8 FTE)	MILS and MBA; some programming skills	47,000.00
Director, Evaluation and Research	Study design and evaluation process	Incidental
Operating		
Photo Permissions (occasional)		300.00
Incentives for Student Input (Planning and Evaluative)		700.00
Total Direct Expenses		
		96,600.00

Pricing for outsourced digital design services range widely, as do the terms of the contracts. Most outsourced digital design fees are based on hourly fees ranging from below $50 to above $90. In 2005, the ITC outsourced production of a small but significant component of a project, which has been reused many times since. The outsourced service was rendered at a rate of $60 per hour. Without considering benefits, the two ITC employees combined cost the University approximately $45 per hour, and the range of services that they provide, customized to the needs and strategies of the University, is far greater than what a digital design company could offer. In an outsourced model, a university representative still must manage the contract. In the ITC model, "inside players" handle both the actual digital design process and any specially contracted services that exceed staff capabilities. Over the years, the decision to outsource has only been made once.

Benefits of Developing Instructional Technology within a Medical School

1. Positive Student Evaluations

The ultimate benefit derived from CAI development is the expansion of learning options for students, and enhancement of student learning. Formative and summative evaluation results have demonstrated the successes of ITC products in these areas. In the 2006 student evaluation results for the reproductive block of the Physiology Course, students were asked to list two or three strengths of the course. Of the 35 responses to this question, 19 focused on strengths of the award-winning ITC modules that were offered as an optional study tool in the course (Table 3).

An example of summative evaluation results is the unpublished 2005 study that assessed whether the ITC's reproductive physiology modules could effectively replace the six lectures on which they were based. This study

Table 3. Formative Evaluation

Year 1 Syllabus/Lecturer Physiology, Dr. LaBarbera 02/2006 **109 of 162 Students Responding 67% Response Rate** ***ANY CONSTRUCTIVE FEEDBACK REGARDING THIS LECTURER'S SYLLABUS MATERIALS OR POWER POINTLECTURE SLIDES?***
2 or 3 Strengths?
Written syllabus was complete and was not too difficult to follow
Great modules online
The online modules were great! I read over the syllabus once, and from then on just used the modules to study.
The modules were slightly helpful (the steroid synthesis chart was very helpful). The syllabus was very helpful.
Thorough explanations of concepts
Online modules and questions were helpful
there was significant overlap in the material given in the syllabus for each lecture. i thought this repetition was very helpful in learning the key points.
The syllabus was very complete without being overly wordly. I felt like the balance of overall concepts and detail was well-mixed.
I thought it was obvious that Dr. LaBarbera wanted us to succeed. **I really appreciated the extra online quizzes and modules.**
I liked the syllabus b/c it explained everything in detail, it made the modules much easier to use.like the hormone chart and pics/graphs
Good modules online
i liked the syllabus. it was one of the better parts of an otherwise bad phys syllabus. Great slides and syllabus
Dr. LaBarbera's section of this course was by far the most organized and well-thought out section that I've experienced at medical school thus far. The materials he provided to us catered to everyone's individual learning style. **The online modules were very helpful, as were the quizzes ascribed to each section.** Very well done, it was a pleasure taking your course.
extremely clear, very helpful
Questions in syllabus help direct learning
The syllabus material was very thorough and well organized. It was laid out in an easy to understand manner.
i liked the modules and repetition of information
Syllabus was well organized and informative
good job at explaining difficult concepts
Almost everything is clearly explained at the level of detail we are expected to understand it in.
The reproductive modules were by far the best learning tool that we have had all year. They were absolutely excellent. The interactive learning helped me to learn the material and retain it. Additionally, the ability to apply it in the different cases in the modules was great.
Loved the modules. Also the practice quizzes helped enforce the difficult material
The modules are what I used instead of his power points
syllabus sections were long but did contain good information
The modules were a definite help. I only wish I had done with sooner....
the modules are GREAT for out-of-class learning
The steroid synthesis pathway diagram was superb. I was able to learn it using that format in less than 10 minutes.
Online Repro blocks are VERY HELPFUL **they were good summaries of important topics**
Modules excellent, syllabus pretty well done.
All the different methods to learn ie syllabus, modules, lecture, quizzes, etc.
The few study guide questions before each section.
I liked all of the pictures and the interactive online material.
very comprehensive
The problem solving session was extremely helpful, and cleared up a lot of things for me.
the learning modules were very helpful

included a randomized crossover trial that compared test scores of students who used the modules with students who attended the lectures. Eighty-two students volunteered to participate in the study, and were randomized into two study groups. Each group was assigned a set of three lectures to attend, and in place of attending the other three lectures, they

were instructed to use the online module for their means of instruction. The entire study group completed an ungraded 5- or 10-question quiz for each lecture, and also completed the Reproductive Physiology portion of the graded Unit 4 exam for Medical Physiology. For each question of each online quiz and for each question of the exam, the number of correct answers in the group using the modules was compared using Student's t-test (unpaired, two-tailed, equal variance) to the number of correct answers in the group attending the lectures to determine whether the online lecture components were as effective as learning tools as traditional lectures.

The results of the study indicated there were no statistical differences in performance on either the online quizzes or the examination between those students using the modules and those students attending the traditional lectures. The conclusion, based on quiz performance, was that learning modules are as effective as traditional lectures in teaching Reproductive Physiology to first-year medical students.

According to the 2007 AAMC Colloquium on Educational Technology, the current evidence base for educational technology in medicine is "anemic." In their research agenda, they call for future attention to the effectiveness of specific technological features or instructional methods.[1] The evaluation results for ITC products will enable the University of Cincinnati College of Medicine to contribute to the research that surrounds educational technology in medicine. The aforementioned research was part of a multi-year study that will be summarized in a paper currently in progress. The paper is being co-authored by the content expert for the project and staff members of the ITC. The ITC is well positioned to conduct research that focuses on the effectiveness of specific design features, and to publish results that shed light on their significance.

2. Sharing

Direct monetary profit through a traditional sales model is an unlikely outcome for the type of modules developed at the ITC. The potential customer base is limited since module content is customized to meet curricular requirements of medical students. There are a finite number medical schools in the United States and the curricula vary amongst them.

Because the intent of the ITC is not to seek monetary profit, and because the ITC completely controls all of the computer programming code used in its multimedia products, there is a great deal of flexibility in how ITC products are shared. One example is that the ITC made separately available each of the 64 animations that comprise our large reproductive physiology project. Each animation is indexed in the web-based Health Education Assets Library, known more commonly as HEAL (http://www.healcentral.org). As such, lecturers from around the world may access the animations and their associated keywords, subject headings and objectives, through HEAL's search engine. They can then assemble a customized combination of animations to use in a PowerPoint presentation or web page. Each animation includes embedded branding information that associates the product with the University of Cincinnati College of Medicine. In addition, if instructors would like to use module in its complete form, organized by goals, objectives and guide questions, it is also freely available in that form.

A link to the complete reproductive physiology module is available at MedEdPortal (http://www.aamc.org/mededportal), which is sponsored by the Association of American Medical Colleges (AAMC). Unlike HEAL, MedEdPortal does not store digital scholarship materials, but instead provides pointers to their host locations. MedEdPortal plans to offer the capability to search by discipline-based objectives and competencies. Objectives-based searching should make it still more efficient for potential users to find University of Cincinnati's ITC products. To encourage proper recognition of digital scholarship in the Reappointment, Promotion and Tenure (RPT) process, MedEdPortal provides a guide to the AAMC educational scholarship & peer review process for RPT Committees. MedEdPortal also supplies data on both the number of individuals who express interest in materials and how many times the materials are downloaded. Like the Journal Citation Reports publication of Science Citation Index (a publication of Thomson Scientific), these "download" reports suggest the degree to which a published work is useful in the academic community. HEAL and MedEdPortal both offer the validation of a thorough peer-review process and increased visibility. Through them, the ITC contributes to the fabric of an evolving peer-reviewed, shared multimedia medical curriculum.

3. Innovation

Each project that the ITC produces presents an opportunity to more fully explore and test application of digital design principles. Within this digital realm, limitations vanish in the exploration of new software packages and new training opportunities that can take ITC presentations to a deeper, more interactive, more engaging and more creative level. For example, the modules often seamlessly blend micro and macro level processes, sometimes presented across time, with the guidance of narration, guide questions and self-assessment opportunities. ITC staff members are exploring training opportunities to enable expansion into the realm of serious games development – computer games built on specific learning objectives that are shared with the user. There is a Serious Games Initiative that sponsors annual summits, and one of their project areas is "Games for Health."[2]

4. Medical Student Recruitment

Students are attracted to the highly customized, unique learning experiences that instructional technology modules can provide, as well as the enhanced clarity of presentation made possible by intermixing video, photos, animation, audio, interaction and immediate feedback. At the UC College of Medicine, even when CAI modules are available

as *optional* study aids, significant numbers of medical school students do choose to use them. The same modules help to recruit new students by demonstrating the school's dedication to optimizing the learning experience and to making good use of the latest technologies. If a school can also highlight the ITC development process, with its heavy reliance on student input, this demonstrates a commitment to actively seeking out student ideas in making plans for improvement.

5. Collaboration

Development of educational multimedia facilitates collaboration among medical faculty within an institution and across institutions. Instructional technology transforms lecture materials into perpetual resources, uncoupling instruction from space and time. The virtual nature of CAI lends itself to cost-effective updates, edits and modifications. This makes it highly customizable to meet the needs of multiple faculty, and helpful in standardizing instruction throughout the medical school curriculum.

The Content Experts

Despite all the clear benefits, it can be difficult to recruit content experts to be involved in CAI design. The demands of traditional teaching and research can leave little time to invest in such projects. The ITC draws faculty experts into the development process by making them aware of the benefits and the value. Toward that end, ITC staff attend curriculum committee meetings one or two times each year to discuss topics related to instructional technology development in the health sciences. A presentation to a curriculum committee might showcase ITC work, highlight developments in the field (i.e. MedEdPortal, Heal or Games for Health initiatives), or describe the range of ITC services. Through execution of ITC services, additional contacts with teaching faculty arise, as well as opportunities to recruit experts for instructional technology projects.

ITC staff also contact faculty individually to foster involvement based on their specialization area. Such a contact might be pursued based on student-level suggestions for new multimedia development in a given area of expertise. ITC staff sometimes approach faculty who teach topics related to a module being developed to ask if they might modify or expand the project to meet their own teaching needs. If there is a perceived knowledge gap in a project that a content expert would like to pursue, the ITC can facilitate recruiting an appropriate expert (as was the case when an Immunologist became involved in a module with a Dermatology focus). Lastly, ITC services are marketed through wall-posted signage, a website (http://aitl.uc.edu/itc) and a web-based form for requesting new projects. The form was created at no cost using Survey Monkey (http://www.surveymonkey.com), which supplies the backend database that stores survey answers and generates reports.

There is another, less direct way that ITC staff foster an interest amongst faculty to become content experts for CAI projects. That method is the diversification of ITC services, which enables interactions with faculty outside of CAI development. ITC tasks include anything that directly supports faculty who wish to optimize technology use in their teaching. Examples include "Audience Response System" support, PowerPoint training, and processing digital video and photos. In addition, ITC staff coordinate studies, surveys and focus groups around ITC products, take care of IRB application materials for human research studies (pertaining to student involvement in studies of module effectiveness), handle permissions requests to publishers for use of original materials and coordinate submissions to HEAL and MedEdPortal. These tasks inform the process of determining topics best-suited for future development and forge vital connections with the faculty.

The Design Process

The effective development of instructional technology relies upon principles that have been outlined in the ADDIE model for instructional systems design.[3] ADDIE stands for "Analyze," "Design," "Develop," "Implement," and "Evaluate," which are the five roughly sequential stages in the CAI development process. These stages can be summarized as follows:

1. **Analyze** – Clarify the instructional problem, goals and objectives.
2. **Design** – Design instructional strategies.
3. **Develop** – Produce materials based on design phase decisions.
4. **Implement and Evaluate**– Test prototypes, conduct formative and summative evaluation, and then put product into full production.

At the ITC, a process of trial and error has led to successful methods and tools for completing the ADDIE stages. These methods and tools are described below within the context of the ADDIE model.

1. Step One: Analyze

Faculty members who are interested in working with the ITC fill out an application form that encourages them to think about how their ideas might manifest themselves in a multimedia project. The ITC has also developed a number of projects based on student reactions to specific areas of the curriculum. Ideas from students have been gathered largely through ITC-sponsored surveys. Table 4 lists projects according to how they originated and Table 5 summarizes the information gathered from faculty content experts at this initial analysis stage.

After collecting the above information and discussing the application with the appropriate content expert(s), additional supporting materials are collected. These could include lecture notes, PowerPoint presentations, textbook chapters, and results of web searching for similar products. The level of pre-development varies depending on the lecture style of the faculty member. At this point, an assessment is made of

what has already been developed in the academic medical community at large, so as not to duplicate it. This is accomplished by searching the Web, if a content expert has not done so, or expanding on his/her work if appropriate. When possible, ITC staff attend the relevant lecture(s) that the content expert presents on the topic.

The ITC uses Microsoft PowerPoint to determine project scope and components. ITC staff and content experts map out a plan with the organizational chart function of PowerPoint to create a cognitive map. While cognitive map software exists, PowerPoint accomplishes the same task, and is a Microsoft Office product that is ubiquitous at the College of Medicine. PowerPoint provides a simple, inexpensive tool for laying concepts out in the form of a hierarchical tree structure, producing a document that is then easily shared and edited by a group.

Based on the initial materials gathered, the ITC produces a chart of potential content areas for inclusion, which represents key topics and how they interrelate. The chart provides something concrete for discussion and forms the basis of a menu structure within the module. This step provides an opportunity for increased understanding amongst the bioscience and instructional technology professionals involved in the project. It begins to bridge the gap between these areas of expertise. Figure 2 shows a working tree diagram for a renal physiology project. The bold format headings are those selected for the first phase of this project.

The next step in the analysis process focuses on the learning problem or issue at hand, and how it can be presented to meet as many student learning styles as possible. The visual, auditory, reading/writing, kinesthetic (VARK) questionnaire identifies student's preferences for particular modes of information presentation.[4] This questionnaire was first described in a 1992 article by N. D. Fleming[5] and has developed a number of adherents since then. The ITC does not administer the questionnaire, but recognizes the validity of each learning style that it seeks to address, and that many preferred learning styles exist within a medical student

Table 4. ITC Projects to Date

Projects Based on Student Requests		
Title	**Location**	**Status**
Embryonic Folding	http://aitl.uc.edu/itc/Final_Embryology.swf	Peer-reviewed publication on HEAL and MedEdPortal
Specific Animations within Repro Phys Series	http://aitl.uc.edu/itc/ReproPhys/1-2-3/1-2-3pathwaysstebystep.swf http://aitl.uc.edu/itc/ReproPhys/1-6-1zonadeficienciespt1.swf http://aitl.uc.edu/itc/ReproPhys/1-6-2/1-6-2zonadeficienciespt2.swf http://aitl.uc.edu/itc/ReproPhys/1-6-3clinicaldiagnosis.swf	Peer-reviewed publication on MedEdPortal and HEAL
ECG	http://aitl.uc.edu/itc/ecg/ECG_files/ECG1.cfm	Self-published on ITC website
Renal Physiology	http://aitlvideo.uc.edu/aitl/renal/renalphys.swf	Draft in Progress
Projects Based on Faculty Ideas		
Repro Phys Series (as a whole)	http://aitl.uc.edu/itc/ReproPhys/index.swf	Peer-reviewed publication on MedEdPortal and HEAL
Neural Tube Development	http://aitlvideo.uc.edu/aitl/lowrie/interface.swf	Self-published on ITC website
Mental Status Examination	http://aitl.uc.edu/itc/mse/msekm.swf	Peer-review pending on MeEdPortal
Hypersensitivity Reactions in the Skin	http://aitlvideo.uc.edu/aitl/dermhyp.swf	Draft in Progress
Lesions of the Cervix	http://aitlvideo.uc.edu/aitl/rsmith/cervix7-27.swf	Draft in Progress

population. Hence, the ITC includes visual, auditory and textual elements in each learning environment created with CAI. Other medical schools have worked with the VARK questionnaire and have determined that students do have preferred learning styles and that there is merit in considering these styles when preparing instruction.[6, 7] When instructional technology is built on an analysis of real learning needs, it does more than simply present biological processes or duplicate text book materials.

Table 5. Initial Information Collected From Faculty Content Experts

- Course(s) in which you would like to use your proposed project
- Specific topics/concepts that you would like to convey via this project.
- Educational objectives that the project should address
- A vision for how your information might be presented on a computer screen
- Elements to include in your project:
    - Sound Effects
    - Narration
    - Animation
    - Diagrams
    - Photographs
    - Video
    - Microscope Slides
    - X-rays
    - Other (please specify)

2. Step Two: Design

After thorough discussion and revision of the hierarchical tree structure, the ITC creates a storyboard, again using PowerPoint, which depicts the screens that will convey the information represented by each cell of the cognitive map, as shown in Figure 3.

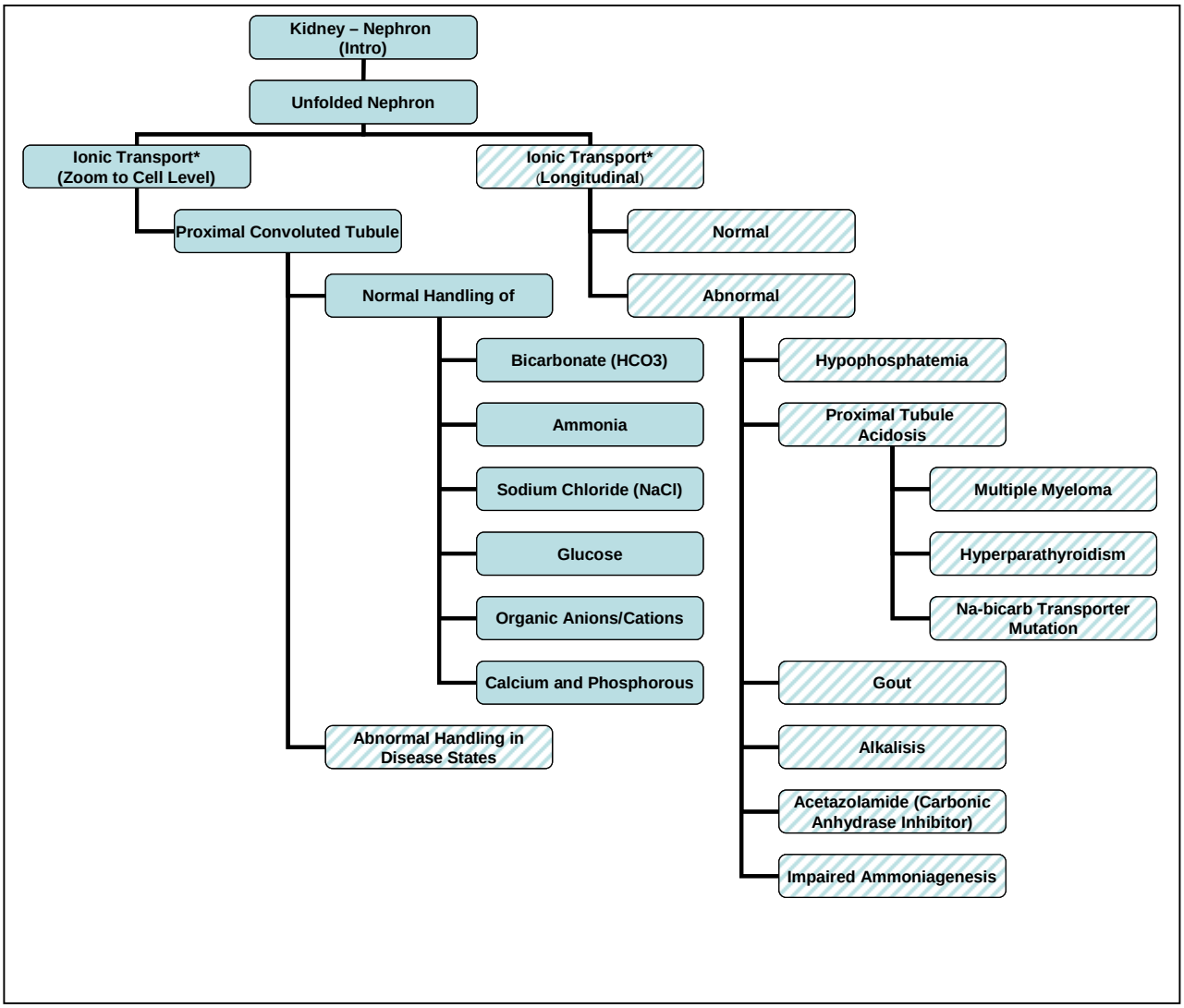
The literature on instructional technology design in the Health Sciences informs the design choices of the ITC. A key design element is interactivity, and some authors have analyzed what aspects of interactivity make it an effective part of the learning process. Troy et al cite the importance of mental challenge and engagement in an activity.[8] Ha and James offer five dimensions of interactivity that fulfill didactic needs: playfulness (stimulating curiosity), choice, connectedness, information collection and reciprocal communication.[9]

For the most part, the ITC adheres to Richard Mayer's widely accepted design recommendations for CAI.[10] Mayer advises that words, pictures and sounds should be limited to what is essential, that corresponding words and pictures should be both close together and simultaneous (not successive), and that important words should be highlighted. In terms of narration, he urges use of a non-accented human voice, and speaking in conversational style. He recommends use of segments for narrated animations, rather than a continuous unit. The only point on which the ITC differs slightly from Mayer's views is that he recommends pairing animation and narration together *without* on-screen text. While it seems true that narration complements animation better than text, students have also expressed that they like to have a text option that exactly duplicates the narration. Optimally, this text is presented with a show/hide option.

In addition to Mayer's recommendations, the ITC has developed the following:

- **Give the User a Sense of Direction**. At the outset, provide an overview, clear goals and objectives, and questions that the user can answer with information from the module.
- **Label Relentlessly**. Include an option to show/hide extensive labels on any informational diagram or animation.
- **Break up Content with Menus and/or Buttons**. The cognitive map shown in Figure 2 is a useful tool in selecting menu and button headings.
- **Build in Opportunities for Self-assessment when Possible**. Self-assessment opportunities transform a learning module from a passive experience to an active one.
- **Develop the Interface around a Consistent Organization Scheme**. Visual cues should indicate to the user the type of information that each click will reveal and its place in the hierarchical structure of ideas.
- **Develop the Interface around a Consistent Color and Font Scheme**. Take the time to make these elements pleasant for the user. Sitting with a

Figure 2. Tree Diagram for Renal Physiology Project



learning module is like sitting in a living room; the colors and flow do influence the experience.

- **Limit the Number of Choices on a Screen**. Lay out a clear path that will give the user a sense of completion if followed; do not have so many choices that the user loses sight of the path.
- **Flatten the Hierarchy of Information as Much as Possible**. Beware of both unused screen space and graphics that lack educational purpose – if these are covering meaningful educational components, look for ways to bring those up a level.

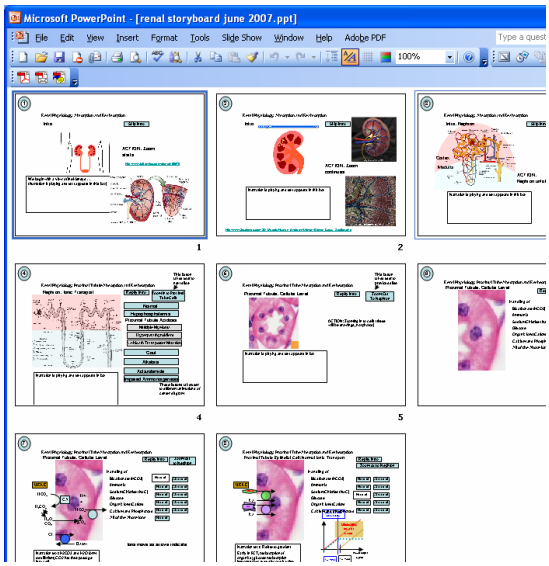
If there is an Animation:

- **Provide a Synchronized Narration that Indicates What is Happening at Each Step.** As Mayer suggested, stop points in the animation can facilitate this process and give the animation a chance to "catch up" with the narration.
- **Give the User Control** over stopping, starting and advancing.

If there is Narration:

- **Provide a Printed Version** that can be hidden or viewed that matches the narration exactly.

Figure 3. Storyboard for Renal Physiology Project



- **Keep Sound Clips Short** (less than two minutes per clip).
- **Give the User Control** over stopping, starting and advancing.

3. Step Three: Develop

The storyboard, once approved, gives rise to a work plan and timeline on which all participants agree. This document is created as a simple table in Microsoft Word, presenting tasks, the people responsible for them, and tentative deadlines. This document is reviewed bi-weekly and edited to reflect changes in priorities and deadlines.

The next step is to create a working prototype using Adobe Flash software. For this step, faculty content experts must create detailed content outlines with goals, objectives and descriptive information. They must provide a representation of any diagrams/graphics to be included on the screen and a script for any animations. In developing the prototype, it is important to reuse code and effective designs from past projects where possible. Content experts must closely oversee this stage of the process to ensure that the digital designer has a clear understanding of each concept and each step in a process. While the storyboard helps with the visualization process, many content experts gain new perspective upon seeing the project begin to unfold as a working CAI model. Hence, steps must be revisited as necessary and developments must be reconstructed until the visions of the content expert and digital designer come together. The continual gathering of input is crucial so that new directions can be applied as early as possible.

Once ready, the prototype is shared with potential users to observe their interactions with screen elements and collect feedback. At this stage focus groups may be assembled to generate additional ideas to integrate into the prototype. This first level of testing validates the features being defined. Next, with continual input from the content expert, design and programming of the project continues until version one is complete.

4. Steps Four and Five: Implement and Evaluate

Once the first version of a product is ready, it is subjected to a thorough process of assessment and revision. Assessment typically includes both formative and summative evaluation. The formative evaluation gathers student reactions to specific features of the module and solicits general feedback. To date, summative evaluations have compared how students who have used a module perform versus those who have not.

Future plans include comparisons between groups that have used a module that employs a certain feature compared with a module that does not. The AAMC Colloquium on Educational Technology, as well as other authors in the field of CAI for the health sciences have indeed lamented that a gap in the research exists around what specific design elements contribute to the effectiveness of educational multimedia in the health sciences.[11, 12] The one element that *has* been correlated with higher final exam scores is the number of self-assessment quizzes that a student completes as part of their online learning experience.[13] In addition, researchers have found that the use of multimedia itself in online testing makes for more effective tests.[14]

Disseminating the Finished Product and Research Results

Once a product has gone through the process of development, assessment and revision, it is submitted to the two established web repositories for digital educational scholarship in the health sciences: MedEdPortal (http://www.aamc.org/mededportal) and HEAL (http://www.healcentral.org). In addition to the standard author, affiliation and keyword information that both web repositories require, the MedEdPortal application requests the following information, which is associated with the final entry on the site:

- Specialty/Discipline
- Educational Objectives
- Keywords
- Accreditation Council for Graduate Medical Education (ACGME) Competencies Addressed
- Intended Learner Audience
- Intended Faculty Audience
- Material contains content that may be suitable to patient education?
- How will users access this resource?
- Has this item been formally peer reviewed elsewhere?
- If Yes, provide a URL for the journal or collection, if available:
- Do you or any of the authors have any significant financial interest or commercial support related to this resource?
- Describe the effectiveness (if available) and significance of your work:
- Describe any special implementation requirements or guidelines?
- Describe any lessons learned:
- List any publications from, presentations from, and/or citations to this resource:
- Does this submission contain time-sensitive biomedical content that will likely become inaccurate, obsolete, or irrelevant during the next 3-5 years?
- Does this submission include any materials not of your own creation that might be owned by someone else, for example, maps, figures, photos, from a textbook or other source?

The peer review process at HEAL and MedEdPortal generally takes about six weeks to complete.
Research results that have been gathered for a particular project are then disseminated at conferences, and study results are prepared for publication.

Conclusions

The effectiveness of an educational module for computer-assisted instruction in the health sciences rests to a large extent upon ongoing communication with both the content author and intended users. This communication can not occur in a vacuum, but must be supported by research on the effectiveness of technologies in improving learning, specific to health sciences education. Challenges to medical school production of educational modules include recruiting and maintaining content experts to serve as authors and juggling an array of projects on a limited budget. At the same time, a distinct advantage to medical school production of educational modules is that the development office is part of the fabric of the institution in which the content experts work. This gives rise to opportunities to communicate and brainstorm about potential new projects. Responsible development of instructional technology by medical schools includes dissemination to the wider audience that could use make use of each product via established, peer-reviewed, web-based repositories. This step reduces the likelihood of redundant development at medical schools worldwide. In addition to sharing the complete CAI projects with other medical schools, it is important to share research results in the field of CAI for medical education. Of particular importance is research that isolates specific design features and proves them to be significant in optimizing medical student learning from CAI.

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OPINION

Pedagogic Reflection: Building a Better Teacher

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ABSTRACT

Most medical faculty lack pedagogical training. Consequently, they don't possess the imagination and insight to create engaging, interactive learning environments. And because they teach as they were taught, the educational experience for medical students suffers. However, close observation of medical faculty reveals that most want to be good teachers; most want to engage their students more effectively. The problem is that while most think they know how to teach, they really don't know what teaching is. This commentary/opinion addresses the idea that poor teaching in medical education may not be a pedagogical problem but rather an epistemological one. By focusing on the need for professional focused reflection, this paper guides medical faculty through some ideas and avenues for creating a reflective process on their own teaching. Medical faculty need opportunities and guidelines for professional reflection on teaching. And they need time to reflect critically about their teaching practices, individually and with peers. .

INTRODUCTION

Pedagogy, argues Paulo Freire, negotiates the place where teaching and learning meet. Effective pedagogy constructs interactive engagements where learners experience and explore content material.[1] With no pedagogical background, many medical faculty perceive teaching as transferring knowledge,[2] as if all that is needed is an exceptional grasp of the material.[3]

Several commentaries have criticized the poor pedagogy of medical educators.[4-8] Cohen emphasizes this:

> [M]edical education is still dominated by ineffective modes of instruction. The majority of educators within medical education employ teaching methods that knowingly fail to change physician behavior and thus cannot be expected to improve the quality of care physicians provide to their patients.[4]

Cohen is correct. But so is Hurst when he writes how medical faculty often lack the training to imagine newer learning experiences.[5] Without pedagogy, instructors perceive education in banking metaphors, imagining students as depositories and themselves as depositors.[1]

As the Education Specialist at the University of South Florida College of Medicine, my primary task is to discern if curricular and instructional practices make sense from an educational perspective. Secondarily, I am constructing an understanding of medical education in practice. What does it look like? What *should* it look like? What should it *sound* like? How does it accomplish its goals of creating physicians?

From both of these perspectives, many elements do not align with education theory, and I imagine this to true across medical education. However, my interactions with faculty tell me the problem is more epistemological than pedagogical. In other words, faculty appear unable to reflect on the nature of teaching and learning. They think they know what teachers do, but in fact they don't know what teaching is. Availing them to a process of professional reflection may ameliorate the ills we see.

The Metacognitive Turn

Metacognition is the process of thinking about your own thinking. It consists of two concurrent cognitive processes: monitoring learning as it occurs, and adapting behaviors and dispositions to become more self-directed.[9]

Developing metacognition is important in becoming a better teacher, as focused critical reflection develops better skills in all professional practices.[10-14] Metacognitive teachers regularly revisit and re-imagine the interactions they have with students. In short, they learn to know themselves as teachers.[15]

Often the process of critical reflection is carried out in a journal instructors keep on their teaching. Autobiographical narratives reveal much to the practicing teacher. Instructors can also take part in critical conversations where two or more instructors meet to discuss their teaching. Other methods include imagining themselves through their students' eyes, and reading on the nature of critical reflection. But always, their professional reflection is focused on teaching practice.[15]

This can be problematic for medical faculty, who may see content material as more important than teaching practice. Consequently, their reflections might only consider whether they have fully covered the material and not the kinds of engagements they develop (or don't) for their students.

To improve this reflection, teachers should not only evaluate personal definitions of their practice, they should also explore other possibilities of effective methods within that practice, i.e: *How can I solicit more questions from my students during lecture? What anecdote will best open my presentation so that student interest is piqued? What are three ways I can check for student understanding during my class? How can I begin the process of moving my methods away from the lecture format?* For medical teachers, this results in redefining and retooling what it means—what it is—to teach medical students.

Two common beliefs about teaching are that it is either the development of skills or the transferal of knowledge, yet each of these negate an integrative understanding of teaching.[16] Even combined they do not say enough. Just as being a physician is more than diagnosing and treating patients, teaching is more than developing skills and knowledge in students.

Teaching awakens learners to the possibilities of life.[1] Good teaching explores world making.[17] This is radically different than defining teaching as the transferal of knowledge or the development of skills. Learning to reflect critically about teaching from this perspective has the potential to change how one behaves in the classroom.

Reflecting on Learning Relationships

Like medicine, teaching is a human enterprise. It involves the difficult process of building and nurturing relationships. Teachers need to spend time thinking about relationships they build with students. They must ponder student needs both inside and outside of the learning environment.[18-20] Such relationships—not the curriculum—inform teachers what, when, and how to teach.

For years, experts in gifted education have extolled the need to differentiate educational experiences for bright students. Without differentiation, students lose motivation and experience slowed intellectual growth.[22-26] Medical students are often described as our best and brightest,[3-5] so it behooves faculty to reflect on how learning environments can be more conducive to learning differences in their students. Effective teaching carefully considers—before and after—the learning experiences of all students.

Effective teaching also means speaking less and listening more. Teachers who frame learning around interactive questions, challenges, and cases, and who demand students respond and perform in class, speak less than their students. In successful classrooms, students interact with students more than they listen to teachers. Research on college teaching shows that students learn and retain more when active methods of teaching and learning are used.[26-29]

The issue is how to direct reflective thought toward these practices. Quality reflection is a social process; teachers must be encouraged to reflect with colleagues. This can be difficult, not only because medical faculty are limited by time and rarely compensated for teaching, but also because they tend to see themselves as independent operators and already fully developed. Ground rules must be established so that experiences are shared respectfully, inclusively, and democratically.[15] Also, time must be made available for this reflective process to occur.

A Paradigm of Learning

Effective teaching is situated within the paradigm of learning, not of teaching. These two places are not similar. A paradigm of learning recognizes that students come to medical school with desires to direct learning toward personal and professional goals. It motivates student curiosity and capacity for new information by engaging them in active learning environments that offer opportunities to apply information flexibly.[26-29] Turning reflective attention toward what students want to learn, and how, helps teachers develop significant student-centered learning.[16]

On the other hand, a paradigm of teaching believes teachers know best what students should be learning in all contexts. It dignifies the curriculum over the student, putting information ahead of understanding. It rarely engages students beyond the mere transmission of information, always becoming teacher-centered learning. It is not the paradigm that withstands the test of critical reflection.

Effective teaching unpacks student desires by querying them at the beginning of a learning cycle to discern the necessary objectives in a particular course, seminar, or clerkship.

These inquiries place the students at the center of curriculum design. Giving students more control over what is learned dignifies their role as medical students, helping them internalize learning. Internalized learning is flexible and can more easily be transferred to other learning contexts.[30-33]

Unreflective teaching treats all students as one prototypical medical student, thinking that each one ought to learn the same thing in the same way. It misses the diversity of intellectual acumen and sophistication; interest and motivation; and cultural, political, and educational background.[34] Effective teaching includes students interacting with, teaching, and assessing other students on a daily basis.[33]

Teacher reflecting should explore the creation of collaborative, cooperative learning environments, where students engage with each other to explore content material. Such explorations should include methods for students to probe past experience, future expectation, and peer-understanding on the topic. Unfortunately, this is not the natural first or second thought for instructors whose epistemological underpinning works through a poor definition of learning.

Effective teachers recognize that some learning results in rapidly diminishing returns, while other learning stays with the learner forever.[16] Just the way material is made available to students, affects the learning process. Consequently, effective teaching always reflects on new ways to engage learners, never allowing last year's lecture or slides to sneak into this year's lessons. This process of looking for new ways is one of the main goals of reflective practice.

Carl Sagan wrote:

> When what needs to be learned changes quickly, especially in the course of a single generation, it becomes much harder to know what to teach and how to teach it. In a world in transition, students *and teachers* both need to teach themselves one essential skill--learning how to learn.[35] (Italics added)

Clearly, the science of medicine changes rapidly, so medical faculty must discover ways to show their students how to learn. Critical reflection can explore the methods toward that end.

Final Thought

The second law of thermodynamics warns us that everything in the universe moves toward sameness. It labels this concept entropy. In teaching, entropy must be avoided. Critical reflection helps.

Through that reflection we can discern how methods regress toward sameness. Perhaps we teach the same lecture each year; perhaps we follow the same power point structure as our colleagues; perhaps we never discern how this year's students are different from last years'. All of these things, and more, lead to entropic teaching.

Medical teacher reflective practice has been studied[18,19,30] and has been found to be a positive source for new insights into strategies that improve the learning environment. In Pinsky and Irby's study on reflection,[30] the deliberative process of talking about teaching failures helped many physician educators deal successfully with failed teaching experiences.

Preventing failed teaching experiences is a way to avoid entropic teaching. Personal interest and curiosity on the process of teaching will go a long ways when directed through intentional reflection. This practice will also improve both your teaching and your student learning.

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