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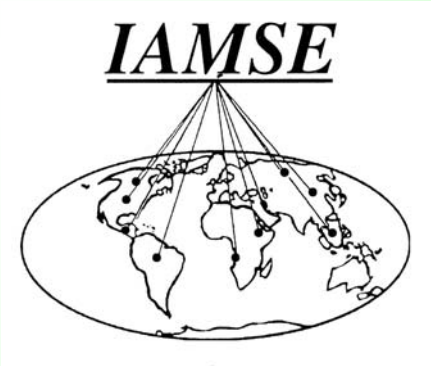


***Assessment of PBL Sessions***

***Classroom Management Issues***

***Virtual Lectures***

***Integration of Basic and Clinical Sciences***

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JIAMSE

*The Journal of the International Association of Medical Science Educators*

**Volume 14** **Number 1** **2004**

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# Message from the Editor

**Douglas J. Gould, Ph.D.**
Editor-in-Chief

This is already the fourth volume of the Journal of the International Association of Medical Science Educators (JIAMSE). I would like to take this opportunity to update you and focus your attention on the current volume of JIAMSE (Volume 14, Number 1), and call your attention to some of the successes that we have enjoyed over the past two years and provide you with an indication of where I see the journal heading in the future.

This edition of JIAMSE is a landmark in many ways: 1) It represents two full years of publication - consistent in timeliness, format and quality, 2) It has a truly International flavor, with nine different pieces by authors from four different countries, and 3) It has an enormous level of variability in topics, all of which fall under the umbrella of medical education. In this volume our regular *Medical Educators Resource Guide* is complemented by a host of commentary and research papers from around the globe, including: 1) papers dealing with student issues - classroom management issues for teaching assistants and a manuscript dealing with student's anxieties associated with the start of clinical training, 2) papers dealing with integration - basic and clinical science integration and a paper discussing scientific and societal integration, and 3) papers dealing with a variety of other topics - virtual lectures, medical ethics, and PBL assessment. The current issue is ample evidence that authors are increasingly looking to JIAMSE to publish and distribute a wide range of medical education pieces that cover all aspects of medical education – and our readers are the beneficiaries!

This issue is the latest in a string of accomplishments for JIAMSE over the past two years. Not only have all of our publication deadlines been met, but we have also successfully overhauled the web component of the journal. Further, our Manuscript Reviewer Database now has 53 members - up from just six members two years ago, we now have our journal listed and cited on numerous professional websites and search portals, have our French and Spanish translation teams continuing their outstanding efforts, and we have an ever-increasing number of papers being solicited to the journal. The steady upturn in manuscripts solicited to the journal is due not only in large part to the efforts of our Editorial Board and outstanding crew of Associate Editors, but also because JIAMSE is gaining respectability and stability in the eyes of potential authors.

We are currently in the process of expanding the Editorial Board in order to add more educational and clinical expertise - as well as to assist with the increase in papers. In addition, we are in the process of going back through the previous volumes of JIAMSE that have already been published in order to verify consistency in format over the years. It is my goal to put JIAMSE up for indexing in Index Medicus as soon as these tasks are complete.

In closing, I hope that you share in my enthusiasm for JIAMSE. It is my desire and commitment to you to continue JIAMSE on the path towards greater success and prominence. I hope that you experience the same sense of pride that I, the Executive Committee, the Editorial Board, our Reviewers and Authors all feel when they consider our journal.

# The Medical Educator's Resource Guide

**John R. Cotter, Ph.D.**

With the academic year about to begin shortly, it is a fitting time to check the status of online resources that are to be used on an established course resource page. Do the web pages still exist on the Internet, and if they do, do the hyperlinks for the web pages still work?

Even if a web page still exists, the Internet address or Uniform Resource Locator (URL) for the web page may be different from the one posted or hyperlinked on the resource page. The reason is that as documents are updated the pathway and/or the resource designation for the web page are often changed. If the address has been changed, it is likely that you will be directed to the web page's new location. If not, first search for the web page by deleting its resource designation. For instance, the hypothetical address <http://domain/pathname/resource> should be shortened to <http://domain/pathname>. If deleting the resource designation does not work, try shortening the URL to <http://domain> by deleting the pathname and resource designation. After deleting the resource designation and, if necessary, the resource designation and pathname carefully examine the website for the resource page that you want to locate.

The shortened URL may lead you to the resource page and its new Internet address. This tactic does not always work though and in the event the link cannot be found use a search engine to pin down the new URL. If this does not unearth the URL, it may be that the web page is temporally offline or that the web page was removed from the Internet or hidden from view.

The start of a new school year is also an appropriate time to upgrade a course resource page. Consider expanding the depth of coverage by adding websites that touch on topics that are not included in the websites listed on the course's resource page. Students can be overwhelmed by being given too much to do, so limit the number of sites by posting only those that students identify as useful and actually use; remove websites that students do not use.

Do not overlook websites that contain information that students might find helpful preparing for examinations. In this issue of the Guide you will find anatomy, histology and pathology websites that have sections for self-testing. As I have pointed out before, students enjoy the opportunity to self-test. This is especially true when the questions are comparable to the ones that they are likely to face on examinations.

If you are aware of a website that has the potential for being used by educators and students of the basic sciences, please consider contributing to the Guide. Once published by the journal, the websites and their reviews will be posted in hyperlink form on the JIAMSE website.

Send all submissions to jrcotter@buffalo.edu or use the IAMSE web page at <http://www.iamse.org/pub/bse_resource.htm>. Please include the URL and a short critique of between 100 and 200 words.

**Center of Biostructure. Medical University of Warsaw.**
http://www.ib.amwaw.edu.pl/anatomy/index2.htm

The Department of Anatomy at the Medical University of Warsaw, Poland has put together a fine site for those students needing help in radiological anatomy, gross anatomy and neuroanatomy. In the "Atlas of Radiological Anatomy", you have access to CT and MRI scans of the thorax, abdominal cavity, knee and head. With the CTs especially, it can be tricky to identify small structures but the web developers have alleviated this problem by outlining hard-to-see features. The amount of detail seen in the images is astonishing; structures such as the azygos vein, carina, thoracic duct, crura of the diaphragm and phrenic nerve are identifiable. As you work your way through the cross sectional images from superior to inferior, textbook anatomical relationships become evident. The most incredible part of this site is the "Atlas of Brain". It illustrates the human brain and cerebral blood vessels with a level of cleanliness that students of anatomy will appreciate. The "Practical Exams" section is a collection of pin examinations that were given over a period of seven years. The specimens, the various ways that they are prepared, the pins and the corresponding list of terms will acquaint students with the set up of laboratory examinations that are intended to test a student's ability to identify structures of the brain and body. *(Reviewed by Bethany Arber, BS, University at Buffalo).*

**Ian Maddison's Radiology Website. London South Bank University.**
http://myweb.lsbu.ac.uk/~dirt/im0.html

As the name indicates, this website is primarily dedicated to radiographic aspects of human disease. It is a very useful adjunct in learning and teaching pathology to both

undergraduate and postgraduate students. The site's high quality images and succinct legends can be used in discussions of disease entities to provide the clinical-radiological-pathological correlations that are always necessary when trying to impress students with the importance of pathology at the undergraduate level. There is the "George Simon Collection" with details on congenital abnormalities and a "Teaching Docs" section that contains a lot of basic information on a variety of topics including digital imaging, pulmonary radiology, disease coding and study methods. The site also contains 324 cases. The cases are organized as "Teaching Cases" according to abnormality and anatomical area and "Unknowns". There is also a "Pathology Index" with links to cases listed in the index. The site is very easy to use. Users do not have to provide any personal information and do not need the fastest Internet connection to access the site. Pathologist will find this site is useful for discussions of the clinical and radiological aspects of disease processes. *(Reviewed by Anurag Saxena, MD, FRCPC, Program Director, General Pathology Residency Training Program, University of Saskatchewan).*

**Mechanisms of Human Disease. Loyola University Medical Education Network (LUMEN).**
http://www.lumen.luc.edu/lumen/MedEd/Pathology/index.htm

Self-assessment case studies are a very nice feature of this site. They are complete with gross and microscopic images and answers, and can be used in TBL or PBL format. A virtual microscopy section, which covers a wide variety of topics important in organ pathology is another valuable feature of this site. Although, if you are planning to project images to a large audience, the images that cover gastroenterology may need to be touched up for better contrast. The best aspect of this website is its completeness; it has Power Point presentations for all the lectures, specific student assignments, self-assessment case studies, lovely radiographic images, and study aids. Some of the areas are password protected or require special software. This site is well thought out, technologically sophisticated, and a wonderful comprehensive student resource. *(Reviewed by Darshana Shah, PhD, Department of Pathology, Joan C. Edwards School of Medicine).*

**Microanatomy Web Atlas. University of Texas Medical Branch.**
http://cellbio.utmb.edu/microanatomy/

When it comes to obtaining a good understanding of histology, the "Microanatomy Web Atlas" is a very useful tool. The organization of the website is impressive – it is comprehensive and contains clear and understandable slides (images) of the tissues and organs. The strength of this site for students is that it can be used when studying for an examination. Under "Histology Topics", the descriptions and information that are given alongside the slides are helpful because going into a histology examination, in addition to their appearance, it is necessary to understand the dynamics of tissues and organs. Any problem that one might have identifying cells in the blood and connective tissues will be rectified by the distinctions that are made between the different cell types. A "Study Guide" and "Practice Practical Exam" can be used in preparing for tissue examinations. The slides that are used in the "Practice Exams" are large and the morphology of the slides is unmistakable. More importantly, in addition to simply asking for the identity of a structure, there are questions that touch on related facts. Obtaining the answers to these is simplified because the answer is revealed when the cursor passes over the slide. This makes for easier and faster learning. *(Reviewed by Joseph Sleilati, BS, University at Buffalo).*

**Pathology C601/C602 Slides & Laboratory Units. Indiana University School of Medicine.**
http://medsci.indiana.edu/c602web/602/C602web/Toc.htm

This is a user-friendly site with multiple options available as adjuncts for the microscope-based laboratory student. Low, medium, high power images with accompanying text pertaining to topics on general and systemic pathology form the backbone of this site. The low power views effectively orient the user to the macroscopic aspects of specimens that are shown at higher magnifications. The digital qualities of the medium and high power images are acceptable for an electronic format. Each study unit under "Slides" concludes with a quiz that relates clinically correlated cases to the relevant pathology of the unit. Some of the material offered, e.g., the cardiac videos, may not be suitable for the designated level of student learning. They will however be of use to more senior students and can be used as refresher course material for teaching of cardiovascular system. One of the most exciting aspects of this website is the availability of interactive clinical cases that have a live audio-video component as well. The video upload is however rather lengthy and time consuming. Despite this drawback, the emphasis on laboratory investigations, results, disease outcomes and treatment plans makes this an extremely valuable tool for the practice of case scenarios. A quiz is available at the end of each case. As the contents of the site are course specific, some sections of this site are password protected. Sample practice exams are available in the multiple-choice format in both general and systemic pathology. These can be used as teaching tools for students and resource material for teachers. The site also provides links to relevant sites of other universities. *(Reviewed by Rani Kanthan, MBBS, MS, FRCS, FRCPC, Department of Pathology, College of Medicine, University of Saskatchewan).*

**PEIR: Pathology Education Instructional Resource. University of Alabama at Birmingham.**
http://peir.net/

The peir.net website is quite comprehensive and fulfills many needs of medical students, residents and faculty. Development of the site was supervised by Dr. Peter Anderson. Although some elements of the site are not available to the public such as the "Gripe Digital Library",

sections of the "Learning Materials" and the specific courses for the University, others are accessible: "PEIR Digital Library" image database and the "Web Guides" for "Pathology Residents and Fellows Resources" and the "Medical Education Resource for Instructional Technology". The "Basic Medical Pathology" series presents lessons in topics applicable predominantly to General Pathology. The learning experience is excellent and includes a pre-test, mini-lecture, study questions module and a post-test. Upon completion and review, the basic principles of disease are presented in an educationally sound approach. Another very useful approach to learning is the case-based section that includes images and basic information from a group of briefly presented cases. The website is well done and is especially useful for General Pathology. It is less useful for the systemic study of disease. The approach is very helpful for those who use the site. *(Reviewed by Peter A. Nickerson, PhD, Department of Pathology and Anatomical Sciences, University at Buffalo).*

**University of Pittsburgh School of Medicine Department of Pathology Case Database and Case of the Month.**
http://path.upmc.edu/index.html

Case-based educational activities provide a rich environment for undergraduate medical education. However, development of suitable cases can be a challenge especially for non-clinical faculty.

Since pathology is a natural bridge between basic and clinical sciences and pathology faculty have direct access to voluminous case materials, this can become a natural resource for shared cases. Interactive case-based learning in an online forum provides opportunities for medical education whereby students may be immersed in clinically-based scenarios at their own time and pace. The Department of Pathology at the University of Pittsburgh School of Medicine has facilitated this potential by publishing a public access, online case database which features the ability to review cases by patient history or diagnosis and by pathology subspecialty. Cases in anatomic pathology and clinical pathology are added monthly, thereby expanding the database. Documentation of contributing authors, dates of publication, and pertinent references enhance credibility. Each case exhibits a patient history and diagnosis and may be accompanied by laboratory values, references, and thumbnail images (which are too small to be useful at native size but can be enlarged in a new browser window to facilitate viewing). Numerous cases are available covering a broad range of topics, and the case search engine allows easy querying based upon user-specified case criteria and level of case difficulty. The case discussion forum was offline at the time of review but, if functional, would offer an opportunity for users to interact and accentuate their familiarity with particular disease processes. This case databank provides a useful resource for health professions educators to utilize and/or re-purpose for their own specific instructional activities. *(Reviewed by Kristina T.C. Panizzi, MAE and Peter G. Anderson, DVM, PhD, Department of Pathology, University of Alabama at Birmingham).*

# Human Rights In Medical Ethics Education

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**ABSTRACT**

Human rights (HR) is important in medicine; violations in HR not only result in health problems but some kinds of HR violations are possible in treatment by medical professionals themselves. Therefore in medical education, awareness of HR, their reflections in the community and in treatment approaches are essential. This article is devoted to HR in medical ethics as a different educational perspective. The pilot study was carried out in our medical ethics course with a class of third year students at Ankara University School of Medicine during Spring 2000 semester. The study focused on the superiority of an interactive education over a classical education in medical ethics through the problems related to HR. The data reflects that role-playing as one of the interactive learning experiences is the best suited to help medical students achieve the curriculum's educational objectives.

**INTRODUCTION**

Human rights (HR) is defined as a relationship between the public authority and citizens. It is important in medicine since violations in HR not only result in health problems but may result from the aid of medical professionals in some instances. Furthermore, HR violations can be regarded as epidemic diseases influencing the overall community. Therefore in medical education, awareness of HR, their reflections in community and treatment approaches are essential.

This research article is devoted to HR in medical ethics as a different educational perspective. In 1999, the World Medical Association declared that medical ethics and human rights must be an important component of medical education. In accordance with this declaration, and owing to the fact that HR is an especially critical issue in Turkey,[1, 2,3] some hot HR issues such as "torture", "hunger striking", "capital punishment" and "hymen examination" have been included in the syllabus of a medical ethics course offered at Ankara University School of Medicine since 1993. Physicians play a critical professional role in the field of HR and should be well informed of their ethical responsibilities and should absolutely develop an occupational identity related to HR.

How do we learn attitudes that contain such responsibilities? Learning of attitudes is realized as follows:[4]

1. Society and culture: Most of the attitudes are learned this way.
2. Role modeling: Moral atmosphere is important.
3. Interactive education: Case discussions, role playing, and simulations help to obtain attitudes with interactive methods. Practice intensifies learning.

Despite agreement on the necessity to adapt adult education principles to medical ethics teaching, there are some difficulties with curriculum integration, experimental learning, and assessment methods. Student assessment is a quite important component of medical ethics education. Most of the authors have emphasized the lack of information regarding evaluation. The perceived difficulty of objectively evaluating intangibles such as human values and prejudices and the lack of suitable and valid assessment techniques are the main reasons of the lack of evaluation. [5,6,7, 8, 9, 10]

Despite problems about the nature of the "humane attitude" and whether it can be taught or not, the humane attitude has an ethical component. Could these courses give students the opportunity to stand outside their extremely narrow focused, "pure" medical activities and look on them from a different viewpoint? The final aims encourage a critical and questioning attitude to professional identity, including human rights subjects. Integration has been accepted as an important educational strategy in medical education. Harden describes eleven points on a continuum between the two polarized debates in favor and against integrated teaching. These points are stressed as isolation, awareness, harmonization, nesting, temporal co-ordination, sharing, correlation, complementary, multi-disciplinary, inter-disciplinary, trans-disciplinary by Harden. Didactics and seminars will be taught as part of the curriculum inevitably

but all of them must not be lectures.[11,12] Interactive learning experiences are best suited to help medical students achieve the curriculum's educational objectives.[13]

## MATERIAL AND METHODS

This study is concerned with HR as a tool to express the importance of proposed interactive education in the material. Therefore, the study focuses on the superiority of an interactive education over a classical one in medical ethics through the problems related to HR.

This pilot study was carried out in the medical ethics course with a class of third year students at Ankara University School of Medicine during spring 2000 semester. The students were divided into Group A and Group B and following the presentation of some theoretical information by the course instructor, were provided with two cases reflecting different HR issues in medical practice. They were then asked to discuss the issues, and following a role distribution, to act out the cases. The role-play was followed by a feedback session in which the students not only expressed how they personally felt about the issues but also assessed the session itself. Finally, a written examination was taken and results were analyzed.

**Case 1:** Dr. A works in a state hospital as a practitioner. The hospital is defined as a reference one and is responsible for providing medical services to detainées. One day while Dr. A is working in the out-patient clinic, two armed gendarmes come in with a man handcuffed. The man is a prisoner and is suffering from nausea and vomiting. The patient is taken into the examination room and the gendarmes are asked to stay out the room, but they refuse to do so and insist on staying in the same room during the medical examination. Dr. A says that they have to wait in front of the door, but they don't accept. If you were Dr. A, what would you do and why? If you were the patient how would you feel?

**Case 2:** Dr. B. is a practitioner and works in a primary health care unit. One day two young girls and two men come to his office. The girls are crying and the men look quite angry. One of the men introduces himself as the director of a dormitory for girls. He then complains about the girls' close relations with the boys. He requests that you perform hymen examination. If you were Dr. B. what would you do? Would you perform hymen examination or not? Discuss your occupational responsibility on this case considering the emotional status of the young girls. Think about the importance of the "informed consent" concept in physician-patient relationships.

## DISCUSSION AND CONCLUSIONS

Instead of applying traditional assessment techniques and relying solely on statistical results, I prefer to focus more on educational experience. The feelings of the medical students after the interactive lecture were so impressive. They noted that this 'drama' approach in teaching made it possible for them to understand the perspective of the patients and to think and feel like them. Generally they agreed that this method is better than having it in the form of a lecture. Their feelings with their words are as follows.... *"I feel deep anxiety when I act the patient", " I think this (writing a medical report) is not my job", " I feel despair myself", "I want to escape", "I'll never forget this experience", "A different kind of learning"...*

The students reported that they know the Declarations of the World Medical Association and the other basic international documents, but they wanted to apply the ethical approach in their medical practice. They emphasized that feelings and emotions are similar to those in the real world and this method is more impressive than traditional lectures.

Medical ethics must be an indispensable part of the medical education. As generally accepted it should be spread to all periods of education and it should be student-centered, integrated and population oriented. Population orientation is also of importance. For example, Yehova witnesses is not a good case for educational discussions in Turkey because it has no connection with the real life practices of our population. Students want to know whether various cases are realistic or not; their preference is always for real cases such as the two already mentioned. For that reason, Yehova witnesses are difficult to understand and too "fantastic" in the students' point of view.

When incorporating such a method into classroom teaching, certain limitations and difficulties should be taken into consideration. For instance, the instructor needs to allocate more time. He or she should be ready to cope with tasks such as scenario writing and developing assessment tasks. The number of students is also a concern. However, it should be noted that the advantages and educational outcomes far outweigh these limitations and difficulties. This method greatly contributes to attitude education, persistent effect, and the students' development of emphatic mindedness, awareness, sensitivity to case discussions on ethics education, as mentioned in the literature.[14, 10]

Lecturing is not the only appropriate method fordeveloping attitudes in medical education; an integrated and interactive method may be preferred, however unfavorable the conditions are. We are responsible for implementing a social and population-based curriculum. This is our primary responsibility both for our students and our society.

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# Formative and Summative Assessment of the Problem-Based Learning Tutorial Session Using a Criterion-Referenced System

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**ABSTRACT**

Many medical schools have moved towards problem-based learning (PBL). Unfortunately, the use of PBL in many medical schools has not been followed with appropriate changes in evaluation of students. Assessment of PBL needs to focus on the objectives that PBL fosters in conjunction with the educational course objectives. In an effort to appropriately assess PBL sessions, The School of Medicine Tec de Monterrey uses a criterion-based system that includes three checklists: 1) tutor assessment of students, 2) self-assessment, and 3) peer-assessment. Each checklist contains criteria that correspond to the four objectives (rubrics) of PBL: knowledge application, critical thinking, self-directed study and collaboration, and a fifth rubric for professionalism and attitude during the discussion. Course objectives are integrated within each of the rubrics. The three checklists are used for summative and formative purposes in all PBL core courses of the Basic Medical Sciences department and for the Gynecology PBL core clinical course. Although no quantifiable data have been obtained, the use of this criterion-based system has helped establish appropriate standards of performance. Additionally, it has assisted in identifying those students who are having trouble developing critical thinking and decision-making skills and has greatly fostered feedback to students. If PBL assessment is consistent with curricular goals and course learning objectives, validity of assessment is enhanced and subjectivity across instructors' evaluations can be diminished.

## INTRODUCTION

Great strides in curricular reform have been introduced into many medical schools since the presentation of the SPICES model by Harden. [1, 2] This model promotes a Student centered, Problem-based, Integrated, Community-oriented curriculum with Elective modules and a Systematic approach to learning, hence the acronym "SPICES". The School of Medicine Tec de Monterrey has developed a competency-based, integrated, spiral curriculum in which PBL is the predominant teaching-learning strategy.

Because of the logarithmic growth of medical information, medical students cannot reasonably be expected to master it all. Medical educators struggle with curricular overload while striving to foster application of students' knowledge and facilitate their independent and critical thinking skills. Meanwhile, medical students have to concentrate on the relevance of basic science to medicine, how to identify and solve clinical problems, and develop the behavior of lifelong learning. PBL is a pedagogic approach designed to achieve these diverse educator/student goals.[3]

Published studies have reported that PBL has four main objectives: 1) to apply a base of knowledge, 2) to develop clinical reasoning and judgment and decision making skills, 3) to foster self-directed learning and 4) to promote collaborative work. [3, 4, 5, 6, 7, 8, 9, 10] Tutorial sessions play the major role in the attainment of these objectives. Guided by the tutor (teacher) and through collaboration among them, students establish the learning objectives for each problem and then commit to independent study. During small group discussion they then apply their self-acquired knowledge to the patient's problem and use their clinical reasoning and decision-making skills to solve it and attain the learning objectives.

A model for a problem-based small group process includes:[11] 1) presentation of the learning scenario (problem), 2) definition of unfamiliar language or concepts, 3) brainstorm (comments) by students about issues that come to mind regarding the scenario, 4) identification of key areas for potential learning and organization of these within a logical, conceptual framework, 6) development of a learning plan with specific questions that ensures that all group members understand and subscribe to the learning

plan, 7) self-study (independent study) centered around the pre-established learning plan, 8) discussion of the problem centered around the learning plan and 9) evaluation of the learning experience of the particular session.

Not only are the learning method and the intent of its outcomes important, but also the evaluation of their achievement. Commonly, assessment of PBL tutorials focuses on the process only; the way students go through the process of the strategy and acquire self-study and thinking skills. One of the important principles of assessment is to match the assessment method to the learning mode, developmental level, subject matter and program outcomes.[12] Thus, assessment of tutorials should also include the knowledge that is being progressively attained. PBL assessment then, must consider student achievement of the objectives sought by the course and those promoted by PBL. Such assessment must be an integral part of the teaching-learning process; it should be continuous and not just take part at the end of it, and it should be both, summative and formative. Formative assessment is a part of the developmental or ongoing teaching-learning process. It includes delivery of feedback to the student, with the aim of improving teaching, learning and the curriculum. Summative assessment occurs at the end of a term or course and is used primarily to provide information about how much the student has learned and how well the course was taught.[13]

Because both the course objectives and those promoted by PBL are fostered and achieved during the tutorial sessions where there is an opportunity of ongoing assessment, a need of an assessment tool that focuses on the continuous attainment of both, the course and PBL objectives was identified. This was particularly important at the School of Medicine Tec de Monterrey where new faculty members were participating in PBL courses. Assessment standardization of the tutorial sessions was needed so that teachers knew exactly what to expect from students and vice versa.

The primary objective of this report was to present a criterion-based system that combines specific course objectives with those inherent to PBL. This system described herein is flexible enough to be adapted and used in any type of basic or clinical science PBL course.

## MATERIALS AND METHODS

Achieving a valid formative and summative assessment requires identification of criteria for each PBL objective. The four main PBL objectives were described as "rubrics". In this report pre-established objectives for the Nutrition and Metabolism PBL core basic science course were considered. Specific criteria for each of the four objectives-rubrics were defined by the author and integrated with the course objectives. A fifth rubric with criteria was added, professional behavior, being an outcome emphasized in all courses of the curriculum. A numeric scale, ranging from one (not developed) to six (very well-developed) was used for each criterion as well as a summative scale to integrate criteria within each rubric (Tables 1, 2 and 4). Three final checklists were developed: 1) an electronic checklist to assess daily student achievement, performed by the tutor (Table 1), 2) a self-assessment checklist (Tables 2 and 3) and 3) a peer-assessment checklist (Table 4).

### Student assessment performed by the tutor (faculty member)

Tutorial sessions of seven to nine students ran three times a week for two hours, every other day, for a total of 11 tutorials per monthly rotation in the four-month course. The scale for each criterion ranged from one (not developed) to six (very well-developed). Every criterion was not assessed daily; criteria that were considered for each tutorial session depended on the objectives to be covered in that particular session, which were defined during the previous session, and they also depended on the PBL step the group of students was working on. In each tutorial session the tutor of the course assigned each student one grade that ranged from one to six, for each of the five rubrics. The tutor added the total score for each rubric, giving a maximum of 30 points per tutorial session (six points per rubric). At the end of the month, the tutor summed the score obtained by each student for every tutorial. Tutor assessment of students had both, formative and summative value. A detailed description of the assessment system, including the three checklists, was provided to the students the first day of the course.

As set by departmental guidelines, daily assessment by the tutor had a summative value of 30% of the final monthly grade; 10% corresponded to assignments and 60% to the written monthly exam. An electronic format used to facilitate the tutor's work is shown in Table 5. Once daily grades were entered, formulas calculated monthly grades. The tutor also used the daily assessment to give continuous feedback to students. At the end of the monthly rotation, the tutor assessed performance of the roles taken by each student during the tutorials (ie. leader, secretary and participant). Role assessment served a formative purpose to improve student performance in future tutorials, but had no summative value.

### Self-assessment

Self-assessment took place at the end of each monthly rotation, using the rubrics and criteria shown in Tables 2 and 3. Self-assessment was a formative way to get students to reflect on their abilities, performance and attitudes, but had no summative value.

### Peer-assessment

Peer-assessment took place at the end of each monthly rotation, using the rubrics and criteria shown in Table 4 (peer-assessment format). Each student handed over this written peer-assessment format to each one of his peers. Peer-assessment also took place in an open session, at the end of the rotation, in which each student gave oral feedback to every other student and to the teacher. Peer-assessment had no summative value; it fostered reflection by students on how their classmates assessed their performance.

**Table 1.** Criteria to Assess Students' Daily Participation in PBL Tutorials Performed by the Tutor

| **Application of Knowledge Base** | **1: Not Developed - 6: Very well developed** | | | | | |
|---|---|---|---|---|---|---|
| Shows evidence of thorough reading of documented sources about…* | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows breadth and depth of knowledge about the problem … | 1 | 2 | 3 | 4 | 5 | 6 |
| Answers questions or shares his/her opinions about… without reading notes/books. | 1 | 2 | 3 | 4 | 5 | 6 |
| Applies acquired knowledge about…. to the problem. | 1 | 2 | 3 | 4 | 5 | 6 |
| **Clinical Reasoning and Decision Making skills** | | | | | | |
| Discriminates important information of the problem from that which is not. | 1 | 2 | 3 | 4 | 5 | 6 |
| Lists the patient's problems… | 1 | 2 | 3 | 4 | 5 | 6 |
| Prioritizes the patient's problems… | 1 | 2 | 3 | 4 | 5 | 6 |
| Interprets (gives meaning) to the information given in the problem…….. | 1 | 2 | 3 | 4 | 5 | 6 |
| Is able to support his clinical reasoning and decision making with evidence about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows evidence and critical understanding of facts about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows ability to generate diagnostic hypothesis about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Is capable of making decisions regarding the diagnostic approach to the patient… | 1 | 2 | 3 | 4 | 5 | 6 |
| Is capable of making decisions regarding the therapeutic approach to the patient… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows ability to generate alternative diagnostic hypothesis according to new information given. | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows evidence of following a sequential management of the patient's problems… | 1 | 2 | 3 | 4 | 5 | 6 |
| Is able at formulating conclusions about the problem… | 1 | 2 | 3 | 4 | 5 | 6 |
| **Self- Directed Learning (Self-study)** | | | | | | |
| Defines learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows evidence of accomplishment of learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows evidence of reading diverse and recent bibliographic sources about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Makes efforts to improve. | 1 | 2 | 3 | 4 | 5 | 6 |
| If necessary, seeks counseling to orient his/her study… | 1 | 2 | 3 | 4 | 5 | 6 |
| Drives him/herself to the limits of his/her knowledge and abilities. | 1 | 2 | 3 | 4 | 5 | 6 |
| Identifies his/her opportunity areas. | 1 | 2 | 3 | 4 | 5 | 6 |
| Establishes learning goals and defines a concrete action plan to meet learning needs about… | 1 | 2 | 3 | 4 | 5 | 6 |
| **Collaborative Work** | | | | | | |
| Works towards achievement of the group's learning goals… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows effective interpersonal abilities. | 1 | 2 | 3 | 4 | 5 | 6 |
| Is interested in participating in daily discussion about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Shares bibliographic sources with classmates about… | 1 | 2 | 3 | 4 | 5 | 6 |
| Respects classmates' opinions. | 1 | 2 | 3 | 4 | 5 | 6 |
| Helps classmates who lag behind. | 1 | 2 | 3 | 4 | 5 | 6 |
| Gives feedback in a constructive and fraternal way. | 1 | 2 | 3 | 4 | 5 | 6 |
| Works as hard as the rest of his teammates. | 1 | 2 | 3 | 4 | 5 | 6 |
| **Attitude during discussion and Professionalism** | | | | | | |
| Accepts feedback with openness | 1 | 2 | 3 | 4 | 5 | 6 |
| Reacts positively to feedback and criticism | 1 | 2 | 3 | 4 | 5 | 6 |
| Manages his/her impulsiveness adequately. | 1 | 2 | 3 | 4 | 5 | 6 |
| Stands up for his/her points of view… | 1 | 2 | 3 | 4 | 5 | 6 |
| Makes an effort to adequate his/her behavior to circumstances | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows ability to change his/her point of view in light of new information given or obtained….. | 1 | 2 | 3 | 4 | 5 | 6 |
| Attended every class and arrived on time | 1 | 2 | 3 | 4 | 5 | 6 |
| Shows responsibility and commitment | 1 | 2 | 3 | 4 | 5 | 6 |
| Is honest. | 1 | 2 | 3 | 4 | 5 | 6 |
| His/her appearance and clothing correspond with that of a medical professional. | 1 | 2 | 3 | 4 | 5 | 6 |

* … = specific objectives of the course, of the class or of the problem are incorporated here.

## RESULTS

This paper describes a criterion-referenced system using Tables 1-4. It was first used one and a half years ago for the Nutrition and Metabolism course. With the intent to standardize the assessment system at the school, as stated by the Assessment Committee, it has been incorporated into each of the four PBL core courses of the Basic Medical Science Department, and has been adapted by the course directors for the Gynecology and Obstetrics core PBL clinical course to increase objectivity of tutorial assessment. Although no quantifiable data to assess the checklists have been obtained, through oral feedback received,

**Table 2.** Criteria for self-assessment

| **Application of Knowledge Base** | **1: Not Developed - 6: Very well developed** | | | | | |
|---|---|---|---|---|---|---|
| I am able to obtain adequate information about the problem…* | 1 | 2 | 3 | 4 | 5 | 6 |
| I comprehend the physiology and pathogenesis of … | 1 | 2 | 3 | 4 | 5 | 6 |
| I am good at recognizing and interpreting the sings and symptoms of … | 1 | 2 | 3 | 4 | 5 | 6 |
| I understand the cost/benefit ratio of the diagnostic tests for … | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to interpret (give meaning) the diagnostic tests for patients with… | 1 | 2 | 3 | 4 | 5 | 6 |
| I understand the rational basis for the treatment of patients with … | 1 | 2 | 3 | 4 | 5 | 6 |
| I am aware of the impact in the morbidity/mortality ratio caused by… | 1 | 2 | 3 | 4 | 5 | 6 |
| I am cable of applying preventive measures for patients with… | 1 | 2 | 3 | 4 | 5 | 6 |
| **Clinical Reasoning and Decision-Making skills** | | | | | | |
| I am able to identify the useful information in the problem… | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to list the patient's problems. | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to prioritize the patient's problems. | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to interpret (give significance) the information given in the problem. | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to support my clinical reasoning and decision making with evidence about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed evidence and understanding of critical facts about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I was able to formulate diagnostic hypothesis with fundaments about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I made decisions related to the diagnostic approach to the patient. | 1 | 2 | 3 | 4 | 5 | 6 |
| I made decisions related to the therapeutic approach to the patient. | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed ability to formulate alternative diagnostic approaches according to new information presented. | 1 | 2 | 3 | 4 | 5 | 6 |
| I was able to prepare a follow-up management plan for the patient's problems… | 1 | 2 | 3 | 4 | 5 | 6 |
| I was able to formulate conclusions about the problem… | 1 | 2 | 3 | 4 | 5 | 6 |
| **Self-Directed Learning** | | | | | | |
| I set learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed evidence of accomplishment of the learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed evidence of reading diverse and recent bibliographic sources about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I made efforts to improve. | 1 | 2 | 3 | 4 | 5 | 6 |
| If necessary, I asked for counseling to orient my study about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I pushed myself to the limits of my knowledge and abilities. | 1 | 2 | 3 | 4 | 5 | 6 |
| I identified my areas of opportunity for improvement. | 1 | 2 | 3 | 4 | 5 | 6 |
| I set goals and established a concrete action plan to achieve my learning needs about… | 1 | 2 | 3 | 4 | 5 | 6 |
| **Collaborative work** | | | | | | |
| I worked towards the attainment of the team's learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed effective interpersonal skills. | 1 | 2 | 3 | 4 | 5 | 6 |
| I was always eager to participate in discussions. | 1 | 2 | 3 | 4 | 5 | 6 |
| I shared bibliographic sources with my classmates | 1 | 2 | 3 | 4 | 5 | 6 |
| I participated in all group activities | 1 | 2 | 3 | 4 | 5 | 6 |
| I attended on time every team meeting and fulfilled my assignments | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed responsibility and commitment in all the team's tasks | 1 | 2 | 3 | 4 | 5 | 6 |
| I respected other people's opinion. | 1 | 2 | 3 | 4 | 5 | 6 |
| I helped classmates who lagged behind. | 1 | 2 | 3 | 4 | 5 | 6 |
| I offered feedback to my classmates in a constructive, friendly way. | 1 | 2 | 3 | 4 | 5 | 6 |
| I worked as hard as the rest of the group. | 1 | 2 | 3 | 4 | 5 | 6 |
| **Attitude during discussion / Professionalism** | | | | | | |
| I was able to discuss a topic and stand up for my point of view about… | 1 | 2 | 3 | 4 | 5 | 6 |
| I attended every class and arrived on time. | 1 | 2 | 3 | 4 | 5 | 6 |
| I studied and prepared for every class. | 1 | 2 | 3 | 4 | 5 | 6 |
| I did my best effort in each class and assignment… | 1 | 2 | 3 | 4 | 5 | 6 |
| I was always eager to participate in the tutorial discussion… | 1 | 2 | 3 | 4 | 5 | 6 |
| I handed my work on time. | 1 | 2 | 3 | 4 | 5 | 6 |
| I showed responsibility and commitment in all the assigned tasks… | 1 | 2 | 3 | 4 | 5 | 6 |
| I was open to criticism and reacted favorably | 1 | 2 | 3 | 4 | 5 | 6 |
| I used feedback to improve my attitudes. | 1 | 2 | 3 | 4 | 5 | 6 |
| I am able to identify my strength and opportunity areas… | 1 | 2 | 3 | 4 | 5 | 6 |
| My appearance and clothing correspond with that of a medical professional. | 1 | 2 | 3 | 4 | 5 | 6 |

* … = specific objectives of the course, of the class or of the problem are incorporated here.

**Table 3.** Marking Scale for Student Self-assessment

| | |
|---|---|
| **Knowledge Base** | |
| More than 45 points: | excellent |
| Between 39 and 44 points: | good |
| Between 32 and 38 points | fair |
| Less than 32 points: | poor |
| **Clinical Reasoning and Decision Making Skills** | |
| More than 45 points: | excellent |
| Between 39 and 44 points: | good |
| Between 32 and 38 points | fair |
| Less than 32 points: | poor |
| **Self-Directed Learning** | |
| More than 45 points: | excellent |
| Between 39 and 44 points: | good |
| Between 32 and 38 points | fair |
| Less than 32 points: | poor |
| **Collaborative work** | |
| More than 45 points: | excellent |
| Between 39 and 44 points: | good |
| Between 32 and 38 points | fair |
| Less than 32 points: | poor |
| **Attitudes and Professionalism** | |
| More than 45 points: | excellent |
| Between 39 and 44 points: | good |
| Between 32 and 38 points | fair |
| Less than 32 points: | poor |

it has been perceived that teachers' and students' opinions have been positive. This checklist system has established objective standards for both teachers and students. Teachers know what to expect and students know the performance standard.

It has especially helped new faculty who have just begun teaching in a PBL course. Rubrics and criteria let them know exactly what to expect from students during a tutorial. Before its use, many teachers awarded all students with the maximum number of points that each tutorial session was worth. Teachers now assigned students a daily grade, which according to oral feedback from students, has been more fair. Feedback to students has been enhanced since the use of this checklist system; individual and group feedback has been fostered.

During individual meetings with teachers, they reported an increase in student participation. Presumably, this was because students knew what was expected from them. Moreover, teachers indicated that students' participation was more directed towards knowledge sharing and decision making skills. Additionally, it helped standardize PBL tutorial assessment across the basic medical science department and has since been adapted for one clinical rotation PBL course.

**Table 4.** Criteria for peer-assessment

| **Attitudes: My classmate 1: Not Developed - 6: Very well developed** | | | | | | |
|---|---|---|---|---|---|---|
| Was able to discuss a topic and stand up for his/her point of view…* | 1 | 2 | 3 | 4 | 5 | 6 |
| Attended every class and arrived on time. | 1 | 2 | 3 | 4 | 5 | 6 |
| Studied and prepared for every class… | 1 | 2 | 3 | 4 | 5 | 6 |
| Did his/her best effort in each class and assignment. … | 1 | 2 | 3 | 4 | 5 | 6 |
| Was always eager to participate in discussion… | 1 | 2 | 3 | 4 | 5 | 6 |
| Was open to criticism and accepted feedback openly. | 1 | 2 | 3 | 4 | 5 | 6 |
| Used feedback to improve his/her attitudes. | 1 | 2 | 3 | 4 | 5 | 6 |
| Participated actively in the tutorials. | 1 | 2 | 3 | 4 | 5 | 6 |
| Shared important and valuable information with the group. | 1 | 2 | 3 | 4 | 5 | 6 |
| Showed responsibility and commitment | 1 | 2 | 3 | 4 | 5 | 6 |
| **Collaborative Work Attitudes: My classmate.....** | | | | | | |
| Handed work in on time… | 1 | 2 | 3 | 4 | 5 | 6 |
| Attended every group meeting and arrived on time. | 1 | 2 | 3 | 4 | 5 | 6 |
| Worked as hard as the rest of the group. | 1 | 2 | 3 | 4 | 5 | 6 |
| Helped classmates who lagged behind. | 1 | 2 | 3 | 4 | 5 | 6 |
| Worked towards achievement of the group's learning objectives… | 1 | 2 | 3 | 4 | 5 | 6 |
| Listened to classmates. | 1 | 2 | 3 | 4 | 5 | 6 |
| Respected other people's opinions. | 1 | 2 | 3 | 4 | 5 | 6 |
| Showed responsibility and commitment in all the team's tasks. | 1 | 2 | 3 | 4 | 5 | 6 |
| Offered feedback to his/her classmates in a constructive and friendly way. | 1 | 2 | 3 | 4 | 5 | 6 |

* … = specific objectives of the course, of the class or of the problem are incorporated here.

By assessing knowledge base, critical thinking and decision making skills, self-study, collaborative work and professional attitudes, through this criterion-based system we observed four main groups of students: 1) those who studied much and strived to make an effort, but who had underdeveloped critical thinking and decision making skills, 2) students who did not study much but had developed critical thinking and decision-making abilities, 3) those very few with personal attitudes and or collaboration problems and 4) those students that studied much, had developed critical thinking and decision making skills and had good attitudes.

## DISCUSSION AND CONCLUSIONS

Critical thinking and a scientific approach to problem-solving are imperative not only for research scientists, but also for physicians.[3] Life long skills such as self-directed learning and collaboration with other health care professionals are also necessary attributes of practicing physicians. These skills are incorporated into medical

**TABLE 5.**

**SCHOOL OF MEDICINE TEC DE MONTERREY BASIC MEDICAL SCIENCES DEPARTMENT**

**ASSESSMENT OF TUTORIAL SESSIONS**

| STUDENTS' FOLIO AND NAME | Session 1 | | | | | | Session 2 | | | | | | Session 3 | | | | | | Session 4 | | | | | | Session 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| NAME | Session 6 | | | | | | Session 7 | | | | | | Session 8 | | | | | | Session 9 | | | | | | Session 10 | | | | | | 30 % | 60 % | 10% | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | KB | CR | SS | CW | P | PTS | PARTICI-PATION | EXAM | ASSIGN MENTS | MON THLY GRA DE |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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KB: Knowledge base CR: Clinical Reasoning SS: Self-study CW: Collaborative Work P: Professionalism PTS: Points

student's training. PBL provides a pedagogical environment that is conducive to developing these skills. However, an objective-based assessment system must be utilized to ensure their attainment.

Although PBL is commonly used in many medical schools, too much emphasis is placed on the process itself. Little attention has been given to the outcomes of PBL. Assessment of PBL courses and/or curricula is usually incongruent with the sought objectives. PBL assessment relies on evaluation principles similar to other teaching-learning modalities. In particular, student assessment should test the individual's ability to fulfill pre-established learning objectives.[8] A PBL assessment tool was defined at the School of Medicine Tec de Monterrey that encompasses both course objectives and those fostered by the PBL teaching-learning strategy. This assessment system consists of three criterion-based checklists: one for tutor assessment of students, another for self-assessment and the third for peer-assessment. Five rubrics were defined for these checklists: knowledge application, critical thinking and decision-making skills, self-directed study, collaborative work and professional attitudes. Criteria for each rubric were also specified.

The value of self and peer assessment has been reported by Friedman.[13] Results from Friedman's study indicate that assessment plays an important role in further developing multiple dimensions of the medical profession. Self-assessment evidence and peer-assessment are legitimate as long as assessment standards are being met. The assessment tool presented in this study includes students' self and peer assessment. The criteria defined for each rubric are the standards students are expected to complete.

Frequently, PBL assessment is used for formative purposes. Those opposed to the summative value of PBL assessment state that evaluation of cognitive and behavioral skills during small group work is subjective. Tutor assessment of students, described herein (table 1) is used for both, summative and formative evaluation. We believe that the teacher's summative assessment should always include a formative component. If both forms of assessment are based on defined criteria, subjectivity can be somewhat reduced and variability of the evaluations across instructors can also be reduced. Using focus groups and a questionnaire administered to students in a PBL curriculum, Willis[14] reported that his students supported summative assessment of PBL groups. In addition, students in the Willis study felt that summative assessment of PBL should also measure behavior (attitude) that contributes to motivation of the group process and cognitive skills relating to the content of the group discussion.

At first glance, the criterion-referenced system presented may seem cumbersome or too time consuming. However, one must consider its advantages. Our criterion-referenced system has set objective standards for student performance. Second, it has helped to guide teachers and students during the PBL process. Third, it has fostered feedback to students, and fourth, it has helped identify students with critical thinking and decision-making deficiencies, allowing teachers to focus on individual students.

Our long-term intent is to use these checklists as our 'gold standard´ for assessing tutorials of all PBL courses in the curriculum. With the five rubrics, criterion within each can be adapted according to the type of course and the course objectives.

The learning strategy used in a course must keep coherence with the content area and with the evaluation system. Hence, PBL assessment should focus not only on the process itself, but also on the outcomes: it should incorporate both, course objectives and those fostered by PBL. All three domains of assessment within the classroom, as well as both types of

objectives are included in the criterion-based assessment tool presented (i.e. tutor assessment of students, self-assessment and peer-assessment). Self and peer review are learning experiences, in and of themselves. They promote the development of reflective skills that are required for self-directed, life-long learning of prospective physicians. The checklists described herein, are tools to assess attainment of acceptable standards of performance during PBL tutorials.

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# Bridging the Gap Between the Scientific and Societal Aspects of Medical Education

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## ABSTRACT

Integrated assessments which are aligned with learning objectives and teaching methods may help to reinforce the linkage of the medical sciences with the professional practice of medicine. In the existing discipline-based medicine program at the University of New South Wales, a project-based assessment in pathology was introduced in 1996, which required students to focus on the cost vs. benefit of investigative procedures. Students have performed well in this individualized assessment, which has experiential and reflective components and is highly rated as a learning exercise. In the new integrated medicine program commencing in 2004, students will undertake a series of project-based assessments linking medical sciences to societal aspects of health and disease. Whether undertaking such assessments contributes to a long-term change in clinical behaviour will require follow-up with graduates from our new program.

## INTRODUCTION

How can we encourage our students to more clearly see the connection between the scientific foundations of medicine and the practice of their profession in the real world? Modern medical school curricula increasingly emphasize societal aspects of disease; public health issues related to screening for and control of diseases; ethical practice of medicine; relationship to allied health professionals; issues related to the availability of healthcare resources and infrastructure; and considerations of cost vs. benefit of diagnostic and therapeutic procedures and interventions. However, students do not necessarily see such issues in the context of scientific medicine. Compartmentalization of learning may lead to an inadequate view of medical practice as being either scientific or social in its intent.

Provided that learning about societal issues in medical practice is integrated with learning about the science of medicine, assessment that is similarly integrated may help to reinforce the linkage of the medical sciences with societal, public health, ethical, resource and cost-benefit considerations. Such "constructive alignment" between objectives, teaching methods and assessment helps to drive deep learning.[1] In this paper, we describe our successful implementation of such integrated project assessment in pathology and our plans to use it more extensively in the new medicine program at the University of New South Wales (UNSW).

### Program Description

The existing UNSW Medicine program is a six-year post-high school entry program, with approximately 210 students enrolled each year. Teaching is largely discipline-based and pathology is taught in the third and fourth years. In third year practical classes, the Department of Pathology has long emphasized appropriate use of diagnostic investigations and the costs associated with their use. To concentrate the minds of students on this issue during their fourth year, which primarily involves clinical training, an innovative project assessment was introduced in 1996. This requires students to discuss the pathologic basis of disease through the study of an individual case and, specifically, to demonstrate an understanding of the role of pathology services in a hospital inpatient setting. Students submit a project report, which is limited to 2,500 words. They are encouraged to discuss the suitability of the case they have chosen as well as the approach to presentation with a pathology tutor. The medical record number of the patient they have selected must be registered with the clinical school administration. As a consequence, projects are unique and self-renewing from one year to the next.

## MATERIALS AND METHODS

Marking of the project is based on the extent to which it satisfies each of five objectives, about which students are advised at the beginning of the year as follows:

1) A clear demonstration of the pathologic processes underlying the clinical features of the case.

**Table 1.** Student perceptions of the Pathology project

| Question | Median rating (lower and upper quartile) | Mean rating |
|---|---|---|
| Did the Pathology project help you to attain a greater appreciation for the role of the pathology laboratory in patient care? | 4 (4,4) | 3.9 |
| Did the Pathology project help you to attain a greater understanding of investigative procedures and their interpretation? | 4 (4,4) | 4.0 |
| Did the Pathology project help you to attain a greater appreciation of cost vs benefit in the use of medical tests? | 4 (3,4) | 3.8 |
| Do you think that the experience of completing the Pathology project will change your test-ordering behaviour as a practising doctor? | 4 (3,4) | 3.6 |

Ratings were on a scale from 1 (strongly disagree) to 5 (strongly agree).

2) A detailed discussion of three investigative procedures performed, which *must* include:
   - An imaging procedure that provided information about pathological changes at a macroscopic level.
   - A cell or tissue sampling procedure that provided information at a microscopic level.
   - Any other investigation that provided additional relevant information about the disease process e.g. in terms of biochemical, microbiologic, hematologic or immunologic abnormalities. This need not necessarily have yielded an abnormal finding.

   The discussion should include a brief explanation of the investigative procedures, and a commentary upon the ways in which the results obtained were interpreted.
3) A cost-benefit analysis of pathology tests performed on the individual during the period of admission to hospital, which examines whether and in what way the results of such tests influenced the management of the patient.
4) Appropriate and demonstrable use of the current medical literature to support the project report.
5) Clear expression and evidence of critical evaluation.

For each objective, a score of zero may be awarded if the report failed to adequately address the objective; one if it satisfactorily addressed the objective; and two if it addressed the objective well. There is no provision for half marks. The student manual includes multiple examples of projects that scored ten out of ten. Clear guidelines are given to graders, who are primarily hospital-based diagnostic pathologists. Each marker grades five-ten projects each year.

Several characteristics of the design of this assessment may help students to see the connections between basic science and real world practice. Notably, the project requires interaction with clinicians involved in the case, so that students are empowered to ask why senior medical staff made the decisions that they did. The task is based on a real patient they have clerked, so is experiential in nature, and it allows considerable autonomy and ownership – with the accompanying responsibility – because students have to think about and select a case that is best going to demonstrate the issues. In addition, there is ample time for reflection as they have over 6 months in which to complete the project. The assessment thus requires student engagement and evidence of learning that achieves at least the fourth (relational) level of Biggs' SOLO taxonomy.[2]

## RESULTS

Students invest considerable effort in writing their reports, at least in part because the project is worth 20% of the barrier assessment in pathology at the end of the fourth year of the program. The submissions are frequently reflective essays of high quality. Cost-benefit issues are usually particularly well addressed, with often stern criticism of the overuse of blood counts, clinical chemistry and imaging procedures.

Using the criterion-referenced approach to marking, in the years 1996-2002 over 60% of students (69.8 ± 3.7, mean ± S.D.) scored eight or more out of ten for the project (range five-ten, median score eight, lower quartile seven, upper quartile nine). In end-of-year evaluations from 2000-2002, students rated the project highly as a learning exercise, with a median rating of five (lower quartile four, upper quartile six) on a scale from one (least favourable) to seven (most favourable).

As summarized in Table 1, students responding to a questionnaire indicated that undertaking the project significantly altered their perceptions of the role of the pathology laboratory, their understanding and interpretation of diagnostic tests, as well as their appreciation of the cost vs. benefit of investigations. They also believed that the exposure to critical analysis of investigations was likely to alter their test-ordering behaviour as practicing doctors. Many students offered additional comments indicating that they felt the project ought to be given a greater mark weighting.

**Table 2.** Perspectives for cross-disciplinary project reports

| List A | List B |
|---|---|
| Relevant normal anatomy and its use in interpretation of clinical manifestations and findings on imaging | Social and behavioural factors contributing to maintenance of health or development of disease |
| Relevant normal physiology or biochemistry and its use in interpretation of clinical manifestations and investigative findings | Screening programs for disease |
| A critical cost-benefit analysis of diagnostic tests performed and the way in which their results influence management | Ethical issues in the particular clinical setting |
| Relevant microbiology and its correlation with clinical manifestations | Impact on the individual patient or the community |
| Underlying pathological processes and their correlation with clinical manifestations | Healthcare policy issues in the particular clinical setting |
| Relevant pharmacology and its correlation with approaches to management | Role of allied health professions and/or alternative medicine in the management of the clinical problem |

## CONCLUSIONS

Encouraged by the results to date, we now plan to extend the use of project-based correlative assessments in the new medicine program which commences at UNSW in 2004. Teaching in the new program will not be discipline-based, but will be scenario-based to encourage students to link a variety of biomedical sciences with relevant considerations of professional practice, healthcare policy and societal issues surrounding health and disease. Students will submit four project reports during Phase 2 of the new program (extending from early third year to approximately the middle of fourth year) of which at least one must be an individual report and at least one a group/team project. At least one project must focus on a population health or a community medicine issue and at least two must be based on individual patients clerked during the year and identified by medical record numbers. The project will be marked as above for the extent to which it addresses each of the following five (suitably modified) objectives:

1) a summary of the clinical problem or population health issue on which the project is focused.
2) a detailed discussion of one perspective from List A in Table 2.
3) a detailed discussion of one perspective from List B in Table 2 – each project submitted by an individual student must address a different perspective from *each* of these lists.
4) appropriate and demonstrable use of the current medical literature to support the project report.
5) clear expression and evidence of critical evaluation.

Students will be advised that their reports should demonstrate integration and correlation of prior and current learning. They will be required to satisfactorily complete all projects in order to progress to Phase 3.

A key question is how to evaluate outcomes beyond the immediate assessment. How can we know whether these integrative assessments really change how our students think about disciplinary inter-relationships beyond the biomedical sciences? In implementing this approach in pathology, focusing on the rational use of investigations, we were cognisant of the multiple interacting factors that impact upon attempts to change medical practitioners' test-ordering behaviour.[3] Trying to achieve behavioural change through a set of project assessments may be optimistic. However, as has long been recognized, "From our students' point of view, the assessment always defines the actual curriculum".[4] Thus a carefully developed assessment tool such as the one described in this paper should certainly convey a powerful message and is a theoretically sound way of trying to bridge the gap between the scientific and societal aspects of medical education. Evaluation of whether undertaking such assessments contributes to a long-term change in clinical behaviour will require follow-up of graduates from our new program.

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# What Are Classroom Management Issues For Undergraduate Science Teaching Assistants?

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**ABSTRACT**

The purpose of this study was to explore and discover classroom management problems encountered by undergraduate science teaching assistants (TAs). Information about TA perceptions of classroom management problems was obtained to better understand how gender, teaching experience, and academic discipline affected their classroom management experiences. Study subjects consisted of 25 TAs in various science departments (e.g. physics, chemistry, and biology) at a large Midwestern University. Sixty percent (n=15) of them were male, and forty percent (n=10) were female. Regarding subjects' teaching experience with undergraduate level students, twenty percent (n=5) of them possessed three years or more teaching experience, forty percent (n=10) had teaching experience between one and three years, and the other forty percent (n=10) had a teaching experience of one year at the time of the study. An Email survey was used for data collection from 125 graduate TAs in various science departments. TAs' responded to ten challenging student behaviors in the classroom that were developed from DiGiulio's (1995) questionnaire. Results from this study reveal a variance in classroom management problems were primarily due to TA type (United States Teaching Assistants or International Teaching Assistants).

## INTRODUCTION

Graduate students serving as teaching assistants (TAs), especially science (e.g. physics, biology, and chemistry) TAs have become increasingly responsible for much of the instruction occurring at the undergraduate level at many universities in the United States.[1] According to Jackson and Simpson,[2] a large percentage of TAs are serving as primary instructors in addition to laboratory instructors. Rosati (unpublished paper) reported that in some universities (e.g. Yale), the proportion of undergraduate instruction delivered by science TAs has reached more than 50%. Allen and Reuter;[1] Cano, Hones and Chism (unpublished report); Pica, Barnes and Finger,[3] all discovered that TAs play a major role in undergraduate instruction, many institutions have implemented training programs to prepare TAs for grading tests and papers, holding office hours, supervising laboratories, leading recitations, and/or assuming full responsibility of a course. However in contrast to this role, very little research has been conducted on factors that influence TA teaching effectiveness.

The purpose of this study is to explore factors that affect TA effectiveness by examining classroom management problems encountered by TAs. This study was conducted to accumulate information about TA's perceptions of their classroom management problems that they experienced in their undergraduate instructional activities.

Specifically, this study was conducted to address the following three research questions:

1. What are the similarities and differences in classroom management issues experienced between male and females TAs?
2. What student attitudes are of concern to science TAs?
3. What are similarities and differences between United States Teaching Assistants (USTAs) and International Teaching Assistants (ITAs) with respect to solving classroom problems?

In this study, a TA is characterized as a graduate student employed as a teaching assistant. An ITA is a graduate student born and previously educated outside the United States. In contrast, a USTA is a graduate student born and educated in the United States. Classroom management is defined as the task of planning, organizing, motivating, and controlling college classroom environments.[4]

### TA Type

Allen and Rueter,[1] report that universities are focusing more on developing training programs to help prepare TAs for their classroom responsibilities. They also found that some

TA training programs are designed specifically for the needs of ITAs. These programs emphasize teaching style, educational and cultural differences, and English proficiency. While studying as an International student for four years I have witnessed, on many occasions, that ITAs are unaware of U.S. educational settings and the nature of interactive teaching in a U.S. classroom environment. ITAs usually see their responsibilities as conveying information and for this reason approach teaching more formally, as opposed to the more interactive ways of the USTAs. Many ITAs experience major obstacles related to their undergraduate educational background, such as lack of speaking English effectively and differences in cultural expectations.[5]

Many people assume that international teaching assistants perceive and experience more problems in classroom than do USTAs.[6] Ronkowski,[7] focused on the differences and similarities between USTAs and ITAs in terms of teaching style, expectations of students, and views on the TA-student relationship. Results from this study revealed more similarities than differences between the two types of TAs.[7] He concluded that differences in experiences and perceptions between ITAs and USTAs were of degree and not of kind. Twale, Shannon, and Moore,[6] investigated TA's self-ratings and students' ratings of native-speaking TAs and ITAs on a total of nine teaching effectiveness factors. Their results showed that international TA's self-ratings were significantly higher than USTA's self-ratings. However, students' ratings of USTAs were significantly higher than their ratings of ITAs. The findings revealed by the current study indirectly suggested that cultural differences influence both USTA's and ITA's perceptions of classroom management.

**Gender**

Gender has been reported to have a significant influence on classroom interactions between TAs and students. Boggs and Wiemann, (unpublished Eric document) reported that student gender influenced academic faculty member-student interactions. They cited that male graduate students spoke more frequently in class and for longer periods. It has been reported that they tended to interrupt female students and professors more frequently in classes taught by female instructors than male instructors.[8] In Brook's[8] study, they found male professors were judged favorably when they spent a large proportion of class time presenting material and information and when the amount of input by students was high. In contrast, female professors were evaluated negatively when using an interactive teaching style with involvement of their personalities in the learning process. The authors suggested that students might have perceived female professors' interactive style as lacking competence in the subject matter. These findings suggest that gender may play a significant role in TA's classroom management experiences.

**Teaching Experience**

The work of Prieto and Altmaier[10] and Davis[5] shows that TAs with more teaching experience reported higher levels of self-efficacy toward teaching, and are rated more highly by their students than those with less experience. In their study of the impact of teaching experience on TA's teaching effectiveness, Shannon, Twale, and Moore[6] divided TA's teaching experiences into three categories: 1) no previous teaching experience, 2) college teaching experience, and 3) K-12 teaching experience. They concluded that TAs with K-12 or college teaching experience were rated as more effective than those without such experience. However, the authors suggested that poor or nonexistent supervision may have affected these findings. We suspect that if TAs do not have any teaching experience, their responses to students coming to class unprepared, missing class, failing to complete homework, or not participating in class may be adversely affected. In contrast, TAs with teaching experience may be more able to identify and find possible solutions to undesirable student behaviors. Therefore, we expect TAs with previous teaching experience to report fewer problems than TAs with no previous teaching experience.

Austin[11] noted that researchers have reported disciplinary differences in teaching and learning in higher education. In addition, faculties teach and conduct research in a cultural context of their particular discipline and institution. Instructors from different disciplines differ in attitudes and personal characteristics. We assume that, based on the findings of previous research on classroom management problems, the academic discipline may influence how TAs handles classroom management issues.

## MATERIALS AND METHODS

**Participants**

Before beginning the study, an IRB approval to survey human subjects was secured. A sample of 125 individuals who received the Email regarding this study were selected using a stratified random sampling from a list of over 450 TAs employed by the university during our set time period. Then an Email was sent to 125 graduate TAs in science (physics, biology, and chemistry) departments at a large midwestern research university. Twenty-five graduate TAs who hold positions in various science departments responded to the survey. We did not attempt a follow-up email because the response number was considered sufficient for the study. Eighteen (70%) were USTAs and seven (30%) were ITAs. Sixty percent were male, and forty percent were female. Our subgroups were the science departments of physics, chemistry, and biology. A blank survey was sent to 125 TAs. Each TA was asked to respond to a ten item-questionnaire (Table 1). The questionnaires consisted of self-assessment items related to classroom instruction and were items selected from published literature. The specific items in the questionnaire were developed from DiGiulio's questionnaire.[9]

## RESULTS

The top five classroom management problems encountered by all TAs were: 1) student comes to class unprepared, 2) student missing classes, 3) student coming to class late, 4) student eating and/or drinking during the class, and 5) student challenging the instructor's comments or lecture. Also included are the top five classroom management problems reported by USTAs and ITAs. Four of the top five classroom management problems experienced by USTAs were also experience by ITAs. However, each type of TA experienced different behavior problems. USTAs reported problems with students who pack up before the class is over and with students who read non-class materials during class. On the other hand, ITA reported having to deal with students who make offensive personal comments to them.

As shown in Table 1, USTAs and ITAs each reported differing student behaviors to be of high concern; USTAs reported the following: Students pack up before class is over. ITAs reported student's behavior as missed classes. In addition, Table 2 indicates the most important differences between male/female USTAs and ITAs. For instance, male USTAs reported four different student behaviors that were not reported by male ITAs: students eating and/or drinking in the class, students packing up before the class is over, students flirting with other students, and students reading non class materials in the class. If compared to the classroom behaviors experienced by male ITAs and female ITAs, students packing up before the class is over and students reading non- class materials in class are classroom behaviors never encountered by both male and female ITAs.

**Table 1.** Top Five Classroom Management Problems experienced by TA

| Problems | All TA (N=25) | USTA (N=18) | ITA (N=7) |
|---|---|---|---|
| Student comes to class unprepared.*+ | 97.7% | 98.2% | 92.6% |
| Student misses classes.* | 85.9% | 90.7% | 75.0% |
| Student comes to class late.*+ | 83.6% | 88.0% | 73.9% |
| Student is eating and/or Drinking during the class.*+ | 63.2% | 64.3% | 60.0% |
| Student challenges my comments Or lecture.*+ | 46.4% | 35.0% | 75.0% |
| Student packs up books before the class is over.+ | 45.3% | 20.5% | --- |
| Student blames me for his/her unsuccessful performance. | 32.6% | 30.0% | 37.5% |
| Student flirts with other students. | 30.0% | 37.5% | 16.7% |
| Student reads *Indiana Daily Service* or other non-class materials in class. | 15.0% | 20.7% | --- |
| Student makes comments that are Offensive to me | 9.70% | --- | 27.0% |

*Notes:* The items listed with frequencies indicate the top five classroom management problems reported by all TA, USTA, and ITA respectively. *These are the top five classroom management problems that were of the high concern to ITA. + These are the top five classroom management problems that were of the high concern to USTA.

## DISCUSSION AND CONCLUSIONS

In this study, undergraduate classroom management problems as perceived by TAs' were investigated. TAs' responses to ten student classroom behaviors described in the survey instrument were used to assess: 1 differences between USTAs and ITAs, 2 gender differences, and 3 disciplinary differences.

The differences found between USTAs and ITAs on student classroom behaviors may be based on TA's educational backgrounds, previous experiences, or perspectives on students. It can also be explained by the differences between the U.S. and international educational systems and cultures. In Althen's (unpublished report) paper, because the U.S. culture values discussion and divergent thinking student behaviors such as "Student challenges my comments or lecture," and "Student makes offensive comments to me during lecture" were of little concern to UTSAs.

Four of the top five classroom management problems experienced by USTAs were also experienced by ITAs. There were three differing classroom management problems reported by each TA group. USTAs reported students who pack up their books before the class was over, whereas ITAs reported problems with students missing class, and students who made offensive comments.

Table 2 presents the gender differences concerning classroom management problems. Female TAs, from both groups (ITAs and USTAs), reported experiencing four different student behaviors than male TAs from both groups: 1 student comes to class unprepared; 2 student misses the class; 3 student comes to class late; and 4 student is eating and/or drinking during class. On the other hand, Male USTA reported six different student behaviors than male ITAs. Briefly, these are associated with students who miss the class, comes to class late, eats/drinks in class, and reads other materials.

When comparing female USTAs to female ITAs, we have found that more female USTAs than female ITAs reported experiencing three student behaviors that are problems: students who comes late, miss class, and students that pack up before the class is over. Similarly, male USTAs differed from male ITAs on four student behavior problems: student eating and/or drinking in the class during the lecture, student packs up the books before the class is over, student flirting with other students, and students reading other non-class materials (e.g. Daily Newspaper) in class.

**Table 2.** Comparison of Male and Female USTAs vs. Male and Female ITAs on Student Behaviors

| | M.USTA | M.ITA | F.USTA | F.ITA |
|---|---|---|---|---|
| Student Behaviors | (N=6) | (N=4) | (N=11) | (N=4) |
| Student comes to class unprepared. | 75% | 75% | 100% | 75% |
| Student misses class. | 75% | 50% | 89% | 75% |
| Student comes to class late. | 75% | 50% | 78% | 75% |
| Student is eating and/or drinking during the class. | 75% | 0% | 56% | 75% |
| Student challenges My comments or Lecture. | 25% | 75% | 18% | 25% |
| Student packs up books before the class is over. | 50% | 0% | 44% | 0% |
| Student blames me for his/her unsuccessful performance. | 50% | 25% | 10% | 25% |
| Student flirts with other students. | 17% | 0% | 20% | 50% |
| Student reads *Indiana Daily Service* or other non-class materials in class. | 33% | 0% | 0% | 0% |
| Student makes comments that are offensive to me. | 20% | 25% | 0% | 0% |

Three variables (e.g. TA type, gender, and academic discipline) relative to TA's classroom management problems were studied. In this study, USTAs reported significantly more classroom management problems than ITAs. Although "learning can take place in the absence of good learning" Welch,[12] good teaching plays a definite role in teaching. The results of this study provide specific information about TA's perceptions of classroom management concerns. TA's responses to open-ended questions in the survey revealed some interesting findings. For example, one TA wrote, "Students have a rather casual attitude toward education and authority, but I wouldn't say it is a problem. It is only problem when they are disruptive…". One of the primary goals of classroom management is to provide the best conditions and climate for learning.[9, 13]

Based on the results from this study, TAs can anticipate potential problems in terms of classroom management. Administration must be committed to providing TAs with quality classroom management instruction. We propose the following: 1 we should train all graduate TAs because they have a significant role in higher education. 2 we should help ITAs to better understand U.S. classroom culture in terms of the U.S. educational system, in elementary and secondary schools (such as ITAs should become familiar with a more teacher oriented classroom style), in order to more effectively communicate with American students. 3 we should provide both USTAs and ITAs with instructional techniques. Teaching relies strongly on a communication process between the teacher and students.[9] Although students are expected to attend class prepared for class discussions, TAs need to challenge and motivate students in order to facilitate the learning process. For that reason, TAs should be provided with at least one instructional course from the Department of Education to learn about instructional techniques and other instructional information that he/she will need to use in the classroom (e.g. how to handle a student if he/she is coming late or being obstructive).

TA developers might use the findings to improve TA training programs. New TAs can be provided with the mock classroom management problems they are likely to experience. This study describes the investigation of TA's classroom management problems in terms of TA type, gender, and academic discipline. The results of this study provide specific information for TAs training programs that helps TA to improve their teaching skills and effectiveness.

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# Virtual Lectures: A New Teaching Format For The Medical School Curriculum

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**ABSTRACT**

Macromedia's authoring programs Flash and Director have been combined to produce virtual lectures in which animated drawings are synchronized with a lecturer's remarks. Virtual lectures can be distributed with a verbatim transcript of the lecturer's remarks. Virtual lectures improve upon live lectures by teaching mainly through visual means, which enhances comprehension and recall. Second, they transform the lecture format from a passive to an active learning process because virtual lectures can be studied in association with textbooks, websites, or the contributions of fellow students. Third, they address potential apprehension by students that material may be missed or misunderstood during a lecture. It is possible that student recognition of convenience, better time management, greater comprehension and improved recall will all ultimately lead to the substitution of many, if not most, live lectures during the preclinical years by virtual lectures.

**INTRODUCTION**

For the past 20 years computer manufacturers and software developers have promised that information technology will transform how students of all ages learn in the future.[1] That promise is rapidly becoming reality, as evidenced by the recent explosion of distance learning programs in traditional colleges and universities and the emergence of online universities.[2] In the world of medical education, software development lags behind hardware acquisition. Medical educators world-wide are only now beginning to use authoring programs such as PowerPoint®, Flash®, Director®, and Authorware® to merge text, animated drawings, digital video and sound tracks into dynamic, highly interactive educational products.[3-5] As the educational value and entertainment index of these programs increase, computer-based programs will begin to seriously compete in both efficiency and effectiveness with textbooks, live lectures, and even face-to-face small group exercises.

In this article I will describe how I am using the authoring programs Flash and Director to produce virtual lectures in histology and gross anatomy. I will also address the impact that information technology will soon have on medical education. Basically, I believe that information technology will change our world from one in which the best and most up-to-date medical information has been restricted to a privileged few at a comparatively high cost to one in which the information is available to almost everyone at very low cost. The best and most current medical information has been limited until recently to a privileged few because it has been available through the teachings of medical educators at only the best medical schools in the world. That restriction is no longer a necessary fact of life because the Internet can bring the words and visual aids of any medical educator into any computer in the world with broadband access to the Internet. Everyone will ultimately have access to the teachings of the best instructors in the world for each basic science and clinical field. Emphasis on teaching the basic sciences and clinical fields in medical school will shift toward tutoring students on how to transform medical information into medical knowledge, and subsequently from medical knowledge to clinical expertise.

Flash and Director are authoring programs produced by Macromedia. Flash is particularly suited for the production of animated figures. Using Flash, images can be moved along defined paths, rendered semitransparent or completely faded out of view, and changed in shape and color. Flash is currently used to prepare almost all of the animations in websites. Director enables an author to direct the production of his/her own movies; hence, its name. In particular, Director can be used to synchronize Flash-generated animated drawings with audio tracks. Furthermore, Director permits programming that allows student interactivity. Director movies can be saved in a format called projectors that are suited especially for the distribution of educational software because they can be played as self-running

  

application files (that is, files that do not require inherent software at the user's end).

Whereas Flash can be self-taught in a few weeks, the use of Director requires considerably more study if the user does not have prior experience writing code for authoring programs. However, when I was introduced to Flash and Director five years ago, I was surprised most by the fact that the basic features of these icon-based authoring programs can be mastered by a teacher within only a few weeks to a few months. These programs quickly empower a teacher to prepare his/her own educational software. In other words, we have entered the era in which teachers at all levels of education can not only serve as content experts but also as graphic artists and programmers in the production of educational software.

It is plausible that individual medical educators or small teams of medical educators will develop most of the best educational software produced in the next 20 years. Such individual and team enterprises will each have the means to produce, market, and distribute their software worldwide at relatively low cost. It is also likely that reliance by medical students on this software as their best source of medical information will increase with each passing year. At some point within the next 20 years, therefore, I believe that a crucial nexus will be attained, namely, recognition by both the medical educators and the medical students at every medical school that the educational software in certain fields produced by educators at other medical schools is decidedly superior to the programs or software offered by their own medical school. As that nexus approaches, it is likely that the teaching responsibilities of basic and clinical science instructors at every medical school will change. Instructors who have not produced high quality software products will be required to integrate other schools' software into their courses.

The effect of information technology on the live lecture format will play a leading role in this dramatic change. I like live lectures: I liked them as a student, and I like them now as a teacher. Live lectures enable an expert in a given field to use plain language as he/she introduces students to the central facts or themes under study. Watching an animated, skilled lecturer who knows how to use imaginative audiovisual aids in his/her presentation can be a stimulating and long-remembered experience.

As an instructor with 27 years of experience lecturing on gross anatomy, I also recognize, however, that live lectures have their limitations. First and foremost, it is frankly impossible for most medical students to remember the bulk of the information presented during a 50-minute lecture. In other words, although live lectures are extremely effective and efficient in introducing students to an area of study, they are neither effective nor efficient in helping students study the details or concepts of the area. Second, students seated in the back half of a large lecture hall do not see audiovisual aids as clearly as those in the front seats. Even if images (such as PowerPoint slides) are kept simple and labeled with large text, students rarely have more than a few minutes to study an image before the lecturer proceeds to the next topic and image. Third, even when a lecturer takes care to speak slowly and clearly, some students may miss or misunderstand the lecturer's remarks and thus take either incomplete or incorrect notes. Students are always presented with the conundrum of whether to just sit and listen in order to understand the central theme of the lecturer's presentation or to intermittently suspend listening in order to take notes on details.

Therefore, when I was first introduced to Flash and Director 5 years ago, my first thought was that these two authoring programs could be combined to produce virtual lectures that not only correct for the limitations of live lectures but also introduce a new and stimulating feature to the lecture format: the synchronization of animated drawings with a lecturer's remarks. Virtual lectures are not digital recordings of a live lecture, but rather lectures created in the virtual world of computers. If virtual lectures are distributed with a verbatim transcript of the lecturer's remarks, students are given three different ways to learn the subject matter: listening to the lecturer, watching the animations, and reading a verbatim transcript of the lecturer's remarks. In other words, virtual lectures accommodate three different types of learners: the auditory learner, the visual learner, and the textual learner.

## GUIDELINES FOR VIRTUAL LECTURES

I have used Director's capability to synchronize Flash-generated animations with audio tracks to produce virtual lectures on histology and gross anatomy. At the time of writing this article, I have completed eight virtual lectures on the histology of the digestive system and am working on the seventh of eight virtual lectures on the gross anatomy of the lower limb. I have adopted five principal guidelines in the preparation of these virtual lectures:

**(1) Make the lecture format an active learning process by dividing virtual lectures into 1 to 3-minute long segments called scenes.** A period of 1 to 3 minutes is generally sufficient to introduce and explain a topic or concept in a lecture. Stopping virtual lectures at the ends of scenes gives students not only the flexibility to match the pace of the lectures with their learning ability but also the capacity to change the lecture format to better fit their learning style. At the end of each scene, students have several options: go back over the scene again; proceed directly to the next scene; take notes; refer to other materials, such as a textbook or a website; or (if two or more students are watching the lecture together) discuss the scene with the other students. Virtual lectures are thus an improvement over live lectures because they afford students the opportunity to transform the lecture format into an active learning process.

**(2) Title the scenes in each virtual lecture and list the titles in a menu at the beginning of the lecture.** The titles essentially provide a bulleted list of the main topics that will be discussed in each virtual lecture. The menu at the

beginning of the lecture also serves as an aid for review, as it permits students to quickly jump to any scene in the lecture.

**(3) Include animated drawings in almost every scene.** The importance of this guideline cannot be over-emphasized. It is critically important because it takes advantage of the fact that most people are better visual learners than auditory learners.[6] The literal translation of the ancient Chinese proverb says it best: A picture's meaning can express ten thousand words. It follows that an animated sequence of pictures can convey even more.

Animated drawings are particularly effective for teaching subject matter involving movements, such as the patterns of blood and bile flow in classic liver lobules, the vesicular transport of IgA into the lumen of the digestive tract, or the relative movements of the lower limbs during the walking gait. In discussions of structural anatomy (such as the histological architecture of a tissue or the gross structure of a synovial joint), where there is not any movement to be illustrated, animation can be applied by constructing a drawing of a microscopic region or gross structure in a stepwise fashion. Different parts of the drawing and their attendant labels are sequentially brought into view to create the sensation of animation and depth.

**(4) Attempt to illustrate in the final image of a scene all the important facts, relationships, and concepts discussed in the scene.** In other words, the final image should summarize the chief topics addressed in the scene. This guideline resolves the problem in live lectures of students having insufficient time to study a slide before the lecturer proceeds to the next topic and slide. It should be noted, however, that there are instances when the chief feature of a scene is an animation instead of just a static drawing or the final image cannot adequately display all the drawings presented during a scene. In such instances, students can still review the animation or other drawings at the end of a scene because Director's programming tools make it possible to switch back-and-forth between the final image of a scene and one or more animations and drawings.

**(5) Distribute a verbatim hard copy of the lecturer's remarks with the software.** This feature particularly helps textual learners. Because reference to the hard copy is the quickest way to access the subject matter discussed in a scene, it is the feature most likely to be used when students review a lecture in preparation for an examination.

## DISCUSSION

As a tool used by students to learn information, it is likely that virtual lectures will prove to be more efficient and effective than all other instruments. First and foremost, they are lectures, which, until the advent of information technology in the late 20th Century, were the most efficient tool for conveying information. Virtual lectures improve upon live lectures by teaching mainly through visual means (that is, through animation), which enhances comprehension and recall (6). Second, they transform the lecture format from a passive to an active learning process. Third, they address potential apprehension by students that material was missed or misunderstood during lecture.

The most important and distinctive feature of virtual lectures is their presentation of animated drawings in synchrony with a lecturer's remarks. A personal story bears telling at this point, because it explains why I believe that this feature significantly improves comprehension and recall. The first virtual lecture I prepared with Flash and Director was a lecture on the histology of the liver. As I developed the storyboards for the scenes, I thought that an interesting way to emphasize the fact that the endothelial cells lining the hepatic sinusoids are densely fenestrated would be to discuss how the fenestrations permit the exchange of lipoprotein particles between the liver's hepatocytes and the portal circulation. Although I had researched and written an article on lipoprotein metabolism about a year prior to beginning the virtual lecture on liver histology, I was chagrined to discover that within that year's time I had forgotten much of what I had written, mainly because none of my annual teaching activities include discussion of lipoprotein metabolism. Therefore, I had to read my own article to refresh my memory before I could prepare an animation showing how lipids are exchanged among VLDL particles, HDL particles, and cells as the lipoprotein particles pass through the capillary beds of extrahepatic tissues and how this exchange of lipids transforms the VLDL particles into IDL particles. It is now 5 years since I prepared that animation, and I can still recall every salient fact because it is very easy for me to replay in my mind EVERY ANIMATED STEP of that scene. The experience of preparing this scene affirmed for me the fact that most of us understand better and remember longer what we see and do than what we hear or read.

The major drawback of virtual lectures is that they deny students the opportunity to ask questions of a lecturer in real time. Questions have to be deferred to either email or a scheduled question-and-answer session. This drawback does limit the value of virtual lectures in small classes (classes of 30 or fewer students). In a small class, the give-and-take between a lecturer and the students is valuable because it permits the lecturer to address individual needs and problems; interest in and appreciation of the subject matter increases because education becomes personalized. Such personalization, however, becomes increasingly difficult as class size increases. In classes of 100 or more students, everyone recognizes that, up to now, the live lecture format has been basically the only practical way for every student to take advantage of an instructor's teachings. Virtual lectures, however, provide a better alternative to teaching large classes. It is thus likely that the extent to which virtual lectures replace live lectures in medical school and allied health courses will be a function of class size, with the guideline being that the larger the class size, the greater the value of virtual lectures.

As a tool used by medical educators to teach, virtual lectures elevate the curriculum to new levels. The curriculum of the

pre-clinical years no longer has to be a dense schedule of live lectures through which students are introduced in lock step to narrowly defined disciplines, such as the various anatomical sciences, biochemistry, physiology, immunology, and pharmacology. Teachers are freed to use virtual lectures in combination with other educational tools (textbooks, websites, problem-based exercises) to focus student effort on using medical information to acquire medical knowledge and to develop clinical skills. As described by Newby et al.[7] in their book *Instructional Technology for Teaching and Learning*, information technology provides the means by which teachers' roles will "shift from the 'sage on the stage' to the 'guide on the side'. Instead of conveying information, they will help learners make use of new information tools to find, analyze, and synthesize information; to solve problems; to think creatively; and to construct their own understandings."

Medical educators, in particular, are also freed to explore integration of their courses both horizontally (within an academic year) and vertically (across academic years). Because virtual lectures make it convenient and easy for teachers to learn what is being taught in other courses, virtual lectures may accelerate the trend of teaching the basic sciences from a more integrated perspective. For example, virtual lectures could greatly assist a team of basic science teachers (consisting of a gross anatomist, histologist, biochemist, physiologist, and immunologist) to work with a gastroenterologist to create a program where first-year medical students learn from a team of basic science teachers the gastroenterology view of the digestive system. Such an approach would present basic science material in its most relevant perspective.

Despite all the lofty pedagogical benefits of virtual lectures just cited for both students and teachers, it would not be surprising if convenience and time management prove to be the principal factors that bring virtual lectures into the medical school curriculum. With virtual lectures, students can enjoy all the benefits of live lectures from the convenience and comfort of their own home or a place of their choosing. It is difficult to believe that most students will choose to slog through inclement weather and congested traffic to attend an 8:00 AM lecture in a cramped and stuffy lecture hall if the alternative is to walk into the kitchen nook, study, or bedroom at home and turn on the computer to 'attend' a virtual lecture. This choice should only grow in popularity as students come to recognize the time-saving nature of asynchronous and distance learning. Although almost all of my students evaluate me as a superior lecturer, I believe, nonetheless, that most students a decade from now will prefer virtual performances of my efforts to that of live ones, mainly because of the convenience and the time saved in 'attending' a virtual lecture. The truth be told, if I were a student right now, I would prefer my virtual lectures; that is why I am working on them.

There are, however, several factors that will impede the development of virtual lectures and their introduction into the medical school curriculum. Quality virtual lectures require hundreds of hours to complete. Moreover, there is very little financial incentive to undertake such efforts. Apprehension by both faculty and deans, however, is the greatest impediment. Although I have been judged to be a superior lecturer throughout most of my teaching career, I am not the best or second best basic science teacher in my school; at best, I am tied for third or fourth position with a number of other instructors. If I were not an advocate of virtual lectures, I would probably perceive the replacement of my live lectures by someone else's virtual lectures as a threat, if not to my livelihood, then certainly to my professional self-esteem. If I were a dean of academic affairs contemplating the introduction of virtual lectures, I would be confronted with a multitude of issues:

- How will the school fill the hours in the first and second years previously occupied by live lectures?
- How can senior teaching faculty be encouraged to adapt to the use of virtual lectures?
- Do teaching faculty need to know more about information technology than the use of PowerPoint and the school's learning management system?
- What will students think of the school's reputation if some courses are taught, in effect, by teachers in other medical schools?

Given the time and effort it will take to prepare quality virtual lectures, it is possible that many schools will begin exploring how to use information technology to change the lecture format by introducing digital recordings of the school's current live lectures. Such digital recordings are relatively easy and cheap to produce and feature the school's own teachers. Their production should prompt teachers to take the initiative in evaluating how this new medium can be best employed. Such evaluation would presumably lead to the gradual inclusion of Flash animations and thus the gradual conversion of the digital lectures into virtual lectures.

In conclusion, I believe that one of the most significant ways that information technology will change medical education will be the substitution of many, if not most, live lectures during the preclinical years by virtual lectures. Student recognition of convenience, better time management, greater comprehension and improved recall should all combine to popularize virtual lectures. Faculty recognition of a greater opportunity to tutor students as well as to teach their subject matter should enhance the extent to which students appreciate and actually use the basic sciences in clinical practice.

Finally, examples of scenes from some of my virtual lectures (including the scene from the histology lecture on the liver discussed in this article) can be reviewed by emailing the author at anafxs@gwumc.edu.

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# What Do We Know About the Anxieties of Students Starting Clinical Studies?

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**ABSTRACT**

This study aimed to determine anxiety-producing situations among medical students starting clinical studies from their own and their teachers' perspectives. Students' perceived anxieties were assessed by means of a questionnaire. The same questionnaire was given to the teachers involved in clinical training during the fourth year of medical education. Teachers were asked to complete the questionnaire as they thought the introductory students would have done. According to the students, the top five situations that produce anxiety were: giving a wrong treatment, getting diagnoses wrong, carrying out cardiopulmonary resuscitation, inadvertently hurting patients and becoming infected by patients. The situations that were found to be as anxiety producing by the teachers were mostly related to communicating with patients. It is important to identify and minimize the sources of anxiety before students are exposed. But the teacher first needs to be aware of these sources and the fact that students may respond differently to their clinical activities.

**INTRODUCTION**

According to the current system of medical education in Turkey, the six-year education period can be considered as two different parts, namely the preclinical phase and the clinical phase. The difference between the two periods is due to numerous factors such as physical environment, context, curriculum, educational methods, training atmosphere, students' and teachers' roles, relations and other details. Most medical students look forward to the clinical phase however, it can be an anxiety producing process. It is important to specify the situations connected to this increased anxiety among students; such information can make an important contribution to the preparedness of both new students and teachers for clinical training. [1]

Sources of stress and anxiety among medical students have been widely investigated. Both anxiety level and its sources change in medical education as students progress. Some factors found to increase stress and anxiety were related to the curriculum, medical school environment, the amount of material to be learned, and examinations and/or grades among early medical students;[2,3] whilst talking to psychiatric patients, effects on personal life, presenting cases, and dealing with death and suffering were found to be stressful events among fourth year medical students. [4] The residency and practice years of medical education were considered to produce a higher level of stress for medical students in another study. [5]

This study aimed to determine anxiety-generating situations among new clinical medical students from their own and their teachers' perspectives. The results may be used to establish regulations to ease the transition between the two phases of medical education. [4-10]

Marmara University Medical School, together with some other medical faculties in Turkey is in the process of changing its curriculum as well as revising its educational methods in light of recent developments. According to the results of a recent study, the majority of the graduates agreed that there was need for a change in the educational system.[11] Graduates, who reported that "changes in the educational system are necessary", indicated that changes should be made in areas such as educational methods, curriculum, audio-visual materials, skills of the trainers and assessment/evaluation methods. They also stated that there was some "essential medical knowledge" in the curriculum that they were not able to acquire during their medical education. Based on this information and on data obtained from clinical observations, clinical training was considered a part of several intervention areas. In order to improve the quality of clinical training, interventions were directed both to the preclinical and clinical phases of medical education. For the clinical part of the education, interventions were focused on teaching skills of the clinical teachers and on evaluation methods. For the preclinical phase of the education a new approach was introduced under the title of "Introduction to Clinical Practice" (ICP).[12] Medical students were introduced to a continuous and comprehensive course

starting on the first day of their medical education. The main issues covered by this three year program were clinical skills laboratory classes (CSL), first aid course, communication skills course, clinical reasoning, research projects, introduction to humanity in medicine, community health experience, and outpatient clinics experience. The aim of the program was to prepare students to care for patients and families in a humanistic, competent and professional manner.

In this study, medical students who had not been exposed to ICP were evaluated. The immediate results of this study can be used to determine the necessary areas of intervention in order to provide a better, less anxious transition between preclinical and clinical phases. The results can also be valuable for making comparisons between students exposed to the new curriculum and those who were not, regarding their perceptions of clinical training.

## MATERIALS AND METHODS

Fourth year medical students were given a questionnaire that covered possible anxiety sources during the first week of their clinical training. The questionnaire was taken from a study by Moss and McManus; [1] with some modifications. There were 39 questions in our questionnaire apart from those which addressed the sociodemographic characteristics of the students. Students were asked to indicate their anxiety levels on a 4-point scale: not anxious, slightly anxious, fairly anxious, and very anxious. The same questionnaire was also given to the teachers involved in clinical training in the fourth year of medical education. Forty-two teachers participated in the study.

Data was analysed in the SPSS for Windows. Chi Square, Mann Whitney U test and Student t-tests were used in statistical analysis.

## RESULTS

Eighty-six introductory students completed the questionnaire, response rate was 78.2%. Fifty-one students were male (59.3%). Forty-two teachers (36.8% specialist, 15.8% assistant professor, 23.7% associate professor and 23.7% professor) completed the questionnaire. The difference between the overall scores of teachers and students was statistically significant (mean score of teachers=2.38, $\pm$ 0.43, mean score of students=1.99, $\pm$ 0.34, t=5.32 p< 0.001). Table 1 rank orders the first ten situations by mean anxiety scores. There was a statistically significant difference between male and female students' mean anxiety scores (Mann Whitney U test, p=0.000). Female students had a higher mean anxiety score than male students (2.18 and 1.87 respectively). Varying results have been obtained in the relationship between gender and anxiety related to medical education in the literature. Some studies did not find any relationship between gender and anxiety [2-4] while others found a difference between the two sexes. [13-14]

**Table 1.** First ten situations that provides the maximum level of anxiety among students according to teachers' and students' perception

| | Students | | Teachers | |
|---|---|---|---|---|
| Rank order | Situation | mean | Situation | mean |
| 1 | Giving a wrong treatment | 3.51 | Carrying out CPR | 3.64 |
| 2 | Getting diagnoses wrong | 3.49 | Giving a wrong treatment | 3.48 |
| 3 | Carrying out CPR | 3.14 | * Dealing with dying patients<br>* Suturing patients | 3.12 |
| 4 | Inadvertently hurting patients | 3.00 | Getting diagnoses wrong | 3.10 |
| 5 | Becoming infected by patients | 2.92 | Carrying out vaginal examination | 3.02 |
| 6 | Dealing with dying patients | 2.57 | * Carrying out rectal examination<br>* Dealing with a sick child | 2.90 |
| 7 | Carrying out rectal examination | 2.53 | Inadvertently hurting patients | 2.88 |
| 8 | Carrying out vaginal examination | 2.45 | Going into the delivery room | 2.83 |
| 9 | Being asked difficult questions by patients | 2.34 | Taking blood from patients | 2.67 |
| 10 | * Dealing with drunk / abusive patients<br>* Taking blood from patients | 2.26 | Dealing with drunk/abusive patients | 2.61 |

According to student perception, fear of making mistakes that could harm the patients was at the top of the list of the first ten leading sources of anxiety. In the teachers' top ten list, fear of making mistakes had also taken a high place, although there were some other tasks such as carrying out cardiopulmonary resuscitation (CPR), dealing with dying patients and suturing. Becoming infected by patients was indicated by the students as one of the important source of anxiety; however, teachers didn't rate it as highly.

Because of differences in the overall scores of teachers and students, differences for particular situations were tested for significance using only a t-test, on a corrected score, obtained by subtracting each individual's mean anxiety level from their score for that situation. In 13 of the 39 situations (33.3%) significant differences in mean anxiety scores between students and teachers were reported (Table 2). The student t-test was used to compare corrected mean scores of students and teachers.

Teachers reported more anxiety for: going into the operating theatre, prescribing, going into the delivery room, dealing with a sick child, being left alone with a sick patient, suturing patients, dealing with drunk/abusive patients, going to post-mortems, attending outpatient practices; while students reported more anxiety for giving a wrong treatment, becoming infected by patients, inadvertently hurting patients, and getting up early for ward rounds.

Differences in mean anxiety scores between students and teachers were also investigated by controlling students' gender. It showed that male students had a higher mean anxiety score in getting up early for ward rounds than teachers, whilst female students had a higher score in dealing with drunk/abusive patients.

## DISCUSSION

Participants in this study were new clinical medical students who were asked to indicate their worries about clinical training at the beginning of this period of their education. Although there were many consistent findings between this study and previous ones that we have conducted, it may be important to note that some of those studies have dealt with only dental or nursing students.

### Students' perception

*"Fear of making mistakes"*

In this study students ranked "giving a wrong treatment" and "getting diagnoses wrong" as the first two situations and "inadvertently hurting patients" as the third to produce the highest anxiety scores. According to a study which analysed the perceived stress associated with the transition from preclinical to clinical teaching among dental students, the highest levels of anxiety associated with general clinical situations were felt for getting diagnoses wrong, hurting patients, dealing with medical emergencies, and becoming infected.[8] Fear of making mistakes that could potentially harm patients was one of the leading sources of anxiety among health sciences students. [1,6, 15]

Since stress is associated with poor performance especially in clinical training,[5-6] it is important to control this source of anxiety. One solution to decrease this fear of "inadvertently hurting patients" students could be to provide opportunities for students to be competent in basic clinical skills before they start clinical training. Such a program could provide a humanistic approach in medical education for both patients and students. Overloaded curriculum and disintegration may be other reasons of this fear. In our system, students are exposed to a huge amount of factual knowledge during the first three years of medical education; however this knowledge is not well-related to clinical practice.

*"Fear of becoming infected by patients"*

In this study, students rated a high level of anxiety for becoming infected by patients. This result has been obtained in other similar studies.[1, 8] One explanation for this fear could be the lack of knowledge and/or practice of medical students in infection prevention measures. Although they are taught these subjects in the early years of medical education, a refresher course can be organized at the beginning of the clinical training.

It has been shown that students develop significant anxiety when they do not have adequate information about new medical courses to be taken in succeeding years.[6, 16] This may be another explanation for this fear, since our students are not informed in advance about the clinical training, the environment, the tasks that they are going to be involved in, etc.

Being a medical student itself may be one of the reasons for this expressed anxiety. It has been shown that medical school poses a number of unique difficulties for undergraduate students, such as arduous intellectual demands, cadaver dissection and, for many, a first exposure to illness and death.[16] This fear remains as an important finding which will be worth investigating especially through qualitative studies. Students have also expressed their worries about the routines of clinical life such as "being up all night" and "getting up early for ward rounds". This result was reported in another study.[4]

### Teachers' perception

In this study teachers were asked to complete the questionnaire as the new students might have done. In general, the teachers' mean anxiety score was significantly higher than the students. They emphasized anxiety-producing situations as such as prescribing, going into the post-mortems, going into the delivery room, dealing with sick children, being left alone with a sick patient, suturing, attending outpatient clinics practice. The situations underestimated by teachers relative to students were: getting diagnoses wrong, giving a wrong treatment, getting infected by patients, inadvertently hurting patients and getting up early for ward rounds. It may be reasonable that teachers did not realize students' fear of making mistakes because they knew how new clinical students became gradually involved in clinical tasks and there were few such risks. Nevertheless, it is to be expected that teachers predict students' fears based on their previous experience with newcomers.

Many of the items that were found to be anxiety- producing tasks by the teachers were related to communicating with patients. In a similar study, students did not cite these items as critical.[1] This is likely due to the students' lack of knowledge and experience in the importance of communication skills in medical practice. Another important point is that the subject of communication did not exist at all in our curriculum until recently.

**Table 2**. The anxiety reported by introductory clinical students and teachers to 39 different situations

| Situations | Not anxious (%) | | Slightly anxious (%) | | Fairly anxious (%) | | Very anxious (%) | |
|---|---|---|---|---|---|---|---|---|
| | Students | Teachers | Students | Teachers | Students | Teachers | Students | Teachers |
| Going into the operating theatre ** | 51.2 | 9.5 | 37.2 | 50.0 | 9.3 | 31.0 | 2.3 | 9.5 |
| Carrying out rectal examination | 12.8 | 11.9 | 32.6 | 19.0 | 43.0 | 35.7 | 11.6 | 33.3 |
| Taking blood pressures | 82.6 | 42.9 | 15.1 | 45.2 | 2.3 | 11.9 | - | - |
| Carrying out vaginal examination | 17.4 | 2.4 | 27.9 | 31.7 | 46.5 | 26.8 | 8.1 | 39.0 |
| Getting diagnosis wrong *** | 1.2 | 2.4 | 7.0 | 21.4 | 33.7 | 40.5 | 58.1 | 35.7 |
| Prescribing * | 25.6 | 14.3 | 43.0 | 52.4 | 19.8 | 28.6 | 11.6 | 4.8 |
| Giving wrong treatment ** | 2.3 | - | 8.1 | 14.3 | 25.6 | 23.8 | 64.0 | 61.9 |
| Going into the delivery room *** | 55.8 | 7.3 | 30.2 | 26.8 | 11.6 | 41.5 | 2.3 | 24.4 |
| Dealing with terminal patients | 22.1 | - | 45.3 | 16.7 | 26.7 | 54.8 | 4.7 | 28.6 |
| Dealing with a sick child *** | 30.2 | - | 43.0 | 31.7 | 23.3 | 46.3 | 3.5 | 22.0 |
| Being left alone with a sick patient ** | 41.9 | 16.7 | 45.3 | 28.6 | 11.6 | 50.0 | 1.2 | 4.8 |
| Suturing patients * | 17.4 | 2.4 | 34.9 | 19.5 | 32.6 | 41.5 | 15.1 | 36.6 |
| Talking to relatives of patient | 66.3 | 26.2 | 30.2 | 52.4 | 3.5 | 21.4 | - | - |
| Talking with patients | 72.1 | 31.7 | 26.7 | 61.0 | 1.2 | 7.3 | - | - |
| Interacting with nursing staff | 79.1 | 42.9 | 20.9 | 52.4 | - | 2.4 | - | 2.4 |
| Interacting with residents | 66.3 | 26.2 | 31.4 | 59.5 | 1.2 | 14.3 | - | - |
| Talking to seriously ill patients | 22.1 | 7.1 | 45.3 | 28.6 | 26.7 | 50.0 | 4.7 | 14.3 |
| Telling patients that you don't know something | 24.4 | 9.8 | 47.7 | 34.1 | 16.3 | 46.3 | 10.5 | 9.8 |
| Being asked difficult questions by patients | 14.0 | 7.1 | 47.7 | 33.3 | 29.1 | 45.2 | 9.3 | 14.3 |
| Explaining to a patient that a diagnosis is unknown | 18.6 | 9.5 | 47.7 | 38.1 | 25.6 | 35.7 | 7.0 | 16.7 |
| Undressing patients of the opposite sex | 45.3 | 19.0 | 36.0 | 54.8 | 12.8 | 21.4 | 5.8 | 4.8 |
| Undressing elderly patients | 59.3 | 38.1 | 34.9 | 50.0 | 4.7 | 9.5 | 1.2 | 2.4 |
| Giving injections | 24.4 | 9.5 | 36.0 | 16.7 | 33.7 | 59.5 | 5.8 | 14.3 |
| Becoming infected by patients *** | 2.3 | 2.4 | 30.2 | 50.0 | 39.5 | 35.7 | 26.7 | 11.9 |
| Dealing with psychiatric patients | 23.3 | 12.2 | 46.5 | 41.5 | 23.3 | 39.0 | 7.0 | 7.3 |
| Dealing with drunk/abusive patients | 19.8 | - | 45.3 | 46.3 | 24.4 | 46.3 | 10.5 | 7.3 |
| Going into the post-mortems *** | 67.4 | 12.2 | 27.9 | 39.0 | 3.5 | 26.8 | 1.2 | 22.0 |
| Attending outpatients practice ** | 59.3 | 50.0 | 34.9 | 45.2 | 5.8 | 4.8 | - | - |
| Finding your way around hospital | 70.9 | 57.1 | 23.3 | 28.6 | 1.2 | 14.3 | 3.5 | - |
| Inadvertently hurting patients ** | 3.5 | - | 25.6 | 29.3 | 38.4 | 53.7 | 32.6 | 17.1 |
| Presenting cases on ward rounds | 17.4 | 7.1 | 48.8 | 47.6 | 25.6 | 45.2 | 7.0 | - |
| Getting up early for ward rounds ** | 55.8 | 38.1 | 26.7 | 54.8 | 9.3 | 7.1 | 8.1 | - |
| Being up all night | 53.5 | 19.0 | 25.6 | 40.5 | 10.5 | 38.1 | 10.5 | 2.4 |
| Helping with a cardiac arrest | 8.1 | 2.4 | 18.6 | 4.8 | 24.4 | 19.0 | 48.8 | 73.8 |
| Taking blood from patients | 20.9 | 4.8 | 38.4 | 28.6 | 30.2 | 61.9 | 8.1 | 4.8 |
| Taking a pulse | 90.7 | 52.4 | 8.1 | 38.1 | - | 7.1 | - | 2.4 |
| Examining patients | 40.7 | 26.8 | 52.3 | 53.7 | 7.0 | 17.1 | - | 2.4 |
| Taking medical histories | 57.0 | 31.0 | 43.0 | 64.3 | - | 2.4 | - | 2.4 |
| Filling in blood request forms | 64.0 | 61.9 | 29.1 | 28.6 | 4.7 | 7.1 | 1.2 | 2.4 |

Significance was obtained by comparing the mean **corrected scores** of the two group by t-test.
$^{*}p < 0.05$ $^{**}p < 0.01$ $^{***}p < 0.001$

Prescribing was another task in which difficulties were underestimated by students relative to teachers. Both teachers and students found carrying out some of the clinical skills to be anxiety-producing such as cardiopulmonary resuscitation, rectal and/or vaginal examination and taking blood from patients. This result is mainly due to the absence of a clinical skill training program in the curriculum of preclinical education for this student cohort. Thus, teachers

did not expect students to feel comfortable in carrying out these skills.

By its very nature medical education is a stressful experience. Trainees suffer high level of stress, interpersonal relations difficulties, depression and anxiety.[17] Therefore it is very important to monitor medical students during their long education process in terms of their changing level of anxieties and their source. It has been shown that high stress scores were related more to fear and disappointment in clinical practice; students who experienced high stress were less stimulated by their clinical activities and developed less confidence in practice.[6] If sources can be identified and targeted early, barriers to learning can be minimized. But the teacher first needs to be aware of these sources and the fact that students may respond differently to their clinical activities.

## CONCLUSIONS

Keeping in mind that the transition period is not yet completed; four types of systems/curricula could be identified in medical education in Turkey at present: the classical system, integrated system, Problem Based Learning, and a mixture of integrated/innovative forms. The Marmara Medical School system has been considered as belonging to last category. Although names and definitions of the systems are subjective, they still make sense. Our medical school is in the process of changing and dealing with well known problems of medical education such as: lack of effective integration between preclinical and clinical phases, overloaded curriculum, lecture-based and teacher-centred approach. We feel that many of the results of this study are due to the above problems.

Running an effective clinical skills training program and first aid course starting in the early years of medical education may help to reduce the anxiety of new clinical students. These subjects are considered in the core curriculum in many medical schools. Students who were exposed to an early introduction of clinical skills teaching regarded it as good preparation for their future studies.[16, 18] Marmara Medical School has included these courses in the curriculum recently.

Communicating with patients remains one of the difficult tasks of medical practice. There is evidence from the literature that communication skills can be taught in courses, and are learnt, but easily forgotten if not maintained by practice.[19] Based on this knowledge and knowing that medical students did not realize its importance, a continuous course on communication skills starting from the early years of medical education may be beneficial.

Introduction of an orientation course seems to be vital before the start of clinical training.[20] Such a program may help students to be aware of their tasks and responsibilities during their clinical training. This program may also include a short site visit at the hospital and practical applications of infection prevention measures. During this program students can be given tips in coping with this new life style. It has been recommended that the first clinical day should closely follow the orientation program so that anxiety related to a new clinical experience might be lessened.[21]

Marmara Medical School has been changing its curriculum, in order to include some of the recommended interventions. However some problems remain. Thus it is very important to explore these findings in longitudinal studies, to observe the effect of interventions and to determine support programs for vulnerable students.

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# A Collaborative Strategy for Reciprocal Integration of Basic and Clinical Sciences

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**ABSTRACT**

Geriatric patient cases are ideal for use by basic science educators who seek to link key principles and concepts with clinical medicine. However, access to geriatric educators and geriatric patients able to highlight the evolution of a particular disease/condition, limits the basic science educator's ability to easily incorporate clinical cases into their teaching. To address this resource limitation, we developed five core geriatric clinical cases, each portraying a patient who ages over time, for repeated use in multiple courses/clerkships across the four-year medical student curriculum. In this article, we describe the process involved in designing the cases with illustrative examples of their use in selected basic science courses. Guided by John Kotter's change process, the project team sponsored a series of invitational workshops composed of basic science and clinical educators whose expertise was related to the patient under review. At each workshop, an abstracted patient record was presented (e.g., longitudinal history, physical exam, laboratory data, and diagnostic images), and participants modified the case to better highlight teaching points associated with their respective courses/clerkships. Each updated case was then circulated to all workshop attendees, and other educators across the curriculum, for incorporation into their instruction. The flexibility of each case enables faculty to use the case(s) in varied settings (e.g., lectures, problem based learning groups, labs) matched to the objectives, resulting in students having a longitudinal experience with five geriatric patients and their diseases. The cases continue to be incorporated into the curriculum with students reinforcing the value of their inclusion as they follow the patient's diabetes and its progression through biochemistry, physiology, surgery and medicine. In summary, Kotter's change steps effectively guided the project team and can serve as a model for educators seeking to enhance reciprocal integration of basic and clinical sciences.

## INTRODUCTION

Basic science educators have sought to link the principles and concepts of their disciplines with clinical medicine by implementing multiple basic science curriculum structures (e.g., organ-based, discipline-based, key features/problems) and formats (e.g., problem-based learning, clinical correlations, simulations, lectures, laboratories). Yet, only 12% of the 2003 graduating seniors surveyed via the Association of American Medical Colleges (AAMC) Senior Graduation Questionnaire[1] strongly agreed that basic science content had sufficient illustrations of clinical relevance and provided relevant preparation for their clerkships.

Simultaneously, clinical educators struggle to facilitate the incorporation of specific topics or populations into the curriculum. For example, because geriatric patients are a critical population in medicine, Dr. Robert N. Butler, the first Director of the National Institutes on Aging, was an early advocate for the exposing medical students to geriatric medicine topics and clinical concepts throughout the medical school curriculum.[1] With funding awarded through AAMC/John T. Hartford Foundation, over 40 U.S. medical schools have introduced geriatrics educational initiatives spanning all four years of the curriculum.

The opportunity to integrate clinical geriatrics and basic science is readily apparent as 85% of geriatric patients have at least one chronic illness, most commonly arthritis,

hypertension, heart disease, or hearing and vision loss.[1] Each of these conditions provides a teaching opportunity to link the foundational principles of basic science with their application in clinical medicine. For example, arthritis provides the opportunity to explore critical concepts associated with anatomy (cartilage), biochemistry (biochemical aspects of connective tissue), and pharmacology (pain management) while diabetes highlights biochemistry and physiology (glucose metabolism, influence of body composition), and microbiology (mechanisms of infection risk). Enhancing students' ability to articulate the key role that basic science concepts plays in understanding disease mechanisms and the associated assessment and management of patients is the shared challenge facing basic and clinical faculty with limited curriculum and faculty time.

**Clinical Continuity within Case-based Instruction**

Recognizing that medical students view the incorporation of clinical cases as a common parameter of effective instruction, we sought to collaboratively develop a common set of core geriatric clinical cases that could be used repeatedly in multiple courses/clerkships across the four-year medical student curriculum. By creating a set of core cases, to be utilized by faculty teaching in basic and clinical sciences to illustrate their discipline/specialty specific concepts, an appreciation for geriatric patients as well as their multiple and complex medical problems could be woven throughout the curriculum by non-geriatricians.

The challenge to medical educators in using geriatrics examples is that the curriculum must also address students' attitudes towards elderly people. Common stereotypes of the old are that they are frail, dependent, reside in nursing homes, and are refractory to medical treatment. In reality, the vast majority of older adults are community dwellers with minimal functional limitations that maintain productive and active lifestyles and seek to remain healthy, actively collaborating in their care.[4, 5] In order to address this attitudinal dimension and the ability to understand the continuous nature of disease progression over time, we added a unique element to our clinical cases: each patient "ages" across the curriculum to highlight the progression of health and illness in the elderly population. With funding from the John A. Hartford Foundation, geriatric faculty selected five geriatric patients who had common disease presentations to serve as the foundation for our curriculum intervention. Each patient's findings, over at least a 15-year period of care, were abstracted to create a paper case highlighting common clinical conditions (Figure 1).

Two challenges faced the geriatric physician educators and the targeted basic scientists and clinical faculty who were intended to adopt and integrate the cases into their existing teaching formats: 1) To what degree did the cases need to be adapted to better match the principles/concepts emphasized for use within the basic science courses and clinical clerkships? 2) What would enhance the likelihood that basic science and non-geriatrics clinical faculty would incorporate the cases within their teaching?

**Figure 1. Five Geriatric Continuity Cases and Critical Topics**


| Case # | Patient Name | Key Topics |
|---|---|---|
| 1 | Mr. Karl Andrews | • Atherosclerosis and complications<br>• Coronary artery disease<br>• Peripheral arterial disease<br>• Stroke |
| 2 | Mrs. Esther DuBois | • Breast cancer<br>• End-of-life care<br>• Arthritis |
| 3 | Mr. Clarence Malone | • Depression<br>• Dementia |
| 4 | Mrs. Violetta Tang | • Urinary incontinence<br>• Osteoporosis<br>• Falls |
| 5 | Mr. Fred Clifford | • Functional aging<br>• Vision loss (cataracts)<br>• Hearing loss<br>• Prostate hyperplasia |

The remainder of this article will describe how collaboration between case authors and a broad base of basic science and clinical faculty was initiated through a series of case consultation workshops. Key features of these workshops will be identified, followed by presentation of preliminary adoption/integration rates by case in the basic science and clinical curriculum.

**A Systematic Approach to Curricular Integration Using Case Consultation Workshops**

To answer these questions of content and utilization, a 1.5-hour "Case Workshop" was held with an invitation only audience specific to each case. As we were seeking to introduce a change in the way educators select and use cases as part of their instruction, we followed aspects of the eight-step change process outlined by John Kotter: 1) establish a sense of urgency; 2) create the guiding coalition; 3) develop a vision and strategy; 4) communicate the change vision; 5)

empower broad-based action; 6) generate short-term wins; 7) consolidate gains and produce more change; and 8) anchor new approaches in the culture.[6] Each of these steps will be briefly described to provide a framework that may assist other medical educators in seeking to synergize basic and clinical science education.

Step 1: Establish a Sense of Urgency

As part of the application for the AAMC/Hartford Award, the project staff conducted a needs assessment that revealed limited systematic exposure to geriatrics in spite of its population-based significance for medical education. Upon receipt of the AAMC/Hartford Award, geriatric education became more visible and public at the Medical College of Wisconsin (MCW) as it represented an influx of funds targeted to a broad-based curriculum initiative. The award was announced in college-wide newsletters, websites and at key meetings of medical educators. The two-year timeline provided a critical level of urgency on the part of the project staff, which included some of MCW's key educational leaders (e.g., Associate Deans involved in undergraduate medical education, Chair of the Curriculum and Evaluation Committee, Division Chief for Geriatrics). In addition, the course/clerkship directors recognized the need to incorporate geriatrics into the curriculum, based on the results of the needs assessment.

Steps 2-3: Create the Guiding Coalition and Develop a Vision and Strategy

As described above, the project team consisted of positional (Associate Deans, Division Directors, Chair of the Curriculum and Evaluation Committee) and influence leaders (members of MCW's Society of Teaching Scholars). Collectively, these individuals were present at all standing committee meetings related to undergraduate medical education. This "coalition" played a vital role in collaborating with the geriatric educators to develop a vision and strategy for designing and implementing the case-based approach to geriatric education. Key features of this strategy included targeting faculty already teaching about the topics associated with a particular aspect of a case, inviting those faculty to participate in the development of each case to insure that it met their needs as instructors, and providing those instructors with the flexibility to adopt/adapt the case(s) to meet their needs. Furthermore, a steering committee of key basic science and clinical faculty opinion leaders was convened to oversee the effort of the project team. This group guided the project team and made suggestions to ensure meeting of project goals.

Steps 4-5: Communicate the Change Vision and Empower Broad-Based Action

The project team and key faculty in each basic science and clinical clerkship associated with an aspect of each case met together for a brainstorming session. For example, the case of Mr. Karl Andrews (Figure 1, Case 1) highlighted diabetes, lipids/cholesterol, coronary artery disease, medications, genetics, hypertension, stroke, informed consent, and rehabilitation. Faculty responsible for teaching glucose metabolism (biochemistry, physiology), lipid formation/cholesterol (biochemistry), imaging (radiology) and rehabilitation (physical medicine and rehabilitation) were among the faculty targeted for invitation. A group e-mail was forwarded to all invitees explaining the project and the need for their input to ensure the case was congruent with the core principles highlighted in their instruction. A personal contact from the project team member who best knew the faculty member followed the initial e-mail invitation.

The result of this targeted and personally invited attendance approach was a broad-based representation of basic science and clinical specialties at each of the five case workshops. Each workshop began with a brief overview of the project, emphasizing the need to adapt the core case so that it could be incorporated into teaching the concepts faculty were already presenting in their instructional units. For example, in the case of Mr. Karl Andrews who begins as a functional 65 year old with multiple risk factors for atherosclerosis including diabetes, the biochemist contributed insights into the pathophysiology of glucose metabolism while the physiologist focused on endothelial cell effects of prolonged hyperglycemia that explains subsequent clinical phenomena in terms of signs and symptoms. To heighten these points, the case was slightly revised to enable the physiologist to incorporate it into his existing core lectures. However, since the educational needs of the instructors did not always coincide, dynamic dialogue about clinical phenomenon and the science ensued. As the geriatrics division chief commented, "This was really fun! For the first time in 20 years of medicine, I had participated in dialogue about medical education. It's not that I don't see these people at committee meetings. (But there) we talk about rank and tenure, faculty fringe benefits, not the science of medicine. And this was all that we did. It was very exciting". The success and "fun" of participating in the first case workshop provided a "short term win" that allowed the project team to continue to use the case workshop format to, in Kotter's terms, communicate the change vision and empower broad-based action.[6]

At the conclusion of the discussion, each individual's key issues were incorporated and faculty members were advised that a final draft of the case would be circulated for review. Following the meeting, the clinician members of the project team finalized the case to insure that changes in findings at age 65 were consistent with disease progression/findings as the patient aged to 70, 75, 80, etc. The updated case was then circulated to the workshop attendees individually and through the course and clerkship director's and the Curriculum and Evaluation list serves.

Steps 6-7: Generate Short-Term Wins, Consolidate Gains and Produce More Change

Following the short-term wins stemming from each case workshop, faculty enthusiasm for incorporating the cases was high. Almost immediately, Cases 1 and 2 were incorporated into first-year basic science courses and into the required M3 medicine course. As students began to recognize Mr. Andrews (Case 1) and Mrs. DuBois, (Case 2)

**Figure 2.** Illustrative use of the Virtual Patient CD-ROM Resources in Cell and Tissue Biology

| Virtual Patient Case | Topic | Description |
|---|---|---|
| Mrs. Dubois | Breast Cancer | • Patient's family history of breast cancer and its relationship to genetic testing referenced in a lecture on cell cycle and cancer.<br>• Mrs. DuBois' history and development of breast cancer discussed during the lecture on Breast Histology.<br>• Particularly useful is her family pedigree, a video clip of Mrs. DuBois' visit to the doctor where testing is discussed and in histological images of breast cancer. |
| | Arthritis | • Her problems with arthritis are highlighted using video clips of gait/walking and patient's description of her symptoms. |
| Mrs. Tang | Osteoporosis | • Data about her osteoporosis is used during the lecture on bone (e.g., bone mineral density studies) and video clips discussing clinical findings (e.g., vertebral fractures). |
| Mr. Clifford | Nodular Hyperplasia | • Images and clinical data regarding patient's nodular hyperplasia (prostate) are used during the male reproductive system lecture. |
| Mr. Andrews | Diabetes | • Material from this case is used in the lecture on the histology of the pancreas (e.g., lab findings of finger stick blood sugar results, glycosolated hemoglobin |

in subsequent courses/clerkships, the faculty recognized that the continuity approach to case presentation was effective in providing students with a relationship with these patients. The flexibility allowed by encouraging instructors to just "mention" the case by the patient name as an example of concepts addressed in class ensured that instructors maintained the autonomy and control over their content that other curriculum change approaches often preclude.

Short-term wins were also celebrated by dissemination of how each course was using the cases at regular meetings of the course and clerkship directors. Recognition was provided in an ongoing manner as each course/clerkship implemented the use of the cases. For example, when Mr. Andrews' case was implemented, its use in biochemistry during discussions of glucose metabolism and later cholesterol metabolism was announced. Physiology was recognized when it used Mr. Andrews to highlight the physiology of diabetes. Surgery was able to use the case in discussing the ankle/brachial indices used to assess vascular disease and Internal Medicine used Mr. Andrews to highlight various clinical aspects during a required clerkship. The implementation of a fourth-year elective centered exclusively on four of the cases was another cause for celebration and recognition. These announcements and recognition continued as each new case was introduced and often resulted in discussion about how the case could be used in other areas.

Step 8: Anchor New Approaches in the Culture

As the cases became finalized, the instructors could choose to incorporate any aspects of the case into their teaching. While dependent upon the decisions of each faculty member, the degree to which core curriculum topics are subsequently revised is limited from year to year. When changes are made, the flexibility of the continuity case structure and the availability of cases highlighting most common issues in the aging provide a strong anchor to sustaining case utilization within the curriculum. An example of how multiple cases have been used in a single course, cell and tissue biology, is presented in Figure 2.

First-year students are now introduced to all the cases during orientation. In this orientation session focused on the medical school curriculum, each patient is identified and associated with the primary disease processes with which they will be associated. The concept of the patient aging as the student encounters them throughout the curriculum is also explained.

To solidify the use of the cases, the project team also took advantage of additional opportunities to embed the cases within the medical student curriculum. One such opportunity was MCW's M1-2 Integrated Rounds, a program sponsored by the M1-2 Course Directors, the MCW Society of Teaching Scholars and the local student chapter of the American Geriatrics Society. This collaborative one-hour session featured a clinical geriatrics faculty member and two basic science faculty members (pharmacology and microbiology) and centered on Mr. Malone (Case 3 depression/dementia). The clinician presented the case and led an interactive session with the medical students generating a differential diagnosis and emphasizing clinical features of the case. The microbiologist then presented background data on one of the possible transmissible causes of dementia listed in the differential of the case and the pharmacologist focused on antidepressant classes and the most efficacious therapy for depression in the elderly. Over

150 students attended the session with very positive evaluations specific to integrating basic and clinical science within the curriculum.

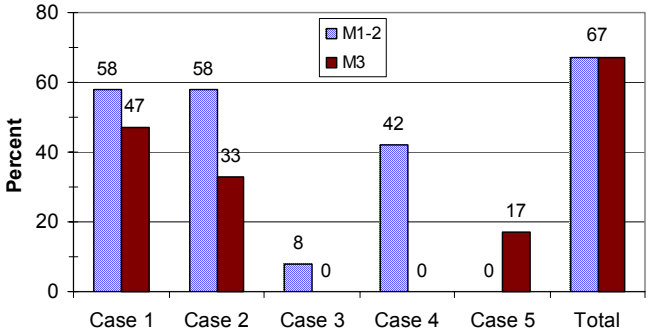
A second opportunity to embed and solidify the cases was through the creation of a required selective in geriatrics. Students are given the written cases in their entirety, rather than the selected elements highlighting the targeted basic science and/or clinical-specific foci approach experienced during the first three years of the curriculum. One case is highlighted during each week of the month-long selective. Each week students individually choose a "learning issue" that highlights some aspect of basic pathophysiology in the case. Thus, this selective provides an opportunity to revisit basic science concepts during the fourth year. Each student then presents the "learning issue" to his/her peers under faculty guidance, which includes basic and clinical faculty. In addition, a clinical interaction with a standardized patient based on the case allows the students to synthesize their knowledge and apply it in a clinical interview.

**Preliminary Evaluation Results and Next Steps**

All five-paper cases have been finalized and successfully integrated into the curriculum. Over two-thirds of the basic science courses have incorporated at least one case as of the 2001-02 year with case five introduced at the very end of that academic year (see Figure 3). Results from the 2003 AAMC Senior Graduation survey reveal a strong positive shift in the perceived relevance of our basic science content moving from a rating of 3.0 in 2001 (1 = Strongly agree; 2 = Agree; 3 = No Opinion) to 2.7 in 2003 (national mean 2.6). The perceived validity of basic science content as relevant preparation for clerkships also shows a promising trend moving from 2.8 in 2001 to 2.5 in 2003 (national mean 2.5). While a number of other initiatives have been implemented that can contribute to these ratings, in their narrative comments students commonly cite geriatrics as an example of clinical relevance.

To maintain our momentum around the longitudinal geriatric case approach and to respond to instructors' requests to make the patients "live", we are in the process of re-creating each case as a CD-ROM-based teaching resource file for instructor use with the support of the Donald W. Reynolds Foundation. Each CD will contain 1-2 minute video clips portraying the patient interacting with a physician, other health care providers, or family member(s) at each of the major age periods to highlight key clinical findings. The video clips are then incorporated onto a CD-ROM along with radiographic images (e.g., bone density scans), still images (e.g., diabetic ulcerated toe, recurrence of breast cancer nodules), and assessment findings (e.g., mental status examination, functional status examination). Each image is then linked to the associated topic and indexed by common basic and clinical science courses/clerkships to allow easy access by faculty to a virtual patient record.

**Figure 3.** Percentage of M1-2 Courses & M3 Clerkship Incorporating Geriatrics Cases 2001-02




## SUMMARY AND CONCLUSIONS

A continuity case-based approach can be successfully used to highlight the sciences basic to medicine across all four years of the curriculum. Guided by Kotter's eight-step change model, a systematic case development approach was implemented that has successfully incorporated geriatrics into our curriculum and can serve as the model for enhancing the clinical relevance of our basic science courses and revisiting basic sciences in the clinical curriculum.

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