JIAMSE

Journal of the International Association of Medical Science Educators

Volume 16 Number 1 2006

IAMSE

Effects of Block Testing

Teaching Pathology

Effects of Lecture Absenteeism

Integration of Basic and Clinical Sciences

IAMSE on the Web
www.iamse.org

ISSN: 1550-8897

JIAMSE

The Journal of the International Association of Medical Science Educators

Volume 16 **Number 1** **2006**

Message from the Editor

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

I will be assuming the daunting position of Editor-in-Chief starting with the December issue of JIAMSE. Our current Editor-in-Chief, Douglas Gould has already done the yeoman work of putting our journal on strong footing with International recognition and a steady stream of high quality peer-reviewed papers on subjects most important to the International medical education community. He and our superb Editorial Board deserve all praise for what JIAMSE is today.

My first IAMSE meeting was in Chicago and I have been a steady contributor to the Basic Science Educator (predecessor of JIAMSE) and to JIAMSE over the years. Currently, I am a Professor of Microbiology and Immunology at the University of Louisville, School of Medicine, and I felt I was at a time in my career where I could take on this important job and devote the time and energy necessary to accomplish what I hope to achieve. When the call came out that Doug was stepping down from his position and IAMSE was looking for a successor, I never thought that I would get the job; I was shocked but pleased when it was offered. I accepted the offer with great enthusiasm, excitement, and strong intentions of building on what has been so ably started.

It is my goal to shepherd JIAMSE to the very top of available medical education journals. It is important to increase the paper submission totals and maintain a high level of quality, so I ask each of you to consider submitting articles to JIAMSE for review on the exciting things you do at your schools to foster better medical education. It is also critical to be indexed in Index Medicus, an initiative that has already been started. Then, we need to increase the exposure radius for this journal in the educational community.

I have requested the Editorial Board and staff to remain and I have happily heard from most of them that they will. I have increased the number of Associate Editors to expand the expertise and also to provide a wider opportunity for targeted editing. I intend to maintain the methodology and quality for review started by Doug. I am looking forward to Doug's assistance in putting together the December issue.

I will be happy to talk to any of you in Puerto Rico about JIAMSE and also about publishing your work in the journal of our association. If you have posters and oral talks, you should definitely consider submitting your work.

In closing, I am very proud and excited to be the next Editor-in-Chief of JIAMSE, and I hope all of you share my pride and the pride of our great organization in this journal which so brightly represents our association.

The Medical Educator's Resource Guide

John R. Cotter, Ph.D.

The five reviews in this issue of the Guide were written by medical and osteopathic students and a graduate student in anatomy. All of the reviews deal with three of the four major sub-disciplines of anatomy: histology, neuroanatomy, and gross anatomy. This may not be a coincidence. Anatomy is one of the cornerstones of medical education and, being as dependent as it is on the illustrative depiction of the body, is perfectly suited to being communicated over the web.

There is a recurrent theme in several of the reviews. In Jeff Henson's review of ***The JayDoc HistoWeb****, he says "the quality of the images makes studying histology at home much easier." For Kahtonna Allen, the* ***Net Anatomy*** *offers "a unique way… to work autonomously while learning and experiencing anatomy." The* ***Neuroscience Resource Page*** *according to Ibrahim Koury, "stands out for the ease with which material is available." And according to Justin Morgan, the* ***Hyperbrain Pathway Quizzes in Neuroanatomy*** *allows students to "learn … at their own pace and independent from the classroom." Since students do not immediately assimilate what they have been taught in the classroom or experience in the laboratory, the student reviewers appear to value and look to websites for ways to learn once they have left the classroom and do not have the guidance of their instructors.*

If you are aware of a site that has the potential for being used by students of the basic and clinical medical sciences, I encourage you to contribute to the Guide. Send all submissions to jrcotter@buffalo.edu. Please include the URL and a short critique summarizing the essence and utility of the site. All submissions will be reviewed for relevance, content and length. Revisions, if needed, will be made in consultation with the author.

Hyperbrain Pathway Quizzes in Neuroanatomy.

http://www-medlib.med.utah.edu/kw/animations/hyperbrain/pathways/index.html

Hyperbrain Pathway Quizzes in Neuroanatomy is a self-instructional learning tool to help medical students understand the most important neural pathways tested in introductory medical neuroscience courses. Dr. Suzanne Stensaas from the University of Utah developed the Hyperbrain Pathway Quizzes. To help reinforce these often confusing neuronal tracts, repetition is the key. The illustrations used in the animations are adapted from the 4th edition of Neuroanatomy: An Atlas of Structures, Sections, and Systems by Duane Haines, Ph.D. Eighteen different quizzes are found in the module. A clue prompts the user to choose the correct neuroanatomical term for the tract or landmark indicated. If the choice is incorrect, a funny and animated voice will sound indicating the need to choose a different answer. When the student chooses the correct answer, a clue is given for the next step in the tract. Students can learn these pathways at their own pace and independent from the classroom. Many students attempt to learn neuroanatomy through repeated rehashing through the notes. The Hyperbrain Pathway Quizzes allow the medical student to become an active learner away from the lecture notes. (*Reviewed by Justin M. Morgan, B.S., University of Louisville School of Medicine*.)

Medical Gross Anatomy Learning Resources. The University of Michigan Medical School.
http://anatomy.med.umich.edu/

The main page of this website contains links to applications designed to help students better understand anatomical concepts and structures. The website is utilized by the medical gross anatomy course taught at The University of Michigan School of Medicine. Thus, some of the links are course personnel specific and password protected. However, most are unrestricted, allowing users to utilize many interesting links; and students pursuing an education in gross anatomy will find these links to be helpful in developing a useful knowledge base. The "Atlas Images" link contains gross anatomical and radiographic images of the brain and body regions. Also included in this website are quick time videos of a variety of organs and body regions under the link "Dissection Videos", which illustrate the proper step by step dissection technique of these structures. These videos also highlight many important observations that can be made during the dissection of a cadaver. There are interactive quick time images of gross specimens under the "QuickTime VR Movies" link, which contain models and 3D images of structures labeled for common landmarks. These models can be rotated both vertically and horizontally so that students can appreciate the three dimensional aspects of each structure. The "Surgical Videos" link provides students with the ability to observe these structures in a pre-mortem setting, as well as an appreciation of their involvement in a variety of surgical procedures. Quizzes are also available under the "Practice Questions" link, along with questions accompanying a few basic case studies ("Clinical Cases") which are designed to allow students to apply basic knowledge to clinical situations. Detailed tables ("Anatomy Tables") of selected anatomical structures are also included for study. This website contains many topics that may interest a wide variety of people who are interested in furthering their knowledge of gross anatomy. Overall, this site should prove to be a valuable resource for students, educators and researchers. (*Reviewed by Laurie Davis, B.S., University of Kentucky*.)

Net Anatomy. Scholar Educational Systems, Inc.

www.netanatomy.com

The aim of Net Anatomy is to teach human anatomy to students of the health professions. It serves as a place to explore, review, and prepare for clinical rotations and the USMLEs (United States Medical Licensing Examinations) and delivers current and reliable information. The information is an integration of several renowned works including, Gray's Anatomy for Students (1985), Netter's Atlas of Human Anatomy (1997), Moore's Clinically Oriented Anatomy (1999). Net Anatomy.com is comprised of several sections including radiography (plain film and magnetic resonance imaging), computerized topography, cross-sectional anatomy, and gross anatomy. These provide complete descriptions of body regions alongside exceptional illustrations. Each section is preceded by educational objectives and how to approach a particular modality. Notably are the cadaver prosections that parallel a student's laboratory experience. User administered tests within each section help assess progress and pinpoint problem areas. Also included are specific clinical correlates that are likely to be encountered in a medical setting. Topics in first year medical gross anatomy are skillfully complemented by this site. The information is unquestionably useful for all levels of medical education. Particularly helpful is an independent and excellent study guide, "Just the Facts", that includes complete reviews on each body system. Net Anatomy.com is a unique way for students to work autonomously while learning and experiencing anatomy. (*Reviewed by Kahtonna C. Allen, M.S., Georgia Campus – Philadelphia College of Osteopathic Medicine*.)

Neuroscience Resource Page. University of Wisconsin Medical School.

www.neuroanatomy.wisc.edu

As a medical student, I am perpetually searching for resources that complement my studies and allow me to maximize the time I spend reading texts and taking in lectures. In seeking out resources for a course in neuroanatomy, I came across the Neuroscience Resource Page. The site contains an expansive bank of resources that can enhance a student's understanding of neuroanatomy. First, informative diagrams and anatomical images of the brain and spinal cord allow a student to pinpoint and label neuroanatomical areas. In addition, videos demonstrate the physical manifestations of some of the more common neurological diseases. Furthermore, the site provides its readers with an online course book that thoroughly explains major concepts in neuroanatomy. Finally, a databank of questions covering several neuroanatomical subjects is particularly useful. The questions allow students to test their knowledge of the course material. The site also offers clinical questions which resemble those of the National Board examinations. Ultimately, the site provides students with many opportunities to supplement their studies and, most importantly, evaluate the extent of their knowledge. With so many options available to students looking for supplemental resources on the Web, this site stands out for the ease with which material is available and as a testing tool. *(Reviewed by Ibrahim Koury, M.S., University of Louisville School of Medicine.)*

The JayDoc HistoWeb. The University of Kansas.

http://www.kumc.edu/instruction/medicine/anatomy/histoweb/

This Website is designed for first year medical students at the University of Kansas. The site is very well organized and focuses on histology. The links are very easy to follow and flow in a logical sequence. The first set of links leads the student through the study of the basic tissue types. The other links then tie the basic tissues to the organ systems. Each link has several well illustrated images and more than one example of a given structure. The captions which can be used for a quick review of the material describe what is seen in each digital image. The detail illustrated by the digital images is comparable to viewing specimens through a light microscope. The images are not cluttered with labels making it much easier to see structures. The ability to expand an image allows a student to pick out details that might be missed in a smaller image. Overall the site is well organized and user friendly. The quality of the images makes studying histology at home much easier. (*Reviewed by: Jeff Henson, M.S., University of Louisville School of Medicine.)*

Integration of Basic Sciences and Clinical Sciences in a Clerkship: A Pilot Study

John C. Sakles, M.D.[1], Renee J Maldonado[2] and Vijaya G. Kumari, M.B.B.S., Ph.D.[3]

[1]Department of Internal Medicine, [2]Office of Curricular Support and [3]Department of Cell Biology and Human Anatomy
University of California Davis, School of Medicine,
Davis, CA 95616, U.S.A.

Phone: (+)1-530-752-3202 Fax: (+)1-530-752-8520 Email: vgkumari@ucdavis.edu

ABSTRACT

Limited formal mechanisms exist for exploring basic sciences during the clinical clerkships in many medical schools. This study was designed to create a model for integrating basic and clinical sciences in a fourth year clerkship. Fifty-eight fourth year students enrolled in the Emergency Medicine clerkship participated in the study, undertaken by the clinical director of the clerkship and a basic scientist. Expert basic scientists were invited as discussants. Clinical presentations commonly encountered in the Emergency Department were selected for a case-based approach. Students researched and discussed both basic science and clinical questions that arose from the case discussion. They completed a questionnaire at the end of the session. More than 50% of the participants reported that the sessions enabled them to achieve a deeper understanding of the basic science principles relevant to clinical problems and improved their ability to evaluate and manage another comparable patient. They noted that this approach would motivate them to explore the basic sciences in the future and agreed that understanding basic science principles would contribute to better patient care. They reported that the availability of a basic science expert facilitated the integration and that they would recommend the model for other fourth year clerkships. Our results suggest that the incorporation of a structured basic science inquiry related to a patient problem in a fourth year clerkship could be an effective approach to encourage the exploration of the relevant basic science principles. Presence of a basic science expert, along with a clinician, enhanced the reported effectiveness of the integration.

INTRODUCTION

The need for a strong scientific underpinning for medical education was envisioned in the late nineteenth century, leading to the Flexnerian revolution, recognized as the single major reform of medical curricula of the twentieth century.[1] The goal, to translate the evolving body of scientific knowledge into clinical practice, is even more significant today than it was in 1910 when the report was first published. The Flexner report resulted in the now familiar "two plus two" curricula in the U.S. medical schools, with the basic sciences taught during the first two years followed by the major or "core" clinical clerkships in the third and fourth years. This curricular formula has since been modified by most schools without significant deviation from the Flexnerian principles in an added effort to create vertical and horizontal integrations. This was initiated by the reorganization of teaching into an organ system-based program by the Case Western Reserve University School of Medicine in 1952.[1] The present medical school curricula in the United States reflect variations on this theme with many medical schools having additionally incorporated innovative learning experiences and teaching methodologies.

The medical curriculum at the University of California Davis (UCD) is structured with the first two years taught largely by faculty on site at the School of Medicine on the Davis campus, and the last two twenty miles away on the wards and in the clinics at the UCD Medical Center on the Sacramento campus or at affiliated sites. Because of the geographic split between the two campuses, accessibility to basic scientists has been limited for third and fourth year students. In the absence of a structured basic science unit incorporated into the third or fourth year clerkships, there is very little opportunity for students to continue to explore basic science issues relevant to clinical problems in a formal way other than by department-sponsored lectures that contain variable amount of basic science materials. Although the basic science departments offer electives, the numbers of students who take these tend to be few since most of these courses are devoid of clinical content and divorced from the day-to-day clinical activities during the third and the fourth years of medical education.

The present study was designed to provide a model for a systematic mechanism for medical students in their fourth year of education to explore, research and strengthen their knowledge base of basic science issues relevant to commonly encountered clinical problems. The study was based on a hypothesis that a systematic and structured exploration of the basic sciences during the clinical years of medical education will sustain student motivation for life-long learning of the scientific basis of medicine as a part of patient care. To accomplish this, a clinician (Dr. John Sakles/JS, Director of Student Programs in the Division of Emergency Medicine and instructor for the required fourth year Emergency Medicine clerkship), and a basic scientist (Dr. Vijaya Kumari/VK, a neurobiologist with a medical degree, in the Department of Cell Biology and Human Anatomy, with main teaching responsibilities in the first year) collaborated to develop a model of an integrated curriculum. A case-based approach was selected since it was considered to be most effective at this stage of the students' training. The basic principles of the study design included: building on prior knowledge, enhancing active learning, and promoting critical thinking and problem-solving skills. We presumed that this model, if successful, could be incorporated more broadly into other clerkships at our school, and in other schools, to create a systematic and structured link between the basic and clinical sciences beyond the preclinical period of undergraduate medical education.

The Emergency Medicine clerkship during the fourth year provided a unique opportunity to achieve our goals for several reasons. At UCD, at the time of the study, Emergency Medicine was a division of the Department of Internal Medicine, and the four week long clerkship in Emergency Medicine was a requirement for all fourth year students, a situation that is paralleled in approximately 20% of all U.S. medical schools. Students in the clerkship have had the opportunity to build a sound knowledge base and clinical skills in Medicine, Surgery, Pediatrics and Primary Care during the third year clerkships. The Emergency Medicine clerkship provides clinical experience that allows medical students the opportunity to apply their knowledge in a wide variety of clinical areas. The clerkship also incorporates "hands on" laboratory sessions including airway management, suturing, and advanced cardiopulmonary resuscitation. Students are also required to participate in problem-based topic discussion sessions using clinical cases to develop a knowledge base fundamental to the management of patients seen in the Emergency Department. We anticipated that the clerkship would allow the identification and selection of cases that have rich basic science underpinnings so that the integration would be more realistic and relevant to the students' ongoing patient care.

One year prior to the full-length study, we carried out a pilot project using one group of seven fourth year students. We used a split-session format with an interval of three to seven days between two sessions. Students were familiar with this teaching method that they had experienced sporadically during the first year of medical school. A case was presented "cold" during the first session to lead to the identification of the most relevant clinical and basic science issues for exploration. During the second session, students shared with the group the information that they had researched, and integrated it with the clinical manifestations, pathophysiology and management of the patient. The pilot study received a strong positive response from the students for its effectiveness in integrating basic and clinical sciences, with 7/7 supporting the incorporation of the model in all fourth year clerkships. Six out of seven students rated the educational value of the sessions as excellent (5, on a Likert scale of 1-5) or very good (4). Thoughtful student comments included the suggestion to choose cases with broad learning potential, to incorporate discussion of molecular biology issues, and to use real cases with images, laboratory data and details of management. Based on these preliminary results, the full-fledged study was begun approximately one year later.

MATERIALS AND METHODS

Study Setting and Participants

The study group consisted of 58 fourth year medical students taking the required four-week clinical rotation in Emergency Medicine at the University of California Davis, School of Medicine. Ten four-week sessions of the clerkship were offered from July to May 1999, with 8 to 15 students per session. Participants were UC Davis medical students and visiting fourth year medical students from other American schools. The UC Davis medical students selected the dates for the Emergency Medicine rotation through a lottery system. Students considering Emergency Medicine as their chosen specialty typically take this rotation early in the academic year, from July through December.

Study Design

The integrated teaching approach required collaborative teaching by a clinician and a basic scientist who was an expert in the field relevant to the clinical case. JS served as the clinician consultant for this study, assisted in some instances by a second clinician chosen from the field represented by the case. VK played a key role in identifying and recruiting the basic science faculty, in addition to serving as the basic science expert for one of the cases. A staff member (Renee Maldonado/RM) assigned to the clerkship was responsible for the logistics. Basic science faculty who volunteered to teach were all basic scientists with PhD degrees. All were supportive and enthusiastic of the integrated approach and understood their roles as experts. It was explained beforehand to the faculty that their role was to facilitate the discussion, prompt questioning, serve as a resource, and ensure that the clinical and the basic science information were integrated in the context of the patient problem. The new integrated teaching/learning session occupied one and one-half to two hours per week for two weeks of the rotation. This was in addition to usual the didactic lectures and laboratories. During orientation for the Emergency Medicine rotation, JS presented an overview of the learning objectives and format of the integrated teaching approach.

Based on the pilot study, we elected to use a split session format and to incorporate some of the principles of problem-based learning. The case was presented "cold" during the first session, with images of the physical findings and laboratory data. The most relevant clinical and basic science issues were then identified by the students for exploration.

Table 1. Sample Cases, Basic Science (BS) and Clinician (CS) Facilitators and Basic Science Principles

Case	Facilitator/s	Basic Science Principles
Stroke	Neurobiology (BS) Hematology (CS)	Localization of pathology; blood supply of the brain; visual pathways and gaze control; hypertension as a risk factor; management (anticoagulants/calcium blockers/tissue plasminogen activator)
Diabetic Ketoacidosis	Biochemistry (BS)	Type I versus type II diabetes; ketones (what they are, why their levels go up); glucose metabolism; diabetic coma; management (fluid and potassium balance)
Sickle Cell Crisis	Biochemistry (BS) Hematology (CS)	Types of hemoglobins; effect of oxygen status on the structure of hemoglobin; coagulation cascade; management (marrow transplant/hydroxyurea/gene therapy)
Myasthenia Gravis (MG)	Neurology (CS)	Physiology and neurochemistry of motor end plates; Neuropathy and myopathy versus MG; double vision and ptosis; management of MG (acetylcholinesterase inhibitors/prednisone/thymectomy/plasmapheresis)

Midway through the study, it was apparent from informal student feedback that the split session format was inefficient for fourth year students and that the same goals could be accomplished in a single session with prior preparation. The format was modified accordingly by providing the cases ahead of time, assigning specific questions to small subgroups of students, and facilitating active discussion of the issues by the group. Since different groups of students took the split session format and the single session format, it was not possible for us to provide accurate comparison of the two methodologies. Since the major goals of the study remained unchanged, the data derived from both groups (using the same evaluation instrument) were pooled for the final analysis.

Although we expected the cases to be selected by the students, practical issues such as limitation of time prevented them from doing this. Therefore, JS selected commonly seen patient cases in the Emergency department with easily identifiable basic science issues: stroke, diabetic ketoacidosis, sickle cell crisis and myasthenia gravis**.** The basic science facilitator was either a basic scientist who taught the relevant material or a clinician with research expertise in the disease. On occasions, a clinician expert who could discuss the principles of management was added to the group. Table 1 lists four cases used in the study, the disciplines of the basic scientists/clinicians who facilitated them, and some of the basic science principles discussed in each case.

For each case, the facilitator/s made sure that the basic science issues covered patient manifestations and disease management. Largely, the topics came up during the discussion through questions that the students raised or information that a student would share with the group. If an important basic science principle was not brought up, the facilitator/s would pose questions related to it to initiate a discussion. Because of time constraints, not all basic science principles could be included in the discussions of each case.

The study was approved by our Institutional Review Board (IRB) and granted waiver of informed consent.

Survey Content and Administration

A survey instrument was designed to determine the degree to which the short-term educational goals of the integrated teaching approach were achieved. It was distributed to the students at the final session and collected in an anonymous fashion. The six questions used in the instrument are included under Results in Table 2 (questions 1-4) and Table 3 (question 5).

RESULTS

The responses to the five questions included in the evaluation questionnaire are presented in Tables 2 and 3. In some instances, answers were missing from the evaluation as reflected by N=<58. The results showed that ninety-seven percent of the participants felt that the integrated sessions enabled them to achieve a deeper understanding of the basic science principles relevant to the clinical cases they reviewed (Table 2, question 1). Eighty-six percent agreed that the sessions improved their ability to evaluate and manage another like patient case (Table 2, question 2). Asked if more experiences like this would enhance their motivation for exploring basic science principles relevant to clinical problems, 69 percent of the participants agreed that it would (Table 2, question 3).

As seen in Table 2 (question 4), 95 percent of the participants felt that understanding basic science principles relevant to clinical problems would contribute to better patient care. The results also revealed that 79 percent of the respondents would recommend the integrated teaching in other fourth year clerkships (question 5, Table 3).

We asked two additional questions to determine whether or not the short-term goals of the study were met by the design of the learning experience. These goals were explicitly

Table 2. Student Responses to Survey Questions 1-4

Questions	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
N=58 ***1.*** *The session(s) enabled me to achieve a deeper understanding of the basic science principles relevant to the clinical case.*	26 (45%)	30 (52%)	2(3%)	0	0
N=55 ***2.*** *The session(s) improved my ability to evaluate and manage another like patient case.*	19(35%)	28(51%)	6(11%)	2(3%)	0
N=58 ***3.*** *More opportunities like this will motivate me, on my own, to explore the basic science principles relevant to clinical problems.*	17(29%)	23(40%)	11(19%)	8(14%)	0
N=58 ***4.*** *A better understanding of the basic science principles relevant to the clinical problems will ultimately contribute to better patient care.*	26(45%)	29(50%)	3(5%)	0	0

Number responses (%)

stated at the beginning of each session and also included in the survey instrument. The two questions inquired about the roles of small group collaborative learning approach and the availability of a basic science expert in meeting the goals of the study. Eighty-two percent of the respondents agreed that collaborative learning in a small group helped to achieve the short-term goals of the study. Twelve percent of the respondents were undecided and 6 percent disagreed that the model promoted collaborative learning. With respect to the presence of a basic scientist to facilitate discussion, 86 percent of the respondents agreed that the availability of a basic science expert enabled them to meet the short-term goals of the study.

We did not formally survey the small number of basic scientists and clinician consultants who volunteered to participate. Comments provided at the end of the sessions indicated their full support of the study goals and methodology. The basic scientists were enthusiastic that the study allowed them to teach students in their fourth year of medical school, with a selective focus on the basic science principles raised in the context of a patient problem.

DISCUSSION

One of the drawbacks of the current medical school curricula is the lack of continued formal integration of the basic sciences with the clinical sciences through all four years of the undergraduate education. It has been pointed out that if the importance of basic science objectives is accepted, these objectives should be achieved early in training, maintained at exit from medical school, and revisited in continuing medical education. [2] At this time, most schools are far from achieving an ideal blend of the basic and clinical sciences during undergraduate medical training, not to mention at levels beyond it.

A review of the approaches adopted by eight schools that participated in a Robert Wood Johnson Foundation project serves to illustrate some of the methods used to integrate basic sciences with clinical sciences. [3] The study found that bringing clinical relevance to basic sciences has been achieved far better than reinforcing basic science in the clinical years. [3] Examples of the former include: the use of a problem-based learning (PBL) format; lectures complemented with small-group, case-based learning; aligning certain basic science subjects such as anatomy with courses in physical diagnosis and Objective Structured Clinical Examinations (OSCEs); co-teaching by basic science and clinical faculty; and, early exposure to and experience with real patients. In contrast to the reasonable degree of success achieved in bringing clinical relevance to the basic sciences, schools encountered far greater challenges when incorporating basic sciences into clinical curricula. In general, these attempts occurred on a small scale and tended to involve supplementing traditional clerkships with PBL sessions or a seminar series designed to focus on basic science issues. Attempts to include basic scientists in ward rounds were not successful for logistical or political reasons.[3]

Our study comes closest to the curricular models that have incorporated PBL in the clinical years. A 1997 review of PBL in the clinical setting found very few that met the criteria outlined in Barrow's taxonomy of PBL. [4] However, more recent publications suggest that PBL is gaining a

Table 3. Student Responses to Survey Question 5

Question	Yes	No
N=58 *Would you recommend the incorporation of this model in other fourth year clerkships?*	46(79%)	12(21%)

greater presence in the third year.[5-7] The most impressive is the Manchester experience[8, 9] that designed cases to trigger basic science objectives, matched faculty- and student-generated objectives, and showed that the students' knowledge of basic sciences increased in their third and fourth years. The results of our pilot study suggest that it is possible to provide an opportunity for a systematic review of the basic sciences during the fourth year by placing it within the context of clinical problems in a required clerkship. Emergency medicine rotation provided an ideal avenue to develop a prototype for this integration since students see an entirety of undifferentiated population of patients with a wide variety of pathophysiologic processes. For example, as in our experience, a patient with sickle cell crisis provided a leading point to the discussion of the molecular abnormalities of hemoglobin and potential therapy targeted at the specific abnormality. This type of review could be critical to the development of life-long learners who need to continue to explore the scientific basis of new ideas on the pathophysiology and management of diseases.

In our study, a high percentage of students felt that the integrated model enabled them to achieve a deeper understanding of basic science principles relevant to clinical problems. The majority of students also reported that they believed that the sessions would improve their ability to manage similar patients in the future. Two-thirds of the students indicated that this learning approach would motivate them to explore basic science principles in future, suggesting that it would be effective in supporting the concept of life-long learning. The presence of the basic science experts was valued and appreciated by the fourth year students who generally have little contact with them beyond the second year.

There are several drawbacks to our study that can be rectified if a full-blown model were to be instituted in the future. Although we were able to provide a model of integration in a month-long fourth year clerkship, this was not supported by other comparable efforts during the fourth year. Any discussion of "paper" cases in the clinical years is often criticized since it competes with the clinical experience and takes the student away from the main "teacher" during the clinical years, i.e., the patient. Although large time blocks spent away from the patient will compromise the clinical rotations, supplementing or replacing some of the didactic lectures with integrated case discussions might be a viable alternative. A better approach will be to motivate the students to focus the sessions on patients they have seen on the wards or in the clinics, thus providing a more meaningful role for the patient, the "teacher" in the learning process. In our study, we were not successful in motivating the students to bring cases that they helped manage in the Emergency Department to the discussion table. Although this appeared to be due to time constraints in a busy rotation with a more pragmatic ("how?" and "what?") than theoretical ("why?") emphasis, the disconnect between the real patient and the learning sessions is likely to have detracted from the benefits of this model.

Problem-based learning need not be the sole teaching method for bringing basic sciences back to the clinical years, as attested by the Rochester Double Helix Curriculum that incorporates an Advanced Basic Science block in each of the third year inpatient clerkships.[10] Multiple learning formats are used to review the basic disease mechanisms at the cellular or sub-cellular level using journal clubs, laboratories, lectures, pathology case reviews, human simulator exercise, PBLs, and student presentations based on patients seen during the rotation. The immersion nature of this experience provides visibility to basic sciences in the clinical years and underscores its value in the education of the physician-in-training.

CONCLUSIONS

Our study suggests that it is possible to provide a structured basic science inquiry, in the context of a patient problem, using the principles of PBL, and aided by the presence of an expert basic scientist, in the fourth year of medical school. A greater emphasis on the basic sciences in the third and fourth years would sustain the relevance and value of subjects often relegated to the first and second year, with a "must get through" attitude on the parts of the students and the clinical faculty. The utility of basic sciences is to provide the theoretical framework for understanding why physicians practice the way they do.[3] Approaches like ours are likely to encourage continued exploration of the scientific basis of clinical practice beyond medical training.

ACKNOWLEDGEMENTS

This study was supported by funds from the Office of the Dean, University of California, Davis, School of Medicine, and by the Harvard-Macy Institute, Physician-Educator Program. The authors thank Dr. Faith Fitzgerald, Professor of Internal Medicine, for her careful and constructive review of the manuscript. We are grateful to William Harley for his valuable assistance with the preparation of the tables.

REFERENCES

1. Ludmerer, K.M. Time to heal. American medical education from the turn of the century to the era of managed care. 1999; New York**:** Oxford University Press.
2. Sweeney, G. The challenge for basic science education in problem-based medical curricula. *Clinical and Investigative Medicine*. 1999; 22(1):15-22.

3. Schmidt, H. Integrating the teaching of basic sciences, clinical sciences and biopsychosocial issues. *Academic Medicine*. 1998; 73(9): S24-S31.
4. Foley, R.P., Polson, A.L., and Vance, J.M. Review of the literature on PBL in the clinical setting. *Teaching and Learning in Medicine*. 1997; 9(1): 4-9.
5. Maleh, D., Burday, M., Collier, V., Polster, J. Problem-based learning in the medicine clerkship: a resident-driven strategy for teaching third-year students. *Academic Medicine*. 2000; 75(5); 522-523.
6. Curtis, J.A., Indy, K.D., and Taylor, B. Successful use of problem-based learning in a third year pediatric clerkship. *Ambulatory Pediatrics.* 2001; 1: 132-135.
7. McGrew, M.C., Skipper, B., Palley, T. and Kaufman, A. Student and faculty perception of problem-based learning in a family medicine clerkship. *Family Medicine.* 1999; 31(3): 171-176.
8. O'Neill, P.A. The role of basic sciences in a problem-based learning clinical curriculum. *Medical Education.* 2000; 34(8): 608-613.
9. O'Neill, P.A., Morris, J., and Baxter, C.M. Evaluation of an integrated curriculum using problem-based learning in a clinical environment: the Manchester experience. *Medical Education.* 2000; 34(3): 222-230.
10. Beech, D.J., and Domer, T.R. Utility of the case-method approach for the integrati on of clinical and basic science in surgical education. *Journal of Cancer Education.* 2002; 17(3): 161-164.

Analysis on the Effects of Block Testing in the Medical Preclinical Curriculum

Uldis N. Streips[1], Gabriel Virella[3], Ruth B. Greenberg[2], Amy Blue[4], Frederick M. Marvin[2], Mary T. Coleman[2] and Mary B. Carter[2]

[1]Department of Microbiology and Immunology, and [2]Office of Medical Education
University of Louisville, School of Medicine
Louisville, KY 40292 U.S.A.
[3]Department of Immunology and Microbiology and [4]Office of the Dean
Medical University of South Carolina
Charleston, SC 29425 U.S.A.

Phone: (+)1-502-852-5365 Fax: (+)1-502-852-7531 Email: unstre01@louisville.edu

Abstract

Using a whole day, comprehensive test three times a semester, rather than many individual course examinations in the same time span is the hallmark of Block Examinations. This manuscript examines the effect such a curriculum change has made at two medical schools of similar size (University of Louisville with 144 students and Medical University of South Carolina with 146). The implementation of Block testing at both medical schools has been associated with a sustainable increase in pass rates as well as absolute scores in Part 1 USMLE at both schools. This testing process is well accepted by faculty and students and appears to provide time for students acquire and retain preclinical material.

Introduction

Preclinical medical curricula, especially in schools using a traditional discipline-based curricular structure, are often characterized by frequent single course examinations which may lead students to memorize that course material for short term retention. One result of this type of "study and forget" cycling is difficulties when the students are facing USMLE Part 1 examinations, because they must relearn much of the material and have no overall understanding of how the subject material from the different courses correlates. Block testing was initiated to encourage a more integrated learning model (see Figure 1).

In this innovative testing model, students are allowed a long period of time (4 or 5 weeks) that is examination-free to independently spend the time in learning and correlating the subject material for all the courses in the study block. At the end of this period, Block week occurs--4 days of free time for study followed by one day (Friday) with 6 hours of a comprehensive examination with all subjects taught in that Block represented proportionally on the examination (for a description of the testing times during the Block Examination, see Materials and Methods). Since each course is represented by questions proportional to the time spent in that course, the problem of having a comprehensive examination which only tests a subset of knowledge is avoided.[1] In this manuscript we discuss how the implementation of the Block Examination process at two medical schools has affected USMLE Part 1 scores, students, and faculty.

Materials and Methods

Block Examination Committee

At the University of Louisville, the Block Examination Committee for the 6 Block tests consists of all second year course directors and two clinical representatives. The Chair of this committee, who oversees the Block Exam initiative, is appointed by the Dean of Curriculum at the Medical School. At the Medical University of South Carolina the Year 1 and Year 2 committees, composed of course directors, are responsible for the preparation of 6 Block tests in each preclinical year.

Block Examination question development

Figure 1. Testing Schedules for University of Louisville Pre- and Post-Block Testing

SECOND YEAR CURRICULUM
PRE-BLOCK TESTING
FALL

L MM PATH ICM	**L**	**L** MM EXAM	**L**	**L**	**L** MM EXAM	**L**	**L**	Exam Week MidTerm MM PATH ICM	**L** MM PATH GEN ICM	**L**	**L** MM Exam	**L** PATH Exam	**L**	**L** MM Exam	**L**	**L** MM Exam	Exam Week Final MM PATH GEN ICM

SPRING

L PHARM PATH ICM	**L**	**L**	**L** PHARM Exam	**L** PATH Exam	**L** PHARM Exam	**L**	**L**	Exam Week MidTerm PATH PHARM ICM	**L** PHARM CNS ICM	**L**	**L**	**L** PHARM Exam	**L**	**L** PHARM EXAM	**L**	**L** Exam Week Final PHARM CNS ICM	Board Prep

WITH BLOCK TESTING
FALL

L MM PATH ICM	**L**	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 1 FRIDAY	**L** MM PATH GEN ICM	**L**	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 2 FRIDAY	**L** MM PATH GEN ICM	**L**	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 3 FRIDAY

SPRING

L PHARM PATH ICM	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 4 FRIDAY	**L** PHARM CNS ICM	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 5 FRIDAY	**L** PHARM CNS ICM	**L**	**L**	**L**	**L**	STUDY WEEK BLOCK TEST 6 FRIDAY	BOARD PREP

L-lectures
MM-Medical Microbiology and Immunology
PATH- Pathology
ICM-Introduction to Clinical Medicine
EXAM WEEK- All courses tested
GEN-Human Genetics
PHARM-Pharmacology and Toxicology
CNS-Clinical Neurosciences

Each participating course (usually there are 3-4 courses participating in each Block test) submits 3-4 questions per lecture hour to the Block Exam Committee for the examination, proportional to their lecture time in that Block. The questions are submitted a minimum of two to three weeks prior to the test. The questions are carefully read by the Committee, and any questions that do not conform to the NBME format are discarded and the question writers are asked to submit new questions or to rewrite the discarded question.[2] In addition, the text of the questions is optimized to reflect the nature of the question in the least number of words possible. Questions with extended matching and clinical scenario questions are encouraged by the Committee from the courses .[3,4] The questions are also reviewed for both basic science and clinical accuracy by the Committee. Any revised questions are returned to the writers of the questions to verify that the changes are acceptable and resubmitted for final approval. The Chair, then requests the

Table 1. Sample Block Testing Days at the University of Louisville and Medical University of South Carolina

University of Louisville		Medical University of South Carolina	
Block Test II (Second Year)		Block Test II (Second Year)	
Questions:		Questions:	
Medical Microbiology and Immunology	129	Infection and Immunity	133
Pathology	90	Pathology	92
Introduction to Clinical Medicine	45	Doctoring	57
Medical Genetics	36	Clinical Genetics	15
Total	300	Total	297
The examination will consist of 6 sections of 60 minutes and 50 questions each.		The examination is given in two 3 hour sessions with half of the total questions in each and one hour break for lunch	

Schedule University of Louisville:

8:00-8:05	Administrative
8:05-9:05	Section 1
9:05-9:20	Break
9:20-10:20	Section 2
10:20-10:35	Break
10:35-11:35	Section 3
11:35-12:15	Lunch break
12:15-1:15	Section 4
1:15-1:30	Break
1:30-2:30	Section 5
2:30-2:45	Break
2:45-3:45	Section 6

Review University of Louisville:
Your answer sheets will be copied and displayed alphabetically outside the review room, B312. The examination with all the keys and questions will be available for review and challenge from 4:30-6:00 PM on Friday and for A-L from 9:00 AM-1:00 PM and for M-Z from Noon-4:00 PM on Monday

course directors to examine possibilities for merging questions across discipline lines but testing similar subject matter. This can be done, for instance, by having a clinical scenario or description to which specific questions from different disciplines can be directed. Our Block Examinations usually have approximately 5 such merged questions.

Assembly of the Block Examination

At the University of Louisville, once the question set is approved, the questions are entered into the LXR Test Version 6 system (www.lxr.com) and randomized into 6 sets of no more than 50 questions per set, distributing the questions with any attached illustrations, tables, and graphs. The assembled examination is proofread carefully by the Chair of the Block Exam Committee to make sure cross-referencing questions are not in the same section, detect any duplicate questions, and ensure that the sections are relatively equally balanced. The examination then is copied and assembled into six booklets with a cover page that states the examination number, section of the exam, and the number of questions and pages represented in this section of the examination. Answer sheets are also imprinted with the section number. A similar methodology is used in year 1 block tests at the Medical University of South Carolina; however, only two booklets are printed, one for a morning session and one for an afternoon session. Each session is 3 hours long, and the maximum number of questions per session is 150. An identical protocol for administration of the tests is followed in year 2, but the Year 2 coordinator does the assembly and randomization of test items.

Examination Day

At the University of Louisville, the Block Examination Committee Chairman distributes to the class of 144 students the schedule for the examination day (see Table 1). That day starts with instructions to the class, and then after each testing section (there are 6 total with a maximum of 50 questions in each) the students turn in their answer sheets, which are duplicated and graded. During the 15 minute break time, the Chairman and associates remove all the previous section booklets from the student seats and replace them with next section booklets and answer sheets. At the end of the Block Examination, the six answer sheets for each student are copied, collated and made available to the students. Then, in a locked room, the entire Block test is displayed by sections on the wall, along with several copies of the key and a designation of the course that provided each question. At that time, students may grade their tests, examine the questions, and discuss the examination with

Table 2. Student opinion on initiation of Block testing at the University of Louisville

How did the new Block Testing examination system change your study habits when compared with your study habits last year (prior to Block Testing)?

Survey	**12/02**	**5/03**	**12/03**	**5/04**	**12/04**	**5/05**
n =	116	100	108	108	123	47
Worse	13.8%	15%	10.2%	4.6%	8.9%	4.3%
No change	44.0%	47%	33.3%	35.2%	26.0%	25.5%
Improved	42.2%	38.0%	56.5%	60.2%	65.0%	70.2%

Mean Likert scale responses for the following questions
(1=strongly disagree; 2=disagree; 3=undecided; 4=agree; 5=strongly agree)

	12/02	**5/03**	**12/03**	**5/04**	**12/04**	**5/05**
1. The Block Exam schedule promoted long-term retention of course material.	2.9	3.1	3.4	3.5	3.5	3.8
2. The Block Exam system helped me prepare for the Step 1 NBME Exam.	3.5	3.6	4.0	3.9	3.8	4.0
3. The Block Exam system facilitated integrated learning.	3.2	3.0	3.4	3.5	3.9	4.0
4. The Block Exam system forced me to keep up with my courses.	3.3	3.4	3.7	3.7	3.7	3.6
5. The Block Exam system supported a cumulative approach to studying.	3.2	2.9	3.6	3.7	3.8	4.0

others in the room. They may also draft challenges to specific questions on sheets mounted on the wall by each section.

At the Medical University of South Carolina the morning and afternoon booklets are distributed to the class of 146 students and collected at the end of each session (see Table 1). The booklets contain a comment sheet where the students are encouraged to express concerns about any item. All comments are carefully evaluated before the test is graded. After the test is graded, once all students have completed the exam (including any who postponed the test for reasons considered valid by the Office of Student Affairs and Academics), and course grades have been returned, a proctored review session is scheduled for students to review the exam and their answers. During the exam review session, coordinated by the Office of Student Affairs and Academics, the students may review their individual exam with the answer key. Students are also permitted to discuss the exam during the session with their classmates and may write challenges to questions. When a student has completed reviewing the examination materials, all materials, including written challenges to the questions, are returned to the session proctor.

Challenges to questions

At the University of Louisville, a committee of 8 students is elected by the class to examine challenges and verify the challenges using books, notes and other sources. The Chair of this committee then submits the approved challenges to the Chair of the Block Examination Committee by Monday evening following test week, who then distributes them to the appropriate course directors. Each course decides which challenges are acceptable and modifies the scoring key to accommodate any changes. The examination is rescored and final scores are separated for each course and distributed to the participating course directors, who release them to the students, if possible, by Friday following the Block Examination. No total Block test grade is used in grading. At the Medical University of South Carolina, the written challenges are forwarded to the respective course directors by the Office of Student Affairs and Academics; students meet with the course director and follow up about their questions and challenges; the course directors then decide which challenges are acceptable and modify the scoring key to accommodate any changes.

Satisfaction surveys

At the University of Louisville, the Office of Medical Education administers a survey to all students at the end of the Fall and Spring semesters. Included in this survey are questions regarding the Block Examination process and the student opinions about this type of testing methodology. The survey is done using a Likert type scale (1=strong disagree to 5=strongly agree).

At the Medical University of South Carolina, students complete end of the year surveys at the end of the first and second year to provide feedback about the overall curriculum and particular curricular goals. Two items on the surveys directly assess students' perceptions of the block testing through a Likert-type scale (as above): "The comprehensive exams helped me integrate learning issues

Table 3. Student Perception of Block testing at Medical University of South Carolina. End of Year Curriculum Effectiveness Survey Results

Year 1 Students	2000 (n=90 64%)	2001 (n=51 36%)	2002 (n=100 71%)	2003 (n=98 70%)	2004 (n=141 100%)	2004 (n=141 100%)
The comprehensive exams helped me integrate learning issues from different classes.	3.4*	3.3	3.9	4.0	4.0	4.2
I like the comprehensive exams rather than individual course exams.	3.8	3.9	3.9	4.2	4.2	4.3
Year 2 Students	**2001 (n=80 57%)**	**2002 (n=58 41%)**	**2003 (n=91 65%)**	**2004 (n=100 71%)**	**2004 (n=72 51%)**	
The comprehensive exams helped me integrate learning issues from different classes.	3.5*	3.8	4.0	4.2	4.3	
I like the comprehensive exams rather than individual course exams.	3.8	4.2	4.2	4.4	4.7	

* Values represent the average score on a Likert-type scale (1=strong disagree to 5=strongly agree)

from different classes" and "I like the comprehensive exams rather than individual course exams."

Statistical analysis
Analysis of USMLE Part 1 scores for students at both universities prior and post implementation of Block Examinations was done with SPSS, Version 14.0.

RESULTS

Student and faculty satisfaction
Results from the satisfaction survey for the students at the University of Louisville are shown in Table 2. Survey results indicate that students in the first class exposed to this testing were apprehensive and in some cases negatively disposed toward this new testing model. However, attitude became more positive over time. Students have also begun to view Block Examinations as a positive preparation for the USMLE Part 1 examination. The administration and implementation of the Block tests has been optimized with time and experience. The course faculty have been generally supportive (based on willingness to participate extensively in the examination process) of this testing method for several reasons: the Block tests are sequestered and this allows faculty to simply modify and upgrade questions year to year, rather than keep producing new and consequently often over-detailed questions; also, the Block Examination Committee assembles and runs the examinations so that duty

Table 4. Results on USMLE Part 1 before and after Block testing

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
National										
Mean score	210	212	215	215	215	215	216	216	216	NA[1]
% pass rate	93%	94%	94%	93%	92%	90%	91%	92%	92%	NA
U of L										
Mean score	208	212	203	207	207	215	210	211*	214*	219*
% pass rate	90%	95%	92%	86%	85%	88%	86%	89%*	93%*	94%*
MUSC										
Mean score	203	206	207	205	207	219*	214*	214*	216*	221*
%pass rate	90%	90%	90%	88%	90%	96%*	92%*	94%*	93%*	97%*

[1] Not available at this time
*students taking USMLE Part 1 with Block testing

Table 5. Grade Point and MCAT Average Scores for Classes Prior to and Post Block Testing

Test Year	Avg. GPA (UofL)	Avg. MCAT UofL)
Prior to Block Testing		
2000	3.53	9.06
2001	3.58	9.04
2002	3.58	9.05
Post Block Testing		
2003	3.58	8.85
2004	3.62	9.03
2005	3.59	9.23
	Avg. MCAT (MUSC)	**Avg. MCAT (National)**
Prior to Block Testing		
2000	9.00	10.00
2001	9.67	10.00
Post Block Testing		
2002	9.67	10.00
2003	9.33	10.00
2004	9.33	10.00
2005	9.33	10.00

is obviated from departmental faculty. A byproduct of this process is the constant improvement of questions by the Block Examination Committee and the faculty to more closely approximate the USMLE Step 1 tests; in addition, the challenge process involves only receiving documented challenges from the student challenge committee, rather than taking time to discuss the same challenges over and over with individual students; finally, any concern about this testing method has been alleviated because student grade averages in individual courses generally have not suffered with this testing, though taking an examination where the questions are integrated among the different disciplines represented, represents a different test taking paradigm than they have experienced previously in single course/subject testing.

Since the introduction of the Block testing at the Medical University of South Carolina, results from students on the end of year 1 and end of year 2 curriculum effectiveness surveys have been consistently positive (Table 3). The quality of the tests has consistently improved, in part, because of faculty development efforts to improve course director and teaching faculty test writing skills and also because the tests are not released except under proctored circumstances and the honor code is upheld. Thus, there is opportunity to continually improve the quality of the items without having to complete a new test every year. The faculty has responded well to the system and the advantages of group review of test items and consideration of post-test comments have become obvious, as reflected by the fact that successful challenges to questions are very rare.

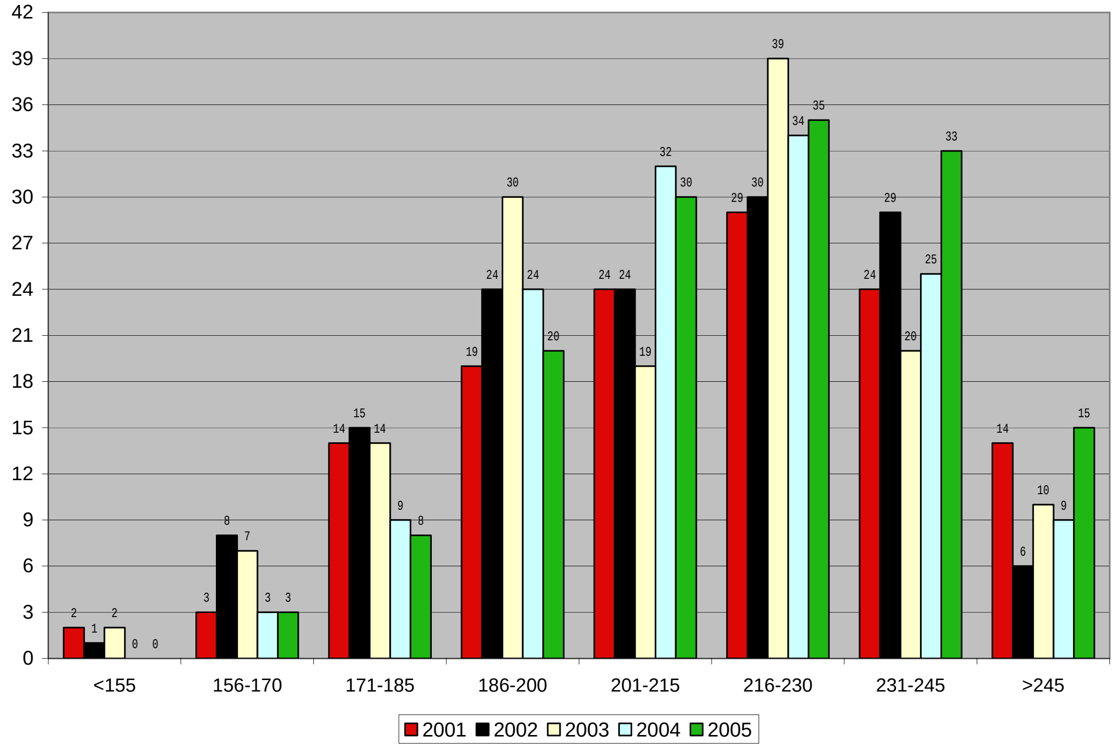
Effect on USMLE Part 1 Scores

This testing method (above) differs radically from traditional stand-alone, course-based examinations. By providing students with 4-5 weeks free of examinations and then several days free of all academic responsibilities for study, it was hoped that the students would be able to correlate the material in all of the courses being taught and gain deeper, more permanent understanding of underlying principles. This, in time, could translate into better performance on the USMLE Part I examination, which tests overall understanding and often includes questions that require thinking across discipline lines. The results at the University of Louisville, School of Medicine and at the Medical University of South Carolina are shown in Figures 2a and 2b and Table 4. Statistical analysis measuring only the USMLE 1 scores independently from any other factors for the University of Louisville group shows that for the years 1996-2002 (n= 946, prior to Block testing) the mean Part 1 score was 209.85 with a SD of 22.16 and SEM of 0.720 while for the years following initiation of Block tests (n=412, 2003-2005) the mean Part 1 score was 215.04 with SD=22.01 and SEM of 1.084. By T-test, df=1356, t= -3.976 and p< 0.001. These data suggest the Block tests are shown to have made a statistically significant contribution to the board scores of students at the University of Louisville. Data from MUSC also indicate a similar positive significant influence on USMLE Step 1 scores following the adoption of Block tests. For the years 1996-2000 (n=695), the mean Part 1 score was 205.77 with a SD of 21.18 and SEM of 0.80, while for the years following the implementation of Block tests, 2001-2005 (n=671), the mean Part 1 score was 215.41 with a SD of 22.86 and SEM of 0.88. By T-test, df=1364, t=8.085 and p<0.001. Though these results are encouraging, it must be noted that at both schools there is a multitude of board preparation efforts and curriculum implementations which may also contribute partially to this success, though many of those efforts bracket the entire time examined, pre- and post-Block Examinations. In addition, an examination of entering grade point and MCAT scores revealed that the classes at both universities have been relatively homogenous with a slight increase in MCAT scores in the 2005 entering class at the University of Louisville (Table 5). Figures 2a and 2b also reveal the overall shift of individual scores to higher levels at both schools following initiation of Block testing. This finding suggests that the Block Examination method may have a positive influence on retention and assimilation of basic science content as tested on the Part 1 exam.

DISCUSSION

Both medical schools represented in this study have documented positive and sustainable increases in USMLE Part I results following initiation of Block testing, although there may be other factors (i.e. other Board preparation efforts such as question groups, shelf tests, etc) which may also partially influence these results. The MCAT and GPA scores have been relatively homogenous and don't appear to play a significant part in this increase.[5-7] Nevertheless, increased student satisfaction and the general acceptance and

Figure 2a. USMLE Part 1 scores at the University of Louisville prior (2001-2002) and post (2003-2005) Block testing



participation by the teaching faculty for this method of testing have allowed Block testing to become an integral component of the evaluation system at both of these medical schools. This cooperation among the course directors in implementing Block testing has also led to improvement of the tests over the last couple of years with better organization and increasingly better questions. Moreover, the review of the Block test by the Block Examination Committee leads to linking of questions across course lines, as well as a better appreciation of other course curricula by the course directors, leading at times to synchronization of lecture presentations.

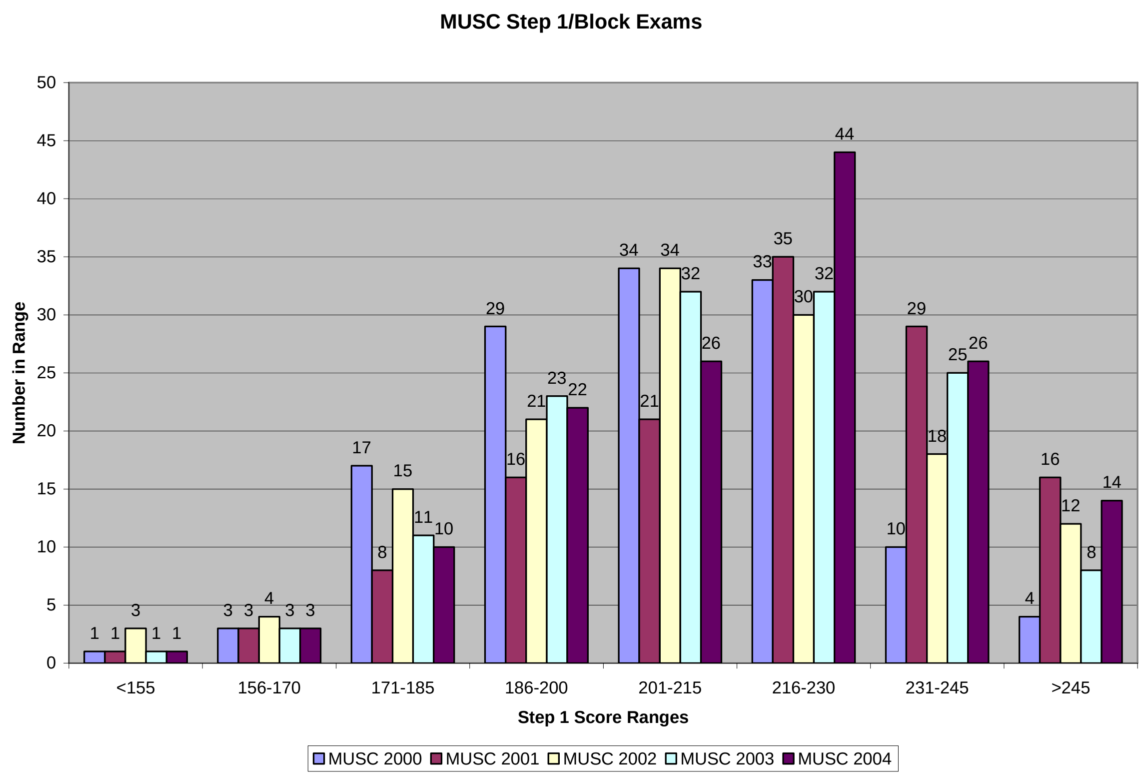
Another result of Block testing has become apparent over time. At the University of Louisville, we allow students ample review time to examine their answers against posted keys and actual reproductions of the examination that identify the department testing each question. This permits the students to calculate an approximate score in each subject, pending challenge; to challenge questions; and, most importantly, the opportunity to discuss the test with classmates. These discussions provide students with an additional learning opportunity where students explain to other students why certain answers are correct while others are not. On average, about a third of the class participates in this discussion, which we believe reinforces retention of the preclinical material among participants.

The challenge process is well received by both students and faculty. At the University of Louisville, having a student committee examine the challenges and verify the valid ones with references to notes, books and sometimes even published papers, makes the challenge process much less adversarial and more efficient with between 60 and 70% of all committee-approved challenges being accepted by the Departments. Moreover, since course faculty are not directly involved in this process, other than to consult with the course director on accepting a challenge to their question, individual students no longer take up faculty time with challenges.

At the Medical University of South Carolina, the post-test review process is not as elaborate but also gives the students an opportunity to learn from their errors. In addition, there has been a concerted effort to reduce the time between the test and grade posting to allow the students a quick transition from a test debate into learning the new topics that are presented as soon as the test is over.

Block testing also demonstrates to the students the physical and mental rigors of a whole day examination, which is similar to USMLE Part 1 testing. It also provides practical evidence that studying methods need to change from short-term memorization to a more integrated long-term understanding. Finally, the change from a single subject examination where the students know the origin of the next

Figure 2b. USMLE Part 1 Scores at the Medical University of South Carolina prior to (2000-2001) and post (2002-2004) Block testing



question, to an examination where questions from different disciplines alternate, requires an adjustment to test taking skills. However, based on evidence from student satisfaction surveys at both medical schools as well as a survey of course grades (below), the students appear to adapt to this test taking from both physical and mental aspects quite quickly (usually by the second Block Examination) (see Table 2). Since the course average scores for the class in individual courses, usually by the second Block Examination, reach identical levels as in the years prior to Block tests, we feel the students become comfortable with integrated testing and that this comfort zone extends ultimately to the USMLE Part 1 examination.[8] As an example, in Medical Microbiology and Immunology, the course average fluctuated between 81.2 and 83.1 in a few years prior to Block testing. In the last three years, post Block testing, the course average score has been: 82.9, 81.8, and 81.8.

This paper shows the effect of implementing Block testing at two different medical schools. The Medical University of South Carolina initiated Block testing in both preclinical years simultaneously in 2001. At the University of Louisville based on the apparent success at MUSC, but for logistical, internal reasons, Block testing in 2003 could be started only in the second preclinical year, which contains Medical Microbiology and Immunology, Pathology, Medical Genetics, Introduction to Clinical Medicine, and Clinical Neurosciences. Consequently, it is interesting that the implementation of Block testing only in the second year at the University of Louisville yielded results that were quite similar to those from MUSC, where Block testing has been run for both preclinical years. This may indicate that experience with this kind of testing even for one school year prepares the students sufficiently for the physical and mental rigors of the USMLE Part 1 examination and helps them achieve better scores. It is also possible that this type of testing changes the way students study and retain information, integrating second year subjects and being better prepared for the material presented on the USMLE Part 1 examination.

The progress of Block testing at both schools will be monitored with the expectation that results will remain as reported. While a few years of experience have allowed both schools to run the Block Examinations seamlessly, there are still many interesting avenues to explore. For instance, it will be very interesting to determine if learning increases with the implementation of Block testing. This would need to be examined both at the clinical expertise level and also in national examinations beyond Step 1. We need to find a compatible mechanism for offering subject Shelf Tests within the Block testing system. We are also continually striving to incorporate integrated questions which include more than a single department questioning a single clinical scenario. It will be important to determine how students respond to these types of questions.[2] The University of Louisville has also now instituted Block testing in the second semester of the first pre-clinical year and we are interested to know how this class will perform on the USMLE Part 1 examination after 9 Block Examinations.

In sum, initiation of Block testing has so far been an extremely positive experience for both medical schools and their student populations. This system should be applicable to many medical, dental, osteopathic, and veterinary schools which need to prepare their students for qualifying examinations.

REFERENCES

1. Markert, R.J. When to use a comprehensive final examination. *Journal of Medical Education*. 1981; 6: 198-199.
2. Case, S.M. and Swanson, D.B. Constructing written questions for the basic and clinical sciences (3rd edition/revised).National Board of Medical Examiners. 2002.
3. Case, S.M. and Downing, S.M. Extended matching items: a practical alternative to free response questions. *Teaching and Learning in Medicine*. 1993; 5:107-115.
4. Bhakta, B., Tennant, A., Horton, M., Lawton, G. and Andrich, D. Using item response theory to explore the psychometric properties of extended matching questions examination in undergraduate medical education. *BioMedCentral Medical Education*. 2005; 5:9 (http://www.biomedcentral.com/1472-6920/5/9).
5. Jones, R.F. and Thomae-Forgues, M. Validity of the MCAT in predicting performance in the first two years of medical school. *Journal of Medical Education*. 1984; 59: 455-464.
6. Vancouver, J.B., Reinhart, M.A., Solomon, D.J. and Haff, J.J. Testing for validity and bias in the use of GPA and MCAT in the selection of medical students. *Academic Medicine*. 1990; 65: 694-697.
7. Veloski, J.J., Callahan, C.A., Xu, G., Hojat, M. and Nash, D.B. Prediction of students' performances on licensing examinations using age, race, sex, undergraduate GPAs, and MCAT scores. *Academic Medicine*. 2000; 75(supp): S28-30.
8. Ripkey, D.R., Swanson, D.B. and Case, S.C. School-to-school differences in Step 1 performance as a function of curriculum type and use of Step 1 in promotion/graduation requirements. *Academic Medicine*. 1998;73: S16-18.

Using Metaphors, Analogies and Similes as Aids in Teaching Pathology to Medical Students

Rani Kanthan, M.D. and Sheryl Mills, M.Ed.
Colleges of Medicine and Education
University of Saskatchewan
Room 2868 "G" Wing
Royal University Hospital
103 Hospital Drive Saskatoon, SK S7NOW8 CANADA

Phone: (+)1-306-655-2158 Fax: (+)1-306-655-2223 Email: rani.kanthan@saskatoonhealthregion.ca

ABSTRACT

Metaphors, analogies, and similes bridge the known to the unknown, and alter the conceptual system of existing knowledge by modifying and strengthening its associations. Although the use of metaphors, analogies, and similes is pervasive in our language, not much has been written about its use as a potential active teaching strategy in medical education to explain complex or abstract concepts. Metaphors, analogies, and similes were used intentionally in two consecutive years of an undergraduate pathology course for medical and dental students for two purposes: a) to communicate and understand complex concepts such as those related to acute and chronic inflammation, thrombosis, embolism and infarction; and b) to provide practice for students to become better communicators of complex medical concepts using these strategies. Students found that working with metaphors, analogies and similes enhanced and aided their learning, and challenged their communication skills. The unexpected impact of creating visual metaphors had a unique potential for improving recall of information. The discussion and negotiation of metaphors can be used in medical education as an effective teaching strategy to augment communication skills towards a better understanding of complex medical concepts. This, in turn, may aid students in becoming effective communicators with their prospective patients.

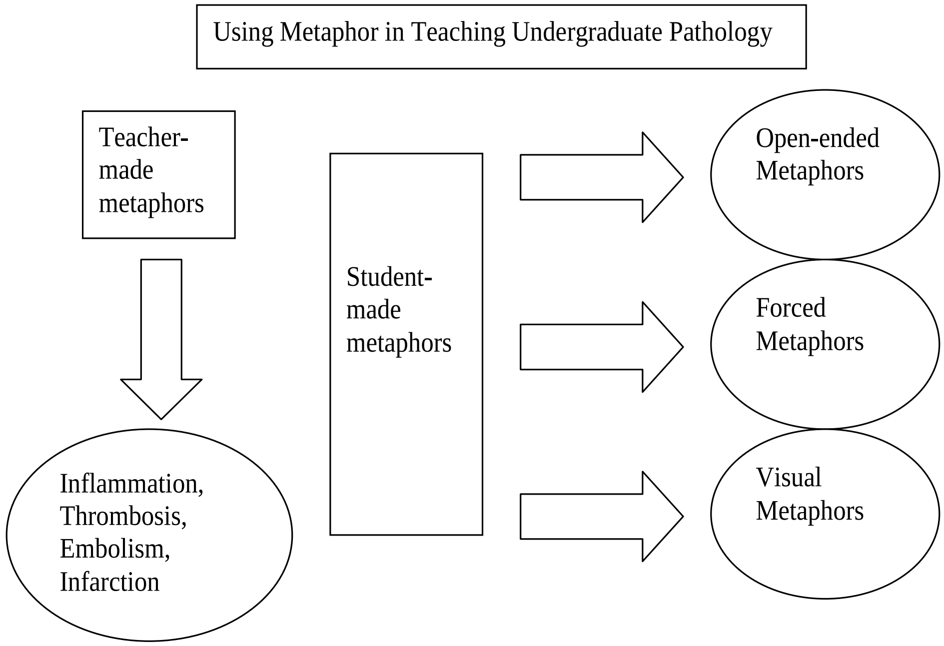
INTRODUCTION

Although the use of metaphors, analogies, and similes is pervasive in our language, not much has been written about its use as a potential active teaching strategy in medical education. A metaphor is defined as a figure of speech in which a word or phrase that ordinarily designates one thing is used to designate another, thus making an implicit comparison, as in "a sea of troubles" or "All the world's a stage."[1] An analogy on the other hand shows similarity in some respects between things that are otherwise dissimilar and a comparison is based on such similarity as in "the operation of a computer presents an interesting analogy to the working of the brain." [2] In contrast, a simile is a figure of speech in which two essentially unlike things are compared, often in a phrase introduced by *like* or *as,* as in "How like the winter hath my absence been" or "So are you to my thoughts as food to life." [3] In the context of this article and in our teaching, we use the terms metaphor, analogy, and simile interchangeably.

The essence of a metaphor is the process of understanding and, perhaps, experiencing one kind of thing in relation to another.[4] Metaphors can facilitate communication by providing something tangible in terms of other more familiar concepts to an otherwise abstract complex medical concept. Metaphors also have the potential to bridge understanding between the known and the unknown, and alter the conceptual system of existing knowledge to modify and strengthen its associations. As such, metaphors may be used as an effective tool to enhance the understanding of complex and abstract patho-physiological processes. [5] Metaphors can also create rapport[2] with students when a known concept, something from their world, is linked with something foreign. Well chosen metaphors provide a connection to that which the students already knows, and offers order to the chaos of the new language and unfamiliar concepts.[6] Perceived order enhances learning. Aristotle compared metaphors to puzzles, and as puzzles, metaphors engage us in solving how one thing is like another.[4] It is this engagement in the process of resolution that makes the use of metaphors so valuable in conveying and understanding complex concepts. This is particularly valuable in the case of medical education wherein new vocabulary with highly refined language is being introduced.

Although some metaphors can be more obfuscating than illuminating, there are simply degrees of appropriateness in the metaphor encapsulating the qualities of the new concept that is being learnt.[4,7] When students develop their own metaphors for new concepts (providing they have a fairly good understanding of the concept), they further strengthen

Figure 1. Outline of the intentional use of metaphors in the instructional teaching of pathology to undergraduate medical students.



their understandings because they are (a) negotiating the appropriateness of the metaphor they are working with, and (b) arranging their understandings in personally meaningful ways.[5]

Metaphors were used intentionally in teaching undergraduate pathology to medical and dental students for two consecutive years (Figure 1). The principle intentions included:

1. Incorporating open-ended, forced, and visual metaphors to teach complex concepts (e.g. acute and chronic inflammation, thrombosis, embolism and infarction);
2. Involving students in a creative dynamic thought process to enhance understanding of such complex medical concepts; and
3. Providing students with a forum to practice the communication of complex medical concepts through the joint exploration of metaphors, analogies, and similes in terms of other things with which they were more comfortable and familiar.

MATERIALS AND METHODS

This study was initiated and carried out by the course coordinator in keeping with her ongoing interest in developing a repertoire of instructional methodologies that engage medical students in their own learning. The instructor has worked on this project with a coach and co-author of this paper, a doctoral candidate in Educational Administration, as part of their on-going interest in active learning in the medical curriculum.[7]

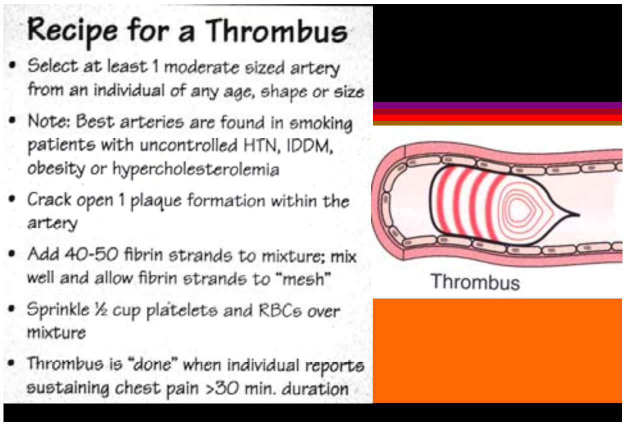
This instructor, who intentionally incorporated metaphor, analogy and simile, taught 13 of the 22 classes in the Year 2003 and 12 of the 22 classes in the Year 2004. In both years, these sessions formed a block series of lectures occurring from the beginning of the course to the midterm exam thereby maintaining continuity of communication. During the first year of study there were 88 students enrolled in the 6-credit course: 60 second year medical students, 26 second year dental students, and 2 graduate students. During the second year of study there were 63 second year medical students, 27 second year dental students, and 2 graduate students.

Instructional Metaphor Examples

The instructor first modeled the use of metaphors by peppering her traditional lecture with explicit metaphorical and analogous examples:

1. For inflammation, the instructor used a sports analogy. Although starting with tennis, a game she is familiar with, she quickly made a switch to football and hockey when it became apparent that the intricacies of tennis were not familiar to many students. She discussed the medical concepts of exudation, transudation, edema, and pus by using the sports vernacular and language (i.e. game strategy plans). She indicated how the game strategies paralleled those of the body in inflammation in terms of:

Figure 2. Recipe card for thrombosis.



- where the sport or game was played. The vascularized connective tissue became the playing field;
- the teams were Team A (the circulating cells in vessels –neutrophils, eosiniphils, basophils, and platelets) and Team B (the connective tissue cells -- mast cells, resident macrophages, and lymphocytes); and
- the extracellular matrix, composed of structural fibrous proteins, adhesive glycoproteins and basement membranes, became the "reserves" on the "bench."

The instructor likened the "quick kill" of acute inflammation to a "blow out" in hockey as opposed to chronic inflammation that resembled repeated overtimes in hockey. In tennis, chronic inflammations, like persistent infections and autoimmune diseases, were described as more closely resembling the prolonged agony of a 5 set tennis match with alternating deuce/match points, while, acute inflammation was likened to winning in three straight sets.

2. The pathogenesis of thrombosis was demonstrated using a toilet roll for a vessel lumen with "Smarties" as cells-- *white* blood cells, *red* blood cells, and *blue* platelets -- stuck to its interior. This actual model was held up as it was created and explained in class. A glue stick was used to "injure" the endothelium so that different cells could "stick" to the inside. The fibrin mesh was illustrated with red "Twizzlers." A recipe card for thrombosis was shown concurrently. (Figure 2)
3. For embolism, the students were asked to create three scenarios for the "perfect murder" using the principles of embolism.
4. Thrombus / Infarction became a plumbing blockage or the "loo" getting blocked. Students were presented with a situation where a tennis ball had found its way into the "S" shaped bend of the toilet bowl. As it absorbed water, it caused the flush to act in unpredictable ways. The ball intermittently obstructed the "flow" with the final result being a complete breakdown and an almighty flooding mess. This process was likened to the fate of a thrombus resulting in the various possibilities ranging from no effect to intermittent blockage to full blown infarction with complete breakdown of normal structure and order.

Student-developed Metaphors

As classes progressed, students were asked to work in small, informal groups to develop visual and verbal metaphors that linked the pathology concepts being presented in the lecture to common visual or verbal concepts. As well as providing a break in the flow of lecture information, it gave students an opportunity to reflect, discuss, and incorporate new concepts into their existing conceptual paradigms. The students had time in class to negotiate metaphors that illustrated the concept through these dialogues. For the verbal metaphors, students were asked to consider how the concept was like *x* and not like *x*. In the "open-ended metaphor," students were given the abstract medical concept, and were free to choose and develop the analogue for the concept. For "forced" metaphors, all students worked with the same analogue. They were given both the concept *and* the other half of the metaphor to which they had to provide supporting evidence for the analogue.

"Visual metaphors" were developed and explained through drawings and pictures that were not intended to be literal representations of the concept. It was hoped that exploring and negotiating the characteristics of new complex medical concepts through discussion and dialogue with metaphors would help to cement these ideas while providing a model that could be used to clarify medical complexities with patients in the future. Students worked in groups to choose an analogue, discuss and negotiate its merits, and then draw it. The drawings were collected at the end of the class and reviewed by the instructor. In this way, the instructor could clear up any misconceptions. Samples of the student responses to the activities were often shared with the large group at the beginning of the next class. Students requested to hear how others had responded and sharing these responses seemed to spark enthusiasm in class.

Data Gathering.

We gathered student responses to the inclusion of metaphors at different points in each class as part of our on-going investigation into the inclusion of active learning. As the instructor had no further direct teaching responsibilities in this course after the midterm, in both years, the students' perceptions of incorporating analogy and metaphor were gathered in the Midterm Evaluation/Reflection questionnaire[7] at the midterm exam. In Year 2003, the questionnaire included room for open-ended responses about the positive, the negative, and the interesting aspects of the course. There was also space for "other" comments. In Year 2004, the questionnaire had no open-ended questions. The questionnaires were collated and the comments were

Figure 3. Examples of student developed open-ended metaphors, analogies, and similes on acute inflammation.

Acute inflammation is ***like*** the ARMY because…	Acute inflammation is ***not like*** the ARMY because…
1. There's a 1st line of defense (soldiers) → circulating cells in vessels	1. Soldiers won't fight until ordered to (inflammation occurs naturally)
2. 2nd line of defense: artillery (CT cells)	2. Both sides kill each other, both sides die (Microorganisms and leukocytes phagocytose invading organism but organism doesn't eat leukocytes)
3. Army reserves (extracellular matrix)	3. In army wars aren't over when opponent dies: peace keeping aftermath etc. (inflammation over once organism resolved).
Acute inflammation is *like* WAR because…	**Acute inflammation is *not like* WAR because…**
1. The "enemy is the bacteria/infection	1. Wars usually last a very long time while acute inflammation lasts a short time
2. The "soldiers" are the immune response cells who share a common "battlefield" which is the organism	2. Wars can end in a truce but there is always a "loser" in acute inflammation
3. There are two sides of the battle (the injury/inflammation and the cells ie. circulating and connective tissue cells) and the two sides possess strategies. The body's cells send certain troops (ie. groups of cell/types of cell) to fight certain battles. For example Eosinophils are sent to battle hypersensitivity.	3. There is potential for inflammation to turn on itself the host if it is dysfunctional
Acute inflammation is *like* DATING because…	**Acute inflammation is *not like* DATING because…**
1. Chemokines attract leukocytes ***like*** pheromones attract a partner	1. You don't engulf/enter your date
2. Pavementing is ***like*** speed dating	2. Not trying to accumulate as many photrus as possible
3. Leukocyte adhesion is ***like*** marriage in that it usually ends in destruction	3. A roll in the hay is more turbulent than leukocyte rolling along vessel wall
Acute inflammation is *like* SEX because…	**Acute inflammation is *not like* SEX because…**
1. Protection can prevent undesirable consequences	1. Once the performance is over it can be done again and again
2. Involves stimulus and response	2. Only requires two people as opposed to many parties
3. Involves chemical attractants, pheremones	3. Inflammation is painful
Acute inflammation is *like* SHOPPING because…	**Acute inflammation is *not like* SHOPPING because…**
1. You roll around looking for something you like	1. Shopping you can think it over
2. When you see it you are attracted and move to it	2. You don't get swelling usually with shopping
3. You buy (engulf) it →the pain comes later with the bill	3. Pus is bad when shopping
Acute inflammation is *like* COOKING because…	**Acute inflammation is *not like* COOKING because…**
1. You have to follow the order of adding ingredients as the vascular changes must follow an orderly sequence	1. In cooking everybody wins, there is no conflict and hopefully no one gets killed
2. You have to have the right ingredients and the right mediators/cell types	2. In cooking you can use many recipes to make the same dish but inflammation requires all key players
3. Adding too much baking powder is like having an excessive/out of control inflammatory response	3. The whole dish is cooked but inflammation is local

analyzed using simple measures such as median, percentages, averages, and range of student comments that were categorized for over-riding themes. Another form of evaluation included a question on the midterm exam directly testing the application of metaphor to the material covered by this instructor. The students' final marks for years 2000-2003 (Table 1) were comparable. This was in keeping with the performance at the midterm as published previously. [7] Therefore, we concluded that the changes in instructional styles did not adversely affect the students' performance as a whole.

In Year 2004, the data collected from this second group of students was more extensive than from the first. It was as a result of the responses of the first group of students that we decided to try this method again and investigate more thoroughly. In addition to the questionnaire at the midterm exam, feedback was garnered from the students in the Year 2004 section halfway to the midterm by asking what they would like to see stopped (STOP), what they would like the instructor to add (START), and what they would like to see continued (CONTINUE).[7]

At the midterm examination the use of metaphors, analogies, and similes as a communication tool for explaining complex medical concepts to patients in clinical practice was also evaluated by written responses generated to short answer questions (SAQs) as seen in the example below:

Figure 4. Examples of student developed forced metaphors, analogies, and similes on acute inflammation to a “TIMBIT”.

Acute inflammation is ***like*** a “TIMBIT” because…	Acute inflammation is ***not like*** a “TIMBIT” because…
• like a macrophage, because if you were to put several Timbits together, you would get a doughnut (several macrophages → a giant cell)	• immune cells elicit different responses because of different stimuli (ex; parasite elicits eosinophilic reaction), but Timbits only elicit one response, satiating hunger
• the aroma of Timbits are like chemoattracts because they draw people to them	• inflammation requires energy to be expended, whereas Timbits are a source of energy
• Timbits come in several varieties so do immune cells	• Timbits are not painful
• has a shell of sugar like a granuloma has a shell of epitheliod macrophages	• inflammation is free – Timbits aren’t (unless they’re given out in class)
• variety of cells involved in inflammation just like the variety of flavours of Timbits	• Timbits come in boxes of 20, inflammation comes in any size needed
• timbits are usually associated with other chemical mediators (ie. caffeine)	• chronic inflammation from infection will make you skinny, Timbits make you fat
• Rolling – you can roll the Timbit around in your hand or tongue	• inflammation tastes, smells bad and Timbits tastes, smells good
• People phagocytose timbits just like neutrophils eating antigens	• you can only find Timbits at Tim Horton’s, you can find inflammation all over the body
• Timbits are sticky, just like activated leukocytes	• Timbits don’t have protein
• You are chemotactically attracted to it and go in for the kill	• Timbits build tissue not damage them
• Timbits and WBCs are round	• Eating a Timbit is enjoyable, inflammation is painful
• Many Timbits marginate and roll in my belly	• Timbits are cold, inflammation is hot
• Adhesion – the glaze from the Timbit wants to sticks to your tongue	• Inflammation is exothermic but Timbit digestion is endothermic
• Chemotaxis – the Timbits presence in your mouth attracts salivary juices from salivary glands	• Leukocyte can be activated and emigrate to the focus of inflammation. Timbit can’t move by itself

A 15-year old lad suffering from familial hypercholesterolemia is referred to your clinic for a consultation. Using verbal and / or visual metaphors as practiced in class:

a) Summarize the key concepts of the pathogenesis of atherosclerosis (2 marks); and
b) Explain the etiopathogenesis of this disease including risk factors (2 marks).

RESULTS AND DISCUSSION

The following are discussed in this section:

1. Student-developed metaphors;
2. Student reactions to the use of metaphors as an instructional tool;
3. The potential of using metaphor as a communication tool; and
4. Challenges and risks involved in using metaphors.

1. **Student-developed metaphors.** Students in both years participated in the classroom activities with varying degrees of enthusiasm. There appeared to be engagement in the activities and a good deal of productive “buzz” in the lecture theatre during the activities.

Open-ended metaphors. When students were asked to consider three ways in which acute inflammation was like *x* and three ways that acute inflammation was not like *x*, they devised their own metaphors based on things they knew and valued, and were thus able to arrange their learning experiences by strengthening understanding by linking something from their world with the newly presented abstract concepts in personally meaningful ways.[5] The students’ metaphors for acute inflammation clustered around 6 main themes:

1.	interpersonal dynamics (including sex/dating)	35%
2.	war and other forms of conflict	18%
3.	regular daily activities	16%
4.	sports (although they had been steered away from this)	14%
5.	natural phenomena	11%
6.	music and concerts	5%

A few examples of student-developed open-ended verbal metaphors for acute inflammation are illustrated in Figure 3.

Students enjoyed hearing what their peers had created at the beginning of the next class and this also served as a review of the concepts of the previous day's class.

Forced metaphors. In class, after small "Timbit" donuts were distributed and enjoyed, students were asked, "How is inflammation like a Timbit? How is inflammation not like a Timbit?" They gave a range of responses (Figure 4). The students, however, seemed less enthusiastic towards this activity in comparison to the creation of open-ended metaphors as revealed in their comments, their hesitation in engaging in the activity, and their overall reluctance to think outside the conventional framework. There may be several reasons for this:

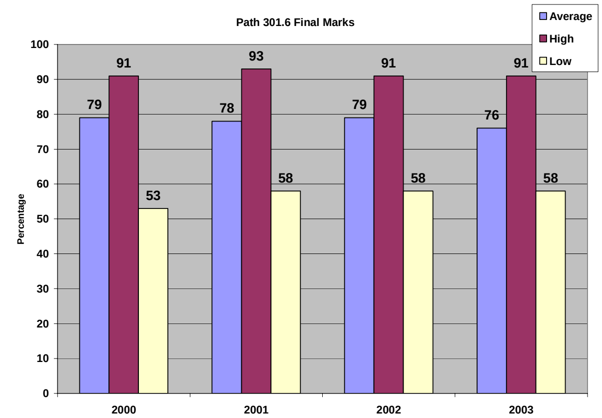
- The comparison may not have resonated with the students.
- The technique may have become over-worked.
- The comparison may not have risen to the potential for it to involve them in working to comprehend the connections.[4]
- They may have felt stifled, trapped, or uncomfortable by the "forced" choice.
- The students may not have understood either half of the metaphor well enough upon these initial introductions to make comparisons and see relationships.[8]
- There may have been a feeling that there was a "right answer" that they were trying to guess, rather than, feeling free to explore and develop possibilities as they had done with the open-ended metaphors.
- Developing open-ended metaphors was a creative activity in comparison to the forced metaphors where students may have felt "restricted."

Visual metaphors. There was a mixed reaction to "drawing" metaphors. There was some "shock" and surprise that this could happen in a university class. There was also enthusiasm for doing something that seemed to be "play." The visual metaphors that students developed for thrombosis, embolism, and infarction fell into 3 main categories: gardening, plumbing, and construction. Figure 5 illustrates examples of their work.

2. Student reactions to the use of metaphor as an instructional tool. Students in both years reported on their learning, and about using metaphors as an instructional and communication tool.

Year 2003. Student responses to analogy and metaphor were varied. Students were asked at the midterm what were the positives, the negatives, and the interesting aspects of the course. Although other comments were directed toward class structure in general, many comments were directed specifically at the inclusion of analogies and metaphors. Of the 39 positive comments, 8 (20%) specifically mentioned analogy and metaphor. Of the 77 negative comments, 6 (8%) specifically mentioned analogy and metaphor, and of the 64 "interesting" comments 18 (28%) specifically mentioned the benefits of analogy and metaphor for "fixing" the

Table 1. Student Final Marks Years 2000-2003



understanding of a medical concept for easy recall at the midterm examination. Many felt that if they drew the concept or were involved in the discussion of the drawing, it helped them to recall the information much easier. However, students were divided in their reactions to being asked to actually "draw" in class. Although only one of the comments was directly negative ("I'm paying $10,000 to draw cartoons"), responses ranged from "interesting" to "threatening" to feeling that it was a waste of their time and that the activity was "childish."

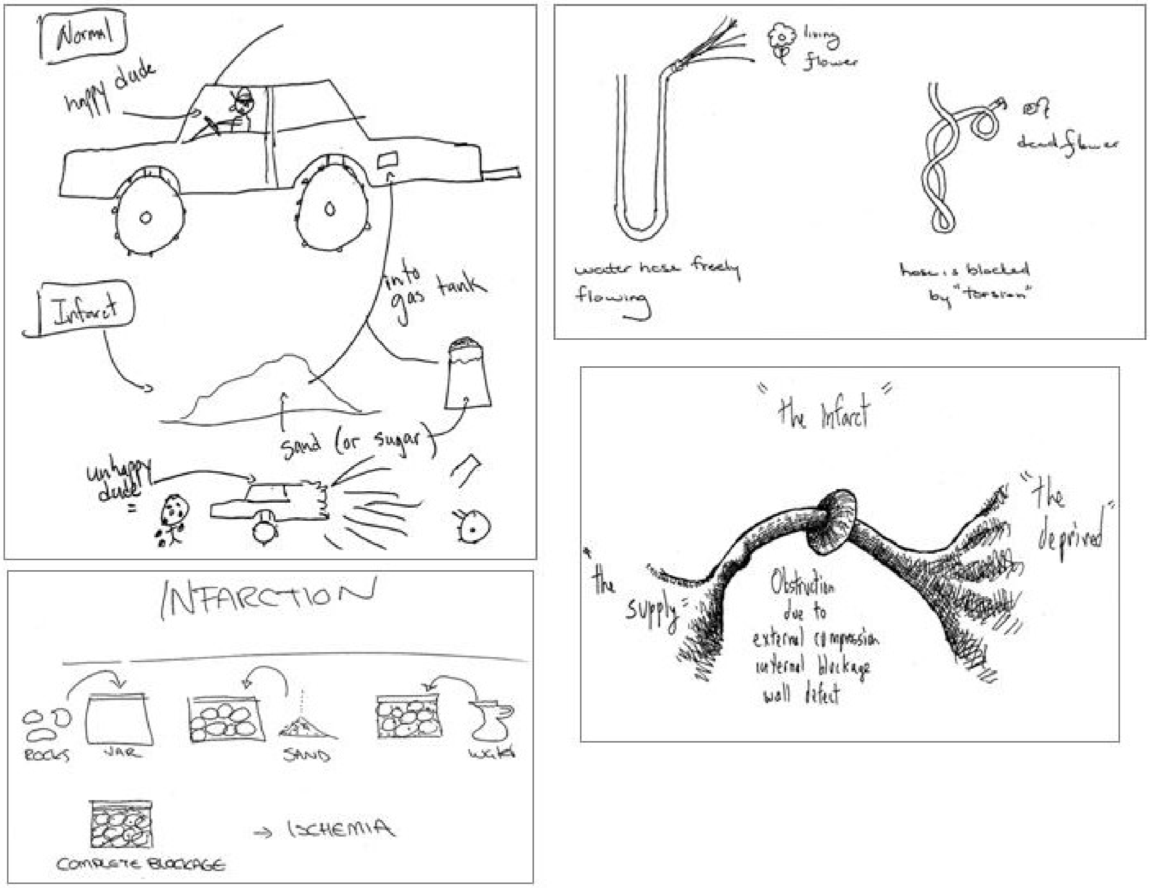
Students explored metaphors in a very different way when they started to draw. They were engaged in a process to clarify their drawings with their peers. When students explored and negotiated metaphors with their peers to reach a consensus, they were in a creative realm which was instrumental in forming new constructs.[9] Negotiating helped them accurately explain the medical concept to the best of their abilities. A metaphor conveys a lot in a succinct way; unpacking the metaphor illuminates the "ineffable."[4] Metaphors generate meaning and aid in understanding anyway,[4] and a visual metaphor has the added advantage of being "visual." Negotiating this through dialogue and discussion with their peers may have also contributed to the learning impact of the visual metaphor.

Year 2004. At the midterm evaluation, response to the statement that analogies introduced by the instructor helped them understand and consolidate the content more thoroughly was as follows (n=86): 17 students "strongly agreed" (20%), 47 students "agreed" (55%), 15 "disagreed" (17%), and 7 students "strongly disagreed" (8%).

Due to the resistant dynamics in the group, these students were not asked to create visual metaphors in the classroom. It was suggested that they might try the technique on their own to see how it worked for them.

3. The potential of using metaphor as a communication tool. Year 2004 students were asked if they had learned any new techniques that might aid in explaining complex

Figure 5. Examples of student developed visual metaphors, analogies, and similes to thrombosis /embolism/infarction.



medical concepts to their patients in the future. Of the 86 responses, 8 "strongly agreed" (9%) (e.g. "relating topics to real life situations—helpful for explaining to patients."), 44 "agreed" (52%), 27 "disagreed" (31%), and 7 "strongly disagreed" (8%). All students attempted the midterm exam question that evaluated this skill. Developing skills in using metaphors at this stage in their careers may help them in the future when they negotiate appropriate metaphors to explain complex medical concepts succinctly and accurately to their patients. The use of metaphors could be considered to be an essential part of the communication skill development and competencies for medical students.

4. Challenges and risks involved in using metaphors. When one thing that is unknown is linked to something that is known, the learner has the benefit of previous understandings and an existing conceptual template in which to embed the new concept. A well-chosen and developed metaphor can illuminate a difficult concept but a weak metaphor may confuse the learner. An ill-fitting, inappropriate metaphor can actually disengage learners[5] by leading them down a conceptual pathway of misunderstanding. It is, therefore, important to clarify the metaphors learners develop to be certain that they are on the "correct" conceptual pathway of understanding.

Independently, a few students made the same observation. Although they felt that they understood the "large picture" of the new concept, they did not feel that they were familiar with the details that made up the larger picture (e.g. "The visual metaphors actually did help me remember basic concepts, but not the fine details"). This has implications for future applications. Global thinking and understanding of a complex medical concept may not lend itself to ultimately putting the concepts into practice. If not checked, students may end up having their understanding of the detailed dynamics that contribute to the big picture overshadowed by a more thorough understanding of the big picture itself.

Students will be aware and conscious of their own use of metaphors and can later tailor this usage to individual patients based on a patient's personal and cultural values and unique presentation of their disease. Just as the instructor changed metaphors "midstream" moving from the less familiar game of tennis to the more familiar game of hockey in explaining acute inflammation, appropriate metaphors that resonate with individual patients are critical.

An instructor's metaphoric skill, imagination, and sensitivity are important in creating a solid learning platform during this demanding period of medical students' lives. It is useful in the two-way communication that facilitates better understanding of the nature of unshared experiences in the transfer of knowledge and the creation of meaningful learning relationships. In this two-way instructional-communication process, great heights of learning and understanding can be potentially achieved with mutually resonant metaphors and methodologies. Instructors' individual personalities and teaching styles will largely determine the various formats of metaphor exploration. Likewise, students have differing learning styles which will have a significant impact on which methodologies will be useful to them. We recommend incorporating varied instructional strategies of which the intentional use of metaphors, analogies, and similes as an additional method for medical educators to draw upon to accommodate these differences.

In order to suitably tailor the metaphors they use, clinicians and teachers require listening skills to pick up on the specific nuances and language of metaphors used by their patients and students. Metaphors used and practiced in learning can then be transferred to clinical situations to assist in the mutual understanding of the underlying disease processes that may cause illnesses.

CONCLUSIONS

Metaphors can serve as an effective instructional teaching tool for understanding complex medical concepts. In this observational study the salient features observed were:

1. The discussion and negotiation of mutually resonant metaphors can be used in medical education as an ***effective teaching strategy*** to augment and ***enhance interpersonal and communication skills*** for a better understanding of complex, abstract medical concepts.
2. It is important for the medical teacher to ***choose appropriate metaphors*** so students understand the concepts correctly as inappropriate metaphors can lead students down conceptual pathways of misunderstanding.
3. Creating ***visual metaphors*** may have a unique potential for improving recall of information; when students drew the "concepts," both the activity *and* the concepts "stuck" in their minds.
4. Some students found that working with metaphors, analogies and similes enhanced and aided their ***learning***.
5. Exposure to and the practice of using metaphors, similes, and analogies may help students to become ***effective communicators*** in their future clinical practices.

ACKNOWLEDGEMENTS

We, the authors wish to thank Ms Carla Merritt, Mr. Todd Reichert and Ms Mitch Hesson for all their help in the production of the figures for this manuscript.

REFERENCES

1. The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by *Houghton Mifflin Company*. Updated in 2003. http://www.thefreedictionary.com/metaphor
2. The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2003. http://www.thefreedictionary.com/analogy
3. The American Heritage® Dictionary of the English Language, Fourth Edition copyright ©2000 by Houghton Mifflin Company. Updated in 2003. http://www.thefreedictionary.com/simile
4. Fogelin, R. Figuratively speaking. *London*: *Yale University Press*. 1988.
5. Reisfield, G., & Wilson, G. Use of metaphor in the discourse on cancer. *Journal of Clinical Oncology*. 2004; *22*(19): 4024-4027.
6. Metaphor in crisis: The language of suffering. Pain and Suffering Interdisciplinary Research Network. Teucher, U. *University of British Columbia*. 2004. http://www.english.ubc.ca/PROJECTS/PAIN/DTEUCH.HTM
7. Kanthan, R. and Mills, S. Active learning strategies in undergraduate medical education of Pathology: A Saskatoon experience. *Journal of the International Association of Medical and Science Education [JAIMSE]*. 2005; 15 (1): 12-18.
8. Rothstein, E. Emblems of mind: The inner life of music and mathematics. *New York: Times Books.* 1995.
9. Sutherland, J. Communicating abstract concepts by metaphor. *Journal of Nursing Education.*, 2001;*40*(9): 417-420.

Effects of Lecture Absenteeism on Pharmacology Course Performance in Medical Students

Anwar Hamdi, M.D., Ph.D.

Clinical Pharmacology Department, College of Medicine
King Khalid University,
P.O. Box 641
Abha, Saudi Arabia

Phone: +966 7 224 7800 Ext. 2602 Fax: +966 7 224 7570 Email: anwhn_81@yahoo.com

ABSTRACT

Few studies have investigated the effects of absenteeism on medical student test results. The purpose of this study was to determine the effects of lecture absenteeism on performance in a medical pharmacology course as measured by test scores. Data on lecture absenteeism in pharmacology and the end-of-semester test scores were analyzed for two classes of medical students during four semesters. Based on the percentage of absenteeism in each semester, students were divided into two groups, group-I and group-II, with less than and more than 15% absenteeism, respectively. The percentage score attained and the frequency of failure in the two groups were compared. In addition, two groups of students were categorized; the uppermost 15% and the lowest 15% are based on test scores. The percentage absenteeism was compared between the groups and correlated with test scores. The percentage of high grades and percentage of failure in group-II (more than 15% absenteeism) were significantly lower and higher, respectively, when compared to group -I. The percentage of absenteeism was significantly higher in the group of students who scored in the lowest 15% of the class. Finally, a significant negative correlation was found between percentage of absenteeism and test score. The above results were similar for the four semesters of the study. The results obtained in this study confirm that absenteeism had a significant effect on the level of achievement in medical pharmacology, and suggest the importance of regular attendance as an effective way of increasing test's scores.

INTRODUCTION

The relationship between medical student absenteeism and class performance has received little attention. Educational researchers have focused mainly, on the effect of absence on test scores; those results have demonstrated a negative correlation between absenteeism and test scores.[1-4] However, the correlation was minimal. For example, Riggs and Blanco[2] reported a correlation coefficient (r) value of (-0.1738).

The content of the Medical Pharmacology course is tightly structured and hierarchical, and lecture-based clarifications of fundamental phenomenon are vital for more advanced understanding. Also, pharmacology facts demand comprehensive understanding, which depend on motivation and enthusiasm for the subject. Therefore, students who attend lectures may be more interested in the subject matter and hence, will study the content in more depth. Finally, studying large groups of students will provide an improved chance to analyze potential relationships between absenteeism and test scores.

The aim of this study was to determine whether there is a relationship between lecture absenteeism and performance in medical pharmacology as measured by the end-of-semester examination.

MATERIALS AND METHODS

Participants

All of the students in the fourth year of the medical curriculum, during the two academic years 2002-2003 and 2003-2004, who had enrolled in the medical pharmacology course, were selected for this study.

Data on 214 students [117 and 97 students for academic years 2002-2003 (class 2005) and 2003-2004 (class 2006), respectively] were recorded during four semesters (fall and spring for the two years). Each semester consisted of three 50-minute lectures per week for 15 weeks. The 30-weeks of lectures covered the entire medical pharmacology course.

Procedures

Lecture topics were guided by authoritative textbooks (i.e., B. Katzung 2001 and Goodman & Gilman 2001). The four-lecturers had extensive experience teaching the course, and three of them have received the best teacher award in basic sciences. Multiple choice question examinations (MCQs) were created based on material presented in the lectures;

each exam consisted of 130 MCQs.

The academic achievement data in this study were based on the results of the comprehensive exam at the end of the semester.

Using a new sign-up sheet for every lecture session, attendants signed their own names only. As part of the college policy, the students were regularly encouraged to attend, but with no reward or penalty for attendance or absence, respectively. However, names of students absent more than seven times (out of 45 lectures: >15%) were sent to the vice-dean before the final exam, for possible alerting of advisors.

Evaluations of academic achievement as presented by test scores and records of attendance were obtained for all students, and those with incomplete data (22, 17, 11, and 5 for the four semesters, respectively) were excluded.

Although that many factors (i.e., the student grade point average and the performance in other courses) can influence the performance on the medical pharmacology examinations, the current study was interested mainly in absenteeism. Therefore, it investigated the relationship between absenteeism and scores in two classes of medical students during their enrollment in the pharmacology course and the factors investigated were grades, absenteeism and the rate of absenteeism.

For each class, the absenteeism and test's scores were studied in two semesters: fall and spring. In order to examine if there were differences between those with low absenteeism and those with high absenteeism, students in every semester were divided into two groups: Group-I with 0-15% absenteeism during the semester period and group-II with more than 15% absenteeism during the same period, and the results were compared. Student test scores were ranked in a decreasing way, and the upper 15% and the lower 15% were defined as good and poor performance, respectively. The percentage of absenteeism between good and poor performance was compared using an unpaired t-test.

Table 1. The percentage of absenteeism and the test scores for the students during the four semesters

	Percent of Absenteeism (Mean ± SD)	Test Scores (Mean ± SD)
Class 2005 (fall) (n=95)[a]	13.75 ± 9.25	68.76 ± 16.91
Class 2005 (spring) (n=100)	16.55 ± 10.33	72.98 ± 13.97
Class 2006 (fall) (n=86)	17.95 ± 10.10	65.05 ± 16.67
Class 2006 (spring) (n=92)	15.80 ± 10.16	63.17 ± 15.28

a: n = Number of Students

Statistical Analysis

Data were analyzed by the SPSS statistical package (version 10.0). Where appropriate, the results are expressed as a mean with 95% confidence intervals or mean ± standard deviation or standard error of the mean. In each class, test scores and the percentage of absenteeism for fall and spring semesters were assessed by the paired t-test; and the relation between these factors was determined by linear regression.

Table 2. Percentage of absenteeism for students whose test scores were either at the upper 15% or at the lower 15%

	Percent of Absenteeism (Mean ± SEM)	95% Confidence Interval (p value)
Class 2005 (fall)		
Poor Performance [a]	19.40 ± 2.33	-20.35 to -9.11 (p<0.0001)
Good Performance [b]	4.67 ± 1.46	
Class 2005 (spring)		
Poor Performance	23.75 ± 2.47	-17.56 to -3.69 (p=0.0039)
Good Performance	13.13 ± 2.33	
Class 2006 (fall)		
Poor Performance	25.50 ± 2.35	-19.24 to -4.82 (p=0.0019)
Good Performance	13.47 ± 2.64	
Class 2006 (spring)		
Poor Performance	18.60 ± 1.38	-12.26 to -3.74 (p=0.0006)
Good Performance	10.69 ± 1.56	

a: poor performance: students who get the lowest 15% of the grades in the exam
b. good performance: students who get the highest 15% of the grades in the exam

Table 3. The correlation between the absenteeism percentage and the test scores

	FALL	SPRING
Class 2005	r = -0.495* (N=95)[a]	r = -0.383* (N=100)
Class 2006	r = -0.476* (N=86)	r = -0.444* (N=92)

a: N = number of students
r = correlation coefficient.
* correlation is significant at $p<0.01$

RESULTS

Absenteeism

At the end of semester, absenteeism was assessed by examining the percentage of absence for every student. The mean percentage of absenteeism during the observed period showed no statistical difference among the four semesters or between the two classes (Table 1). However, there was a significant correlation between the fall and spring absenteeism in each class. The correlations (r) were 0.6824 ($p<0.0001$) and 0.7425 ($p<0.0001$) for classes 2005 and 2006, respectively.

Exam Performance

To examine the effect of absenteeism on exam grades, this study looked at student scores for four exams in two different classes. The mean test scores during the observed period showed no statistical difference among the four semesters or between the two classes (Table 1). However, there was a significant correlation between the fall and spring test scores in the two classes. The correlations (r) were 0.668 ($p<0.0001$) and 0.7826 ($p<0.0001$) for classes 2005 and 2006, respectively.

Figure 1 shows the mean percentage of occurrence for grades for the four exams that were analyzed. In relation to test scores, the scholastic rating method was as follows: A+: 95-100, A: 90-94, B+: 85-89, B: 80-84, C+: 75-79, C: 70-74, D+: 65-69, D: 60-64, and F: less than 60. For each exam, higher attendance was associated with better grades. Students whose attendance was more than 85% earned substantially, higher grades than did students whose attendance was less than 85%. Practically, significant differences were observed for all passing-grades with the largest differences are for the A+, A, B+, B, and C+ grades (Figure 1). On the other hand, results showed that the percentage of failure in students of Group-II (more than 15% absenteeism) was significantly higher when compared to the percentage of failure in students of Group-I (less than 15% absenteeism) (Figure 1). For example, 13 of the 14 students of class 2006 who failed the fall-semester's examination were in Group-II. Surprisingly, 11 out of the 13 students had failed the spring-semester's examination as well.

When the students were ranked according to their test scores, the uppermost 15% and the lowest 15% were designated good and poor performance, respectively. The percentage of absenteeism was significantly higher in the poor performance students in the four semesters included in the study (Table 2). In order to determine the correlation between being absent from lectures and test scores, the subset of the samples that had no missing values were studied. A simple correlation and a regression analysis, using the test scores as the criterion variable and the percentage of absenteeism from the same semester as the predictor variable, were conducted. Table 2 presents the results of these correlations and regressions. The analysis indicated a significant ($p<0.01$) negative association between test scores and percentage of absenteeism from the same semester (Table 3). The correlation coefficients (r) ranged from -0.383 to -0.495, indicating weak, but consistent relationship.

DISCUSSION

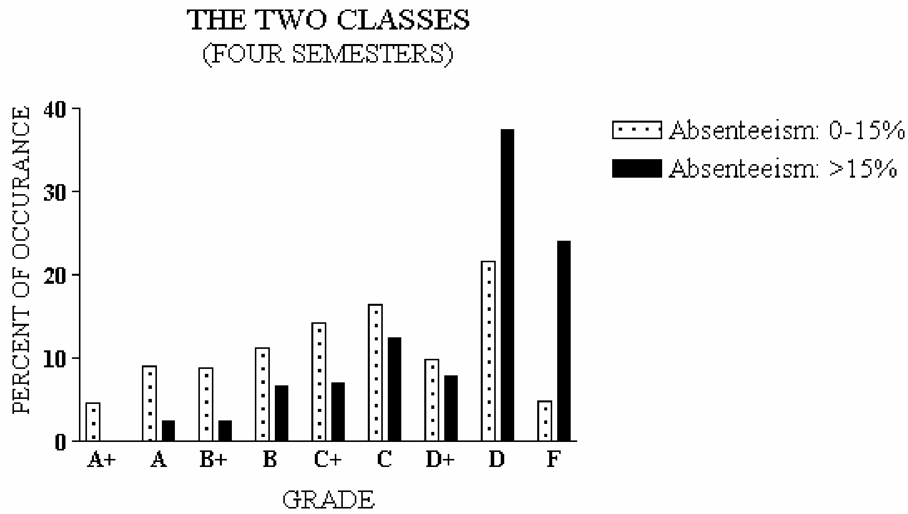
This study addressed the issue of whether absenteeism from lecture would have an effect upon one measure of academic performance: the test scores in our medical pharmacology course. Statistical analyses were applied to the absenteeism data and test scores in order to discover if there were significant patterns of change over time from fall to spring semester and/or from class of students to another. The analysis showed that neither the percentage of absenteeism, nor the test scores varied from semester to semester or from class to class. Those data validated further analysis by demonstrating an established and prevailing phenomenon and not an occasional or temporary one, at least, during the two-years of the observation period.

Results indicate that absenteeism was highly and negatively related to test scores. Test scores were significantly better for students whose absenteeism was low, than for students whose absenteeism was high. The effect was not only statistically significant, but was also conspicuous, especially for the higher grades. On the other hand, the number of failures among students with more than 15% absenteeism was significantly higher than among those students with less than 15% absenteeism (7:6, 10:1, 13:1, and 14:2 for the four semesters, respectively). This finding is consistent with and more established than Dhaliwal's finding of 6:4 for the ophthalmology exam.[3]

Students who performed poorly (the lowest 15% of the students) were having a nearly two-fold absentee rate (180%) compared to the students who performed well (the uppermost 15% of the students). It is possible that students who performed poorly have weak motivation to attend lectures and less enthusiasm to learn. Therefore, it is important to identify those students early in the course by monitoring their attendance and encourage them to improve their attendance and thereby, enhance their performance.

Finally, the results of this study demonstrate that absenteeism from lecture has a negative effect on

Figure 1. Grades distribution of end-of-semester examinations for students whose percentage of absenteeism was less than or more than 15%



A+: test score: 95-100, A: 90-94, B+: 85-89, B: 80-84, C+: 75-79, C: 70-74, D+: 65-69, D: 60-64, and F: less than 60.

performance of students on medical pharmacology examinations. Previous studies by Riggs and Blanco[2] and Dhaliwal[3] showed a negative correlation between lecture absenteeism and obstetrics and gynecology and ophthalmology examinations, respectively. However, the correlation in the current study is stronger than the correlation in the previous publications. This finding may suggest a weaker role for the other factors that affect test scores in medical pharmacology. Also, the substantial difficulty of the pharmacology material requires great efforts by the lecturer for explanations and simplifications; so that, the lectures will increase the students' understanding of the textbook material. Consequently, the student who fails to attend lectures will develop less understanding of the topic and will not perform as well in the course.

CONCLUSIONS

The evidence presented here suggests that student's absenteeism has a profound effect upon her/his performance and should be considered seriously when explaining student course achievement.

REFERENCES

1. Flournoy, D.J. and Hyde, R.M. The relationship of lecture attendance and course grade for second-year medical students. *Journal Oklahoma State Medical Association.* 1984; 77(1): 20-22.
2. Riggs, J.W. and Blanco, J.D. Is there a relation between student lecture attendance and clinical science subject examination score? *Obstetrics and Gynecology.* 1994; 84(2): 311-313.
3. Dhaliwal, U. Absenteeism and under-achievement in final year medical students. *The National Medical Journal of India.* 2003; 16(1): 34-37.
4. Khan, H.U., Khattak, A.M., Mahsud, I.U., Munir, A., Ali, S., Khan, M.H., Saleem, M. and Shah, S.H. Impact of class attendance upon examination results of students in basic medical sciences. *Journal of Ayub Medical College, Abbottabad.* 2003; 15(2): 56-58.

Health Science Faculty Members' Perceptions of Curricular Integration: Insights and Obstacles

Jennifer K. Brueckner, Ph.D. and Douglas J. Gould, Ph.D.

Department of Anatomy and Neurobiology
University of Kentucky College of Medicine
Lexington, KY 40536-0298 U.S.A.

Phone: (+)1-859-323-3780 Fax: (+)1-859-323-5946 Email: jbrueck@uky.edu

ABSTRACT

The objective of this pilot study was to analyze the results of a survey of basic science and clinical faculty regarding the integration of their institution's health sciences curriculum. Forty-four basic and clinical scientists responded to our survey, providing information regarding their level of interest in a more integrated curriculum and the level of integration that they currently enjoy at their institutions and opinions on obstacles to integration. Results indicate that interest in integration of the curriculum is high, that individual faculty members are interested in increased integration, but that the current level of integration is not adequate. Clinicians are less positive about curricular integration than were their basic science counterparts. The main obstacles cited by survey participants include the lack of a reward system for faculty to put effort into integration and lack of time. In sum, although faculty members recognize that integrating the basic and clinical sciences into a more cohesive experience for students is of interest to them and of benefit to their students, there is currently not sufficient support in the form of faculty time or reward to move forward towards a more vertically integrated curriculum.

INTRODUCTION

Medical education is changing rapidly, with more than half of American medical schools engaged in curricular reform.[1-4] Many of these modifications focus on implementing horizontal and/or vertical curricular integration[5]. Horizontal integration blends either related basic science disciplines in order to enhance students' understanding of body systems[6-7] or related clinical sciences through interdisciplinary clerkships.[8-12] This form of integration is often accomplished by the elimination of departmentally-oriented teaching.[13] Horizontal integration has become the norm over the last ten years in many medical institutions in the form of problem-based learning.[14-17] Vertical integration refers either to the incorporation of clinical experience into the early part of the curriculum[5, 18-22] or to the reintroduction of basic science material in the clinical years.[5-6, 23-26] While early clinical exposure programs have become a widespread component of the undergraduate curriculum, integration of the basic sciences during the clinical years still remains a challenge for many schools.[25] Without vertical integration, a medical school curriculum may suffer from content gaps[5] that may prove problematic when students enter their clerkship experiences.[27]

While there is a plethora of studies documenting student perceptions of integrated medical curricula,[28-32] only a limited number of studies have addressed faculty perceptions of horizontal[31, 33-34] and vertical integration.[17] The present descriptive pilot study queried both basic and clinical science faculty regarding their attitudes toward integration in order to expose barriers to integration and to identify potential new mechanisms for facilitating implementation of integrated curricula.

MATERIALS AND METHODS

The study population consisted of 44 volunteer basic science and clinical educators in 2002. This group consisted of 34 clinicians from disciplines including allied health, nursing, medicine and pharmacy along with 10 basic science educators. Most faculty participants (32/44) were surveyed at the 2002 University of Kentucky statewide annual community-based faculty conference (Preparing Practitioners for the 21st century VIII: Piecing Together the Educational Experience). This meeting is a multidisciplinary community-based teaching conference intended to provide a forum for dialogue between campus-based and community-based faculty. The remaining 12 faculty members were surveyed at the 6th annual meeting of the International Association of Medical Science Educators (IAMSE) in Guadalajara, Mexico. IAMSE is an interdisciplinary organization that focuses on promoting integration within and between basic and clinical scientific disciplines.

A nine item survey was used to gauge the perceptions of these basic science and clinical faculty regarding curricular

Table 1. Survey items

1. Please indicate your gender:	Male		Female		
2. Do you consider yourself a:	Basic science educator		Clinical educator		Both
3. Do you hold a:	Ph.D.	M.D.	Both	Other:	
4. Institutional affiliation:					
5. What do you view as the primary barrier of integration of the clinical and basic sciences at your institution?					
On a scale from 1-5, with 1 being low and 5 being high, please answer questions 6-8:					
6. To what degree do you currently integrate basic and clinical science instruction of students?					
7. Rate your interest level in working with basic scientists or clinicians to enhance integration in education.					
8. Rate your interest level in participating in future dialogues/efforts toward enhanced integration of basic and clinical education for health profession students.					
9. List 1-2 specific ways that you feel basic science educators might better prepare students for their clinical education.					

integration in their program (Table 1). The instrument probed their program's current level of integration, their individual interest level in increasing integration, perceived obstacles to successful integration and potential solutions that could help increase integration.

Results

The survey results elucidated several interesting trends in basic science and clinical faculty members' views on the process of integrating the health science curriculum. Figure 1 displays the participants' opinions on their program's current degree of integration, their interest in increasing integration and their interest in a dialogue on this topic. These items were rated on a Likert scale (1-5), with 1 indicating low interest and 5 representing high interest. Regarding the current level of integration in their program, the clinicians reported less integration (3.3/5) than the basic scientists (3.7/5). Basic scientists had a stronger interest in increasing integration of clinical materials (4.4/5) than did clinicians in reintroducing basic science topics into their clerkships (4/5). Moreover, basic scientists showed more interest in initiating a dialogue with clinicians (4.1/5) than did their clinical counterparts (3.6/5).

Faculty participants provided many comments regarding obstacles to integration and insights to improved integration. Table 2 demonstrates themes identified in response to survey questions 5 and 9. The primary obstacles to integration included lack of faculty time and incentive to participate in the integration process. Interdepartmental conflict and limited opportunity for interaction between basic scientists and clinicians were also common barriers cited. Responses to question 9 (suggestions) closely paralleled the obstacles identified above, including a formal mechanism for faculty reward and acknowledgement for efforts toward integration as well as increasing communication between basic scientists and clinicians. Some of the more novel ideas included enhancing basic science faculty clinical exposure as well as establishing integrated planning teams for curricular redesign.

Discussion

Basic science and clinical educators alike recognize the need for greater integration in the health sciences curriculum.[24, 27, 35-36] Many faculty respondents in our study expressed an interest in increasing the level of integration at their institutions and wish to open an ongoing dialogue on the topic of increasing integration. Our finding that basic science educators were more positive about curricular integration than their clinical counterparts is consistent with the 2 other studies that address this topic.[17, 34] We can only speculate as to the source of this discipline-specific difference in enthusiasm for curricular integration. Schmidt's[5] observation that it is "easier to bring clinical relevance to the basic sciences than to reinforce basic science in the clinical years" may provide some insight into the observed differences. In addition, Vernon and Hosokawa[30] have shown that faculty attitudes and opinions vary by degree and type of participation in integrated curricula and this is consistent with the fact that many of our clinical faculty respondents noted a current lack of integration in their programs. Negative faculty attitudes can present a significant barrier to integration[37] and an open line of communication between basic science and clinical disciplines may combat the perception that basic sciences are irrelevant to clinical practice and encourage vertical integration.[5]

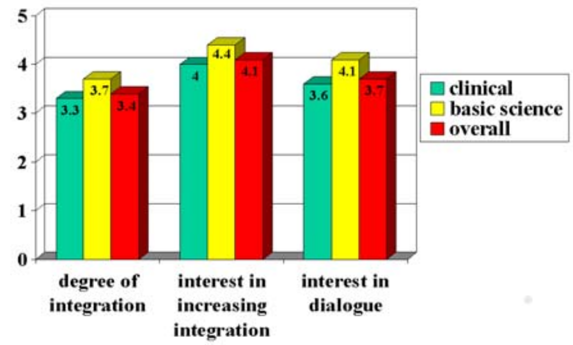
Other insights into advancing integration efforts identified in this study were consistent with those mentioned by Tresolini

Table 2. Obstacles to Integration and Suggested Strategies for Improved Integration

Obstacles:
1. Lack of faculty time to prepare integrated courses
2. Little faculty incentive to prepare integrated courses
3. Institutionalized 'turf' issues associated with integration
4. Lack of standardized level of student 'base' knowledge
5. Limited opportunity for interaction between basic scientists and clinicians

Suggestions:
1. Increase communication and increased contact between basic science educators and clinicians
2. Establish integrated planning teams
3. Increase use of 'case based' presentations
4. Increase basic scientists' clinical exposure and experience
5. Increase faculty reward and acknowledgement for efforts

Figure 1. Faculty participants' views on curricular integration (1 indicates low interest, 5 represents high interest).



and Shugars[37] and included strong administrative leadership, faculty development programs and an enhanced faculty reward system for participation. Overcoming departmental barriers and "turf" issues also presents challenges for our faculty participants as well as others.[5-6, 27, 38] In order to move forward with the integration of the basic and clinical sciences throughout the health science curriculum, interested schools should offer better faculty and departmental incentives and establish mixed teams of educators consisting of clinicians and basic scientists when planning for course redesign.

Conclusions

Certain limitations of the study must be noted. Seventy-two percent of the faculty participants in this study were from the state of Kentucky, with the remaining sample drawn from nine different US states and from Mexico. The small faculty sample precluded us from examining attitudinal trends between disciplines within the basic science and clinical science faculty categories. Plans are underway to recruit more faculty participants across a wide range of disciplines in order to determine if a relationship exists between professional specialty and attitude toward curricular integration.

References

1. Anderson, M.B. A guide to the 130 reports in this snapshot supplement to Academic Medicine. *Academic Medicine*. 2000; 75(9): 10-14.
2. Jones, R., Higgs, R., de Angelis, C. and Prideaux, D. Changing face of medical curricula. *Lancet*. 2001; 357: 699-703.
3. Hollander, H., Loeser, H. and Irby, D. An anticipatory quality improvement process for curricular reform. *Academic Medicine*. 2002; 77(9): 930.
4. Satterfield, J.M., Mitteness, L.S., Tervalon, M. and Adler, N. Integrating the social and behavioral sciences in an undergraduate medical curriculum: the UCSF essential core. *Academic Medicine*. 2004; 79(11): 6-15.
5. Schmidt, H. Integrating the teaching of basic sciences, clinical sciences and biopsychosocial issues. *Academic Medicine*. 1998; 73(9): S24-S31.
6. Dahle, L.O., Brynhildsen, J., Fallsberg, M.B., Rundquist, I. and Hammar, M. Pros and cons of vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum: examples and experiences from Linkoping, Sweden. *Medical Teacher*. 2002; 24(3): 280-285.
7. Woodman, O.L., Dodds, A.E., Frauman and A.G., Mosepele, M. Teaching pharmacology to medical students in an integrated problem-based learning curriculum: an Australian perspective. *Acta Pharmacologica Sinica*. 2004: 25(9): 1195-1203.
8. Magrane, D., Ephgrave, K., Jacobs, M.B. and Rusch, R. Weaving women's health across clinical clerkships. *Academic Medicine*. 2000; 75(11): 1066-1070.
9. Demmer, L.A., Totzkay, C.M. and Zapka, J.G. An interdisciplinary interclerkship in genetic testing and ethics. *Academic Medicine*. 2001; 76(5): 538-539.
10. Green, V.L. and Sara, D. Introduction of contextual legal issues in an interdisciplinary program for the study of ethical dilemmas in obstetrics and gynecology for third-year medical students. *American Journal of Obstetrics and Gynecology*. 2002; 187: S44-48.
11. Lowitt, N.R. Assessment of an integrated curriculum in radiology. *Academic Medicine*. 2002; 77(9): 933.
12. White, M.J., Zapka, J.G., Coughlin-Storm, J., Alexander, M.K. and Bauer-Wu, S. Interdisciplinary collaboration for health professional education in cancer control. *Journal of Cancer Education*. 2004 Spring; 19(1): 37-44.
13. Elliot, M.K. Are we going in the right direction? A survey of the undergraduate medical education in

Canada, Australia and the United Kingdom from a general practice perspective. *Medical Teacher*. 1999; 21(1): 53-60.
14. Barrows, H. A taxonomy of problem-based learning method. *Medical Educator*. 1985; 20: 481-486.
15. Norman, G.R. and Schmidt, H.G. The psychological basis of problem based learning: a review of the evidence. *Academic Medicine*. 1992; 67: 557-565.
16. Albanese, M.A. and Mitchell, S. Problem based learning: a review of the literature on its outcomes and implementation issues. *Academic Medicine*. 1993; 63: 52-81.
17. Brynhildsen, J., Dahle, L.O., Fallsberg, M.B., Rundquist, I. and Hammar, M. Attitudes among students and teachers on vertical integration between clinical medicine and basic science within a problem-based undergraduate medical curriculum. *Medical Teacher*. 2002; 24(3): 286-288.
18. Elam, C.L., Wilson, H.D., Wilson, E.A. and Schwartz, R. Physicians for the 21st century: implications for medical practice, undergraduate preparation, and medical education. *KMA Journal*. 1995; 93: 247-252.
19. Lutbetkin, E.I., Schmidt, H. and Charon, R. Risks and benefits of early clinical exposure. *Academic Medicine*. 1999; 74(11): 1153.
20. Abramovitch, H., Shenkman, L., Schlank, E., Shoham, S. and Borkan, J. A tale of two exposures: a comparison of two approaches to early clinical exposure. *Education Health*. 2002; 15(3): 386-390.
21. Herold, B.C., McArcle, P. and Stagnaro-Green, A. Translational medicine in the first year: integrative cores. *Academic Medicine*. 2002; 77(11): 1171.
22. McLean, M. Sometimes we do get it right! Early clinical contact is a rewarding experience. *Education Health*. 2004; 17(1): 42-52.
23. Patel, V.L. and Dauphinee, W.D. Return to basic sciences after clinical experience in undergraduate medical training. *Medical Educator*. 1984; 18: 244-248.
24. Nierenberg, D.W. The use of “vertical integration groups” to help define and update course/clerkship content. *Academic Medicine*. 1998; 73(10): 1068-1071.
25. Rudich, A. and Bashan, N. An interdisciplinary course in the basic sciences for senior medical and PhD students. *Academic Medicine*. 2001; 76: 1072-1075.
26. Abu-Hijleh, M.F., Chakravarty, M., Al-Shboul, Q., Kassab, S. and Hamdy, H. Integrating applied anatomy in surgical clerkship in a problem-based learning curriculum. *Surgical Radiological Anatomy*. 2005; 27: 152-157.
27. Halasz, N.A. We create and can remove the roadblocks to good basic science education. *Academic Medicine*. 1999; 74(1): 6-7.
28. Duban, S., Mennin, S., Waterman, R., Lucero, S., Stubbs, A. and Vanderwagen, C., Kaufman, A. Teaching clinical skills to pre-clinical medical students: integration with basic science learning. *Medical Educator*. 1982; 16(4): 183-187
29. Vernon. D.A. Attitudes and opinions of faculty tutors about problem-based learning. *Academic Medicine*. 1995; 70(3): 216-223.
30. Vernon, D.T.A. and Hosokawa, M.C. Faculty attitudes and opinions about problem-based learning. *Academic Medicine*. 1996; 71(11): 1233-1238.
31. Zanolli, M.B., Boshuizen, H.P.A. and DeGrave, W.S. Students’ and tutors’ perceptions of problems in PBL tutorial groups at a Brazilian medical school. *Education Health*. 2002; 15(2): 189-201.
32. Stevenson, F.T., Bowe, C.M., Gandour-Edwards, R. and Kumari, V.G. Paired basic science and clinical problem-based learning faculty teaching side by side: do students evaluate them differently? *Medical Educator*. 2005; 39: 194-201.
33. Kaufman, A., Klepper, D., Obenshain, S.S., Voorhess, J.D., Galey, W., Duban, S., Moore-West, M., Jackson, R., Bennett, M. and Waterman, R. Undergraduate medical education for primary care: a case study in New Mexico. *Southern Medical Journal*. 1982; 75(9): 1110-1117.
34. Musal, B., Taskiran, C. and Kelson, A. Opinions of tutors and students about effectiveness of PBL in Dokuz Eylul University School of Medicine. *Medical Education Online*. 2003; 8:16. Available from http://www.med-ed-online.org.
35. Vidic, B. and Weitlauf, H.M. Horizontal and vertical integration of academic disciplines in the medical school curriculum. *Clinical Anatomy*. 2002; 15: 233-235.
36. Boon, J.M., Meiring, J.H. and Richards, P.A. Clinical anatomy as the basis for clinical examination: development and evaluation of an introduction to clinical examination in a problem-oriented medical curriculum. *Clinical Anatomy*. 2002;15:45-50.
37. Tresolini, C.P. and Shugars, D.A. An integrated health care model in medical education: interviews with faculty and administrators. *Academic Medicine*. 1994; 69(3): 231-236.
38. Ginzberg, E. The reform of medical education: an outsider’s reflections. *Academic Medicine*. 1993; 68: 518-521.

The Satisfaction Levels of Students on Academic Support and Facilities, Educational Activities and Tutor Performance in a PBL Program

Berna Musal, M.D., MHPE[1], Yucel Gursel, M.D.[1], Sema Ozan, M.D.[1], H. Cahit Taskiran, M.D.[1] and Henk van Berkel, Ph.D.[2]

[1]Department of Medical Education
Dokuz Eylul University School of Medicine,
35340 Inciralti
Izmir, Turkey.
[2]Department of Educational Development and Research
Maastricht University
The Netherlands.

Phone: +90-232-4124680 Fax: +90-232-2590541 Email: berna.musal@deu.edu.tr

ABSTRACT

Dokuz Eylul University School of Medicine changed its curriculum from a traditional one to a Problem-based Learning (PBL) curriculum in 1997. The objectives of this study were to investigate students' satisfaction levels regarding academic support, facilities of the School, educational activities and tutor performance and to compare the satisfaction levels in different years. At the end of each of the academic years 1999, 2001 and 2003 satisfaction levels, opinions, and expectations of the students were determined with a questionnaire. On a five point scale (1:min, 5:max), the satisfaction scores for academic support and facilities of the School varied between 1.9±1.1 and 4.2±0.9 and the scores on educational activities varied between 2.8±1.4 and 4.1±0.9. The points attributed to PBL sessions, professional skills program, basic science practicals, and self-study activities were higher than the overall assessment point of educational activities. The performance scores of the tutors given by the students varied between 3.5±1.0 and 4.4±0.9. The highest satisfaction scores were observed in 1999, followed by a moderate decrease in 2001, and a moderate increase in 2003. As part of the program evaluation studies, the findings of the present study were evaluated and necessary revisions were made. The present study may constitute an example of using student feedback in evaluation and revision of PBL programs.

INTRODUCTION

Since the early eighties, growing awareness of the discrepancy between the undergraduate medical education and Turkey's basic health needs started a review process regarding the undergraduate education of physicians. A Turkish Parliament report in 1991, demonstrated that only a slight proportion of medical practitioners were capable of coping with the health demands of the country.[1] The main problems of medical education declared by the Turkish Medical Association were the lack of integration between basic and clinical sciences, incompetence of physicians in basic professional skills, the lack of awareness of community health problems and difficulties in the transfer of acquired knowledge and skills to professional life.[2] These reports and International developments in the field of medical education led Dokuz Eylul University School of Medicine (DEUSM) to seek solutions to the problems of undergraduate medical education. Based on our literature review, preparatory visits to PBL implementing medical schools and considering PBL principles such as a student centered approach, facilitation of integration of basic and clinical sciences, learning to learn and transfer of knowledge and skills to professional life, a PBL curriculum was adopted. Its implementation started in the 1997-1998 academic year.[3]

The duration of our undergraduate medical education is six years and PBL is the principal educational strategy in the first three years of the undergraduate program. Task-based learning was adopted as an educational strategy for clerkships in the 2000-2001 academic year.[4,5] The first three years of undergraduate education are structured on a modular basis. Through PBL sessions, which are the main foci of the modules, the curriculum focuses on knowledge, comprehension, application, analysis, and evaluation in the cognitive domain. PBL provides a learning environment in which competence is fostered not primarily by teaching to impart knowledge but through encouraging an inquisitive style of learning. The cognitive effects of PBL on student learning are increased retention of knowledge, enhanced integration of basic science concepts in clinical problems, development of self-directed learning skills, and enhanced intrinsic interest in the subject matter.[6] The new curriculum has all of the aforementioned advantages. The lectures, usually limited to one hour per day, provide some clues to increase students' motivation and curiosity and support our students during periods of independent learning. Basic clinical skills are acquired in clinical skills laboratories and basic science practicals are implemented in laboratories. During these educational activities trainers adopt a coaching role and facilitate student learning until they reach competency level. Community-based educational activities begin in the first year and continue until the end of the sixth year. Field studies help students gain knowledge about the health organization and problems of the country, and help them learn how to evaluate humans in biological, psychological, and social contexts.[7] Starting with the first year, special study modules provide students with an opportunity to gain in depth knowledge and skill in a field that is of interest to them. Continuous efforts are made for the horizontal and vertical integration of the curriculum.

In DEUSM, module-end, semester-end, phase-end written and practical assessments are used to evaluate the students' knowledge and skill levels. The passing grade is 70 out of 100 points. Different assessment methods such as multiple choice questions, mini scenarios, essay questions, and, Objective Structured Clinical Examinations (OSCEs) are used to determine knowledge, understanding, application, analysis, synthesis, and evaluation levels within the cognitive domain. Tutors use a "Tutorial Student Assessment Form" to evaluate the students' performance in PBL sessions.

The relationship between the administrative structures of the medical school and teaching hospitals, the other responsibilities of teachers and administrators, and the intricacies of the curriculum as a system of interrelated components means that any real change has wide repercussions.[8] An ongoing evaluation is essential to determine if the new system is working to produce a better product.[9] Curriculum evaluation includes gathering information about the merits of the educational program and program monitoring helps to determine whether corrective measures are indicated.[10,11] In DEUSM, several methods such as the evaluation of students based on their performances in PBL sessions and the other educational activities by tutors and trainers, achievement scores of students in exams, tutors', trainers', and students' oral and written feedbacks and educational research studies are being used for the evaluation of the educational program. In addition to existing quantitative and qualitative studies of the program evaluation, the following research questions were developed:

- What are the satisfaction levels of PBL students concerning the academic support and facilities of DEUSM, their educational activities, and tutor performance?
- Does the level of satisfaction vary from one year to the other?

The main objective of the present study was to gather information from students in order to improve the educational program. This study is an example of the first level of Kirkpatrick's program evaluation model.[12] The results of this study were presented and discussed in the meetings of the educational committees and the Undergraduate Medical Education Committee to improve the quality of the educational process in DEUSM.

MATERIALS AND METHODS

At the end of the 1999, 2001, and 2003 academic years, this survey was repeated to monitor the changes in students' satisfaction levels and opinions. Only the preclinical students participated in the survey. They were asked to fill in a self-administered questionnaire in 20 minutes. The participating students were informed about the purpose of the study and their oral consent was obtained. The main limitation of the study is that since there were no third year PBL students in 1999, the questionnaire was given only to first and second year students. In 2001 and 2003, the PBL students of the three preclinical years were included in the study. The students' response rates on their satisfaction levels for the years 1999, 2001 and 2003 respectively were as follows; 90.3% (196), 93.3% (403), 94.2% (374).

The questionnaire consisted of open-ended questions regarding the students' opinions and expectations, and a three-dimensional five point scale on the satisfaction levels of students (Appendix 1). The dimensions of the scale were academic support and facilities of DEUSM, educational activities, and the tutor performance.

The students rated the performance of their tutor during the last tutoring period. The items used in the evaluation of the tutors were based on a description of a tutor's tasks.[13] Different rating scales were reviewed for developing the rating scale.[14-17]

The student satisfaction levels on academic support and facilities provided by DEUSM, educational activities, and tutor performance were determined as dependent variables and academic years as independent variables.

The inclusion of open-ended questions aimed to encourage students to express their opinions and feelings relevant to the previously mentioned dimensions of the scale. In order to enhance confidentiality, the students were asked to leave the questionnaire anonymous.

Table 1. Satisfaction points of students on academic support and facilities of DEUSM

Academic support & facilities	Average satisfaction points ± SD				
	1999	2001	2003	F*	P value
Communication with teachers	4.19±0.9	3.80±1.1	3.90±1.0	9.458	<0.001
Priority of student education	4.14±0.8	3.47±1.1	3.58±1.1	28.196	<0.001
Covering the needs of students	3.85±1.0	3.02±1.0	3.22±1.1	41.435	<0.001
Physical conditions of the library	3.23±1.1	3.35±1.1	3.77±0.9	22.584	<0.001
Learning resources of the library	3.16±1.1	2.95±1.1	3.66±1.0	45.094	<0.001
Computer facilities	3.09±1.3	3.26±1.1	3.45±1.5	5.009	0.007
Social activities	2.94±1.3	1.91±1.1	2.49±1.3	51.934	<0.001

*One Way ANOVA

At the end of the 1997-1998 academic year, a pilot study was applied to first year students and reliability studies were performed. The Cronbach alpha coefficient of the scale on educational activities was 0.85. In 1999, items on academic facilities and tutor performance were added to the scale and reliability studies were repeated following their application. The reliability analysis of the items of the scale were as follows; academic facilities α: 0.80, educational activities α: 0.84, tutor performance α: 0.95. The coefficients of all dimensions being greater or equal to 0.80, the scale was considered as reliable. The findings of the year 1999 were used in the Master of Health Profession Education Program thesis of the first author in Maastricht University, Netherlands.

SPSS program and One Way Anova test were used for data and statistical analysis.

RESULTS

The average satisfaction points of the three-dimensional scale are presented in Tables 1, 2 and 3. The satisfaction levels for academic support and facilities of DEUSM are shown in Table 1. The satisfaction scores for communication with teachers were higher than the scores of other items for all three years (4.19±0.9, 3.80±1.1, 3.90±1.0). The scores on social activities were under the midpoint (=3.0) of the scale. Compared to 1999, the scores attributed to physical conditions of the library, learning resources, and computer facilities increased in the year 2003. Except for the scores attributed to the physical conditions of the library and computer facilities, the scores showed a certain decrease in 2001 compared to 1999 and an increase was observed in 2003.

The satisfaction levels for educational activities are shown in Table 2. The points attributed to PBL sessions, professional skills program, basic science practicals, and self-study activities were higher than the overall assessment point of educational activities. The scores attributed to lectures follow these educational activities.

Tutor performance scores given by the students are shown in Table 3. The item on the provision of a comfortable, trustworthy group environment was highly rated in all years. The items on analysis and synthesis of knowledge and motivation of tutors were also highly rated. Stimulating an extensive reporting of the information collected during self-study period was rated less than other items. In chronological order, the overall assessment of tutor performance, on a five point scale, was 4.32±0.8, 3.87±1.1 and 3.99±1.0 points.

The highest satisfaction scores were observed in 1999 and followed by a moderate decrease in 2001 and a moderate increase in 2003.

DISCUSSION

In the present study, among the items on support and facilities provided by DEUSM, the highest score was attributed to communication with tutors. This was attributed to the underlining tutors' openness to bilateral communication and their adoption of roles facilitating learning.

In line with the transition to the PBL program, efforts to improve the physical conditions of the library and learning resources have been intensified and they are still actively pursued. The relative increase in scores attributed to these items in year 2003, compared to those of 1999, is thought to parallel the attempt to improve both. In answers given to open-ended questions, the intensity of students' expectations on the development of library's learning resources is noteworthy.

Table 2. Satisfaction points of students on educational activities

Educational activities	Average satisfaction points ± SD				
	1999	2001	2003	F*	P value
PBL sessions	4.06±0.9	3.51±1.2	3.77±1.1	17.761	<0.001
Professional skills	3.95±0.9	4.10±0.9	4.07±1.0	1.679	0.187
Basic science practicals	3.72±0.9	3.65±0.9	3.75±1.0	1.088	0.337
Lectures	3.69±0.9	3.28±1.1	3.59±1.1	12.813	<0.001
Self-study	3.72±1.1	3.34±1.3	3.73±1.2	12.530	<0.001
Professional values-ethics	3.38±1.2	3.26±1.3	3.12±1.3	2.677	0.069
Field studies	3.36±1.2	2.80±1.4	2.99±1.4	10.832	<0.001
Special study modules	3.14±1.4	2.55±1.4	3.07±1.4	12.813	<0.001
Communication skills	3.04±1.2	2.90±1.3	3.22±1.3	5.793	0.003
Assessment methods	3.17±1.1	2.90±1.1	3.29±1.1	12.097	<0.001
Overall assessment of educational activities	3.70±0.8	3.33±0.9	3.59±0.9	14.844	<0.001

*One Way ANOVA

In Olmesdahl's study, second and third-year medical students were asked to rank their ten most distressing needs and concerns. Content overload was identified as the most serious concern followed by learning problems and time management.[18] In Miller's study, perceptions of first-year medical students and strains imposed on them were presented. In addition to academic workload, another major problem faced by these students was how to manage leisure activities and social relationships.[19] In the present study, almost 1/3 of students complained about the inadequacy of time for social activities and insufficiency of sociocultural activities. The scores attributed to social activities were under the midpoint of the scale for all years. The efforts of the Sociocultural Activities Committee are believed to have contributed to an increase in the scores in 2003. The students' demands and expectations concerning the augmentation of social activities are still present.

Considering students' satisfaction points on educational activities; PBL sessions, professional skills, and basic science practicals have higher satisfaction points than the overall assessment point of educational activities. PBL has advantages such as providing a learning experience that is much more enjoyable than sitting through hours of lectures.[20] It promotes the activation and elaboration of prior knowledge and enables a cognitive process called epistemic curiosity.[21] Students play an active role and use an iterative process of seeking new information. The advantages of PBL may have supported students' positive perceptions. Professional skills and basic science practicals are implemented with competency-based approach and trainers take on a coaching role working with their students until they reach competency level. The trainers' supportive role and physical conditions of the laboratories such as anatomical models, mannequins may have contributed to students' high satisfaction levels.

In the scale evaluating students' perception of their tutors' performance, the item on "the provision of a comfortable trustworthy group environment" was highly rated. A tutor should establish a climate of openness that allows students to say what they believe or know, without fear of censorship or being put down. Learning can only occur when ideas can be freely expressed.[22] In the present study, high satisfaction points were attributed to the feedback opportunity provided by the tutor. This study gives the impression that the tutors provided a positive learning climate and an opportunity for self-reflection and evaluation of group process. In a PBL session, tutors' metacognitive questions assist the organization, generalization, and evaluation of knowledge. The items in the scale on asking questions towards analysis and synthesis of knowledge, and the motivation of tutor were given subsequent high points. It is also noteworthy that the lowest score was attributed to the item "stimulating an extensive reporting on information collected during self-study." When this finding was discussed at tutor meetings, the explanations of tutors generally converged on the same point. At this stage, particularly when a topic was outside of their field of expertise, tutors had difficulty asking appropriate questions and generating an in depth discussion of a particular topic. The provision of more detailed subject specific information for tutors was proposed as a solution to this problem.

Table 3. Tutor performance points given by students

Tutor performance	Average satisfaction points ± SD				
	1999	2001	2003	F*	P value
Provision of a comfortable, trustworthy group environment	4.43±0.9	4.03±1.1	4.13±1.0	9.890	<0.001
Feedback opportunity of students provided by the tutor	4.35±0.9	3.94±1.2	3.90±1.1	12.060	<0.001
Asking questions toward analysis and synthesis of knowledge	4.31±0.9	3.85±1.1	4.01±1.0	13.223	<0.001
Motivation of tutor	4.30±0.9	3.76±1.2	4.00±1.0	17.691	<0.001
Facilitation of recognizing gaps in knowledge base	4.25±0.9	3.71±1.2	3.93±1.0	16.187	<0.001
Giving supportive feedback	4.35±0.9	3.94±1.2	3.90±1.1	12.060	<0.001
Facilitation of implementation of PBL steps	4.24±0.9	3.75±1.2	3.95±1.0	14.166	<0.001
Facilitation of integration of basic and clinical science	4.20±0.9	3.79±1.1	3.94±1.0	9.863	<0.001
Stimulating generation of specific learning issues for self-study	4.16±1.0	3.79±1.1	3.94±1.0	7.978	<0.001
Stimulating students to participate actively in PBL process	4.03±1.1	3.80±1.2	3.91±1.0	2.888	0.056
Stimulating an extensive reporting on information collected during self-study	3.77±1.0	3.51±1.2	3.79±1.1	6.475	0.002
Overall assessment of tutor performance	4.32±0.8	3.87±1.1	3.99±1.0	13.177	<0.001

*One Way ANOVA

Although variations were observed in items concerning tutor performance, all related items were above the midpoint of the scale. This was seen as a positive sign in favor of the tutors' performance. In DEUSM, faculty members are required to take "Basic Training Skills" and "PBL" courses before they take tutoring role. PBL course participants are given the chance of observing at least two PBL sessions and sharing their experiences with course trainers.[23] This training process facilitates tutors' adoption and actualization of the PBL philosophy. In another study carried out in DEUSM, it was shown that tutors had positive thoughts on the efficacy of PBL.[24] The school's efforts to adapt tutors to the system and tutors' adaptation may have contributed to the students' satisfaction points on tutor performance.

In general, the students' ratings showed high satisfaction levels regarding the educational activities, educational facilities of DEUSM and tutors. These findings were consistent with the feedback given by the students throughout the year. Besides the cognitive effects, positive learning environment, and more opportunities for student-faculty interaction, several other factors may have contributed to the high satisfaction levels. During the curriculum revision process, the management style was changed from a rigid, mechanistic and hierarchical structure to a more flexible, organic and participative structure. The faculty members were motivated by their participation in the process. Almost all of them were involved in the change process as an educational committee member, tutor, trainer, evaluator, lecturer, or case writer. Continuous educational activities such as Basic Training Skills Course, PBL Course and weekly tutor meetings were carried out to facilitate the faculty members' adaptation to the new curriculum. The PBL curriculum and positive organizational climate of the inaugural years may have contributed to the high satisfaction levels of the students. A slight decrease was observed in the satisfaction levels of students three years after the implementation of the new program. In 2003, an increase in nearly all the parameters was viewed as a positive finding. In comparison with 1999 and 2003, the low ratings in 2001 were interpreted as an aberration. This may reflect the variations in institutional work rhythm and motivation. Factors like weariness of the academic staff and administrative changes may have led to the reduction of initial high energy and motivation levels. These factors may have caused the slight decrease in the satisfaction scores of students in 2001. A subsequent increase in administrative support, meetings of the educational committees on a regular basis, in-service training activities, and the development of standards and algorithms on the functioning of committees enhanced the functioning of the educational system and motivation of the academic staff. These may be the contributory factors to the positive change in the satisfaction points in 2003.

CONCLUSIONS

Studies based on opinions and satisfaction levels of students may have a considerable role in monitoring, identifying positive and problematic areas and implementing necessary revisions of an educational program. In the present study, the satisfaction levels of preclinical years' students in the years 1999, 2001 and 2003 were evaluated. The findings of the present study are continuously used as part of program evaluation studies. The present study may constitute an example for PBL-implementing schools in the integration of student opinions into program evaluation studies.

ACKNOWLEDGEMENTS

The present study was sponsored by the Dokuz Eylul University Scientific Research Projects Centre.

REFERENCES

1. Turkish Parliament Research Commission; *Turkish Parliament. Report on medical education in Turkey: Point of view of the student*. Ankara, 1991.
2. Kılıc, B. and Sayek, I. Turkish Medical Association. *Report on Undergraduate Medical Education*. Ankara, 1997.
3. Elci, O.C. and Aksakoglu, G. Dokuz Eylul joins the family: active medical education. *Medical Education*. 1998; 32: 222-223.
4. Ozkan, H., Degirmenci, B., Musal, B., Itil, O., Akpinar, H., Akalin, E., Ozkan, S. and Alici, E. Task based learning in Dokuz Eylul University Medical School, Turkey. *Medical Teacher*. 2004; 26(3): 279-280.
5. Ozkan, H., Degirmenci, B., Musal, B., Itil, O., Akalin, E., Kılınc, O., Ozkan, S. and Alici, E. Task based learning program for clinical years of medical education. *Education for Health*. 2006; 19(1): 32-42.
6. Musal, B., Aksakoglu, G. and Ucku, R. Community-based education program of Dokuz Eylul School of Medicine. *Education for Health*. 2003a; 16(2): 218-221.
7. Craig, P. and Bandaranayake, R. Experiences with a method for obtaining feedback on a medical curriculum undergoing change. *Medical Education*. 1993; 27: 15-21.
8. Grant, J. and Gales, R. Changing medical education. *Medical Education*. 1989; 2: 252-257.
9. Coles, C.R. and Grant, J.G. Curriculum evaluation in medical and health-care education. *Medical Education*. 1985; 19: 405-442.
10. Bandaranayake, R. Implementing change in medical education in developing countries. *Medical Teacher*. 1989; 11: 39-45.
11. Dolmans, D.H.J.M. and Schmidt, H.G. The advantages of problem-based curricula. Techniques in medical education: problem-based learning. *Postgraduate Medical Journal*. 1996; 72: 535-538.
12. Kirkpatrick, DL. Evaluating Training Programs. 2nd ed. San Francisco: Berret-Koehler Publishers, Inc; 1998.
13. Barrows, H.S. and Tamblyn, R.M. *Problem-Based Learning: An approach to Medical Education*. New York: Springer Publishing; 1980.
14. Dolmans, D.H.J.M., Wolfhagen, H.A.P. and van der Vleuten, C.P.M. Long-term stability of tutor performance. *Academic Medicine*. 1996; 71: 1344-1346.
15. Kalaian, H.A. and Mullan, P.B. Exploratory Factor Analysis of Students' Ratings of a Problem-based Learning Curriculum. *Academic Medicine*. 1996; 71: 390-392.
16. Robins, L.S., Gruppen, L.D., Alexander, G.L. and Fantone, J.C. A predictive model of student satisfaction with the medical school learning environment. *Academic Medicine*. 1997; 72: 134-139.
17. Litzelman, D.K., Stratos, G.A., Marriot, D.J. and Skeff KM. Factorial validation of a widely disseminated educational framework for evaluating clinical teachers. *Academic Medicine*. 1998; 73: 688-695.
18. Olmesdahl, P.J. The establishment of student needs: an important internal factor affecting course outcome. *Medical Teacher*. 1999; 21(2): 174-179.
19. Miller, P.M.C.C. The first year at medical school: some findings and student perceptions. *Medical Education*. 1994; 28: 5-7.
20. Albanese, M.A., Mitchell, S. Problem-based learning: A review of literature on its outcomes and implementation issues. *Academic Medicine*. 1993; 68(1): 52-76.
21. Schmidt, H.G. Foundations of problem-based learning: Some explanatory notes. *Medical Education*. 1993; 27: 422-432.
22. Barrows, H.S. A specific, problem-based, self-directed learning method designed to teach medical problem-solving skills, and enhance knowledge retention and recall. In: HG Schmidt, ML De Volder, editors. Tutorials in problem-based learning: A new direction in teaching the health professions. Van Gorcum Ltd; 1984. p. 16-32.
23. Musal, B., Abacioglu, H., Dicle, O., Akalin, E., Sarioglu, S. and Esen, A. Faculty development programs in Dokuz Eylul School of Medicine: In the process of curriculum change from traditional to PBL. *Medical Education Online* [serial on the Internet]. 2002; 7: 2. Available from: http://www.med-ed-online.org/pdf/res00030.pdf
24. Musal, B., Taskiran, C. and Kelson, A. Opinions of tutors and students about effectiveness of PBL in Dokuz Eylul University School of Medicine. *Medical Education Online* [serial on the Internet]. 2003; 8:16. Available from: http://www.med-ed-online.org/pdf/f0000073.pdf

Appendix

The Satisfaction Levels Of Students On Academic Support And Facilities, Educational Activities and Tutor Performance In a PBL Program

Year: __________________
Academic Year: __________________

Your satisfaction level regarding the educational activities and facilities throughout the year.
Please indicate your satisfaction level by marking the below items between 1 and 5 (1: minimum, 5: maximum)

	Satisfaction level				
	1	2	3	4	5
Academic support & facilities					
Communication with teachers					
Priority of student education					
Covering the needs of students					
Physical conditions of the library					
Learning resources of the library					
Computer facilities					
Social activities					

Educational activities					
PBL sessions					
Professional skills					
Basic science practicals					
Lectures					
Self-study					
Professional values-ethics					
Field studies					
Special study modules					
Communication skills					
Assessment methods					
Overall assessment of educational activities					

Your satisfaction level regarding the performance of your tutor during the last four PBL modules
Please indicate your satisfaction level regarding the performance of your tutor during the last four PBL modules by marking the following items between 1 and 5 (1: minimum, 5: maximum).

	Satisfaction level				
	1	2	3	4	5
Tutor performance					
Provision of a comfortable, trustworthy group environment					
Feedback opportunity of students provided by the tutor					
Asking questions toward analysis and synthesis of knowledge					
Motivation of tutor					
Facilitation of recognizing gaps in knowledge base					
Giving supportive feedback					
Facilitation of implementation of PBL steps					
Facilitation of integration of basic and clinical science					
Stimulating generation of specific learning issues for self-study					
Stimulating students to participate actively in PBL process					
Stimulating an extensive reporting on information collected during self-study					
Overall assessment of tutor performance					

What is your general opinion on the educational activities throughout the year?

What are your opinions regarding the educational facilities (library, counselling, communication with trainers) and social activities provided by the School?

What is your overall opinion regarding your PBL tutors?