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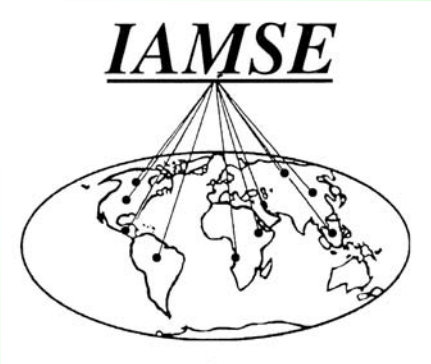

Exit Exam Performance

A Cross-Institutional Pharmacology Partnership

Physiology Practical Assessment

Using PBL Evaluations

Evaluation of Student Learning

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Message from the Association Manager

Julie K. Hewett
IAMSE Association Manager

Hopefully in the past few weeks you have had the opportunity to visit the IAMSE web site and have seen some of the changes that have taken place. The new website has been under development since late last spring when the Technology Task Force, Chaired by Peter Anderson gathered and made several recommendations regarding site navigation, design, color and use of animation. This task force also looked at ways to streamline the information offered, making navigation quicker and easier. This resulted in the reduction of several hundred pages without eliminating any content.

The launch of the new design is only Part I with many more web-related changes to come. The next phase of re-design will specifically address the membership directory. In the coming weeks we will be switching to a web-based membership directory database that will allow for ease-of-use as well as the ability for members to directly update their profile online. This new system will also allow for additional information to be stored with a member profile such as a picture or areas of expertise. It is our goal that the new searchable membership database will be online by the end of January, 2005. Along with the new membership directory, keep your eyes open for other services as well, such as the IAMSE listserv, allowing for online networking between colleagues.

Also within the next couple of weeks a second technology based application will be setup to support the various Committee and Board Member activities. A private Intranet that allows for file sharing, task scheduling and project management will be implemented. This web-based tool will greatly enhance the communications capabilities of the Board and Committees. This communications tool will greatly aid in the manuscript review process for JIAMSE and the review of abstract submissions for and annual IAMSE meeting.

The last phase of the website re-launch will probably have the greatest impact. This involves the creation of a web-based Resource Bank. In the past the IAMSE membership has requested the development of a resource bank that contained a wide variety of items from Case Studies to Exam Banks to listings of available resources on a wide variety of topics. One of the challenges has always been "how to present" this information in a useable format. At the very least, the content must be searchable. The Technology Task Force is currently looking at the various types of resources that could be stored as well as ways to 'categorize' the content. Once this guideline has been established and content reviewed, an online Resource Bank will be launched. This new resource will allow the visitor to search by keyword or resource type, based on a category. Files of various types can be stored and downloaded by the visitor. A system will also be developed that will allow for IAMSE members to offer contributions of content to the library. It is our hope that the "*Resource xChange Session"* at the upcoming July meeting in Los Angeles (July 16-19, http://www.iamse.org/conf/conf9/index.htm) will provide meaningful content as well.

As with any website the work is never completed! This current version is the 3rd generation of many more websites to come. If you would like to assist in the continual development of the website and the resources it has to offer, please contact Pete Anderson (petera@path.uab.edu) or myself (julie@iamse.org) with your ideas and suggestions.

The Medical Educator's Resource Guide

John R. Cotter, Ph.D.

The goal of the Medical Educator's Resource Guide is to identify World Wide Web sites that are judged to be of interest to basic science educators. In this edition of the Guide, all of the reviews presented below should be of interest to basic science educators who teach histology.

The reviews illustrate how the same subject can be approached in different ways. The first site teaches the basic histology of blood cells with images and a list of pertinent features for each cell type. The next site makes a point of drawing a user's attention to the features that the authors consider valuable in identifying a structure. The third site utilizes a virtual microscope to simulate the operation of a real microscope and the last website in this issue of the Guide combines histological images with a comprehensive explanation of the histology.

The Medical Educator's Resource Guide is interested in publishing reviews of websites from all of the medical science disciplines. If you are aware of a site that has the potential for being used in teaching the medical sciences or facilitates the learning of the medical sciences, consider submitting a review of the site to the Guide. Send all submissions to jrcotter@buffalo.edu. Please include the URL and a short critique that summarizes the essence and utility of the site.

Hematocell.fr.st Laboratory of Hematology, University Hospital - Angers, France.
http://www.med.univ-angers.fr/disciplines/lab_hema/index.shtml

Educators, researchers, medical and dental students will find this site helpful. The website guides the user through the histology and pathology of blood. In their opening statement, the authors point out that the site contains "several hundreds of images" that illustrate "normal, reactive, and malignant conditions." Originally written in French, the authors have included a translation of the text that readers of English will appreciate. The site is recommended as a place to learn the morphology of cells found in the blood and bone marrow. A novice to the field of hematology will benefit the most by using the images to reinforce and emphasize what they have learned in a customized teaching program. A more advanced student will benefit from the clinical cases. (*Reviewed by Fady Zaki, B.S., University at Buffalo*)

Histology Online. University of Medicine and Dentistry of New Jersey. School of Osteopathic Medicine.
http://www3.umdnj.edu/histsweb/

The main instructional section of this website "Labs" has the structure of a laboratory manual and the feel of an atlas. The images, which as the authors point out are "representative" of the histological materials used for a class in histology, are embedded with the directions for studying the specimens. The combination is effective and one can easily imagine students working with or wanting to work with a microscope and a computer side by side. The way they are used in this class may be different because the authors recommend using the site in preparation for each laboratory topic. With the exception of the stages of blood cell development, the basic morphology of the tissues and organs at the light microscopic level are adequately covered. But the authors indicate the site and its images are best used as a supplement to the microscope laboratory. Other sites should be examined for images of electron photomicrographs. Many of the units close with a grouping of the images that dramatically illustrate the morphology of the different tissues and organs and all of the units end with a substantial quiz. (*Reviewed by John R. Cotter, Ph.D., University at Buffalo*)

The Virtual Slide Box. University of Iowa.
http://www.path.uiowa.edu/virtualslidebox/

The Virtual Slide Box is set up like a real microscope laboratory. The users of the site view digital microscope slides that illustrate the microscopic structure of the organs. The users are given instructions for examining the slides and just as in a real laboratory they are on their own to locate the structures that are contained in the images of the organs. A search is accomplished by moving a cursor over a selected area of a digitized specimen and magnifying the selected area with a magnifying tool or by selecting the desired level of magnification from a magnification menu. The speed with which this is done is surprisingly fast thus making it very easy to quickly examine an entire specimen. The process does require some skill and understanding of organ structure, however. That may be the object of the exercise depending on how the site is to be used. The Virtual Slide Box contains a sampling of many organ systems and parts of the body. The site is truly incredible. The authors of this site have placed a virtual microscope at the disposal of anyone wishing to use one or see how one might be used in teaching histology. (*Reviewed by John R. Cotter, Ph.D., University at Buffalo*)

Welcome to Histology at SIU SOM. Southern Illinois University School of Medicine.
http://www.siumed.edu/~dking2/index.htm

Welcome to Histology, which is authored by Dr. David King, is an inordinately helpful, instructive source of histological information. It's strong points are: precise verbal definitions of concepts and the morphology of structures that are inherent to histology; excellent photomicrographs that can be enlarged; precise thoughtful labeling of the images; logical, extended presentations of given topics, for example, the cells that comprise connective tissue, the basic structure of the neuron, the layering of the cerebral cortex, and the types and distribution of collagen; a good balance between morphology and function; and an avoidance of superficial treatments of cells and tissues. Though well organized, instructive and interesting, this resource is more useful for an individual who has some prior knowledge of histology. The information which is very understandable and organized would be overwhelming to one who lacks a previously garnered overall view of histology. As apparently implied or suggested in the material, a hard copy of a standard histology text remains a requirement of the student. On the other hand, this presentation is an outstanding review for a student who wishes to test oneself or extend one's knowledge. This reviewer did get lost in the maze of information and experienced some difficulty returning to a given page after having requested an enlargement of an image. This may not be an issue with users who are knowledgeable in the use of computer-based teaching programs. Dr. King's invitation for the reader's comments and questions can only serve to improve his program. (*Reviewed Chester A. Glomski, M.D., University at Buffalo*)

Medical Students' Performance in the IV Year Exit Exam: Effect of Clinical Reasoning Exercises, Self-Observation on Tape, and Faculty Feedback on Clinical Skills

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ABSTRACT

The Clinical Performance Examination (CPeX) is administered at the end of the IV year required Internal Medicine Clerkship. The exam consists of eight standardized patient encounters, during which the students are required to perform a focused history and physical exam based on the patient presenting complaint. A remediation plan consisting of the following steps was developed for students who fail the exam:

Step I: Students' performance review.
Step II: Clinical reasoning exercise assignment.
Step III: Formative feedback session with self-observation on videotape.
Step IV: Additional faculty-guided clinical reasoning exercise.

During the academic year 2002-03, 21 students out of 191 (11%) failed the initial CPeX. The students who failed went through the remediation process and retook the exam. The post-remediation exam scores show significant improvement in both history and physical examination skills. We conclude that: clinical reasoning exercises help students understand how to choose the most important components of the history and physical exam to best delineate the patient's problem and to develop a differential diagnosis; self observation on tape helps the student to gain an awareness of their deficiencies and to focus on their own areas of weakness; and formative feedback plays a central role in aiding students to improve their performance, as widely supported by the literature.

INTRODUCTION

In this era of great technological progress, it's becoming common to think that diagnoses can be made easier by ordering tests and that complex decisions that face physicians every day can be made by looking at computerized practice guidelines. However, this is not the case. Excellence in basic clinical skills (i.e. history taking skills, physical examination skills, clinical reasoning skills, patient-physician interaction) continues to be of critical importance in the professional life of the practicing physician. Despite the obvious importance of basic clinical skills, there is a wealth of studies documenting significant deficiencies among students and residents in developing these skills.[1-4]

At our institution, faculty observation of student performance in the exit exam shows that a large number of students have inadequate clinical skills, especially with respect to history-taking and physical examinations. These data are in line with many publications and with the latest report of the Association of American Medical Colleges on the clinical education of medical students in the United States. The report concluded that there is a clear need to ensure that medical students acquire fundamental clinical skills, particularly history-taking and physical diagnosis skills.[5]

The students who failed the CPeX, were allowed in the past to retake the exam without undergoing any type of intervention. On average, students' clinical performance remained poor even if the exam cases didn't change. To help the students better understand their own deficiencies and improve their performance, we decided to develop a targeted remediation process for students who fail the exam. The remediation process is comprised of clinical reasoning exercises, self-observation on tape and formative feedback. In addition we have made changes to the CPeX including

case revision by a committee of faculty members and development of case specific checklists to better identify the students' areas of deficiencies. We also introduced a formal faculty discussion-feedback session following the patient encounters.

MATERIALS AND METHODS

CPeX

The Clinical Performance Examination (CPeX) is administered at the end of the IV year Required Internal Medicine Clerkship. The exam consists of eight standardized patients (SP) encounters, during which the students are required to perform a focused history and physical exam based on the SP's presenting complaint. Prior to entering the examination room, the students are provided with the patient's name, age, gender, chief complaint, and vital signs. Specific instructions are posted on the door to each examination room, reminding the students to perform a focused interview and physical examination as indicated for the problems suggested in the interview. Faculty observe the students from a video room as the encounters are being taped. SP encounters are 12 minutes each. The students do not receive verbal feedback from the standardized patients. After each patient encounter, the students return to a writing station where they are given eight minutes to write a problem list and a differential diagnosis. At the end of the exam, students have two 15-minute faculty discussion/feedback sessions where they are asked programmed case specific questions about two of the patient encounters. The students are asked to justify the problem list based on the data gathered and to explain the differential diagnosis based on the problem list. Questions are asked by the faculty on the pathophysiologic principles that underlie the patient's problems as outlined by a specific faculty guide to assure standardization among different faculty. The faculty give students feedback on their performance, pointing out strengths and weaknesses of the interview, physical examination, and patient/physician interaction.

Case Specific Checklists and Standard Patient Reliability

In order to better identify the areas of deficiencies, we have developed case specific checklists comprised of critical items on the history and physical. The standardized patients complete the checklists at the end of each student's encounter. The faculty observes one student during two clinical encounters and completes the relative checklists as well. A random review of videotapes has shown high concordance between patient and faculty checklists, assuring grade accuracy. Specifically, a sample of 164 SP checklists was selected. All of the eight cases were represented. Each SP checklist was compared to a faculty's checklist. Items were identified for which the SP decision was not confirmed by the faculty observer. A second observer was subsequently assigned to review the videotapes. Confirmed items on the checklists were supported by at least two of the three observers. The percentage of confirmed items for each sampled encounter was calculated. The final data show that the SP decisions were confirmed 91 percent of the time (Table 1).

Table 1. Standardized Patient Reliability on CPeX Checklists

Case #	# of SP's Sampled	# of Encounters Sampled	Average %Confirmed
1	4	15	93
2	3	27	98
3	2	23	90
4	3	17	82
5	3	15	95
6	4	23	91
7	5	27	91
8	3	27	91
Total/Avg.	27	164	91

CPeX Grade

In order to pass the exam, the students have to correctly perform 65 percent of the critical items on both the history and physical examinations. The final CPeX grade is based on multiple components as follows:

History:	40%
Patient/Physician Interaction	10%
Physical Exam	40%
Faculty Discussion & Feedback Session	10%

Remediation Process

Students who fail the exam go through a remediation process with a faculty member. The remediation process consists of the following steps:

Step I: Students' performance review. The faculty member reviews the patient's checklists and the clinical encounter tape to identify in advance the students' areas of weakness.
Step II: Clinical reasoning exercise assignment. The faculty contacts the student and asks him/her to focus on two of the exam cases. Specifically the student is asked to think about what elements of the history and physical exam are relevant in those clinical situations.
Step III: Formative feedback session. The faculty meets with the student for a formative feedback session, during which the cases are discussed and pertinent parts of the tape are reviewed with focus on the students' areas of weakness.

Table 2. Number of students scoring less than 65% on History and Physical Examinations (Academic Year 2002-03)

Year	Month	# of Failing Students	Total Taking Exam
2002	July	4	14
	August	3	14
	September	2	19
	October	1	17
	November	2	21
	December	1	20
2003	January	3	18
	February	4	24
	March	0	22
	April	1	23
	TOTAL	21	191

Step IV: Additional clinical reasoning exercise.
The student is asked to read a short clinical case unrelated to the exam and identify which portions of the history and physical are relevant to the diagnosis under consideration. The case is then discussed with the faculty who guides the students through this clinical diagnostic exercise.

After going through the remediation process, the student is allowed to retake the exam.

Statistical Analysis
The Cochran-Armitage trend test was used to analyze the monthly pass and fail data throughout the academic year.

RESULTS

Throughout the academic year 2002-03, 21 students out of 191 (11%) failed the initial CPeX (Table 2). The students who failed went through the remediation process and retook the exam. The post-remediation exam scores, with a few exceptions, show significant improvement in both history and physical examination skills (Table 3). Statistical analysis of the monthly CPeX failure rate shows that there is an increasing proportion of students passing the test in the second half of the academic year. Specifically, the Cochran-Armitage trend test shows that there is an increasing trend of better performance among students later in the year ($p = 0.041$).

A comparison of the case component percentages shows that many students, including those who pass the exam, demonstrate difficulty with both history taking and physical examination skills, while they usually have a good command of interpersonal skills.

DISCUSSION

Our data show that, with a few exceptions, there is significant improvement in student's performance on CPeX after targeted remediation. We believe that clinical reasoning exercises, self observation on tape and formative feedback play a central role in aiding students to improve their clinical performance.

Students' observation reveals that they have difficulty taking a pertinent focused history and deciding what items of the review of systems, past medical history, social history, family history are relevant in a specific patient. As a result of that, it becomes harder for them to choose the appropriate items of the focused physical examination. This problem is certainly due in part to insufficient knowledge and clinical exposure. Indeed, as mentioned above, the Cochran-Armitage trend test shows that there is an increasing trend of better performance among students later in the year ($p = 0.041$). This could be due to several factors, including a general improvement in clinical skills due to more exposure to patient care. Nevertheless, even in the presence of adequate knowledge and clinical exposure for their level of training, students need help to understand how to choose the most important components of the history and physical exam to best delineate the patient's problem. That's where the clinical reasoning exercises come into play. They help the

Table 3. Pre- and post remediation scores of students who failed the Clinical Performance Examination

	History		Physical	
	Pre- %	Post %	Pre- %	Post %
Student	Remediation Scores		Remediation Scores	
1	66	79	46	94
2	68	92	35	90
3	64	83	40	58
4	68	86	52	90
5	77	77	33	83
6	56	80	56	69
7	59	82	71	73
8	68	88	48	96
9	64	74	44	73
10	64	67	50	63
11	68	77	42	92
12	59	65	44	85
13	62	88	42	88
14	67	89	40	69
15	73	74	50	63
16	71	83	52	81
17	67	73	40	71
18	67	83	48	79
19	67	71	54	71
20	71	73	31	63
21	65	67	50	75

students to analyze and integrate data, to select and use information effectively and to develop a differential diagnosis.[6-7] As a result of our findings, we have introduced a series of clinical reasoning exercises during the IV year Internal Medicine Clerkship. The students break into small groups and a faculty member helps them to work through several of the most common complaints and symptoms physicians are faced with in the daily practice of medicine. There seems to be a consensus among students that clinical reasoning exercises are very helpful in improving their clinical skills. Preliminary analysis of the pass/fail data of CPeX for academic year 2003-2004, after implementation of the clinical reasoning exercise, shows an increasing trend of better performance compared to last academic year.

Faculty feedback on videotaped performances is also a useful tool in improving medical students' clinical skills. Self observation on videotape helps students to fully understand and to gain an awareness of their deficiencies, in order to focus on their own areas of weakness.[8-9] After receiving feedback the students improve their ability to elicit relevant information and to perform the appropriate physical exam.[10-12]

CONCLUSIONS

Gaps in medical knowledge can be easily identified when they generate major obstacles to the student's ability to take a pertinent history and perform an adequate physical exam. On the other hand, the lack of effective clinical reasoning strategies is harder to diagnose and more difficult to remedy. Direct observation of students' performance plays a central role in identifying problems with clinical skills. We find that the use of SPs in simulated medical encounters is a valuable tool to assess students' performance, in addition to direct observation with real patients. The use of clinical reasoning exercises and self observation on tape with faculty feedback is a useful tool to help students improve their clinical skills.

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A Cross-Institutional Partnership for Teaching and Learning Pharmacology

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ABSTRACT

The focus of this paper is the development of a multi-layered teaching and learning partnership between a school of medicine and school of pharmacy, designed to introduce interprofessional teaching and learning in the medical school's pharmacology course. It features the process of building an alliance between a medical school and school of pharmacy, which includes the students, faculty and administrators of each organization as key participants. The paper emphasizes that the strategies used to move forward with the partnership were key to facilitating effective change, and highlights the benefits of the multi-layered cross-institutional partnership. The authors also highlight what they found most applicable and useful from the organizational change literature in the development of the partnership. This paper provides faculty with an opportunity to recognize challenges and successes for building new and valuable partnerships for their courses and organizations, and an approach to developing partnerships that optimize teaching and learning in the basic sciences.

INTRODUCTION

As increasingly recognized by the medical and applied sciences communities, for collaboration in patient care, research, and education to occur, it is key that some level of joint training occurs and that the importance and benefits of such collaborations be modeled and reinforced with students. The activities between different groups of professionals provide an increased understanding of each other's knowledge and range of skills, enhanced teamwork skills which can be used to address patient problem-solving/management, and an increased understanding of roles and responsibilities. Given that literature in nursing and other health care fields notes that there has been a significant shift in the nature of health care work, the education of health care professionals has not shifted accordingly.[1] A continued delineation of roles between healthcare professionals[2] indicates the need to move toward a collaborative approach to healthcare education, such as the one presented in this paper. If members of the medical and pharmacy professions intend to work as peers, then that goal will be only be fully accomplished if joint training of the professionals becomes an integral part of professional development.[3]

To help respond to the need for a more collaborative approach between two professions that must work together in today's health care system, we have developed an innovative multi-layered partnership intended to rejuvenate curricula, as well as faculty teaching and student learning, across and within two organizations; a school of medicine and a school of pharmacy. This paper provides a model for the development of a multi-layered teaching and learning partnership across and within these organizations. The model features the process of building an alliance between the medical school and school of pharmacy. This alliance includes the students, faculty and administrators of each organization as key participants. The paper highlights the value of building strategic relationships and institutional support. In doing so, we draw upon what we have found to be applicable and useful from the organizational change literature in the development of our partnership.

This paper further provides information about the challenges and successes for building new and valuable partnerships for courses and organizations, and provide an approach to developing partnerships that optimize teaching and learning in the basic sciences.

Interprofessional Trends in Healthcare Delivery: The assumption that educational partnerships lead to collaborative educational practices may not necessarily hold,[1] instead too often a disconnect between education and practice occurs. It is important that we draw upon the successes in multiprofessional education as we move to develop our own collaborations.[1]

Although development of explicit knowledge is inherent to the continuing education within a specialization, there is a need for interprofessional learning.[4] Providing students with learning opportunities within a multi-professional context can provide a foundation for developing effective communication and teamwork skills. Begun early in their professional education, inter-professional educational experiences may also help students with different professional backgrounds develop an increased understanding of each other's knowledge and range of skills, enhanced teamwork skills toward patient problem-solving/management, and an increased understanding of roles and responsibilities.[4,5]

An approach toward successfully incorporating interprofessional experiences into clinical practice is to incorporate an interprofessional approach to teaching at an early stage in the curricula of each profession.[1] Moreover, this approach is consistent with several benefits including early interprofessional socialization, and the ability to share knowledge, increase clinical skills and understand other healthcare professions.[1] Consistent with multiprofessional work, the primary focus of the clinical pharmacist continues to be that of an educator with medical residents and students, and pharmacy residents and students.[6]

The Role of Pharmacists in Medical School Education and Healthcare Delivery: The pharmacist has an important role in medical school education and healthcare, and it is important that these roles reflect each other. In pharmacy education in the United States, there is a paucity of compulsory interdisciplinary education. However, the importance of interdisciplinary approaches in education has been recognized by the American Council on Pharmaceutical Education (ACPE).[7] In the recent accreditation guidelines developed by the ACPE for the Doctor of Pharmacy (PharmD), working in partnership with other health professionals is a professional proficiency objective that should be attained through the school of pharmacy curriculum.[8] The pharmacists' healthcare team role has evolved to include interdisciplinary teamwork as part of pharmaceutical care. Pharmacists are now expected to work with the patient and healthcare team when developing a therapeutic plan.[8] In addition to patient care activities, many pharmacists also regularly present pharmacotherapy sessions for medical students and residents to learn about drug therapy.[6]

A study examining the state of clinical pharmacy practice in family practice residency programs reports that pharmacists have more than 60% of their time dedicated to the residency program. The study further notes that pharmacists are as likely to have academic appointments in a school of medicine as they are in a school of pharmacy.[6]

The importance of the pharmacist's role in medical student education is reflected in a study of third-year medical students' knowledge of clinical therapeutics. The study by Ward and Miloszewski[9] notes that therapeutics tutorials led by pharmacists improved medical students' understanding of drugs in clinical practice, and that the pharmacist was acknowledged by medical students as the appropriate person to lead their therapeutics tutorials.

The role of a clinical pharmacist in a residency program is reported by Ables and Baughman[10] to be that helping of residents make decisions about drug therapy. That same article further notes that an observed increase in communication between the residents and clinical pharmacists may suggest a need for developing interprofessional collaboration and awareness of the need for pharmacotherapeutic information.

A report by the Institute of Medicine also recognizes the importance of interprofessional approaches to education to the quality of healthcare delivery. [5]

The primary purpose of this paper is to highlight the development of a multi-layered partnership between a school of medicine and school of pharmacy to introduce interprofessional teaching and learning in the medical school's pharmacology course. This approach helped the partnership move forward and was key to facilitating effective change; many benefits occurred as a result of this multi-layered cross-institutional partnership.

MATERIALS AND METHODS

The impetus for building the partnership: With its transition to a new course director and redesign of specific portions of its curriculum, the medical school's pharmacology course introduced case-based small group sessions with a focus on students' problem-solving and critical thinking skills. A goal of the course was to address and model early in students' professional lives, the importance of interprofessional collaboration between physicians and pharmacists in the care of patients. The decision was made by the medical school's director of curriculum and faculty development, and the pharmacology course director, to approach a colleague at the school of pharmacy with an invitation to the pharmacy school to partner in this new initiative. Though located in the same city as the medical school, the school of pharmacy is a separate institution and located across town from the medical school. The initial formation of the inter-

institutional partnership between the University of Massachusetts Medical School (UMMS) and Massachusetts College of Pharmacy and Health Sciences (MCPHS) began with preliminary conversations between UMMS's Director of Curriculum and Faculty Development, UMMS's Director of the medical school's second year pharmacology course, and a Department of Pharmaceutical Sciences MCPHS faculty member (Figure 1, Tier II). The role of this group was to serve as what Duck[11] refers to as the "Transition Management Team" (TMT), a key component of the change process. This began the development of the inter-institutional partnership.

It is important to note that the focus of a TMT is on managing, not leading, change. The purpose of the team is exclusively to manage and oversee the change effort. Via eight tasks noted by Duck, the team ensures that the various elements involved in the transition come together such that the change is realized. However, Duck points out that the TMT does not have sole responsibility for accomplishing each of the eight tasks. The tasks applicable to the transition involved in the pharmacology partnership closely paralleled those described by Duck[11]and were the responsibility of this cross-institutional TMT (Figure 1, Tier II). The eight tasks as managed by this partnership's TMT are briefly described as follows.

Throughout the process of developing the intra-and inter-institutional partnership, the three members of the TMT (Figure 1, Tier II) provided faculty development sessions in order to align the work of the participating faculty and facilitators with the aim of the partnership, and thus established a context for change and provided guidance**,** the first of the tasks delineated by Duck.[11]

Tasks 2-7 are as follows: stimulate [interprofessional] conversation; coordinate and align projects [and activities]; ensure congruence of messages, activities, policies and behaviors; provide opportunities for joint creation; anticipate, identify, and address people problems; and prepare the critical mass. These tasks were collectively addressed through faculty development sessions which further served to provide an arena for the interprofessional conversations necessary for modeling and reinforcing - a key component of the partnership. The faculty development sessions also served as a forum for those involved in various tiers of the partnership (Figure 1) to voice their ideas, and thus helped to facilitate empowerment as the partnership moved forward. Further, the sessions served to coordinate and align communication among individuals involved in the partnership and the activities of the partnership. The cross-institutional representation at the faculty development sessions further offered an opportunity for collecting and disseminating information pertaining to process and content as needed for the well-being of the partnership.

The eighth and last of the noted tasks is to provide appropriate resources.[11] The time and resources necessary to create and carry out the partnership were available because of the academic positions of each member of the transition team.

It was critical to have each of the three transition team members participate in moving forward in each of these eight task areas. The partnership and its activity would have been less effective without what the three members brought to the partnership table.

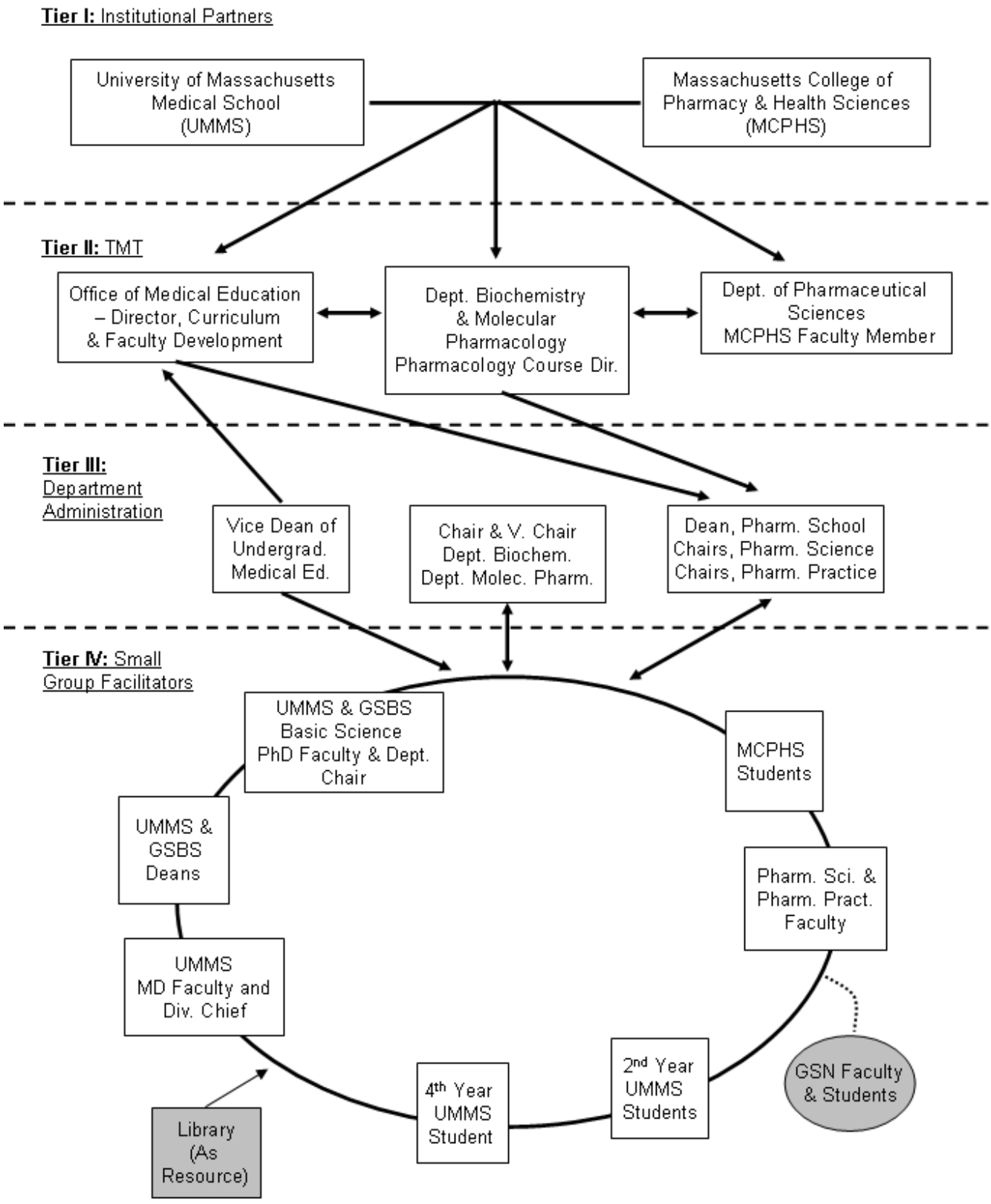
The initial request to partner was specifically intended to encourage pharmacy school faculty to co-facilitate the small group problem solving sessions with medical school faculty. Continued discussion with pharmacy school faculty and administration, and a formal presentation to the pharmacy school faculty and administration detailing what the partnership would consist of, led to an agreement to go forward with the partnership.

As the team began building its intra-institutional support and partnerships, it was vital to the inter-institutional partnership to have administrative support from each of the schools. Consequently, the team's next step in moving forward with the inter-institutional partnership was to secure collaborative relationships with department administration, in our case this meant deans, vice deans, and department chairs and vice chairs (Figure 1, Tier III). These collaborative relationships with administration, and their agreement and identification with our goal, was key in having their support and involvement in the form of an alliance of medical and pharmacy school leaders who supported this new partnership. It was particularly important to have MCPHS administrative support, as well as their willingness to take a risk in trying a new relationship.[12] The medical school was taking less of a risk in that the effort was assisting their teaching efforts.

As the partnership evolved and was shaped, it was decided, in addition to pairing faculty from each of the schools as small group facilitators, to also pair fourth year students from each of the schools as small group facilitators. With this, the three initial change management team members brought a fourth year medical student into conversations for the purpose of informing its ongoing work with a student perspective.

At the Massachusetts College of Pharmacy and Health Sciences, faculty from two separate departments and fourth year pharmacy students, enrolled in the Doctor of Pharmacy program, participated as small group facilitators (Figure 1, Tier IV). The first step focused on acceptance of the cross-institutional partnership model – this required changes in attitudes of both students and faculty as to the benefits of becoming involved in model. Several barriers had to be surmounted before an effective dialogue between the Medical School and the School of Pharmacy occurred. First, a feasibility assessment and acceptance of the project had to be established. This was approached by presenting a mini-proposal outlining the concept and goals of the project to the Chairs of the School of Pharmacy's Pharmaceutical Sciences

Figure 1. The inter- and intra-institutional partners for teaching and learning pharmacology



and Pharmacy Practice Departments and the Dean of the Massachusetts College of Pharmacy & Health Sciences (MCPHS) (Figure 1, Tier III) to gather comments, suggestions and preliminary approval. Second, a working dialogue between the School of Pharmacy's Pharmaceutical Sciences and Pharmacy Practice Departments was established to generate educational goals for the project. Third, formal contact between School of Pharmacy's Pharmaceutical Sciences and Pharmacy Practice Departments faculty, and the Director of Curriculum and Faculty Development and the Department of Biochemistry & Molecular Pharmacology's Director of Pharmacology Course at the Medical School, both involved in development of the collaborative partnership was established (Figure 1, Tiers II and III). This meeting was pivotal in determining whether the partnership would go forward. At the meeting, the Medical School programs directors (Figure 1, Tier II) presented their concepts and format involved in the implementation of the collaborative cross-institutional partnership to the School of Pharmacy faculty. This was followed by a question and answer session to discuss any issues and problems involved in the cross-institutional partnership. Finally, and importantly, a subsequent meeting was held between the faculty members of the School of Pharmacy's Pharmacy Practice Department to determine how the partnership would impact individual programs and whether to accept the partnership.

In addition to pharmacy faculty, fourth year MCPHS students completing their professional electives were given a description of the project and its potential benefits and then asked whether they would participate as facilitators in cross-institutional partnership. Students at the fourth year level were chosen as facilitators for this cross-institutional partnership as they had completed their course work, and it was thought that they could also effectively contribute their professional viewpoint and insights to the small group discussions. Students were chosen based on their ability to problem-solve, and complete critical thinking quizzes and questions throughout their pharmacology courses.

At UMMS, deans, a division chief, division director, department chairs and vice chair, and faculty from several basic science and clinical departments, as well as a fourth year medical student were invited and participated in the partnership as small group facilitators (Figure 1, Tier IV). This group included a dean and basic science faculty from the University of Massachusetts - Worcester Graduate School of Biomedical Sciences (GSBS), which is located on the same campus as the University of Massachusetts Medical School. Acceptance and participation by the UMMS partners was achieved through one-on-one conversations regarding the benefits of partnering. The purposeful selection of facilitators was instrumental to the on-going institutional support, both in terms of resources and acceptance of change, of the cross-institutional aspect of the partnership. UMMS second year students, for whom the Pharmacology course is a required course, were participants in the small group sessions.

The timeline of building any partnership will differ from institution to institution, and depends on the type of the partnership being developed. However, we have provided an outline of the process and sequence of building this partnership, which took approximately six months.

Cross-Institutional Faculty Development: So as to inform all partners in this initiative, cross-institutional faculty development sessions were held to model and reinforce interprofessional communication and learning with respect to participants' roles as co-facilitators of the case-based small group problem solving sessions. These sessions also served to inform faculty and student facilitators of the process (i.e., small group facilitation skills) and content (i.e., case topic and objectives) of each small group session. A faculty development session was held a week prior to each small group problem solving session for the three-fold purpose of 1) introducing the faculty and student facilitators to the case topic and objectives, 2) drawing on the expertise and strengths of each member, and stimulating the sharing of knowledge and perspectives between the professions, toward more informed small group sessions, and 3) enhancing small group facilitation skills. Consequently, each faculty development session focused on both the content of each session, as well as the process of small group facilitation, and was co-facilitated by the Pharmcology Course Director and the Director of Curriculum and Faculty Development.

RESULTS

Interprofessional approaches to education have the potential to benefit students in a number of ways. They help to provide students with an increased understanding of the roles and responsibilities of other health professionals. Without opportunities for students to interact with other health professionals, the barriers to successful collaboration and communication may be more difficult once they enter professional practice.[5,8,13] Interprofessional experiences require relevance and need to be appropriate to real life training. [8,14] Therefore, curricula designed to included such experiences, fosters students' understanding of the roles and responsibilities of other health care professions, and makes the most effective use of healthcare team members.

Such approaches also help students to acquire an understanding of interprofessional knowledge and range of skills. Leininger notes that numerous problems among the different health care disciplines are connected to not only a lack of knowledge, but a decreased perception, of their actual and possible contributions.[15] Developing a cross-institutional educational partnership model has the potential to foster among students an appreciation and increased awareness of skills contributed by different healthcare disciplines. These attributes can be carried into their professional careers and used to develop partnerships in the care of patients.[5]

Enhancing teamwork skills toward improving patient management is an additional benefit provided to students through interprofessional educational experiences. A number

of interprofessional partnerships have led to improvement in health care. Adverse drug events (ADEs) are a common yet preventable phenomenon in today's health care.[16] Previous studies analyzing the frequency and degree of ADEs have shown that 42% of life-threatening and serious events were preventable.[16,17] Furthermore, during the same study almost 50% of avoidable ADEs were the result of mistakes in the prescribing procedure.[16,17] Subsequent studies have assessed the benefits of interprofessional health care participation in lowering the rates of adverse drug events. Specifically, when pharmacists are part of the health care team they positively impact ADEs, as evidenced by a significantly lower rate of ADEs caused by prescribing mistakes.[18,19]

In light of the increasing recognition of the collaborative roles and work of healthcare team members, it is vitally important to begin to move toward an interprofessional approach to education.[5]

End of course student evaluation data for the Pharmacology course shows that 93% of students felt that the small group problem solving sessions enhanced their overall understanding of pharmacology. On the end of course evaluation, students commented that additional learning activities they would find helpful are "more small group problem solving sessions", "more small group sessions on a regular basis", and "more case-based learning." Students also commented that the small group problem solving sessions cases "…were excellent tools in terms of overall understanding of course material and application to future clinical practice."

Data from facilitators and students supports the statement that teamwork and interprofessional learning were two key benefits for students at both institutions. One hundred percent of both facilitators and students across all sessions agreed or strongly agreed that that their small "group worked as a team to help further its understanding of the underlying basic science issues of the case"; "each person contributed resources and knowledge to the group discussion"; and "the group came prepared with information to explain the issues under discussion."

An average of 98 percent of medical student responses, across all small group sessions, agreed or strongly agreed that the sessions were "presented in a way that helped me integrate knowledge and ideas with others in my group"; and that "an effective communication process was established in the group." One hundred percent of medical students across sessions responded agree or strongly agreed that the sessions "addressed my learning needs around this topic." One of the students from the Pharmacy school who co-facilitated with a medical student commented that "pairing with 4th year medical student worked out very well in that the medical student] was able to answer some of the pathophysiology based questions much more thoroughly and on a higher level which the med students were more likely to understand," and that she, as a pharmacy student, "was able to answer a number of the students' questions" that related more to her area of professional expertise.

Each small group session also had five content-based objectives pertaining to the case topic. One hundred percent of the students agreed or strongly agreed that "as a result of the case-based session, they had a better understanding of the the pharmacology content specific to each case. Examples of content objectives were "an understanding of some of the physiologic changes that occur with aging that may affect the pharmacokinetics and pharmacodynamics of drugs", "issues involved in prescribing for the elderly", and "the potential for adverse effects of herbal preparations including serious adverse affects."

DISCUSSION

This partnership of the Medical School with the School of Pharmacy brought together different perspectives of the learning process and broadened the perspectives gained beyond a single institution. It required unique expertise of participants, strategic relationships, institutional support, and interconnected work, and it offered mutual benefit. Two key benefits of the interprofessional education provided by the partnership for the students of both institutions were the development of teamwork skills for patient problem-solving, and the modeling of interprofessional learning. Moreover, the partnership benefited both the School of Pharmacy and the Medical School as it achieved one of the ACPE professional proficiency objectives for the Doctor of Pharmacy, namely, working in partnership with other health professionals through its incorporation in the school of pharmacy curriculum,[7] and the Medical School benefited from interprofessional teaching for its students and among its faculty, engendering a collaborative teaching and learning environment.

The significance of teaching and learning partnerships involving interprofessional experiences in education has been an area of focus in the Royal Pharmaceutical Society's "Pharmacy in a New Age" initiative.[20] Subsequent studies related to this initiative have looked at the advantages of collaborative education among community pharmacists and physicians. The study by Parr and collegaues examines the implementation and evaluation of collaborative education among community pharmacists and medical practitioners. The authors conclude that the advantages of this approach to learning are a positive impact on the professionals.[21] The data suggest that interprofessional approaches to education have the potential to increase professional development, advance reciprocal comprehension between health professionals, and increase professional communication.[16]

Similarly, a report by the Institute of Medicine advocates "providing more opportunities for interdisciplinary training" as the healthcare delivery system works to redesign the education of its professionals.[5]

Continued development of the partnership during the next academic year will include faculty and students from the medical school's Graduate School of Nursing, and a more structured inclusion of the Library.

CONCLUSIONS

Effective development of a multi-layered partnership requires interconnected work and mutual benefit. It is therefore important that in moving forward with the development process, the individuals designing and managing the change be aware of principles key to effective change and apply them strategically in order to optimize the goals of the partnership.

Institutional partnerships are more effective and sustainable when individuals within each institution are included and play a role in its development. The partnership brings together different perspectives and expertise from two institutions into a strategic alliance. Our experience has been that in bringing together the expertise of each professional in the teaching and learning partnership described in this paper, we have expanded the knowledge and skills of individuals at all layers of the partnership, both intra- and inter-institutional. As a result of this joint professional effort, we believe that we have also modeled interprofessional problem-solving and teamwork skills for the students of both institutions, skills which will ultimately benefit healthcare delivery. As Mundinger points out, the time is right for this promising idea to become part of our joint professional efforts.[3]

Future Plans to Enhance the Partnership: As development of the partnership continues during this next academic year, the transition management team (Figure 1, Tier II) intends to approach the Dean of the University of Massachusetts – Worcester Graduate School of Nursing (GSN), which is located on the same campus as the University of Massachusetts Medical School, about becoming another partner in this multi-layered partnership (Figure 1, Tier IV). The GSN offers a pharmacotherapeutics course within their nurse practitioner curriculum and has been involved in other collaborative efforts with the medical school.

The change management team also has plans to increase the role the medical school's library has played in the course (Figure 1, Tier IV). Though the library has served as a course resource for student and faculty, in the upcoming academic year it will be asked to take on an expanded role by providing students with formal sessions, with a focus on Pharmacology, on how to yield better results when searching the literature. An overview of the information given to student will be conveyed to small group facilitators by a representative from the library during faculty development sessions, so that facilitators can draw on the yield of the students' literature searches during discussion of the literature during the case-based small group problem-solving sessions.

There are also discussions pertaining to the development of richer and more robust cases that would call for an increased use of problem-solving and critical thinking skills among students and facilitators, as well as develop in students skills that will benefit them as they begin practicing evidence-based medicine.

Focused attention on recognizing and creating opportunities to better utilize the expertise of the facilitators, who have been drawn from various specialties within each institution is on-going. In addition, we continue to nurture the partnership and stay open to opportunities to enhance the partnership in ways that benefit the teaching and learning of pharmacology within both institutions.

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The Comparison of OSPE with Conventional Physiology Practical Assessment

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ABSTRACT

The Objective Structured Practical Examination (OSPE) is a new concept in practical assessment of physiology in our country. It is a modified form of Objective Structured Clinical Examination (OSCE) but is used for evaluation of pre and paraclinical subjects. Although theoretically known, very few medical colleges have incorporated OSPE as an assessment tool in the curriculum of first year medical students. We wanted to compare the marks obtained in OSPE and the other conventional methods. The OSPE marks showed similarity with clinical examination and were different from marks of other experimental procedures like graph and chart. A similar result was found in two examinations. We conclude that OSPE can replace the existing pattern of clinical examination. To replace others it would require an elaborate and structured OSPE bank. Presently, it can supplement but not replace the conventional methods. Any change must first be thoroughly evaluated before it can uproot a well-defined and time-tested assessment methodology.

INTRODUCTION

A uniform and reliable practical evaluation of medical students is always desirable. In order to ensure objectivity, we have converted to MCQ's for selecting new entrants to the medical colleges and short structured questions for evaluating theoretical knowledge during the medical curriculum. In line with the same principle and to make practical assessment more comprehensive, objective and unbiased we decided to introduce the Objective Structured Practical Examination (OSPE) in the first year of our medical college. The OSPE is a method of objectively testing the practical knowledge and skills acquired during the preclinical years of a medical curriculum. This method was standardized by the All India Institute of Medical Sciences.[1] It is a modification of Objective Structured Clinical Examination (OSCE) used for clinical evaluation.[2] At present OSPE is conducted in a few medical colleges in association with other conventional methods, and is being allotted a small percentage of marks. However, in time to come, it is expected to replace the other subjective assessment methods. Introducing a new concept in a traditional framework is always met with sceptism.[3] The aim of the present study was to see the relationship between the scores obtained by medical students in OSPE and other traditional methods during various evaluations in the first year of medical college. This pilot study was meant to give us an idea whether any of the existing evaluation methods were similar to OSPE and could be replaced in order to increase the objectivity in assessment.

MATERIALS AND METHODS

The study was conducted in the department of physiology on 100 medical students at the University College of Medical Sciences, Delhi, India. Seventy-six students participated in all evaluations held at different times during the first year of the medical curriculum.

The classroom exercise

The students were tested in groups of 25 each. The OSPE consisted of two procedures and two question stations. The questions were changed randomly for different groups of students. An attempt was made to make the atmosphere as congenial as a routine classroom exercise with the aim to familiarize the students with this new system of examination.

The examination exercise

Two examinations were held in different semesters with different course content. The OSPE was included along with the conventional methods of practical assessment. A

Table1. Comparison between different assessment methods in first examination.

	1B	1C	1D
1A	0.000*	0.000*	0.059
1B		0.028*	0.000*
1C			0.000*

The p value of the difference between the observed means of various groups. *p<0.05 is significant. 1, represent the first exam. A, B, C and D denote marks of OSPE, hematology, graph and chart, clinical examination respectively.

Table 2. Comparison between different assessment methods in second examination.

	2B	2C	2D
2A	0.105	0.000*	0.374
2B		0.442	0.000*
2C			0.000*

The p value of the difference between the observed means of various groups. *p<0.05 is significant. 2 represents the second exam. A, B, C and D denote marks of OSPE, hematology, graph and chart, clinical examination respectively.

similar set of eight question and two procedure stations were allocated to 25 students. A student spent three minutes at each station, questions were randomly changed each day and the entire schedule lasted for four consecutive days. The OSPE questions were designed to test the cognitive aspect of learning mainly knowledge, comprehension and synthesis of facts. The procedure stations were from clinical examinations and hematology course chosen to evaluate the psychomotor skills and affective domain. Each question was to evaluate a specific learning objective of the course content.

Other conventional assessment techniques included hematology practical (HP), clinical examination (CE) and graphs and charts (GC). In HP the students were asked to perform a small laboratory exercise using a blood sample, like counting blood cells or staining smears. This is not necessarily done in front of the examiner and was followed by an oral question answer session (viva voce). In CE the students were asked to clinically examine and elicit signs in a simulated patient. The idea was to test the techniques of doing a clinical examination of various systems in simulated patients. The examiner evaluated the psychomotor skills and asked relevant questions. In GCs, some diagrams, photographs and graphs were given to the student to explain. All these exercises were followed by a viva or a question answer session. A total of ten marks were allocated to each type of assessment procedure. All these evaluation types have been routinely practiced for many years in most medical colleges of our country. They are relatively subjective, unstructured, can have errors of bias, ambiguity and obsolesce. It is for this reason that the concept of OSPE was introduced.

Statistical Analysis

The mean and standard deviation of marks obtained in all exercises (hereafter referred as groups) were calculated. Hierarchical analysis of variance showed the change between the groups was significant. ($f=48.842$, $p<0.001$). Tukey's test of multiple comparisons at 5% interval based on observed means was done to individually compare the result of the different methods of assessment. (table1 and 2). Comparison was done between any two groups at 95% confidence level ($p<0.05$ is significant).

Simple Pearson's correlation method was used to find the association between marks of the question and procedure stations. The mean difference between the two was compared by the Student's t test.

RESULTS

The mean and standard deviation of marks obtained in all exercises is shown in Figure 1. In the second examination (4-8) the scores obtained are higher.

Comparison of OSPE with hematology practical

The OSPE marks of first examination were different, but those of the second exam were similar to the respective HP marks. (Table 1 and 2).

Comparison of OSPE with graphs and charts

The OSPE and corresponding GC marks of both examinations were statistically different ($p<0.05$). (Table 1 and 2).

Comparison of OSPE with clinical examination.

The OSPE and corresponding CE marks of both examinations were similar. (Table 1 and 2).

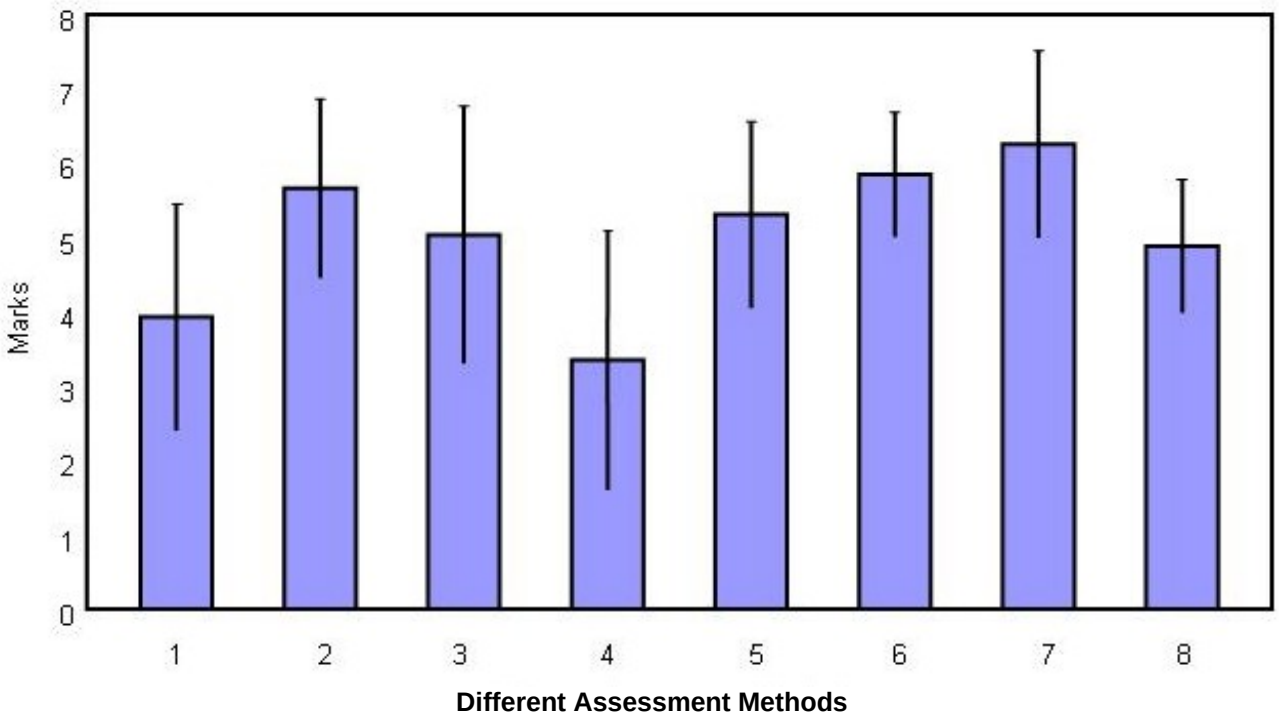
Comparison between other groups

Similarity was seen between marks of HP and GC of second exam. All other comparisons showed differences.

Comparison between question station and procedure station of OSPE of classroom exercise.

No significant correlation was observed between the two question stations, two procedure stations, and the total marks obtained in the question and procedure stations. ($p>0.05$). When the mean marks were compared by the two-tailed 't' test there was significant difference between the two questions and procedure stations ($p=0.008$, $p=0.001$ respectively), but the total marks of both the question and procedure stations did not differ significantly ($p>0.05$).

Figure 1. Marks of Different Assessment Methods



The mean and standard deviation (STD-Dev) of the marks obtained in different forms of assessment. Maximum marks =10. 1, 2, 3,4 represent marks of OSPE, hematology, graph and chart, clinical examination respectively in the first examination.5, 6,7,8 represent marks of OSPE, hematology, graph and chart, clinical examination in the second exam.

Students scored differently in the various evaluation procedures. OSPE marks were similar to clinical examination and different from marks of graphs and charts. The comparison with other forms of evaluation is varied.

DISCUSSION

In an attempt to improve the practical assessment in our institution, OSPE was introduced for the first time along with the other conventional assessment procedures like HP, GC and CE in the first year of medical curriculum. We wanted to see the relationship of marks obtained in OSPE and other forms of evaluation.

Our first observation was that a significant variation in the marks obtained in different assessment procedures. This was a consistent finding and was found in both the examinations. We generally expect that good students would do well in any form of evaluation.[4] Since this was not observed we presume that the various assessment methods assess different capabilities of the students.[5] The comparison of OSPE with other forms of assessment, showed a consistent similarity to CE, a variation with GC and a varied response to HP. In procedure stations of OSPE and CE the student performs in front of the examiner and the psychomotor skills are mainly tested. In a previous study, undertaken to see the relationship between OSCE and clinical cases, no correlation was reported. It was suggested that OSCE should be employed for evaluation of specific clinical skills, but for comprehensive evaluation a combination of OSCE and clinical cases should be used.[6] In the initial part of our checklist we had included statements to test the affective domain of learning. The student had to address the subject politely, make him comfortable, explain the procedure etc. The question stations were included to evaluate the cognitive aspect of learning. A written component, when added to OSCE, is known to improve reliability and economize on the resources.[7] Our question stations in OSPE also served this purpose. We are of the opinion that OSPE if properly structured, along with a short written component can replace the current clinical examination exercise taught in the preclinical years. It may not be so useful in the final year course if the investigation, differential diagnosis and management are to be discussed unless different OSPE (OSCE) stations are made for each.

OSPE scores were different from those of GC. These test the student in cognitive aspects like recall and interpretation. They also rely on the communication skills of the student. Question stations would have to be elaborately designed if they are to be used instead of GC. When other assessment methods were compared with each other, a varied pattern of responses was observed. The lack of correlation between both the procedure and the question stations could be because they were testing different things. A student may not know everything.

A few questions emerge from this. Firstly, should we expect the different instruments of assessment to yield similar results? Secondly, if they do, does it mean that they are testing the same domain and in that case, should they be continued together or not?

To answer these questions we must look into the association of OSCE and other assessment tools. OSCE has shown positive correlation with other forms of assessment like ward evaluation, American Board of Surgery In training Examination (ABSITE), short answer questions and subjective rating.[8,9] However basic science scores and MCQ's showed no correlation to OSCE.[10,11] Hence there is no generalization that all assessment tools must correlate. If there is similarity between the instruments it could be that we are testing the same skills.[12] A similar study has been carried out earlier.5 The authors found no correlation between varied forms of assessment and felt that these methods were testing different abilities of the students. We must however keep in mind that there is no gold standard for assessment and so we cannot say which method is better. [8] The criterion of a good examination includes validity, reliability, objectivity, practicability, relevance, and promotion of learning, power to discriminate between students, relaxed environment and a positive student feedback.[13] Clearly no single test fulfills the criterion of a good examination and the different methods complement each other.

If we are to discontinue any method we must be aware of the possible consequences on learning.[8] The OSPE-like OSCE is associated with "achieving" style of learning but not with "meaning" or "reproducing" style of learning.[14] The OSPE complements other methods of assessment. It allows us to directly observe the student, give similar questions to all students, check on minute details in order to standardize and focus our evaluation, to be more objective and unbiased in marking. On the other hand our conventional methods allow for an in-depth analysis of the subject, with more interaction between the examiner and the student. The examiner's professional judgment and experience can make the examination a learning exercise as it provides an instant feedback to the student. These advantages justify their inclusion.

CONCLUSIONS

Our results have shown OSPE marks similar to clinical examination and different from graphs and charts. In the present set up OSPE can replace clinical examination and not graph and charts. However we feel that an elaborate OSPE bank may be able to overcome these lacunae. Till that is done, in physiology practical examination we should utilize different techniques in order to increase the validity of the examination.

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Using Problem-based Learning Evaluations to Improve Facilitator Performance and Student Learning

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ABSTRACT

This paper will report the relationship between course and faculty evaluations for a problem-based learning (PBL) experience in a medical school curriculum. Identifying relationships between students' reflections about the problem-based learning experience and how well facilitators guided the group (e.g., helped identify key learning issues) can answer fundamental questions about the potential of PBL to advance essential skills and knowledge. In 45 PBL groups across the 2001 and 2003 academic years, students completed a facilitator and a PBL course evaluation. The facilitator evaluation included nine questions. Each question used a five-point scale from Poor (1), Fair (2), Somewhat good (3), Good (4) to Excellent (5). The PBL course evaluation included 9 questions on a standard 5-point scale, ranging from Not at All (1); Slightly (2); Somewhat (3); Mostly (4), and Completely (5). Two statistical analyses were conducted to address the research questions. First, a factor analysis was used to explore the organization of underlying factors in the facilitator and course evaluations. Factor analysis can provide evidence of construct validity for both instructional and learning dimensions. Using each factor as a variable, factor scores (mean of the items in each factor) for the facilitation evaluations were used to predict factor scores yielded from the course evaluation. A regression analyses explored the potential for facilitator performance scores (independent) to predict student observations about their own learning (dependent). An analysis of the questions reveals reasonable interpretations of the two factors (Collaboration and Independent Leaning Skills). The results revealed significant relationships between the facilitator scale score and both scale scores for the course evaluations. Overall, these results suggest that the facilitator evaluation reveals a global indication of facilitator performance. Targeting the quality of specific skills, then, may require additional assessment strategies, such as having trained raters evaluate facilitator performance. An analysis of the course evaluation also reveals that students distinguish self-directed learning skills from collaborations skills. The connection between these factors suggests that facilitator performance, although limited, does impact the extent of students learning and development. Failing to recognize the importance of appropriate facilitation skills may ultimately compromise the learning environment.

INTRODUCTION

Some researchers observe that teaching evaluations can be valid and reliable instruments.[1] Analyses of the variability of evaluations, however, suggest that they are not created equally.[2] Despite some concerns with evaluations, educators rely on them to explore the potential of PBL to impact student learning and to judge facilitator performance. The purpose of this paper is to report how course and facilitator evaluations for a (PBL) course were developed, and to investigate the components of the evaluations. An analysis of the evaluation data will also address the extent facilitator performance influences student learning. Exploring these issues will help identify both the limitations and benefits of using evaluation data to make decisions about PBL courses.

PBL was first developed by McMaster University Medical School in Canada. Several other medical schools have adopted PBL into their curricula, such as Maastricht (the Netherlands), Newcastle (Australia), and University of Hawaii. PBL can be designed using several different strategies, which may be peculiar to an institution's requirements, objectives, and resources.[3] While it may be developed differently, PBL in medical education generally is designed to challenge a student with a complex problem, which, like healthcare delivery, may not lend a clear course of action or immediate answers.[4] PBL drives students to cooperatively work together to evaluate information and solve problems, which aim to develop critical thinking abilities, communication, and team-building skills. As

faculty help guide and facilitate the PBL group, each student must explore and coalesce new information, bridging the gap between the parameters of the classroom and clinical practice.

The responsibilities for both students and faculty in the PBL process are different from traditional learning methods.[5] Student must do more than sit, listen, and take notes. They must assume a more active role to explore information to understand a problem, develop potential diagnoses and create tenable treatment options. These activities help integrate clinical and basic science material. Students also discuss concepts, question ambiguity, and forge their own opinions, which further a sense of commitment to learn. Faculty must avoid lecturing content material or dispensing critical information, which stymies students' self-directed learning and development. Assuming the characteristics of facilitator and tutor, PBL faculty is to refrain from answering questions. Students must find and reflect on information to target the problem, requiring little or no formal instruction from faculty.

Researchers have examined whether PBL helps students develop knowledge and essential life-skills, such as self-directed learning. Some studies, for example, have contrasted students' acquisition of content knowledge in traditional programs with PBL learning approaches. Albanese and Mitchell[6] reported that in some PBL courses, students did not acquire as much content knowledge when compared with students engaged with lectures, as evidenced by performance on multiple-choice exams. In a similar study, Vernon and Blake[7] found that students' performance on factual knowledge assessments did not favor traditional instruction.

While there may be a some disparity between the overall retention of students' knowledge in a PBL curriculum and in traditional curricula, requiring students to spend time acquiring, integrating, and evaluating information has several advantages that traditional learning strategies do not capture.[8] As Barrows[3] noted, "The irony is that few formal assessment procedures can distinguish problem-based learning from conventional curriculum students because such procedures are generally insensitive to the cognitive and behavioral differences that are observed in PBL."

Some research has used assessment methods other than traditional tests to examine whether PBL has an impact on students' higher-order skills. For example, Blumberg and Deveau[9] used surveys that reported significant differences in students' attitudes and behaviors. After completing a PBL course, students reported that PBL helped them to develop communication sills, examine issues that were not specifically addressed, and foster self-directed learning skills. In another study, students in the McMaster's program rated themselves as being better prepared than students taught through traditional methods at implementing independent learning, problem solving, self-evaluation, and data-gathering skills.[10]

MATERIALS AND METHODS

At the West Virginia University School of Medicine, multidisciplinary faculty designed a PBL learning experience to augment an interdisciplinary basic-science course, Human Function. It is a yearlong course that combines the disciplines of biochemistry, human genetics, and human physiology. The PBL course includes one facilitator and eight students to a group. The course is divided into two, 15-week semesters. After the first 15-weeks, students are placed into a new PBL learning group with a different facilitator and different students. All students, then, have the benefit of two facilitators each year, and working with different peers in each component. The aims of the PBL sessions are:

- to integrate information across the various disciplines of basic and clinical sciences
- to narrow the gap between basic and clinical sciences by using clinical cases to illustrate basic science principles
- to enhance students' acquisition, retention and use of knowledge
- to enhance students' self-directed learning skills
- to develop students' communication and interpersonal skills
- to increase students' level of intrinsic interest in the subject matter

Each 15-week component includes five cases. Each case is divided into three parts. First, students are confronted with a complex problem. A packet of information explains a patient's chief complaints, a psychosocial history, physical symptoms, and particular lab results. Students are asked to share and explore hypotheses of the patients' condition. Students also identify key learning issues, or questions about the material. The learning issues, which drive students' self-directed learning skills, are researched before the next PBL meeting.

Second, students discuss the collected information that addresses the learning issues. As students cooperatively share information, PBL aims to develop critical thinking abilities, communication, and team-building skills. Addition information about the patient is given, yielding more learning issues for the third, and final, PBL component. The last component begins with the presentation and discussion of the learning issues. Addressing learning issues help students refine their hypotheses about the patient's presenting problem, eventually leading to a course of action and a full discussion about the implications of the medical condition.

Several authors have suggested recommendations about how tutors should conduct a PBL group.[11] Using these recommendations as a guide, the West Virginia Medical School outlined the facilitator's responsibilities for the PBL learning experience, which were addressed in a one-day training session for all facilitators. The Problem-based learning facilitators will:

1. Avoid lecturing and offering information that students could retrieve for themselves.
2. Assist the group to work cooperatively.
3. Guide the group by asking questions.
4. Aid students with the identification of appropriate learning issues or questions.
5. Aid students with identifying gaps in knowledge that need to be addressed.
6. Help the group develop learning issues that integrate the basic and clinical sciences.

In order to ascertain whether the PBL learning experience was meeting its aims and whether the faculty were displaying appropriate facilitation skills, course and facilitator evaluations were implemented after each 15-week PBL course between the 2001 and 2003 academic years. Questions were phrased to address specific learning outcomes and facilitator behaviors. The focus of these evaluations, then, was to answer fundamental questions about what students were expected to learn, how they were taught, and what skills they advanced and furthered.

This research study was guided by two research questions:

1. What is the underlying structure of the facilitator and course evaluations?
2. Is there a relationship between PBL facilitator evaluations and student reflections about learning?

At the end of each semester, students were asked to complete two evaluations: a PBL course evaluation and a facilitator evaluation. Students' names remained anonymous and the evaluation results were not given to faculty until the semester was completed. Approximately 12 PBL groups were completed for each semester. The evaluations were collected from each group and anonymously labeled PBL group one, PBL group two, etc. Faculty names were not revealed with the analyzed data. Participants included PBL learning groups between the academic years of 2001 and 2003, yielding a total 45 groups. A total of 28 facilitators facilitated the 45 groups. Approximately six to eight students completed each PBL evaluation and facilitator evaluation after each 15-week component of PBL.

In 45 PBL groups across the 2001 and 2003 academic years, students completed the facilitator and the PBL course evaluation. The facilitator evaluation included nine questions. Each question used a 5-point scale from Poor (1), Fair (2), Somewhat good (3), Good (4) to Excellent (5). The PBL course evaluation included nine questions on a standard 5-point scale, ranging from Not at All (1); Slightly (2); Somewhat (3); Mostly (4), and Completely (5).

Two statistical analyses were conducted to address the research questions. First, a factor analysis was used to explore the organization of underlying factors in the facilitator and course evaluations. Factor analysis can provide evidence of construct validity for both instructional and learning dimensions. Gall, Borg, and Gall[12] defined construct validity as: "The extent to which inferences from the test's scores adequately represent the content or conceptual domain that the test is claimed to measure" (p. 756). One criticism of factor analysis to explore dimensions of an instrument is that the choice of method may determine the factor solution. For example, analyzing data without rotation does not minimize the number of variables that load highly on any given factor, which varimax rotation is likely to do. Therefore, analyzing the data with factor analysis should be supported with a theoretical foundation.

The theoretical foundation of facilitator and course evaluations, however, is mixed. Some research, for example, suggests that evaluations of faculty performance tend to load heavily on one factor that is indicative of a global factor. Other research suggests that multiple factors indicate that students can distinguish between dimensions, such as instructional skills and course organization skills.[2] For the purposes of this study, an exploratory approach was implemented, which can be characterized as a theory-generating approach. While attention was made to craft questions that target specific facilitation skills and learning outcomes, there is no existing evidence to suggest that particular questions should load into distinct factors. This is particularly true for the developed facilitator evaluation, which did not include some domains identified in the literature, such as course design issues.

A principal component analysis with varimax rotation was used to maximize the potential that questions will align with a particular factor, which is a common rotation option for exploratory analysis. The factors revealed, as well as the pattern of the factor-loading, will suggest hypothetical or explanatory constructs. An analysis of the latent variables will ideally yield plausible labels that distinguish one factor from another.

If a reasonable relationship between questions in each factor can be defined, a linear regression will be conducted. Using each factor as a variable, factor scores (mean of the items in each factor) for the facilitation evaluations will be used to predict factor scores yielded from the course evaluation. A regression analyses will explore the potential for facilitator performance scores (independent) to predict student observations about their own learning (dependent).

RESULTS

The results for the facilitator evaluation revealed a single factor that explained approximately 55% of the variance. All questions loaded at least .537 with the factor, allowing for no rotation of the solution (Table 1).

These results suggest all nine items represent a global construct: general facilitation skills. A one factor solution may indicate a halo effect, which suggests that students cannot distinguish between facilitator skills. That is, if a student rates a facilitator high on one particular skill, then the other skills are probably also rated highly. This result is also consistent with the information processing models of performance ratings.[2] This model posits that students have general impressions of facilitator performance. Semantically

Table 1. Factor Loading for Varimax Orthogonal One Factor Solution

Item	Factor Loading
Faculty Evaluation Questions	
Rate how well:	
the facilitator guided the group by asking questions.	.829
the facilitator accepted feedback from group non-defensively.	.659
the facilitator helped the group stay on track	.800
the facilitator exhibited enthusiasm.	.791
the facilitator helped identify gaps in the group's knowledge	.653
the facilitator helped set learning issues.	.807
the facilitator helped the group bond as a team.	.857
the facilitator helped integrate learning issues in the basic and clinical sciences.	.537
the facilitator helped the group include psychosocial issues in case discussions.	.723

Factor loadings for the nine faculty evaluation questions, which resulted in a one factor solution. There were a total of 28 facilitators who conducted 45 PBL groups between the academic years 2001 to 2003. Approximate 6 to 8 students completed the facilitator evaluation for each group.

Table 2. Factor Loading for Varimax Orthogonal Two-Factor Solution for the Course Evaluation

Factor One: Collaboration Skills	Factor Loading
To what extent did my participation in PBL help develop my communication skills?	.836
To what extent did my participation in the PBL group help to develop my teamwork skills?	.828
To what extent did my participation in PBL help develop my problem-solving skills?	.731
Factor Two: Independent Learning Skills	
To what extent did my participation in PBL help me become an active learner?	.701
To what extent did the learning issues generated in my PBL group stimulate me to use materials and resources other than the ones provided for in my other courses.	.736
To what extent did my participation in PBL help me learn and understand basic science principles and concepts?	.744

Factor loadings for the six course evaluation questions, which resulted in a two factor solution. There were a total 45 PBL groups between the academic years 2001 to 2003. Approximate 6 to 8 students completed the course evaluation for each group.

similar questions cue the students to retrieve these general impressions to make judgments about specific skills, which reveals little or no difference between skills.

These results also suggest that the questions targeted a singular dimension: facilitator skills. Questions that addressed issues such as course organization, preparation and appropriateness of material, and facilitator's knowledge of the material were not posed. The one factor solution, then, is a reasonable alignment with the original intention of the evaluation.

The results for the PBL course evaluation revealed a two-factor solution. The principal-components solution revealed that three of the nine items were grouped for the first factor (Collaboration Skills), totaling 31% of the variance explained. The second factor (Independent Learning Skills) included three items that explained 23% of the variance. Aggregating the two factors yielded a cumulative 54% of the variance explained (Table 2).

An analysis of the questions reveals reasonable interpretations of the two factors. The first factor, Collaboration Skills, captures several skills that characterize interaction and cooperation between students. The three questions focus on developing communication skills, teamwork skills, and problem-solving skills, which emphasize group interaction to address the problem and explore solutions.

The second factor, Independent Learning Skills, includes questions that focus on the attributes of active and independent learning. Students are expected to be engaged in the learning process, use multiple sources of information, and assume a self-directed role in considering all aspects of a case.

The next step of this analysis is to investigate whether facilitator performance is related to student learning. Questions for each factor were collapsed into a mean, revealing three scale scores. Considering that the factor analysis revealed reasonable interpretations of the latent variables, this analysis explored whether the facilitator scale score predicts the two scale scores for the course evaluation. The purpose of the linear regression is to treat the factors as variables and ascertain a possible relationship between the factor scores. The results revealed significant relationships between the facilitator scale score and both scale scores for the course evaluations (Table 3).

These findings suggest that facilitator performance, as a global factor, is related to factors distinguishing student learning. The relationship between facilitator performance

Table 3. Regression Analysis Summary for General Facilitation Skills Predicting Factors Related to Student Learning

Factors	Predictor Variable: General Facilitation Skills			
	B	SEB	B	R^2
Factor 1 Collaboration Skills	0.145	0.046	0.067	0.028*
Factor 2 Independent Learning Skills	0.154	0.060	0.138	0.019*

Regression summary analysis for general facilitation skills predicting factors related to student learning. General facilitation skills revealed significant value for both Factor 1 and 2 at alpha level .05. There were a total of 28 facilitators who conducted 45 PBL groups between the academic years 2001 to 2003. Approximate 6 to 8 students completed the facilitator and course evaluation for each group. * $p < .05$

and the collaboration/independent learning skills is an intuitive one. For example, facilitators are responsible for engaging students, aiding with learning issues development, and encouraging students to use multiple sources of information. Students' general impression of facilitator performance, then, is appropriate aligned with the learned skills.

Still, the results suggest that the relationship between facilitator performance and student learning is limited. The R^2 value represents the total amount of dependent score (Collaboration and Independent Leaning Skills) variance that can be explained by the independent or predictor variable (Facilitation Skills). In this analysis, only 3 % of the Collaboration Skills and 2% of Independent Learning Skills can be explained by Facilitator performance. Therefore, while facilitator performance is a significant predictor, roughly 97% of the variance remains unexplained or due to other factors.

DISCUSSION

The results of this study reveal several implications. First, the interpretation of the factor analysis for the facilitator evaluations suggests evidence for construct validity. The factor analysis technique is a strategy to indicate the extent variables relate to an underlying factor. It is up to the researcher to define conceptually the factors.[12] Construct validity, as a function of the scores, suggests that the test is measuring what it purports to measure. The single factor for the facilitation evaluation is consistent with the original design, which focused on observable performance that students could reliable judge. Issues such as course organization skills and quality of learning materials were not addressed. Defined in this way, the construct of general facilitation skills is a reasonable interpretation of the data.

The results, however, suggest there are limitations with using facilitator evaluations to inform facilitator training. Because the factor analysis reveals little distinction between facilitator skills, it is difficult to use the results to extrapolate suggestions for facilitator development. For example, a facilitator may acknowledge a need to improve her ability to set appropriate learning issues. However, if the facilitator receives a high score on any item, then the facilitator is also likely to receive high scores on all the other items, including setting appropriate learning issues. The evaluation data is therefore unlikely to confirm or refute whether a facilitator should address specific skills.

Second, the distinction between the course evaluation factors also presents a tenable argument for construct validity. An analysis of the questions reveals an appropriate inference that the factors are conceptually different and definable. That is, Collaboration Skills are conceptually distinct from Independent Learning Skills. This evidence also suggests that students are able to distinguish these skills, and reflect on gains in learning relative to the two factors.

Third, the linear regression results suggest that facilitator performance can predict some of the variance in student learning. In addition, this relationship is distinct for learning related to issues such as self-directed learning and the interaction of students. This evidence can be used to inculcate the importance of facilitator skills, such as posing questions, exhibiting enthusiasm and defining quality learning issues. As reflective educators, facilitators can be reminded that these skills are necessary to achieve the aims of PBL.

Still, the regression analyses highlight the need to move beyond facilitator performance and explore other variables that may impact student learning in PBL. Researchers may examine, for example, how learning preferences, PBL materials, and grading strategies may inhibit or excite learning in PBL. Understanding these influences will help maximize student learning and development, and ultimately answer fundamental questions about PBL and its potential to further essential skills.

CONCLUSIONS

Overall, these results suggest that the facilitator evaluation reveals a global indication of facilitator performance. Targeting the quality of specific skills, then, may require additional assessment strategies, such as having trained raters evaluate facilitator performance. An analysis of the course evaluation also reveals that students distinguish self-directed learning skills from collaborations skills. The connection between these factors suggests that facilitator performance, although limited, does impact the extent of students learning and development. Failing to recognize the

importance of appropriate facilitation skills may ultimately compromise the learning environment.

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Evaluation of Student Learning: A Continuum from Classroom to Clerkship: A Webcast Audioseminar Series for Spring 2004

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ABSTRACT

In the spring of 2004, IAMSE sponsored a webcast audioseminar series titled "Evaluation of Student Learning: A Continuum from Classroom to Clerkship". Six nationally recognized experts in evaluation of student learning presented seminars that described various ways to develop and use evaluation methods in settings generally found across the medical curriculum. Our audience included members of institutional faculty development programs and individual faculty members from many countries across the world. Our webcast series allowed registrants to listen to the presentation in real time while viewing the presenter's slides on their computer web browser. The presentations were interactive, allowing the audience to ask questions or provide information from their own experiences. Audio recordings of the seminars, accompanied by the slides were archived on the International Association of Medical Science Educators (IAMSE) website, and are available to registrants who want to review the seminars. Evaluation of student learning proved to be a very popular topic, and the audience numbered well over 100 for each of the six seminars. We urge educators to carefully read the following philosophical and practical approaches to evaluation of student learning. Use these white papers to convince colleagues, Chairs and Deans that there must be a solid evaluation plan for their institution. It is important for educators to measure the return values on education and make them a part of annual reports. Each seminar speaker provided a summary of content and major points of discussion following their presentation. These summaries are reproduced below.

Fundamentals of Evaluation in Medical Education

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Feedback is a key feature of any system that promotes learning. This is true whether we are talking about an individual student's efforts to learn new knowledge or skills, or an organization's efforts to improve its process or product. It is in this context that evaluation was discussed as it applies to medical education. Fundamentally, evaluation is the systematic collection of information for decision-making. It is a key component of a process of action, reflection and planning. Evaluation questions and strategies can range from a focus on learner's experiences and abilities to larger organizational concerns characterized by questions about the curriculum, students, faculty, institutional processes or organizational mission. Regardless of the focus of a specific evaluation effort, the purpose of an evaluation is quality improvement.

The first part of the presentation focused on student assessment and its relationship to determining competency. Learners vary in their level of competency from novice to expert; the challenge is choosing assessment strategies appropriate for the level of competency. Assessment strategies vary in the extent to which they are objective or subjective and quantitative or qualitative, thus each requires specific implementation considerations to assure reliability, validity, efficiency and acceptability. Since each assessment strategy has strengths and weakness, a system of assessment that uses multiple strategies will provide the most accurate reflection of learner competency. In basic science education, the multiple choice question (MCQ) is the most frequently used method of student assessment, most likely because of their objective quantitative format as well as their

familiarity to both learners and faculty. However, since patients don't present with five choices during a medical encounter, MCQs have their limitations too. A number of questions were provided to help educators think through decisions about which student assessment methods to choose.

The second part of the presentation focused on program evaluation. Essentially, while the process of designing a program evaluation is similar to designing a student assessment, there are differences in terms of scale as well as the types of questions that frame the data gathering. The program evaluation model by Kirkpatrick was used, indicating that evaluations can focus on participant reactions, learning, behavior change or real world impact. Again, evaluation strategies were discussed in terms of the various levels of Kirkpatrick's model, with idea that each has strengths and weaknesses and that multiple measures provide the more data for decision-making purposes. When deciding on an evaluation strategy, the question of resources, stakeholders, mission and values need to be considered. The discussion following the presentation focused on different methods of collecting information and their appropriateness to different needs or situations. In addition, there was discussion of the strategies for disseminating evaluation information to faculty, as a means of involving faculty in on-going planning and decision-making.

Evaluating Student Learning in the Didactic Setting

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The seminar on "Evaluating Student Learning in the Didactic Setting" presented different methods to assess student learning both objective and subjectively. However, before assessing student learning, one must determine curricular expectations through development of specific objectives for each contact hour in a course. This also allows for appropriate exam development in which all written exam questions match or correspond to an objective. With excellent course objectives and exam development, one may use multiple objective and subjective methods to evaluate student learning; both short-term learning and long-term learning.

The objective ones include use of examinations. Internal exams can be used to assess student learning in specific topics, or blocks with comparison studies of previous successful years. Comparison of one academic year to another year that has been deemed successful may allow one to determine academic achievement in the next year by analyzing class averages and class block averages. This use of internal exams is limited because it is based on internal critique only.

National Board of Medical Examiner subject exams also allow a course director to assess learning of specific topics and blocks through the "item analysis" results. One may also compare the class with other medical schools in the United States and Canada, and one may compare one internal class with another. Class percentile ranks and comparison of expected percentile ranking with observed percentile ranking may give data supporting student learning. Use of subject exams may also evaluate long-term learning and knowledge retention of orphan topics, topics not covered extensively in a course, and topics in which there may have been specific problems.

Subjective means discussed included data obtained from peer review, student surveys both current and retrospective, faculty participating in future courses and the student effective index. These may all be used to evaluate student learning. Obtaining adequate response rates to faculty and student surveys may be challenging. Voluntary participation is the preferred method. Students and faculty should feel a professional obligation to participate in a way that may potentially improve a course and student learning. Enticements may be used and include students receiving extra points, temporary delay in receiving student grades, and for faculty, small gift certificates or small financial gifts for their time and opinions.

Assessment of student learning should occur throughout the course via well-designed internal exams, and preferably with an external end of the year exam. There are other times that a course director may need to focus in on specific topics to evaluate student learning including 1) faculty change in lectures, 2) significant content change, 3) change in teaching methodology, and 4) utilization of new faculty members in teaching of the course.

The most common methods used to evaluate student learning, according to many course directors, are internal exams looking at topic – block specific data, yearly comparisons and class means, and student perception obtained from student surveys. Additional methods of assessing student learning, including these may provide additional support that students in a class are learning the material outlined in the course objectives. It is recommended those additional methods besides internal exams and student surveys be used to evaluate student learning. An end of the course external exam is recommended to both evaluate and compare student learning with other schools.

Evaluating Student Learning in the Clinical Setting

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May 5, 2004

The purpose of this session was threefold: discuss common problems with clinical performance ratings (CPR), explain

steps necessary to judiciously evaluate problem learners, and describe strategies for enhancing CPR.

The quality of performance ratings are determined by their accuracy, reproducibility, generalizability, and validity. The main sources of errors in CPR systems include the raters: -evaluating behaviors they didn't observe, or don't remember observing -not the performance rating system, and the rating form itself. Problems associated with raters vary, but sample problems involving raters are:

- evaluating behaviors they didn't observe, or don't remember observing
- not using the full scale but rather being hawks (rare) or doves (most common)
- not wanting to record negatives
- rating a learner high or low in all categories rather than discriminating among the different categories

Clinical performance rating systems need to be administered with attention to detail. The who, what, when, how, and so what questions associated with any system should be documented and implemented as such.. Examples of problems include:

- tardy forms or no forms completed
- lack of follow up when negative ratings or comments are submitted
- insufficient number of raters to truly generalize performance
- insufficient attention to due process guidelines

And lastly, examples of problems associated with the rating form include:

- too many items on the form
- no indication as to the extent of observation by the faculty member
- no global rating scale to capture "gestalt" judgment of faculty member

These lists are not exhaustive but represent many of the weaknesses in clinical performance rating systems.

Faculty should be educated on how to detect common symptoms among problem learners and how to effectively intervene. An impaired learner can have psychological, substance abuse, or physical illness problems. It is critical that faculty document noted problems and submit their written concerns to the clerkship or program director. If communicated verbally, the education administrator should document the date and time of the conversation. Preventative measures such as having a meaningful mentor/advisor system, a critical incident report system, and clearly documented expectations for the learners are helpful. The key guidelines are to:

- document changes in personality, performance, or physical appearance in a timely way
- provide clear and consistent communication, both verbal and written
- due process must be afforded
- intervene early
- protect the learner's right to confidentiality
- be aware of your institution's policies for addressing problem learners.

Education administrators can enhance their clinical performance ratings by taking several steps. These steps are nicely spelled out in a paper by Dr. Reed Williams and colleagues entitled "Cognitive, social and environment sources of bias in clinical performance ratings" published in Teaching and Learning in Medicine, 2003. The authors offer a list of suggestions that should be considered when aiming to hone your clinical performance evaluation system.

It is a difficult but critical responsibility to evaluate our learners in the clinical environment. There are challenges to implementing a fair and accurate performance evaluation system in the busy and complex hospital environment. But we can hone our ability to judiciously and accurately evaluate our learners with adequate attention to: 1) educating our faculty raters so to ensure adequate calibration and cooperation, 2) planning and documenting a sound performance evaluation system, and 3) having in place procedures for appropriately addressing problem learners.

Options for Evaluating Student Learning in PBL Programs

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May 20, 2004

In this session a classical, iterative version of problem-based learning (PBL) is described, in which the case discussion stimulates learning. All material is discussed twice, first without prior preparation and then after researching the questions raised in the first session (called learning issues). Next seven learning outcome categories are outlined according to Fink's (2003) taxonomy of significant learning that guide our options for evaluating student learning in PBL. These categories are: learning how to learn, motivation/interest/values/respect for others, human dimension, integration/connection, application/problem solving/critical thinking, knowledge, and skills. Specific embedded assessments that are congruent with this taxonomy of learning that can be used at each step are identified. For example, the summaries of learning issues can be evaluated for: deep-learning (learning for understanding and meaning, and many connections are formed among concepts learned) , use of evidence-based decision making to evaluate information, synthesis of knowledge, evidence of self-directed learning, information literacy skills, and written communication. Many different types of categories of outcomes can be evaluated throughout all in-class PBL activities including: professional behaviors, leadership effective team behaviors, and management of complex projects. These evaluations are based on repeated observations of in-class interactions. Faculty, peers and the students can assess themselves on these dimensions. few examples of non-embedded, authentic evaluation tools that

are consistent with the PBL process, such as the triple jump are discussed.

An evaluation framework is proposed for selecting what to evaluate and how that considers the outcome category, the rationale for selection, the specific outcome to be evaluated, how the outcome should be measured and how to collect data to measure the outcome. Finally, the framework is applied to examples of how to evaluate deep learning and information processing. Deep learning falls in the categories of learning to learn, application and problem solving. Problem solving is hard to measure directly, but evidence of deep learning is a prerequisite for problem solving. Deep learning can be evaluated from the student discussions of cases, particularly on the second go around with the material. Students collectively can create concept maps of their understanding of the case and the underlying basic science that explains the disease process. Scoring rubrics can be used to evaluate students' concept maps. Usually a group grade is given and then individual students can earn more or less than the group grade for performance that was markedly above or below the standard performance. Peer feedback is helpful in determining the individual points. Information literacy standards for higher education have been established by the Association of College and Research Libraries including: determination of information needs, acquisition of information effectively and efficiently, critical evaluation of information and its sources, incorporation of selected information into one's knowledge base and use of information legally and ethically. The process of generating, researching and reporting on learning issues allows us to evaluate students on information literacy

Association of College and Research Libraries www.ala.org/acrl/ilintr.html Fink, LD. (2003) Creating Significant Learning Experiences. San Francisco: Jossey-Bass

Computer-Based Assessment of Medical Knowledge and Skills

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June 1, 2004

For centuries, medical educators have used traditional means for assessing medical knowledge and skills: paper-and-pencil tests, microscope-based exams, and clinical skills exams with simulated patients. Some of these trusted methods, however, have serious drawbacks. For instance, in a typical microscope-based exam students are given little time to examine a specimen and are not allowed to review their answers. Not uncommonly, specimens change or become damaged during the examination process.

Recent advances in web-based and robotic technology have remedied some of the disadvantages of traditional assessment methods. These new formats of assessment, however, are expensive and introduce a new set of challenges. For instance, security concerns are raised because students need to be tested in shifts due to limited seating capacity in computer laboratories. Also, students could conceivably use the Internet inappropriately during the exam using "instant messaging" or surfing the World Wide Web to find answers. It has been UCLA's experience, however, that reminding students of the Honor Code is sufficient to avert widespread cheating.

In this seminar, emerging trends in the field of computer-based assessment were discussed. "Virtual patients" are computer-based simulations with which students can interact to sharpen their diagnostic reasoning and procedural skills without risks to patients. Virtual patients range from relatively simple web-based applications to very complex, high-fidelity computer-driven mannequins. These simulations can be used to assess clinical skills to the extent to which they can track and document students' clinical decisions and treatment choices.

Computer adaptive testing (CAT) is being adopted increasingly in standardized testing but has not yet found widespread use in medical education. It was introduced in this presentation as a potential novel method to measure medical knowledge with great precision. Based on Item Response Theory, CAT selects a unique sequence of test items to estimate a student's proficiency. Difficulty level of the questions is based on the student's performance on previous questions. CAT, however, requires a large set of questions with established psychometric properties such as difficulty level. Therefore, this method may not be feasible for individual institutions unless medical colleges collaborate.

Fortunately, recent technological advances have facilitated collaborations among institutions. For instance, several XML metadata schemas have been developed to describe the content and characteristics of test items such as the IMS Question and Test Interoperability Specification (www.imsglobal.org/question/). As an increasing number of medical schools use electronic course management systems that are compatible with such metadata schemas, we may see more sharing, banking and re-deployment of test items in the near future.

In conclusion, computer-based testing resolves some problems associated with conventional assessment methods but at the same time introduces new challenges. Because computer-based assessment opens new ways to improve the validity and reliability of testing, it is worthwhile exploring how sharing of test items among medical schools can address the increased cost. Finally, but importantly, writing effective test items is and remains an art regardless of the sophistication of the assessment method.

Putting it Together: Planning an Effective Evaluation System

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June 17, 2004

This final session addressed how faculty might use many of the concepts presented in this evaluation series to create a broader system of evaluation. Initially the talk distinguished broad purposes of evaluation. This was accomplished by orienting the participants to Jacob's five-phase model for program evaluation that covers pre-curriculum evaluations (e.g. needs assessments and task analyses) accountability evaluations and program impact evaluations. Curriculum planning, implementation and evaluation were considered as integrated components of larger systems not independent activities.

Several tools were presented to participants to assist in designing program evaluation. First we discussed how the evaluation system could focus on: learners; courses; or the entire academic program and its related mission and outcomes. In determining what to evaluate, faculty can select the content, process, learners or outcomes; for each one can ask "what," "who," or "how" related questions.

Next, participants examined Kirkpatrick's hierarchy of levels of evaluation that has considerable overlap with Miller's hierarchy of competence. In evaluation, one can incorporate evaluation that emphasizes the reaction of learners (satisfaction), learner accomplishments (knowledge and skill acquisition), transfer of learning to new or real settings or ultimately, the impact of the program on important outcomes such as health care delivery or community.

The session then addressed how databases can be used as practical management tools in evaluation. One such tool used at the College of Human Medicine tracked all the performance-based assessments across the four-year curriculum. For each core area recognized by NBME (e.g. history taking) the database reflects where in the curriculum the assessment occurs; classification of the assessment method (e.g. standardized patient); and if it is a primary or secondary source of evaluation data for the College. From this matrix we are able to: determine areas where we have evaluation gaps or redundancy; establish if we are using a desirable range of assessment strategies; and determine if our courses and rotations are incorporating the types of assessments valued by the College.

Finally, the "Evaluation System Checklist" was discussed that is designed to help faculty examine not just their own course evaluations but the entire program system and whether that system provides important information for decision-making. For example, a system for evaluation should have a broad mission statement that guides decisions about evaluation priorities and resources. Also, are there specific protections for student privacy and confidentiality?

The seminar finished with questions and observations about the challenges of creating practical evaluations that inform us on the progress of our academic programs and the learners served by them.

Series Summary

Several recurring themes can be seen in this series. One is that any method of evaluation of student learning must be carefully planned before the educational endeavor is undertaken. How they are to be used, and for what purpose they will be used must be determined beforehand. For example, this may be formative or summative evaluation of students, or program evaluation. This is especially true of interventions that will not be evaluated by typical objective exams. Second, there must be continuous and consistent feedback to the evaluators about the reliability and usefulness of the methods being used. Frequent refinement may be necessary. Third, methods must be consistent with the educational setting and methods by which students are learning. Finally, more than one method of evaluation should be in place (for example, direct observations by faculty, skills assessments, computer-based assessment, evaluation of student logs or student reports). The principles presented in the series will be extremely helpful to faculty and administrators assessing their own methods of evaluation of student learning.

Preparing a Manuscript for Submission to the Journal of the International Association of Medical Science Educators

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ABSTRACT

The objective of this paper is to address one of the primary reasons that manuscripts are rejected for publication in the Journal of the International Association of Medical Science Educators (JIAMSE), poor manuscript writing. One of the primary goals of the International Association of Medical Science Educators (IAMSE) annual meeting is to improve the way we teach medical science students. The information that IAMSE members share in their poster presentations represents cutting-edge medical education research. The impact of these presentations is limited if the results are not disseminated beyond the annual IAMSE meeting to a larger audience. It remains a goal of the JIAMSE Editorial Board to encourage IAMSE members to share their medical education research with the community of medical educators by publishing the results of their work in JIAMSE. The journal is the peer-reviewed, biannual (June and December) electronic journal of IAMSE that is published in three languages (i.e., English, French, and Spanish). JIAMSE publishes multiple types of medical education related contributions, including: original research manuscripts, reviews, editorials, opinion papers, and announcements. Submissions address a wide range of topics that are of interest to IAMSE members, such as the introduction, application, and success of new teaching methods. In this paper, readers will receive practical information on how to strengthen their medical education reports for publication in JIAMSE. Guidelines for each section of a medical education research manuscript will be addressed as well as key elements that JIAMSE editors use when reviewing a paper for publication.

INTRODUCTION

The annual meetings of the International Association of Medical Science Educators (IAMSE) provide educators with an ephemeral exchange of ideas for improving medical science education, including possible solutions to educational problems. However, publication in our organization's peer-reviewed journal, the *Journal of the International Association of Medical Science Educators* (*JIAMSE*), provides a permanent record of medical science education issues, methods, and findings. Published educational research is the delivery system that we as medical science educators rely on to better understand contemporary educational issues and to examine, utilize, and/or test the methods and findings of other medical science educators.[1]

Although other forms of scholarly interchange may reach and influence the ideas of a far greater number of colleagues (e.g., posting an article on an electronic bulletin board), [2] publication in peer-reviewed journals such as *JIAMSE* is frequently considered the ultimate product of scholarly activity.[3] The rigorous and anonymous assessment of peer-reviewed publications provide employers with an external method for evaluating an employee's professional service. "Within the university, a faculty member's published record is used to guide a host of evaluation-based decisions, such as appointments to tenure, promotion to a higher rank, and awarding merit salary increments."[3] Thus, publishing medical education research in refereed journals is essential to both the growth and development of medical science educators and the field of medical education.

There are articles in the literature that address how to write medical education manuscripts for journal publication.[4-5] Yet, writing poor manuscripts (i.e., "text difficult to follow, to understand … inappropriate statistics and over interpretation of the results") was recently reported as a fatal flaw warranting manuscript rejection.[6] Although *JIAMSE* publishes different types of medical education-related contributions (i.e., original research manuscripts, reviews, editorials, opinion papers, and announcements), the Editorial

Board of *JIAMSE* has made similar observations of original research manuscript submissions. Thus, the main purpose of this paper is to describe how potential authors can successfully publish their medical education findings as original research manuscripts in the *JIAMSE*. This objective will be accomplished by providing specific guidelines for each section of an original research manuscript. A secondary purpose of this presentation is to describe the publishing process from submission to publication.

Original Research Manuscript Section Guidelines

Organization and presentation of original research manuscripts in most medical education journals (including JIAMSE) is SIMRAD.[5] The acronym SIMRAD stands for Summary (or Abstract; manuscript synopsis), Introduction (literature review and research question), Methods (how study was conducted), Results (findings) and Analysis (data statistics, part of results), and Discussion (what results and analysis mean). Original research manuscripts in medical education should employ the scientific method of solving medical education-related problems, or exploring and testing an idea related to medical education. Authors of original research medical education manuscripts can speed up the editorial process and maximize their chances of acceptance by using and understanding SIMRAD, hence the purpose of the following sections.

Title

Although the manuscript title is not contained within the SIMRAD acronym, it is probably the most important component of a paper.[4-5] Search engines, including both MEDLINE and Educational Resources Information Center (ERIC), use title words to locate indexed research papers.[7] Moreover, the title is the first thing potential readers see and what makes them decide whether to invest the time to read more of a paper.[8]

The title should clearly indicate the content and breadth of the study, and should not be misleading.[4] Key words should be included to capture the reader's attention.[9] However, avoid putting too much information into the title (e.g., conclusions).[8] Prune unnecessary jargon and trite phrases (e.g., "A study of…") to keep the title as short as possible (generally 15 words or less).[7-8] Creation of the title should in most instances follow the body of the entire paper.

Abstract (Summary)

Abstract and summary are two terms that denote the same component of the original research manuscript. For JIAMSE, the heading abstract is used on original research manuscripts. The abstract is as important as the manuscript's title, because it is the only part of the paper that most people will ever read.[8]

The abstract serves two main purposes: 1) it helps a person decide whether to read the paper, and 2) it provides the reader with a framework for understanding the paper.[7] It must precisely cover each and every major aspect of the study. Vague or incomplete abstracts may be one reason why only about half of all published papers are ever cited.[9] The abstract should summarize the following components: 1) introduction/objective (why study was done), 2) methods (type of study; study setting/conditions; subject and/or group size and selection; interventions/treatment; and main outcome measures), 3) results (main outcomes, including means, standard deviations, level of significance, etc.), and 4) discussion/conclusion (only those conclusions supported by study data; application statement; recommendation).

Abstract length is journal-specific; however, all MEDLINE-indexed abstracts cannot exceed 400 words. JIAMSE abstract length is a maximum of 250 words. All numbers in the abstract should be written as numerals. Abbreviations and acronyms should be spelled out the first time in the abstract. References should not be included. On a time-per-word basis, the abstract ought to be the most labor-intensive part of the manuscript.[8]

Introduction

The introduction should provide enough information to understand the rest of the paper.[7] It should establish a clear relationship between what is already known about the research problem (literature review) and the specific research question(s), hypotheses, and/or objectives under study.

Search the literature carefully—chances are, someone, somewhere had the same idea before you, but that does not negate your work. The literature review provides a framework for the problem under study. It should explain why the problem was researched and how the study will contribute to existing knowledge.[7] Key references should be cited that clearly relate to the study problem. Most references will appear in the introduction section. The unique contribution of the study needs to be highlighted. The research question is the backbone of the study and should be clearly and easily found in the Introduction section.[4]

In specialist journals, some knowledge of the subject can be assumed. However, readers of many journals, including JIAMSE, may be unfamiliar with jargon-specific words and phrases related to the study. Consequently, technical language without explanation may obscure the study's value and/or its practical implications to non-expert readers.[4]

Methods

The methods section should consist of a step-by-step, logical, detailed description of how the study was conducted.[5] "The research design is the second most important element of a study, the research question being the most important."[4] Detailed clarity of the study's methods allow readers to critically evaluate the validity of the study's results and conclusions, as well as to replicate the study. The study design must be appropriate to minimize or control as many invalidating factors as possible (e.g., biases that favor a specific outcome; confounding variables that permit alternate outcomes).[4] Subjects/participants recruitment, exclusion/inclusion, and assignment to different groups should be described. To be statistically valid (i.e.,

generalizable), the subjects must be randomly selected from the population and randomly assigned to study groups.[4] An example of study instruments/tools (e.g., questionnaires, interview forms) should be included as figures or tables. Specific details about the study's independent variables (e.g., treatment/interventions) and dependent variables (e.g., consequences, effects) should be given. If arduous treatments/interventions have already been published, cite the source and give a synopsis only.[8] Describe the statistical methods used to analyze the data. It is essential that the appropriate statistical test(s) be used in data analysis. If you are unsure about statistical procedures, consult someone with the appropriate knowledge. Additionally, cite the name and version of the statistical software used.

Results and Analysis

The results and analysis section is the most important part of an experimental research paper, and is usually written as a singular section in a manuscript called results.[9] This section should provide a summary of what was found rather than an exhaustive listing of every possible analysis and data point.[7] At the beginning of the results section, review group(s) characteristics and composition, and study parameters (e.g., independent variable and dependent variable). The focus of the results should be on the objectives described in the introduction, allowing the data to demonstrate whether these objectives have been achieved.[5]

Tables and figures should be used to help simplify extensive and complex data. They need to summarize information (e.g., means and standard deviations), be accurate (e.g., totals equal data reported), and be able to stand alone (e.g., not require reference to text to explain it).[4] Figure and table abbreviations should be spelled out in corresponding legends. Data in tables and figures need not be restated in the text of the results and vice versa.

Dispassionately describe data and its subsequent analysis from a statistical interpretation only.[8] Avoid subjective interpretation in the results section, such as adjectives that imply opinion (e.g., " there was a huge difference…") as well as conclusions. Judicious use of opinions and conclusions are appropriate for the discussion section. Present the results in varied formats to help maintain the reader's interest.[5]

Discussion

After the abstract, the discussion is the hardest section to write.[8] Begin the discussion section by returning to the specific problem investigated, giving a clear synopsis of your major findings and a critical comparison with findings of similar studies (both areas similarity and difference).[7] Differences are as important as similarities when seeking explaining study's findings. Speculate on points of difference, so the reader can make some overall conclusion of your findings along with others.

Avoid repeating the results section by addressing debatable aspects of your study (e.g., different outcomes from previous studies, study limitations).[9] Question the methods you used (e.g., were they effective, or could they have been improved?) Did you have unexpected changes arise during the study. If so, how were they addressed? Try to anticipate questions a reader will have. Present your thoughts and arguments logically and try not to meander.

Identify the practical and/or theoretical implications of your findings, and how your work has added to knowledge of the topic within the study's limitations.[4] Avoid overstatement and exaggeration (e.g., "These exciting findings demonstrate convincingly…"). Modest conclusions may be more effective than bold claims. Try to avoid an indecisive ending (e.g., "…further work is necessary to answer the question raised in this study"; "These preliminary findings will need to be confirmed by others."). Indicate where further research should be directed to address questions raised by your work..[5]

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