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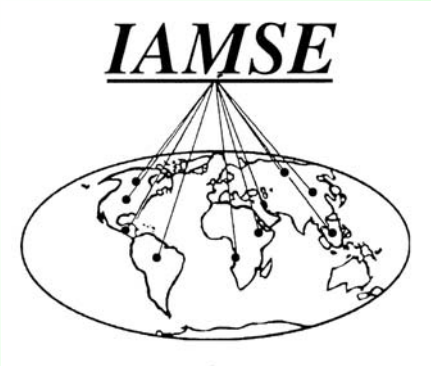

Digital Games as Educational Tools

Student Clinical Pathology Presentations

Effectiveness of Hybrid Model in Medical Pharmacology

Computer-Based Animations as Student Aids

Medical Student Study Habits

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Message from Editor-in-Chief

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

Welcome to issue 19-4. We have variety of articles to appeal to your curiosity and which may add to you armament for curricular innovation. This issue again demonstrates that a variety of publications, from monographs to short communications, are possible with our journal. You are welcome to examine this and other issues to choose what type of presentation you would like for YOUR publication in JIAMSE. We are waiting for your submission.

Good reading to all of you,

Uldis N. Streips, Ph.D.
Editor-in-chief, JIAMSE

The Medical Educator's Resource Guide

John R. Cotter, Ph.D.

The one thing students crave in a course in Histology is the opportunity to self-test. In so doing, the students anticipate being able to evaluate their preparation for an examination and getting a glimpse of what a histology examination might be like. The craving is understandable because many students, even those in professional school, may not have had a comparable course as undergraduates and do not know what to expect especially with respect to the laboratory-based questions that are typically used in a histology examination. There may even be the hope that the questions will be similar or identical to the ones that will be used by their instructors to assess achievement in the course especially if their instructors provide old examinations or practice questions.

In this issue of the Medical Educator's Resource Guide, we review four websites that offer some degree of self-testing. One of the sites – MedStudySites.com - is a depository for examinations from many disciplines. The other websites give the user the opportunity to self-test in histology and are particularly strong as self-testing websites because the scope of the testing should give the user an indication of how well she or he understands basic concepts in histology.

If you are aware of a website that has the potential for being used by educators and students of the medical sciences, please consider contributing to the Guide. Instructions for submitting a review may be found at <http://www.iamse.org/jiamse/author_info.htm>. *Send all submissions to* < *jrcotter@buffalo.edu* >.

Histology Home Page. The University of Oklahoma.

http://casweb.cas.ou.edu/pbell/Histology/histo.home.html

The authors of the Histology Home Page, Paul Bell and Barbara Safiejko-Mroczka, have created a self-instructional electronic laboratory manual and self-tests for the topics covered in their course in histology. There are three sections devoted to self-testing: "Unknown Sets", "Practice Quizzes" and "Practice Exams". With the exception of a sample final examination, the "Practice Exams" are closed to anyone from outside the course. The other two self-testing options offset the deficiency. In "Unknown Sets", users are expected to answer image-based questions and encouraged to wait for feedback that comes in the form of a list of answers. The questions used under the heading of "Practice Quizzes" require users to respond to fill-in-the blank style questions. The approach is challenging but friendly: the user can check to see if an answer is correct, ask for help that takes the form of a hint as to how the term for a structure is spelled or the user can elect to immediately see the answer to a question. The large number of questions used in "Unknown Sets" and "Practice Quizzes" and the resemblance of the questions used in both of the quizzes to questions that are likely to be used by instructors at other schools make the time spent on these quizzes well spent. (*Reviewed by John R. Cotter, Ph.D., University at Buffalo.*)

MedStudySites.com. MedStudySites, LLC.

http://www.medstuds.com/Hstology/

The MedStudySites manages a website directed toward health profession students. The site claims it is "aimed to perfect [student] understanding and retention of the most commonly tested material." On the site, students can share study strategies, study guides, practice exams, and old exams in a multitude of disciplines, including Histology. The site has an easy-to-use navigation bar. The "How to Study Histology" section provides helpful study skills, especially for the beginning student and explains how to systematically approach the study of Histology. The site reminds students to correlate structure with function and that cells are actually dynamic structures, not flat pictures, as slides portray them. Furthermore, the site suggests that students remember to consider the stain and scale of what is seen. The "Study Guide" section of the site provides PDF study guides uploaded by other students. Depending on each student's study style, this section could be helpful but is quite limited, providing only two study guides, one for the respiratory system and one for the esophagus and stomach. The "Histology Practice Test Questions" lists links to websites from various universities, including practice tests with images and tests without images. The linked sites vary in their level of detail and picture quality. Most of the sites allow for creation of quizzes: the quizzes can be made to include or exclude particular organ systems or tissue types. The sites without images provide a good test of how well a student has integrated the material taught in Histology with that taught in the other basic science courses. The "Old Exams" section of the histology site is comprised of old exams that students have submitted from Histology and Microscopic Anatomy courses. This section is very limited as well; to date, it contains only one exam that is of minimal benefit since the first 24 (out of 50) questions are to be answered in conjunction with slides that are not available on the site. If this section were expanded, it would be much more useful for students that would like to test themselves

using material compiled from multiple professors. If medical educators submitted practice exams and old exams themselves, the site would be more valuable to students embarking on their study of the discipline of Histology. (*Reviewed by Ashley Becker, B.A., University at Buffalo.*)

The Student Source. University of Virginia School of Medicine.

http://www.med-ed.virginia.edu/

The Student Source is an arm of the University of Virginia Health System homepage. Through the "Academics" dropdown submenu, students in the School of Medicine can link to course handouts, PowerPoint presentations and study aids. Although many of the links are integral to coursework at the Medical School and only available to those affiliated with the School, many of the other pages are accessible through the Internet. Outside users, for example, will find self-study questions and practice quizzes for several basic science subjects. The sections dealing with cell biology, histology and physiology are particularly useful and contain atlases, study questions and quizzes. The quizzes, which can be lengthy, are largely lecture-based but do contain a few laboratory-based images. (*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

Dr. David King's treatment of practical histology is expansive and best suited to users who are familiar with histology.* By the same token, the website is ideal for students of histology who are looking for a way to test and evaluate their understanding of the terminology and concepts that form the foundation of the discipline. Look for the self assessment questions (SAQ) sections for each of the major topics covered by the website. The questions are multiple choice questions - there are no image-based questions. Dr. King points out that the questions are designed to reinforce the terminology that is applied to the structure of the cell and the architecture of the tissues and organs. He indicates that the level of difficulty may not reflect the level difficulty of the questions used in real histology examinations. Nonetheless, it is difficult to imagine how using the self assessment tests would not help students prepare for an examination in histology. While the content of a single practice test or even multiple tests are unlikely to be broad enough to test complete mastery of the material, the website does make an attempt to do so by using a surprisingly large number of questions. (*Reviewed by John R. Cotter, Ph.D., University at Buffalo.*)

* Glomski, C.A. Welcome to Histology at SIU SOM. Medical Educator's Resource Guide. *Journal of the International Association of Medical Science Educators*. 2004; 14 (2): 40.

SHORT COMMUNICATION

On Pens and Presents: a Teaching Experiment to Assess the Influence of Pharmaceutical Industry Promotional Activities on Medical Students

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ABSTRACT

During a lecture, randomly some second year medical students received small gifts, while others received nothing. Students who received a pen were four times more likely to believe non-authentic slides to be true than those who received nothing. We conclude that small promotional incentives are not harmless.

Medical doctors tend to think that other doctors are influenced by promotional activities of pharmaceutical companies, but that they themselves are not.[1,2] From a company's perspective, however, there is evidence that promotional activities are quite successful.[3] In addition, pharmaceutical companies would not spend 15,000 million dollars per year on promotional activities if they did not believe it to be effective.[4]

For medical students the influence of promotional activities of pharmaceutical companies seems to be only of remote concern. Having all been students ourselves, we remember the temptation of obtaining free pencils and presents whenever possible. In a student mind this might be morally justified because of their low income, the fact that they do not yet write drug prescriptions, and the relative innocence of these incentives.[5]

To explore the influence of small promotional incentives, we simulated a promotional activity during a university lecture to second year medical students and assessed the consequence of it on students' judgments of information credibility.

The experiment was done during a lecture in a regular course on scientific reasoning for all second year medical students. At the start of the lecture the group was divided into two groups, one at either side of the central corridor. Then, a clinical researcher told the students they were part of an experiment, of which the purpose would be revealed later. The researcher addressed the students on the – randomly chosen – left side in a positive way, by saying they were intelligent students who participated very well during the previous lectures. As a reward for their behavior, he gave them a pen with the logo of the Leiden University Medical Center, and he promised them a small toy, a yo-yo, after the experiment. The yo-yos were presented on the bench before the students and were not

distributed to prevent the students from using them during the experiment. The other half of the students was neglected and addressed negatively once, by saying they seemed less interested during the previous lectures and, as a result of that, they were not given the free gifts. Then, the researcher presented a series of nine slides. The presentation was a fabricated review on the evolutionary development of the nose. In the first five slides truly existing species like an elephant, a spiny anteater, and a platypus were described. The last four slides showed pictures of animals belonging to the non-existent species of rhinogradentia.[6] All students received a form together with the instruction to check a box whether they believed the authenticity of each slide. After the presentation, paper forms were collected and analyzed. We counted the number of students in each group believing at least one of the last four slides.

During the lecture, 172 students were present, all participated. Of the 97 students who received a pen, 20 believed the authenticity of at least one of the slides with non-existent species. Of the 75 students who did not receive a pen, only four believed the authenticity of at least one of these slides (relative risk 3.9, 95% CI 1.4 – 10.8).

By giving medical students some small incentives in a comforting style, we were able to accomplish extended belief in information that was ultimately not true. We found a statistically significant difference between the groups although the type of incentives we used were cheap (a pen and a yo-yo) and the lecturer was not trained in selling activities or commercial presentations.

Several studies have shown that students and physicians tend to underestimate the effect of promotional activities on their own opinions.[1,5].We believe we are the first to show the effect of promotional activities in a direct controlled experiment with medical students. Our results support the analysis of Dana and Loewenstein who argue that small gifts may be surprisingly influential, as judgments on for instance the credibility of information are subject to an unconscious and unintentional self-serving bias.[7] In the United States pharmaceutical companies seem to realize this, as over 90% of third-year medical students receive promotional incentives, like pens and coffee mugs, with a mean exposure frequency of one gift or sponsored activity per week.[5]

Moves towards disentanglement have been recognized.[8] The American Medical Student Association issued a 'Pharmfree' campaign, calling for an end to gift giving, free lunches, and so on.[9] Recently they produced the PharmFree scorecard 2009 evaluating conflicts-of-interest policies of medical schools in the United States.[10] Moreover, recently Brennan and colleagues proposed a policy under which academic medical centers in the United States should take the lead in eliminating the conflicts of interest that still characterize the relationship between physicians and the health care industry.[11] Yale University School of Medicine developed their own guidelines that do not allow any form of gifts to Yale physicians, regardless of monetary value.[12] To our knowledge, in Europe no information, university guidelines, or teaching programs are available.

As a means of stimulating students to reflect on the effects of accepting small gifts, an experiment like this could be part of any regular curriculum. In our university, the experiment has been done before and, although not formally tested, the results were similar and always elicited meaningful discussion with students. An experiment like this could well be an instructive element in educational interventions that recently have been developed.[13,14]

In conclusion, we have demonstrated that offering small promotional incentives in a comforting style can influence judgments of information credibility of second year medical students. The experiment was relatively simple to carry out and can easily be introduced into any medical curriculum to directly show to medical students that small promotional incentives are not harmless.

CONFLICT OF INTEREST

The last five years, FWD received unrestricted grants for research from Amgen and Johnson & Johnson, and was involved in projects which received unrestricted grants from Abbott, Baxter Healthcare, and Genzyme. AJMdC was involved in a project sponsored by Bristol Myers-Squib. In addition, at congresses both authors received pens and small presents from various companies.

ACKNOWLEDGEMENT

The idea behind this experiment has been developed and tested by Prof. Enrico Marani, Leiden University Medical Center, The Netherlands.

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SHORT COMMUNICATION

Digital Games as Educational Tools for Medical, Dental, and Physical Therapy Students

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ABSTRACT

Computer-savvy net-generation students think and learn in different ways. Three educational games of varied complexity were designed for medical, dental and physical therapy students. Student feedback and examination performance outcomes were positive. Specially-constructed digital games offer an enhanced, effective, non-threatening, fun, educational learning environment, with increased student engagement and satisfaction.

Since the 1960s, digital gaming has increased in popularity, creating a generation of "homo-zappiens" who think and learn differently. The electronic world has equipped students with a desire for a) instantaneous gratification b) stimulating visuals c) prizes for achievements, and d) continual accessibility. Due to changing expectations, conventional education does not effectively stimulate students. The merging of digital gaming and education, "edutainment", combines the enticement of gaming with the importance of learning. E-learning strategies offer students a holistic education to mirror their capacity of elastic-learning.

In response to these changes, a collaborative project to create specially-designed digital games as a teaching/learning tool was undertaken by the College Of Medicine at the University Of Saskatchewan with members of a developmental team from Educational Media Access and Production (EMAP), facilitated by a technology-enhanced-learning (TEL) grant from the provincial government. Game design principles included strategic-thinking and problem-solving thereby contextually bridging the gap between the theory and application in a fun, game-like atmosphere. User-friendly games were focused on time-on-task activities with motivation and goal-orientation through rewards, clues, and partial-solutions to maintain progression and self-direction of individual learning.

Game One: **Word Scramble** reviews the new content-specific medical vocabulary, terminology, and factual knowledge utilized in the pathology courses (Figure 1a). In one minute students must descramble the letters to unravel a pathological term, gaining points for correct letter placement, emphasizing the value of accurate spelling. Help features of a hint option provides a brief definition of the term, enforcing word meanings, and a "take a letter" option places one letter in the correct spot. Each game is composed of ten words. First-time scores ranged from 47.75-62.4%, (overall average 51.64%), increasing to 78.07% (76.14%-82.06%) on students' second attempt and continued to escalate. An overall percentage improvement of 26.43% (13.52-34.31%) was observed (Figure 2). The game **Word Scramble** proved to be an effective learning tool for students who attempted the activity multiple times. Qualitative data indicates

students found this game to be useful in building/improving their vocabulary**.**

Game Two: **Path to Success** challenges the player to correctly answer multiple choice questions in order to save a patient (Figure1b). The patient's life force and ECG reading reflects the player's score. Three forms of help are available to the players: ask an expert, poll the crowd, and 50/50. Each form of help may be used once with no added penalty. Upon completion of the game a feedback page appears, informing the player of their success rate.

Game Three: **The Path is Right** introduces a new host, Basil Philic, who guides the player through the game (Figure1c). Players place wagers on each question, then answer the multiple choice, fill-in-the-blank, and extended-matching questions to win or lose this amount. Upon completion of one of the three sections of the game, players may use their winnings to purchase virtual prizes.

Path to Success and **The Path is Right** were received with overwhelmingly positive student feedback (Figure 3). In their comments, students noted that the digital games provided a "relaxing, fun way to reinforce concepts/terminology". 100% of the students found both these games to be a useful pre-exam review tool and an enhancer of personal learning. It was noted that the games "tested [their] knowledge base and detected areas of weakness", encouraging student-centric learning. The majority (92%) of students found **The Path is Right** and **Path to Success** to be effective learning tools that reinforced concepts and terminology in pathology. Playing these games allowed students to "feel more confident in [their] knowledge"; while feeling "relaxed" (77%) (Figure 3).

Game data for analysis are available to faculty upon the student' completion of the game. Results can be sorted by gender, score, date completed, area of study, and the questions answered. Besides providing routine demographic data points, this also highlights trends in areas of inadequate student knowledge that can be addressed.

Since their popularization in the 1960s, computers have become integral members of the learning environment[1]. Of the modern world, Prensky states "the human mind and imagination are not sufficient enough to imagine what is happening"[2], a declaration reflected in the development and diversification of areas of studies that require an increase in information to be fit into curriculums already under a strict, inflexible timeframe[3]. The use of 'after-hours' gaming extends the learning environment outside of the classroom, opening up valuable contact time for the prescribed new content, thus, alleviating professor and student stress.

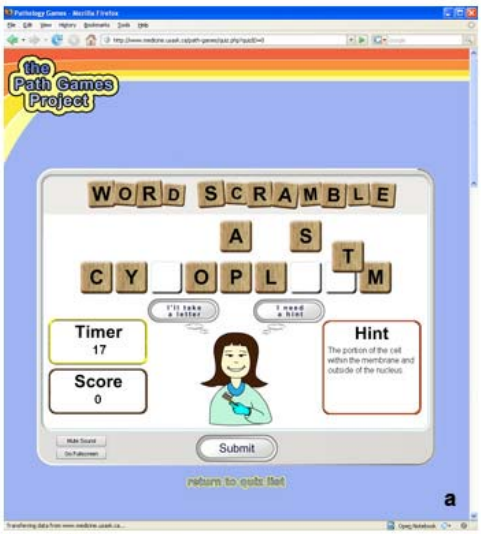
Our specially-designed digital games intricately balance educating, computing, and learning in an effort to create an appealing, imaginative, and creative game-design[3,4]. Educational and cognitive psychologists agree that individualized instruction taught by subject-matter experts is the best-practice educational model, a type of instruction only made possible virtually. Game 'extras', such as clues, hints, timers, and levels of difficulty personalize learning[5]**.** Game features such as 'virtual' prizes provide immediate feedback with instant gratification, facilitating information processing and true learning[6].

"Some forms of learning are fast-paced, immensely compelling and rewarding whereas by comparison school strikes many…as slow and boring"[7] writes Vivou et al, emphasizing the importance of student engagement in education. These thoughts are echoed by many education researchers who believe that people are happiest when they are completely absorbed in their activities[8]. As stated by Perensky "the key…is not curriculum, certification, or testing, but rather engagement"[2]. Digital games are an alternative educational tool for the current generation of students who demand challenges, instant gratification, immediate feedback, rewards, and accessibility as tools of engagement.

The educational design of all three of our digital games was based on the underlying principles of Bloom's taxonomy of learning[9]; the first level is knowledge: the ability to remember, memorize, and recognize facts, evaluated through rote-memory questions. Short-term and long-term memory is enhanced through digital gaming as students are forced to quickly recollect information as demonstrated in **Word Scramble**. It is essential that these skills are honed and perfected before a higher level is attempted. Gaming allows for lessons that can be practiced repeatedly until mastered as computers [virtual instructor] have "infinite patience". Comprehension of what has been learned is the second level, challenging students to interpret, discuss, and predict. Digital gaming can teach higher order thinking skills such as strategic thinking, interpretative analysis, problem solving, plan formulation and execution, and adaptation to rapid change. The third level is the application level: problem-solving, constructing, and illustrating information. Simulation games such as Immune Attack[10] enhance this level, and are currently being used in defense, architecture, city planning, government companies, education and medicine. The importance of information application through digital games drives home the concepts in real time. Application of facts to a life-like scenario bridges the gap between education and practice further emphasizing the relevance and importance of the information taught.

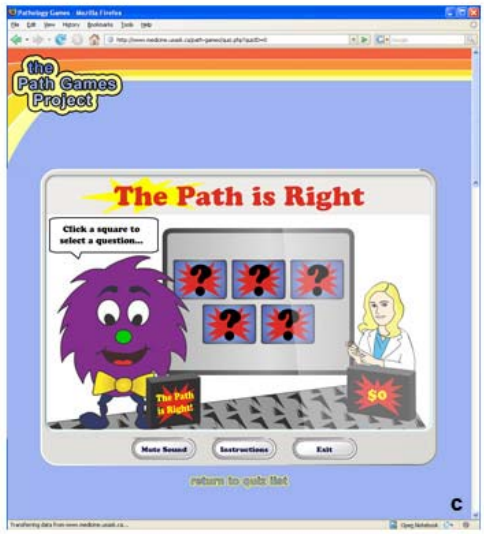
Traditional education has focused on the "three Rs" of learning (reading, writing and arithmetic). Currently, students yearn for 'three Es': ***E***ducation, ***E***ngagement, and an ***E***xtended learning environment. Specially-constructed digital games offer an enhanced, effective, non-threatening, fun, educational learning environment, with

Figure 1: Screen shots of the three-specially designed digital games Word Scramble, Path to Success, and The Path is Right.



a: ***Word Scramble***: This is a screen shot of this specifically designed game whose goal is to familiarize/improve the vocabulary in the language of pathology. The aim of the game is to unscramble the letters to discover the pathology term. Seen in the figure are the letters to spell the term "cytoplasm", the hint that would be provided upon request, the timer which challenges the player to work under pressure, and the button "take a letter" which will place one letter in the correct space.

b: ***Path to Success***: This is a screen shot of a unique game whose goal is to answer multiple-choice questions to save a dying patient and strengthen their life force (your knowledge). On the right an ECG and a life force meter gauge the progress of the player. The left side of the screen shows the three hints available to the player: 50/50, poll the crowd, and ask an expert. A series of multiple choice questions tests the player's knowledge on a myriad of subjects within the domain of pathology.



c: ***The Path is Right***: This screen shot demonstrates one aspect of this interactive gamed aimed to solve a variety of fill-in-the-blank and multiple choice questions to win virtual money and buy virtual prizes. The host, Basil Philic guides the player through the different challenges and offers feedback and awards upon completion. Five options for questions can be viewed creating a player-centric game that offers a sense of control.

Figure 2. Word Scramble Game scores with repetition

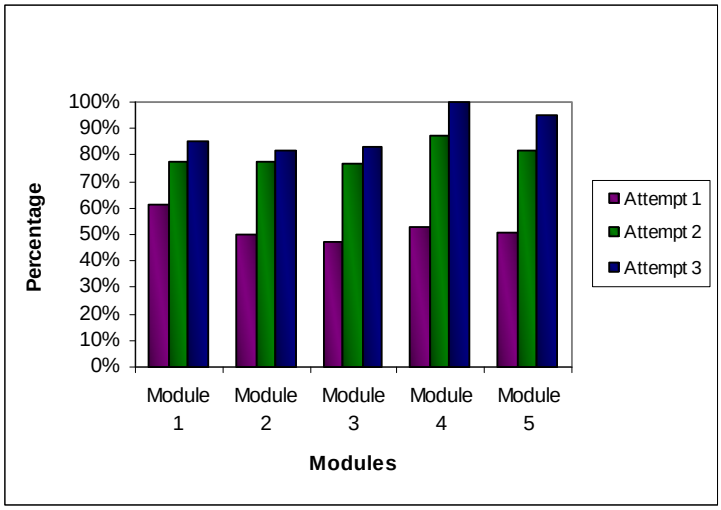
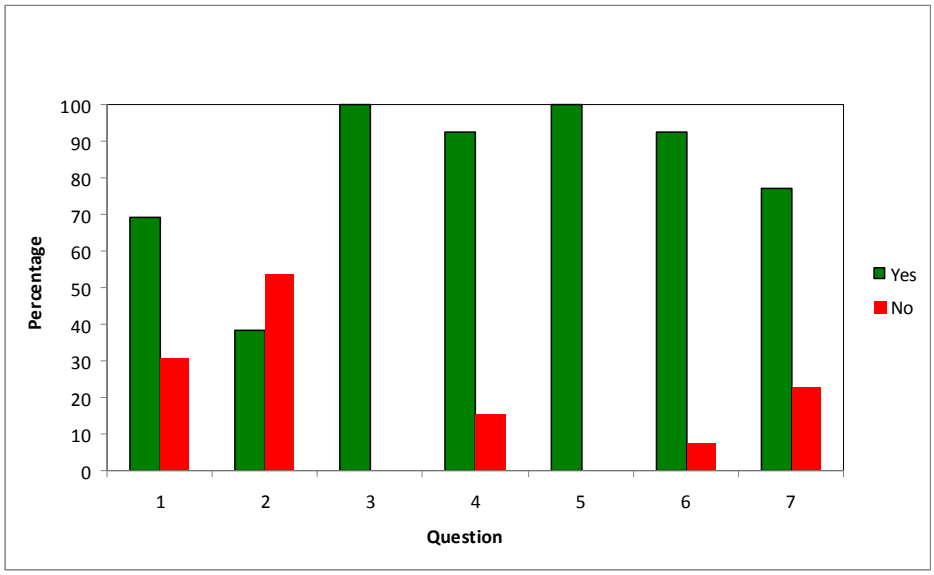


Figure 2. The percentage score attained by students at every attempt of Word Scramble was recorded and analyzed. This graph demonstrates the improvement observed between the first and second, and the second and third attempts of the game. Repeated attempts correlate with higher scores.

Figure 3. Responses to Student Feedback Questionnaire



The histograms represent the responses to the questions as listed below:

1) Did you prefer to play the games individually?
2) Did you prefer to play the games in groups?
3) Were the games a useful pre exam tool?
4) Were the games an effective learning tool?
5) Did the games enhance your personal learning?
6) Were the games fun and relaxing?
7) Did the games relieve your stress?

increased student engagement and satisfaction. Digital games as educational tools provide dual opportunities by enhancing traditional and contemporary student-learner experiences. Future plans include using digital games for nursing and pharmacy students. Ongoing research is also proposed in the design/construction of higher level thinking games.

CONFLICT OF INTEREST

Authors have no conflict of interest to declare.

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MONOGRAPH

Student Clinical Pathologic Correlation Presentations

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ABSTRACT

Medical curricula have traditionally focused on content delivery with students as onlookers, primarily with a didactic lecture format. Even group teaching methods require faculty development of the structure, objectives, and much of the content delivered in the group setting, without a formal and sustained student presentation format. There is minimal reliance upon student-generated curriculum delivery. Both methods and contact hours to support student acquisition of competencies in medical education that drive research, data analysis, composition and presentation skills are needed in a curriculum, particularly within basic science disciplines. This report describes a method that supports multiple skills-based competencies as well as delivery of curricular knowledge-based content with the use of student presentations in the form of clinical-pathologic correlation (CPC) exercises by students to peers. Deployment of these CPCs with a rising class size occurred over a period of 6 years in a medical school pathology course. Course ratings remained high during that time, and student success in the course was supported with these CPCs.

INTRODUCTION

Medical teaching has evolved to include curricular components that support achievement of competencies in the domains of knowledge, skills, and attitudes.[1] Traditionally, curricula have been biased toward components such as lectures that support the knowledge domain, with standardized multiple choice question examinations to test the acquisition, retention, and use of knowledge.[2] Meaningful instruction with assessment involving skills and attitudes has been harder to achieve, particularly within basic sciences, though some models do exist.[3] The preclinical basic sciences typically devote a majority of their assigned curricular time to a lecture format, according to the Association of American Medical Colleges (AAMC) Curriculum Management and Information Tool (CurrMIT).[4]

Students with different learning styles may benefit if multiple learning methods are applied.[5] A subset of curricular time can be deployed through group teaching methodologies such as case-based, team-based or problem-based learning. However, within those group processes students are not typically made individually accountable for specific skills competencies such as communication, informatics, data analysis, critical thinking, and translational research. Faculty are typically responsible for developing group exercises, and the students then work within the resulting structured framework to primarily acquire knowledge content. In the current study a plan was devised by the author that addresses multiple skills-based competencies outlined in the LCME standards of accreditation (ED-1-A, ED-12, ED-17, ED-19, and ED-28),[6] the AAMC Medical School Objectives Project (MSOP) medical informatics competencies,[7] replaces faculty lectures, and allows students responsibility for development and presentation of CPC exercises containing knowledge content.

METHODS

The Systemic Pathology course ran for 22 weeks in the 2nd year of the curriculum at the Florida State University College of Medicine from 2002 to 2008, encompassing 6 medical student classes, with the author as course director. Each class was assigned to groups of 3 to 4 students for each clinical-pathologic correlation (CPC) exercise. The total number of CPC groups ranged from 10 for the initial class size of 30 students to 26 groups for a class size of 102 in the 2007-8 academic year. When the class size exceeded 50 students in the 2005-6 academic year, the class was divided in half (cohorts A and B) and two separate CPCs given, one for each half of the class, sharing the time with two other curricular exercises (Table 1).

Table 1: Shared Curricular Hours

Time of Day	Cohort A	Cohort B
8:00 am	CPC #1	Microbiology Team-Based Learning session
9:00 am	Radiologic Correlations	Microbiology Team-Based Learning session
10:00 am	Microbiology Team-Based Learning session	CPC #2
11:00 am	Microbiology Team-Based Learning session	Radiologic Correlations

Cohorts A and B attended separate classrooms, with one or more faculty per classroom. The faculty stayed in one room and the cohorts switched rooms at 10:00 a.m. Thus, the faculty repeated facilitation of each exercise for each half of the class, but the students did not repeat sessions. A total of 10% of course instructional hours were devoted to CPCs, with the number of lecture hours reduced to provide adequate time.

The students were given a detailed guide for constructing their CPC presentation. The CPC topics were assigned by the course director and were chosen to integrate with the course content delivered concurrently. The topics were not covered elsewhere in the course, so the knowledge-based content of CPCs was delivered solely by students. The topics included disease entities such as androgen insensitivity syndrome, paroxysmal nocturnal hemoglobinuria and angiodysplasia that were uncommon but had mechanisms of disease that were part of the course learning objectives. The topics chosen were not covered in detail in the course textbook (*Robbins & Cotran Pathologic Basis of Disease*, Elsevier-Saunders, Philadelphia, PA, ISBN: 978-1-4160-3121-5), and they required research with literature review by the students, along with data analysis. The students were directed to be creative in developing their own presentation history for a single patient. The CPCs were delivered as PowerPoint-based presentations in the classroom using the general objectives outlined in Table 2.

The CPC was presented by students in a reverse format: instead of an expert starting with an unknown case with data to analyze and deciding on a diagnosis in a presentation before an audience that only listens, the student presenters were given the diagnosis and developed the case to present as an unknown to their peers. Their classmates had to respond to the progressive disclosure of the data by interacting and developing a differential diagnosis list and suggesting ways to work up the patient before moving on to the next PowerPoint slide. The student presenters were encouraged to direct questions about the case to their peers so as to facilitate interaction. The students were advised that the journey was as important as the destination for this exercise. About halfway through the CPC, the presenters compared their differential diagnosis list to that developed by their classmates, and then the diagnosis for the case was revealed. The presenters then finished with a detailed discussion of the pathophysiology of the disease and their treatment plan.

All students in the class were responsible for reviewing the PowerPoint files posted following each presentation to the course electronic website (Blackboard®). At least one examination question was formulated by the course director from each PowerPoint file. All presenting group members were required to collaborate and participate in development of both content and presentation. Limiting groups to no more than 4 students facilitated sharing of

tasks within the 50 minute time frame of the presentation. The grade for the CPC was assigned by the author, who attended all presentations and provided informal feedback.
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was not a specific evaluation item. No written comments specific to CPCs were made by any students on course evaluations.

Table 2: CPC Objectives

Presentation time frame	Up to 50 minutes, allowing time for questions
Number of PowerPoint slides	No more than 35, apportioned among the following: presentation; history; physical exam; ancillary studies; differential diagnoses; pathophysiology; treatment plan
Number of references	At least 8 for the case content, of which 4 should be full text scientific journal articles and 2 from a peer-reviewed electronic database
Treatment Plan	Develop a multidisciplinary treatment plan for your patient. Research the needs of your patient including co-morbid disorders, disease management issues, and/or psychological consequences. The evidence-based plan must incorporate clinical guidelines and community resources available. Include at least 3 references specific to the treatment plan.
Presenter responsibility	All students in a group must give part of the presentation but be able to answer questions about the case as a whole.
Grading	20 points maximum (each student gets the same score) apportioned as follows: content 8 points, style 2 points, delivery 8 points, references 2 points.
Professionalism	Students are to be professionally attired, as though seeing a patient, or presenting a paper at a national conference.

RESULTS

The CPC contributed 3% of the total assessments factored into the grade for the course. Students were told at the beginning of the course that it was expected every group would attain the maximum score. Of the 349 students enrolled over 6 years, 85% received the maximum score, 14% received a deduction of 1 point because the group documented fewer references than required, and 1 group (1 %) received a 2 point deduction for inaccurate data. The overall course performance was enhanced for all students via the CPC exercise and no student grade diminished because of the CPC. When the class was divided, half attending the one presentation and reviewing only the PowerPoint slides of the second presentation, there was no statistical difference in performance between cohorts A and B on presentation-derived examination items.

Group members reported spending a minimum of 1 hour and maximum of 4 hours individually developing the content for the presentation. Collectively, group members spent an average 2 hours putting the presentation together. Groups averaged 1 hour meeting with the course director for mentoring regarding the process and content.

The average Systemic Pathology course rating, using a Likert scale, was 4.63 (out of 5 possible) for the 6 years in which the CPC exercise was part of the course. The CPC

DISCUSSION

This CPC exercise illustrates how preclinical medical students can deliver assessed course content as part of their curriculum, rather than faculty, and do an equal or better job when given explicit instructions. These students in a second year pathology course were not complete novices at PowerPoint presentations. They had given presentations (as part of small groups of 4 to 6 students) in first year anatomy and cellular biology/histology courses, and in a second year microbiology course, but those prior presentations averaged only 10 to 15 minutes in length. Thus, students could build upon prior experiences through curricular vertical integration. Students want to impress their peers, so the quality of the presentations was equivalent to faculty lectures. Every CPC presentation developed by the students was unique and exhibited creativity.

Informatics skills were reinforced as part of the AAMC's MSOP concerning medical informatics competencies.[7] Students used the library's electronic resources to perform their research of the medical literature and then organize their data. Data analysis and critical thinking were required because the presentation could not be developed from a sole information source, and the disease processes assigned as topics were uncommon, complex and the focus

of ongoing research. A treatment plan had to be formulated to fit the data. A shared project to produce a poster or paper to reinforce such skills has been described.[8] However, this CPC format required a PowerPoint presentation that further enhanced informatics skills with application of direct peer-to-peer communication.

The skills-based competencies of communication, data analysis, critical thinking and research applied to patient care are typically not incorporated into basic science teaching and assessment, but left to the clinical skills components of the curriculum.[9] Those skills were assessed via the CPC through the presentation format, based upon the successful completion of the task assigned as well as quality of the presentation. Regardless of the scores on knowledge-based assessments in the course, all students performed admirably for this exercise. It could be argued that a high score was a "given" for this CPC exercise and served no discriminatory function, but on a criterion basis, the students did what they were asked to do, met the objectives, and demonstrated competence.

Incorporation of communication skills practice and assessment into the curriculum is difficult to achieve[10] but has shown benefit for medical student functioning in the clerkship setting.[11] Assessment of communication skills is often incorporated into an objective structured clinical examination (OSCE). However, each OSCE station does not typically require sustained and formally organized presentations and occurs in a one-on-one setting. The exercise described here reinforced communication skills because each group of students had to work together to produce a single presentation, then give a seamless presentation to their classmates over a sustained time frame (50 minutes). The use of a 10 to 15 minute "mini-lecture" by student groups has been described, but not longer presentations such as the CPC format.[12] Student presentations have been utilized to facilitate their future teaching role as residents.[13]

The structure and objectives of this CPC exercise were designed to keep students focused and prevent them from spending too much time on the exercise. The students were advised that quality content for knowledge yield was more important than computer wizardry that could become a time sink in preparation of the presentation. The 3% contribution of the CPC to the overall course grade was pegged at a level deemed high enough to make the effort worthwhile to students while low enough so as not to mask poor performance on standard knowledge-based examinations. Given the lack of specific comments by the students regarding the CPCs, this formula appears to have worked.

This exercise included novel approaches to scheduling curricular events. First, the contact hours were shared among curricular components, keeping the contact hours constant for students, while increasing the contact time required for faculty. Smaller cohorts of students afforded more opportunities for classroom interaction. Though faculty time required in attendance for this format was effectively doubled, preparation time was not. Second, a significant portion (10%) of instructional hours was given to students for meeting competencies while delivering knowledge content, making the student CPC exercise an alternative to lecture hours.

The possibility of being asked questions motivated the student presenters to be thorough in their preparation, understanding of the topic and collaboration. The audience initially were reluctant to ask questions of their presenting peers, but were encouraged to participate by pointing out that the presenters had made the effort to gain expertise and that they should be honored with the opportunity to share their knowledge. The students also learned that an "I don't know" response could be followed up with additional research and an answer e-mailed to the class following the presentation.

In mentoring the students, it became apparent that they gained insight into the scientific process of investigation. Whereas textbooks present what appears to preclinical medical students to be solid factual uncompromising information, the medical literature is not so straightforward. Students had to apply data analysis and critical thinking to synthesize their research on a topic into a cogent presentation. They often had to present multiple viewpoints or reconcile conflicting information.

In retrospect, LCME standard ED-32 (narrative descriptions of student performance and of non-cognitive achievement) could have been included as part of the assessment strategy for this exercise. Informal comments were made to the students during mentoring and following the presentation, but such comments were not part of a written record. There were no incidents involving professional behavior during the presentations that required action be taken.

Though no formal attendance role was taken during these exercises, there were three factors driving attendance: a graded quiz in concurrent Microbiology team-based learning sessions, questions directed to students in any of these sessions, and a small cohort size. Students missing from these curricular exercises had to obtain formal excused absences, according to standard school policy.

CONCLUSION

The CPC exercises afforded students an opportunity to apply communication, informatics, research and critical thinking skills in a preclinical basic science course. Knowledge-based content was delivered by students to peers in lieu of faculty lectures. All students demonstrated competency in fulfilling objectives outlined for the CPC

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OPINION

Association Between Student Absenteeism at a Medical College and Their Academic Grades

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ABSTRACT

It is a universal phenomenon that students often choose not to attend college classes. There are a number of reasons for this, but the effect of absenteeism is uniform, in that it can directly affect the students' academic grades. The objectives of this study are: (i) to estimate the prevalence of student absenteeism, (ii) to observe the association between absenteeism and academic performance and (iii) to review student activities during the absenteeism.

A cross-sectional questionnaire study was carried out among 300, third year medical students attending the King Saud University. The questionnaire consisted of items related to the pattern of absenteeism (frequency, timings and reasons for being absent). The student's G.P.A was considered to be an essential marker of student performance. Only the questionnaires with complete information were considered for analysis. Data entry and analysis were carried out using the EPI Info 2003 Program and SPSS/PC+ statistical software. Out of 300 students, 172 responded with complete information. The response rate was 57%. The mean GPA for male students was 3.74 and for female students was 3.94. Students without a history of absenteeism had a higher mean GPA (4.05) in comparison with students with a history of absenteeism (3.75). The usual time of absence was during the morning and in the pre-examination period. The primary cause of student absenteeism (61.83%) was over-sleeping. The other major causes were studying (28.01%) or socializing with friends (10.14%). From the results of this Study it can be concluded that class absenteeism by medical students can significantly affect academic performance. Appropriate measures are therefore required to reduce student absenteeism.

INTRODUCTION

Regular class attendance is related to a student's commitment to pursing education either at a school or college. Professional courses such as medicine require high attendance. The aim of undergraduate medical education is to produce a physician with adequate knowledge of health and disease, reasonable medical skills and a healthy attitude towards patients and their families. [1]

Even though there have generally been many changes in the way medicine has been taught in the Kingdom of Saudi Arabia, some medical colleges are still following the traditional lecture format of teaching. Lectures and classroom discussion represent the primary means of teaching for undergraduates. Do students who miss a lot of classes perform poorly on exams because they were not present when the topics were covered or, alternatively are students with high levels of absenteeism less committed to academics in general? The effect of on-line lecture

recordings in relation to lecture attendance and continuous assessment in pharmacology students was reported.[2] While absenteeism among students in other professional courses has been addressed in several studies, [3, 4] the effect on medical student grades has not been evaluated. The causes of absenteeism by medical students have also received little attention in the literature. An exploratory study on absenteeism and the academic grades of medical students was carried out with the objectives: (1) to quantify the prevalence of lecture absenteeism among 3rd year medical students, (2) to quantify an association between the absenteeism of 3rd year medical students and their academic grades and (3) to find the reasons for absence and the activities of students during their absence.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted during the academic year of 2006/2007, among the 3rd year medical students, at the King Khaled University Hospital, Riyadh. The study subjects were 300 male and female students. A structured pre-tested questionnaire was developed with the questions related to patterns of absenteeism, reasons for absenteeism, and activities during absence from classes. Data relating to the number of study hours per week, GPA (Grade Point Average) and individual student opinion about absenteeism were also collected.

Data entry and statistical analysis were carried out using EPI Info 2003 and SPSS/PC+ (Version 11.0) statistical software. Descriptive statistics (mean, mean standard deviation and proportion) were used to summarize the quantitative and qualitative variables. The individual Student's t-test and one-way analysis of variance (ANOVA) were used to compare the mean values of the continuous variables across the levels (2 and 3) of categorical variables. A Chi-square test was used to observe the association between two categorical variables. A p-value of < 0.05 was considered as statistically significant.

RESULTS

Out of the 300 students, 251(83.7%) among which 175(69.7%) were males and 76(30.3%) females, responded by completing the questionnaire. Because the GPAs were available for only 172 students (124 males and 48 females), the analysis was carried out only for these study subjects. The mean (sd.,) of the GPA of 172 students was 3.79(0.59) and the range was from 2 to 4.95. The mean (sd.,) study hours per week was 9.32(9.12) and the range was from 0 to 48 hours.

The number of students who responded about absenteeism varied differently at different times of the academic year and also varied between male and female students. The pattern of absenteeism revealed that a higher proportion of male students were absent than female students at all the times of the academic year. However, 68.7% of female students were absent during the pre-examination period, as compared with 49.2% of male students, indicating that female students were concentrating more on their exams rather than attending the classes at college. The habit of absenteeism during the previous academic year was prevalent in 86% of the students. (Table 1)

Table 1. Prevalence of Absenteeism of Study Subjects

Absenteeism	Male (%) (%) n = 124	Female n =48	Total n=172
Absent sometimes during the previous academic year	110 (88.7)	38 (79.2)	148 (86.0)
Absent in morning lectures	67(54)	16(33.3)	83 (48.2)
Absent in afternoon lectures	32(25.8)	7(14.6)	39(22.7)
Absent at beginning of academic year	13 (10.5)	1 (2.1)	14(8.1)
Absent at pre-exams	61(49.2)	33(68.7)	94 (54.6)

There was a statistically significant difference in the mean GPAs of students who were absent and those who were not

absent during the previous academic year. Students who were not absent had higher GPAs than students with a history of absenteeism, and the difference was statistically significant (p = 0.02) (Table 2). Comparison of the mean GPA values of students during their previous academic years revealed a statistically significant higher mean GPA for students who attended morning lectures, when compared with mean GPAs of students who were absent. No statistical significant difference was observed in the mean GPA of students in relation to the absence from afternoon lectures, absence at the beginning of the academic year and absence during the pre-examinations period. (Table.3)

The comparison of the mean GPA values for students across the three response categories of academic performance that were affected by absenteeism, showed not only a statistically significant difference in the mean values but the results were also inversely related to their opinion on academic performance and absenteeism (p = 0.036). That is, those students who felt that their academic performance would be 'increased' or have 'no change' through absenteeism had significantly lower mean GPAs, when compared to those students who felt that their academic performance would be decreased by absenteeism. (Table.4)

The main reasons stated by both male and female students for absenteeism were lengthy lectures and a lack of interest in the lecture subject. The stated activities during absence from lectures were sleeping, spending time with friends and studying. Approximately 48% of female students and 28% of male students spent time in studying when they were absent during lectures.

Table 2. Comparison of Mean GPA of Study Subjects in Relation to Their Absence During Previous Academic Year

Absence during previous academic year	No. of Students	Mean (Sd.,) GPA	p-value
Yes	148	3.75 (0.59)	0.02
No	24		

Table 3. Comparison of Mean GPA's of Study Subjects in Relation to Their Absence at Different Times of an Academic Year

Time of Absence	No. of subjects	Mean (Sd.,) GPA	p - value
Absence in morning lectures			
Yes	83	3.63 (0.59)	0.0004
No	89	3.95 (0.57)	
Absence in afternoon lectures			
	39	3.64 (0.65)	0.06
Yes	133	3.84 (0.57)	
No			
Absence at beginning of academic year			
Yes	14	3.58(0.88)	0.16
No	158	3.81(0.56)	
Absence at pre-exams			
Yes	94	3.82 (0.31)	0.51
No	78	3.76 (0.41)	

Table 4. Comparison of Mean GPA's of Study Subjects in Relation to Their Opinion Regarding the Effect of Absenteeism on Academic Performance

Opinions of students regarding effect of absenteeism on their academic performance	No. of subjects n = 145 (%)	Mean (Sd.,) GPA	p-value
Increased	39 (26.9)	3.59 (0.62)	0.036
Decreased	19 (13.1)	4.01 (0.55)	
No change	87 (60)	3.76 (0.57)	

DISCUSSION

This study provides an assessment of the consequences of absenteeism on student academic performance. The correlation between absenteeism and low GPA achievement among medical students has not been studied extensively. Even though this study has limitations (questionnaire based data, low sample size and recall bias), the findings suggest that mean GPA performance is significantly affected by absenteeism. These findings are in line with Anwar Hamdi [5] whose study found that absenteeism had a significant effect on the level of achievement in medical pharmacology courses, and suggested the importance of regular attendance as an effective way of increasing test scores. Fernandes and coworkers [2] reported that continuous assessment marks were lower in pharmacology students, where students followed online lecture recordings and reduced their lecture attendance. Also, it has been reported that good attendance showed good results and those with poor attendance are at risk of poor performance during examinations in basic medical sciences. [6]

Concurrent with modern education technology, some of the medical colleges in Saudi Arabia continue to employ didactic teaching in the medical education curriculum. Well organized and carefully presented lectures provide an up-to-date view of the subject. [7] They are invaluable for imparting in-depth knowledge to the entire group of learners at the same time, thus saving time and resources. Since the entire class is exposed to a single teacher, uniformity of the teaching experience is ensured. [7] However, the learner must be physically present and mentally receptive for learning to occur. The subjects in this study had different patterns of absenteeism during their academic year. Approximately half the students stated that their usual time of absence was for the morning lectures and sessions, showing that medical students do not prefer early sessions, possibly due to their tendency to study during the late hours of the night, thereby over-sleeping in the morning. Only small numbers of students had a history of being absent in the afternoon and even less had a history of being absent early in the academic year, which shows that students are more active in the afternoon, and that all students are eager and enthusiastic to start their education early in the academic year. A higher proportion were absent in the pre-examination period, which could be explained by their allocating this time for more intensive study before the exams. Regarding the student opinions on the effect of absenteeism and their academic performance, most of the students considered that their absences did not affect their grades in any way. But an inverse relation was observed between their views and their GPAs.

This study highlights that while student absenteeism may contribute to low achievement, the reverse is also possibly true, where low achievers are more likely to absent themselves than higher achievers. Under-achievement assumes critical importance for medical care providers who are involved in decision-making in life-and-death situations. Attempts should be made to identify potential under-achievers before their entry into the medical curriculum. Prompt remedial measures should be taken to prevent the cycle of absenteeism and under-achievement, which has a snowballing effect. Further studies are required to investigate the micro approach to resolving student absenteeism for particular sessions and their performance in examination questions associated with those sessions.

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Effectiveness of the Hybrid Model of Case-Based Teaching in Medical Pharmacology

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ABSTRACT

A need for an alternative to the routine didactic format of lectures has always been appreciated by medical school faculties. This alternative is always expected to produce better learning outcomes and also suit that particular institution in terms of composition of students and the infrastructure available. The current study was designed to investigate the effectiveness of the hybrid model of case-based teaching by comparing it with the traditional didactic form of lecture delivery. The effectiveness was measured by a multiple choice question (MCQ) test, which served to assess the student learning outcome. The use of a hybrid model of case-based teaching methodology showed enhanced student academic performance compared to the traditional didactic lecture format. This performance with the hybrid model appeared to be independent of subject matter, student group composition, order and type of topics presented. Students appreciated the significance of clinical application of basic science concepts. This hybrid model does not require any additional man power or infrastructure and can be practiced in a large lecture hall setting. Based upon the subjective responses, students indicated that such a format allowed the students to appreciate the integration of information between theory and practice. We conclude that a hybrid educational format greatly improves the learning outcome in pharmacology, a typical basic science course. Future studies will be conducted to investigate if this trend is consistent with all basic science subjects.

INTRODUCTION

There has always been a need for an alternative to the traditional didactic format of lectures in medical education.[1,2] Academic faculty have expressed doubts about the wisdom, effectiveness and educational efficacy of such a didactic format to teaching the basic medical sciences.[3]. Problem-based learning (PBL) is practiced in many institutions in which the knowledge is dissiminated in a group-centered environment. Implementation of PBL typically as defined by Barrows et al.[4] would be challenging to practice in all institutional systems.

It is incumbent upon medical school curricula which provide the medical student with a large body of knowledge to ensure that efficient pedagogical strategies are utilized to establish and optimize student understanding. By discussing a clinical case related to the topic taught, students evaluate their own understanding of the concept utilizing a high order of cognition. This process encourages active learning and produces a more productive outcome[5,6].

The other issue, which has been highlighted time and again, is the monotony in didactic lectures. Usually, the concentration level of the students starts diminishing approximately 10-20 minutes after the start of the lecture and improves slightly towards the end of the lecture[7]. Providing short breaks where students can discuss amongst each other offers an excellent opportunity to break the monotony in the didactic lecture setting. The new methods of teaching such as problem-based teaching, team-based teaching and small group discussions have greatly addressed this problem. However, didactic teaching remains the primary mode of teaching in many institutions. This study was aimed at investigating and comparing the learning outcomes of students when taught using a hybrid model of case-based teaching and the traditional didactic form of lecture delivery.

MATERIALS AND METHODS

The entire protocol was discussed and approval from the Institutional Review Board was obtained. A group of 38 student volunteers from a Medical Pharmacology course who fulfilled the essential criteria were invited to take part in the study. The students were enrolled in the Medical Pharmacology-I course, which is taught in the first year.

The students were randomly divided into two groups identified as Group A and Group B, and were informed they would have to attend two sessions one hour each for two consecutive weeks, each week constituting a different teaching methodology. Students were not informed of the topic to be taught and all the students were required to sign an informed consent form.

To start, Group A students were taught a new topic, which focused on "bacterial cell wall synthesis inhibitors." The lecture was started with a brief introduction to the topic and was delivered in a routine didactic format. Upon completion of one major concept, a mini-case was projected with relevant questions below the case. Care was taken that 1) the case was brief (mini case) and was formulated to match the students' level of knowledge acquired from the lecture content taught until the case projection, 2) questions were directly related to the mini-case and 3) enough time (~ 3 minutes) was provided for the students to discuss the short questions posed at the end of each case and the faculty tried their best to stay away from the discussion and allowed the students to complete the discussion part. A typical mini-case is presented in Appendix I.

The students were asked to discuss amongst themselves (in this case their immediate neighbors) for three minutes. Immediately following the discussion the faculty randomly picked individual students to explain the answer to the questions posted below the case. The student orally presented their answer while the other students in the class were allowed to comment on the question and add additional information to the answer if needed. This answering session was scheduled for approximately three minutes. The entire session lasted for 5 to 6 minutes. Two such mini-cases were incorporated within the 1-hour lecture session. The important points were summarized towards the end of the lecture session. Immediately following the completion of the lecture the students were asked to answer a 10-question USMLE type MCQ test. A time limit of 12 minutes was given to the students to complete the test. The answers along with the question paper were collected and the students were allowed to leave the lecture hall. The structure of the hybrid model used in this study is demonstrated below (Figure 1).

The next hour involved Group B, where the same topic with the same contents was taught; however, the teaching methodology utilized was a traditional didactic format with reviewing key points prior to explaining the next major concept. The lecture was completed in the same fashion as with group A by summarizing the important points covered during lecture. Immediately after the session the students were also asked to answer the same 10-question USMLE type MCQ test as completed with Group A, which had typical USMLE type questions. A time limit of 12 minutes was also given for students to complete the test.

On Week II the topic chosen was "bacterial protein synthesis inhibitors." During this week the groups were crossed-over, where Group A was taught via the traditional didactic lecture format and Group B was taught using the hybrid model of case-based teaching (Figure 1). Immediately after the respective lecture sessions the students were asked to answer the same 10-question USMLE type MCQ test. A time limit of 12 minutes was given to the students to complete the test. The score sheets of the students were then scanned for results and analyzed

At the end of sessions for Week II, all students participating in the study were asked to evaluate three specific criteria in the hybrid model of case based teaching on a six point Likert scale. Appendix II represents a copy of the evaluation sheet. The structure of the entire study in both Weeks I and II is summarized in Figure 2.

Means and their confidence intervals are expressed at the 95% confidence level. The standard two group T-test was used to test whether the outcomes for the two groups are significantly different. The P values reported thus reflect the probability of obtaining our data for the two groups conditional upon the null hypotheses that the two groups do not significantly differ in outcomes.

RESULTS

Data obtained from student performance on the tests following each lecture session were analyzed. In Week I Group A students were taught utilizing the hybrid model of case- based teaching, while Group B students were taught the same topic in a traditional didactic lecture format. The mean class average on the MCQ test for group A in the first week was 85.50. This was significantly higher than the mean class average of students belonging to group B where the mean class average on the MCQ test was 63.89. It should be noted that both groups were taught the same topic and were asked to answer the same MCQ test (Table 1, Figure 3).

In Week II, Groups A and B were taught in terms of the opposite teaching modality, i.e., Group A students were taught utilizing the traditional didactic lecture format while Group B students were taught according to the hybrid model of case-based teaching. In Week II the mean class average on the MCQ test for Group A was 71.79. This was significantly lower than the mean class average of students belonging to Group B where the mean class average was 84.44. Again both groups were taught the same topic and were given the identical MCQ test (Table 1, Figure 3).

We pooled the data to remove the bias of the order of treatment, topic taught and the student group composition. The Week I and Week II hybrid model of case-based teaching data was pooled and compared with the Week I and Week II traditional didactic teaching data. The average class performance was significantly higher when the topics were taught using this hybrid model of case-based teaching (85.00) than when the topics were taught using the traditional didactic format of lecture (69.73) (Table 2, Figure 4).

Figure1. Structure of the hybrid model of case-based teaching

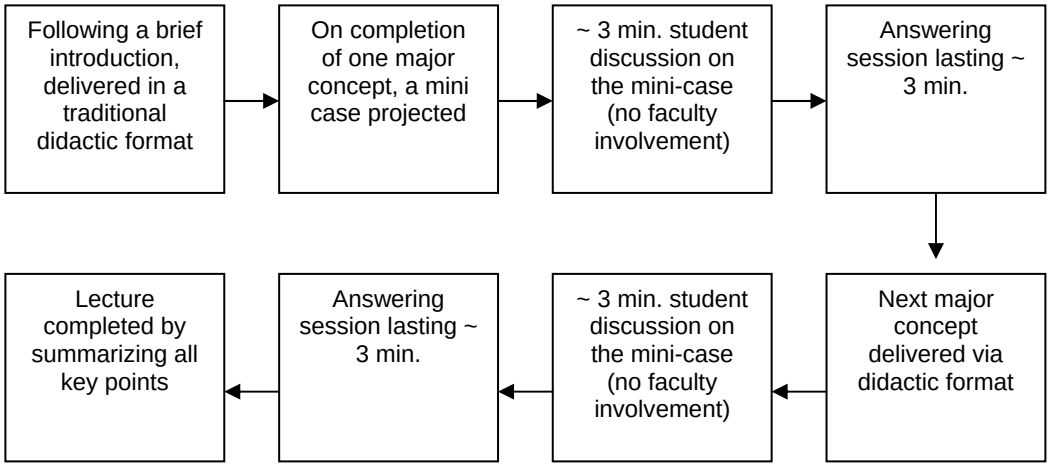


Figure 2. Structure of the study for Weeks I and II

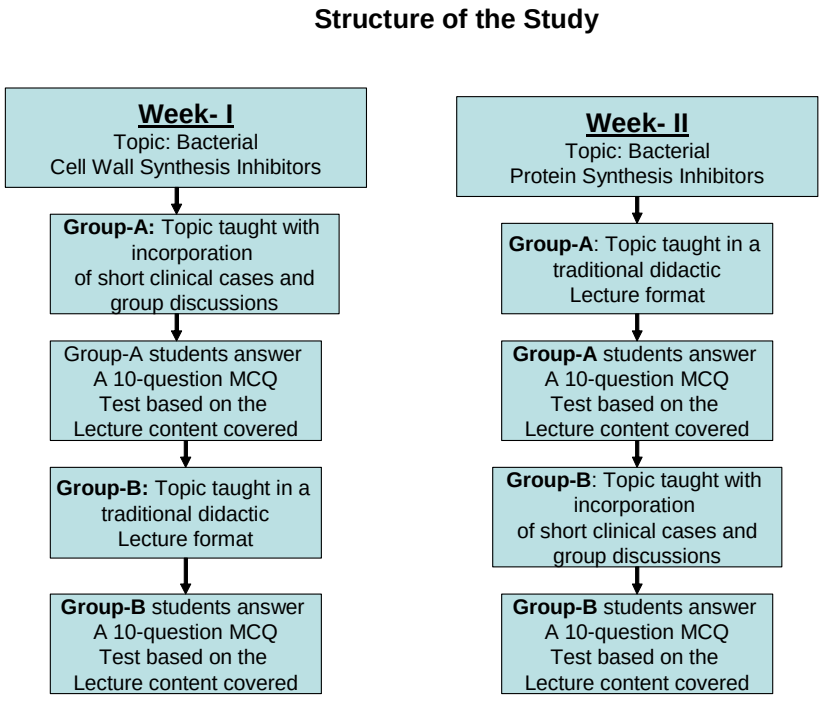


Table 1. Percentage score of students in two individual groups

	Group A	Group B
Hybrid model of case-based teaching	85.5 ± 13.56	84.44 ± 10.97
Traditional didactic lecture format	75 ± 15.73	63.89 ± 17.54

(P<0.005)

At the end of the sessions in Week II the students were asked to rate three specific elements related to this kind of case-based teaching by using a 6 point Likert scale. Scores were high for each of the elements rated (Table 3).

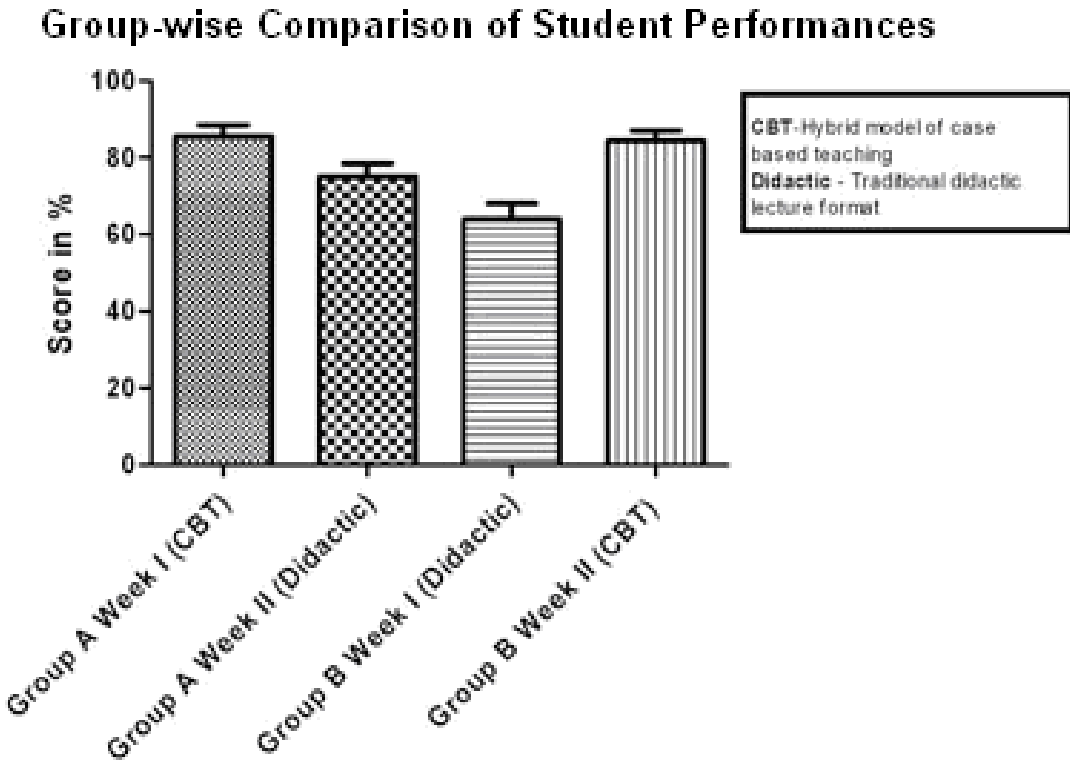
Table 2. Percentage score of students when pooled based on the teaching methodology

	Group A & B Pooled
Hybrid model of case-based teaching	85.00 ± 12.25
Traditional didactic lecture format	69.74 ± 17.32

(P<0.005)

teaching data was pooled and compared with the Week I and Week II traditional didactic teaching data. The average class performance was significantly higher when the topics

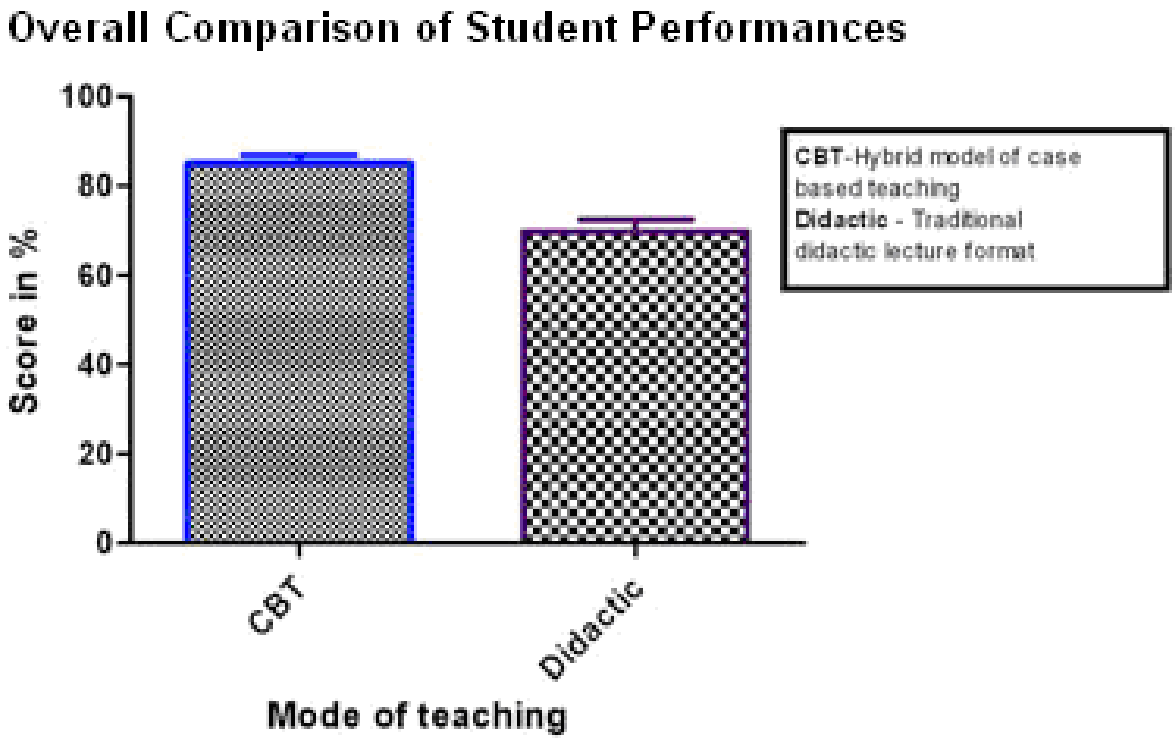
Figure 3. Student performance in the MCQ tests. The scores are expressed as Mean ± Standard Deviation. Statistical significance for all the comparisons made were P<0.005



We pooled the data to remove the bias of the order of treatment, topic taught and the student group composition. The Week I and Week II hybrid model of case-based

were taught using this hybrid model of case-based teaching (85.00) than when the topics were taught using the traditional didactic format of lecture (69.73) (Table 2, Figure 4).

Figure 4. Comparison of overall student performance following the hybrid model of case-based teaching vs. traditional didactic lecture format (Simple T-test was used to compare the results with a P<0.005).



At the end of the sessions in Week II the students were asked to rate three specific elements related to this kind of case-based teaching by using a 6 point Likert scale. Scores were high for each of the elements rated (Table3).

Table 3. Scores obtained on a 6point Likert scale that measured various components of case-based teaching (1-stronly disagree, 6-strongly agree)

Component Evaluated	Score (Pooled A and B) (Max score=6.0)
Integration of Knowledge	5.4
Builds Confidence	5.4
Link between Theory and Practice	5.3

DISCUSSION

The results of this study indicate that the learning outcome is significantly enhanced with the hybrid model of case-based teaching, where students were allowed to discuss the specific points in the case that pertain directly to the topic. The hybrid model utilized in this study showed better student performance when compared to the traditional didactic teaching method for both Group A (85.5 ± 13.56 vs 75 ± 15.73, respectively) and Group B (84.44 ± 10.97 vs. 63.89 ± 17.54, respectively). In addition, the results indicate that this optimal teaching methodology is independent of the group composition of students. The pooled data also confirms these observations of the same statements above, where there is a significantly enhanced student performance with the hybrid model of case-based teaching (85 ± 12.25) when compared to the traditional didactic lecture format (69.74 ± 17.32).

The results indicate that students assimilate knowledge much better when the lecture is taught with the incorporation of mini-cases, allowing for discussion and reinforcement of the key elements of the topic. While only one student was randomly picked for answering, we found that the entire class was actively involved in the discussion

process. The mini-cases incorporated into lectures allowed correlation of the basic concepts to a clinical setting. Allowing students to discuss the cases with their immediate neighbors also enhanced their basic skills in communication, sharing the information with others and supporting team building skills.

The analysis of student response sheets, where students scored three criteria related to the hybrid model of case-based teaching indicates that students strongly agree that mini-cases are very useful in incorporating pharmacologic knowledge into clinical science and increases their level of confidence in approaching their first "real patient." Student responses also show that discussing specific clinical problems in the form of mini-cases under the supervision of faculty enhanced interest among students and increased their level of confidence in gaining clinical knowledge.

It is also noted that it is possible to introduce modifications in the teaching format to allow for implemention within a traditional basic science curriculum. Such modification does not require additional resources in terms of technology or man power, which remain serious concerns when introducing new strategies into an academic environment.

Case-based large format teaching is currently utilized in the Medical Pharmacology course at this institution and we find that students prefer and enjoy the hybrid model. It allows active student participation in the learning process and moves teaching from faculty centered to being more student centered. During the discussion sessions, the instructor acts as a facilitator and supports the activity without being actively involved in the process. This method also addresses the issue of monotny in the delivery of didactic lectures, where the attention span of the stduent is optimal only at the beginning and end of the lecture.

We suggest that the incorporation of mini cases is a more efficient way of delivering basic science content rather than a traditional didactic format. The method is well accepted and appreciated by students. Didactic lectures remain valuable in providing students an overview of a particular topic being taught, however the format of delivery is a teacher-centered activity, which may allienate students away from the learning process. It would appear that implementation of this new mode of lecture delivery encourages students to define the learning objectives by themselves and to learn to work as a team. This mode of delivery of lectures acts as a judicious mixture of both didactic lectures and case-based problem solving learning methods.

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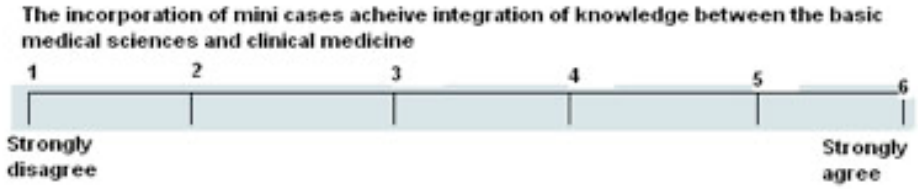
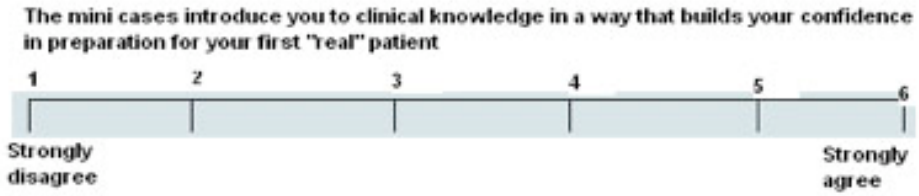
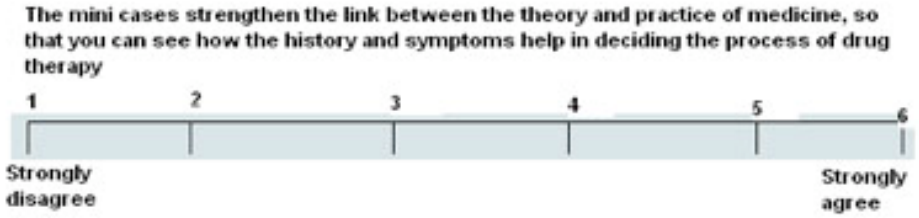
Appendix I: A 29-year-old married man is consulted by his family physician for an ulcer on the penis. On touch the ulcer is painless. History reveals that in the recent past he had unprotected sex at night clubs.

1. What is the provisional diagnosis?
2. What is the drug used to treat this condition?
3. What is the Mechanism of Action of the drug used in this case?
4. What is the drug which can prolong the duration of action of the antibiotic used in this case?

Appendix II: Survey Questions







Computer-Based Animations as Student Aids in Learning Bladder Anatomy and Physiology

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Keywords: medical education; animations; static graphics, randomized controlled trial

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ABSTRACT

Although animations may intuitively appear more effective than static graphics, evidence for the superiority of computer-based animations is contradictory. This study aimed to investigate whether animations are superior to static graphics as aids to medical students in learning the anatomy and physiology of bladder filling and emptying. We randomized 29 senior medical students into 3 groups: system-paced animations, static graphics, and control. Subjects in the animation and static graphics groups completed a cognitive burden scale and a satisfaction survey immediately after the intervention. All 3 groups completed retention and transfer tests after completion. The difference among the 3 groups was significant for both retention and transfer test scores ($F = 10.862$, $P < .0001$ and $F = 7.903$, $P = .002$, respectively). Post hoc analysis using Tukey's HSD revealed no significant difference between the animation and static groups for either retention or transfer. However, both the animation and static intervention groups scored significantly higher than the control group for both retention and transfer ($p = .001$ and $p = 0.003$ for animation and $p = 0.001$ and $p = 0.009$ for static, respectively). The cognitive load was higher in the animations group but not significantly. Animations did not appear to be superior to static graphics as aids in learning the anatomy and physiology of bladder filling and emptying. Nevertheless, both intervention groups scored better than the control group.

INTRODUCTION

Medical educators are increasingly using animations as part of their teaching and learning activities. However, animations may not always enhance learning, and their creation is time consuming and expensive. Few studies have explored the effectiveness of animations in medical education. [1] To learn from static graphics, students must first construct a dynamic mental model. Animations may offer the advantage of illustrating phenomena that might otherwise be difficult to visualize, such as abstract concepts and temporal and spatial relationships. [2] Advocates of animations contend that animations offer a more realistic representation of content and thus spare the learner from exerting cognitive effort on the mental construction of a dynamic representation. [3] The purpose of this study was to compare the effectiveness of complex, computer-based animations with narrations versus static

graphics with narration for the improving transfer of knowledge and student retention.

MATERIALS AND METHODS

Subjects and setting

We recruited 29 third- and fourth-year medical students during their geriatrics clerkship rotation at the University of Miami Miller School of Medicine. We received UMMSM exempted institutional review board approval for this study.

Intervention

Subjects were randomized to 3 groups: animations with narration (n = 10), static graphics with narration (n = 10), and the control group, which received no intervention (n = 9). The time-on-task was approximately 30 minutes. Identical content was used in both interventions and consisted of 8 sets of animations and corresponding static graphics depicting the anatomy and physiology of bladder filling and emptying accompanied by a male voice narration synchronized to the static graphic or to the animation sequence. The students were able to control the onset of each presentation by clicking on the mouse, but otherwise the static graphics and animations were system-paced. The sequence of animations in each set was segmented into a variable number of screens (between 2 and 13) corresponding to the static graphics.

Data collection

Subjects completed a demographics questionnaire and rated their average knowledge of the anatomy and physiology of bladder filling and emptying on a 5-point Likert scale (ranging from 1, "very little," to 5, "a great deal of" knowledge). Immediately after the intervention, the students in the intervention groups completed a cognitive burden difficulty-rating Likert scale (ranging from 1, "extremely easy," to 9, "extremely difficult") and a satisfaction survey. Then they took a retention test comprising 5 essay-type questions (knowledge) and a transfer test comprising 7 essay-type questions (deeper processing and application). The control group completed the retention and transfer tests without any educational intervention. The intervention groups completed the educational intervention under laboratory conditions, in one sitting and using a desktop computer with a sound card. Two researchers independently scored the subjects' retention and transfer tests in a blinded fashion. The final score was the average of the two scores.

Data analysis

Outcome measures were scores on the retention and transfer tests and level of cognitive burden. Descriptive statistics and an ANOVA were used to analyze the results. Cohen D was used to calculate effect sizes.

RESULTS

The 29 medical students in this study were either fourth-year (83%) or third-year (17%). Sixty-one percent were men (21 to 35 years). Subjects rated their knowledge of bladder anatomy as 3.3 in animation, 2.7 in static graphics, and 3.2 in the control group (differences were not significant.)

The interrater reliability of the two observers was 0.82 for the retention test and 0.93 for the transfer test. The differences among the 3 groups were statistically significant for both retention and transfer scores (F = 10.862, $p < .0001$, and F = 7.903, $p = .002$, respectively). The animation group scored significantly higher than the control group for both retention and transfer ($p = .001$ and $p = .003$, respectively) in the post hoc analysis using Tukey's HSD, with effect sizes of 2.40 and 1.95, respectively. Similarly, the static graphics group also scored significantly higher than the control group for both retention and transfer ($p = .001$ and $= .009$, respectively; effect sizes of 1.79 and 1.48, respectively). However, there was no statistical difference between the animation and static graphics groups for either the retention or transfer test scores (Table 1). The mean cognitive burden in the animation group was higher than in the static graphics group (4.0 as compared to 2.8), but the difference did not reach statistical significance (Table 1). Forty percent of the students in the static graphics group expressed boredom about viewing the module as compared to only 20% in the animation group (difference not statistically significant). Twenty percent of the static graphics group, compared to 50% of the animation group, would choose to view the materials again (not statistically significant).

DISCUSSION

We observed significant differences in the retention and transfer test scores between the control group and the interventions. We did not find any significant difference in the scores between the system-paced animation and static graphic groups. We did observe a trend for higher cognitive load and motivation in the animations group.

Our findings are consistent with earlier research on the use of animations in non–health care areas, [4] as well as the findings in a recent naturalistic trial using animations as learning aids for medical students. [5] Because the learner can control the pace of presentation of static graphics, which may reduce extraneous processing and thus cognitive load, deeper and more relevant cognitive processing and hence better learning may result. [2] Animations, on the other hand, may increase extraneous cognitive load and thus impede the selection, organization, and integration of information, which are important for meaningful learning. [6] Recent experiments demonstrate that instructional animations depicting human motion tasks are superior to static graphics, but a similar advantage is not seen for abstract, non–movement-based tasks, [7] which is consistent with the results of our study.

Table 1. Test scores and cognitive burden level

	Animations Scores (M ± SD)	Static Graphics Scores (M ± SD)	Control Scores (M ± SD)	Animations vs. Static Graphics P	Animations vs. Control P	Static Graphics vs. Control P
Retention	40.8 ± 9.9	40.7 ± 14.7	19.6 ± 7.6	1.0 (NS)	0.001 (S)	0.001 (S)
Transfer	21.8 ± 4.4	21.0 ± 5.5	14.1 ± 3.6	0.91 (NS)	0.003 (S)	0.009 (S)
Cognitive burden	4.0 ± 1.6	2.8 ± 1.3	NA	0.08 (NS)	NA	NA

NA = not applicable; M = mean; SD = standard deviation; S = significant; NS Non-significant

Limitations of the study

Our findings should be interpreted with caution because of the several limitations to the study. The small sample size may underestimate a true difference between animations and statics in regard to student learning. In addition, we did not assess the baseline knowledge and skills of our subjects in the content area but rather relied on their self-assessments.

CONCLUSION

The effect of animations appears similar to static graphics for student learning as measured by retention and transfer tests, and animations may increase cognitive load. Future larger studies should address the effectiveness and efficiency of learner-paced animation for diverse content areas, with different levels of learners and with different types (and complexity) of animation.

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Medical Student Study Habits: Practice Questions Help Exam Scores

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ABSTRACT

Second year medical students were surveyed to determine what resources best helped them study for pathology exams. The list included attending lecture, listening and viewing recorded lectures posted to the internet, reading textbook or high yield review books and reviewing posted practice quiz or published practice clinical vignette questions. Students were asked to rank these items relative to time spent utilizing these resources for studying. Fifty one percent of students in the class responded. Students who indicated they spent more time using a practice exam question book did significantly better ($p=0.007$) on exams than those who did not use this resource. Students who indicated they relied more on audio-recorded lectures than actual attendance of lectures did not do as well on exams ($p=0.056$. Our results indicate that utilization of clinical vignette exam questions helped students the most for learning and understanding material.

INTRODUCTION

Medical school teaching practices have evolved over the past decade from static 'kodachrome' slide presentations to PowerPoint presentations, followed by voiced-over PowerPoint lectures, which are posted on a course Web site for students to review. Since each medical student in our program must now purchase a laptop computer, all have access to the Web site. The second year medical school course directors at West Virginia University have noted over the past few years that lecture attendance in the second year has been decreasing. About 70 to 75% of second year students attend lectures at the beginning of the fall semester, diminishing during the second semester with poor attendance at lectures the day before or day of an exam, to as few as 5% of the class. We asked our second year medical students to fill out questionnaires ranking resources by the amount of time each was used to study for pathology exams.

MATERIALS AND METHODS

This study was approved by the Institutional Review Board of Health Sciences Center at West Virginia University. Cover letters and questionnaires were sent out to 107 students in the second year medical school class of West Virginia University near the end of the school year. The survey asked students to rank study resources they used to study for pathology exams. Items included lecture attendance, viewing of recorded lectures, use of textbook[1], practice with USMLE style questions[2], quiz questions posted online, interactive case studies [CD-ROM] [1], attendance of review sessions, review books and other resources (Table 1). Returned surveys were linked to

Table 1. Utilization of Resources in Studying for Pathology Examinations

Resources	% Average score	p value
Lecture attendance	86.1	0.280
Powerpoint/Camtasia viewing	82.0	0.056
Pathology textbook –Robbins 7th ed	84.0	0.389
Companion practice question book	90.4	0.007
Companion online interactive case studies	84.9	0.906
Online posted practice quizzes	86.2	0.776
Other websites for practice exams	86.3	0.489
Review session attendance	85.1	0.999
High yield review books	87.0	0.281
Other study tools	83.6	0.505
Overall score for respondents	85.1	

student cumulative score and then the student name was removed from the data base. Bivariate fit analysis was used to compare utilization of study sources with final exam scores.

RESULTS

Responses were received from 55 of 107 (51%) students. Results were tabulated for ranking of resources by time of student use. Those students who spent more time using the review book containing clinical vignette questions[2] did significantly better (p=0.007 than other students. Students who relied more on audio-recorded lectures than attendance of lectures showed a negative correlation with exam scores (p=0.056 although not statistically significant. Similar trends were seen when these two items were compared to scores on the NBME pathology subject exam, but again, this was not statistically significant (data not shown).

Other items including lecture attendance, utilization of textbook[1] , use of practice questions from various sources, use of study companion interactive material available on disk[1] , attendance of review sessions prior to exam and use of any high yield review books were not significantly different (Table 1). Several students used other review books, most commonly *Rapid Review Pathology*[3]. Nine students who mentioned using Goljan had a mean score on class exams that was 3 points higher on the average than the mean for the class; this was not statistically significant due to the small numbers for comparison.

Several students made comments regarding their attendance of lectures. Lectures by faculty who were very understandable in lecture were well attended while those by lecturers who were difficult to follow or had excessive information were poorly attended.

DISCUSSION

A recently published study monitoring lecture attendance identified that almost 60% of students regularly attended lectures, whereas 30% used recorded lectures exclusively[4]. The most common reasons given for attending live lectures are lack of motivation to watch recorded lectures, professionalism and respect of the instructor, interact with classmates and better value for tuition money. The

majority of students viewing recorded lectures used video-accelerating technologies to save time. The students used the time saved to study other material, rest or sleep in, or pause recorded lectures to take notes[4]. Several of our students mentioned saving time by speeding up the audio to almost twice the normal speed.

In another study, 83% of a medical school class indicated that lecture attendance was determined on a case-by-case basis which related to previous experiences with the lecturer[5]. Students would be more likely to attend lectures if the lecturer provided understandable explanations and concepts rather than merely listing facts and integrating information[5]. Availability of electronic material did not affect the decision to attend lectures for 90% of these students[5]. Our students made similar comments, indicating that for lecturers who just read from their PowerPoint presentations or who covered a dense amount of material, the students' time was better spent viewing recorded lectures rather than attending the lectures.

In another study 64% of students used recorded lectures to review for exams[6]. Viewing occurred most often from home during weekends and immediately prior to examinations. Students who more frequently accessed recorded lectures had significantly ($p<0.002$) lower exam scores[6]. These results are similar to our findings which showed that, although not statistically significant, students who relied more on the recorded lectures did not do as well as those who attended live lectures (average of 3 percentage points lower). We can hypothesize that the students who attend lecture spend more time overall on their studies than do students who simply review lectures at home. Alternatively, some of the discussion before, during or after class may stimulate learning or several adult learning styles may be facilitated by in-class lectures, including nonverbal cues that are not available to students who only review lectures online.

In one study, students rated lecture format more highly than watching closed-circuit television for the same lecture material, although exam scores were similar[7]. By comparison, in a randomized trial, those students who viewed live lectures performed similarly on exams as those who accessed a recorded lecture online[8]. With randomization of live versus online lectures, students on clerkship performed similarly on the exam. However, students relying on online resources required less time to complete the lecture[9].

Last year Pilarski and colleagues published a positive response of 1st year medical students to recorded lectures[10]. These students felt that the recorded lectures helped them learn the material, reduce stress and anxiety, and did not affect classroom attendance[10]. For our second year class, posting of recorded lectures does appear to affect classroom attendance. While students have many different ways to study, which includes reading the text book, students can perform well on examinations using high yield review books and practice exam questions as resources. Students who used practice clinical vignette-type questions on average scored 5 points higher than the class average, which was statistically significant ($p=0.007$). Students who utilized recorded lectures over other resources overall scored 2.9 points lower than the class average ($p=0.056$). Our survey demonstrates that the use of resources other than lecture material may help students learn the information and, in particular, practice questions helped to reinforce the material.

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