JIAMSE

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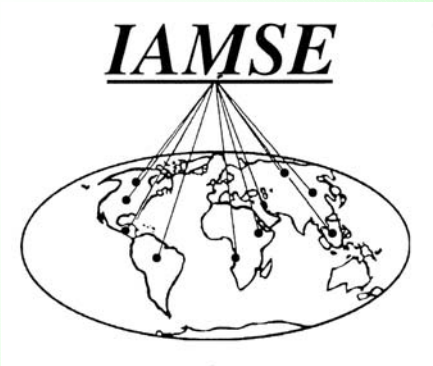

Financing U. S. Medical Schools

Personality and Computer use

COMMENTARY: Why the Basic Sciences?

Patient-Physician Interactive Learning Module

IAMSE on the Web
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The Journal of the International Association of Medical Science Educators

Volume 12 **Number 1** **2002**

Message from the Editor

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

Over the past several months substantial changes have occurred with our journal. The *Basic Science Educator* has evolved into the *Journal of the International Association of Medical Science Educators* (JIAMSE). This change is manifested not only by a new name, but a restructuring and redesign of the journal and all of its Web-Based components. As the new name suggests, JIAMSE is the public face of IAMSE and as such publishes research, opinions and commentary under the broad context of medical education. Modifications to the physical and administrative structure of the journal complement many additional changes that will impact our membership, authors and readers.

Physical and administrative changes that have taken place include: 1) my selection by the Executive Committee as the new Editor-in-Chief, 2) the new cover which incorporates some color while still managing a professional feel consistent with the *Basic Science Educator*, 3) a recommitted and expanded cadre of Editors and 4) a new journal format. The new format eliminates the 'sections' approach that formed the backbone of the *Basic Science Educator*, instead we have opted for a more traditional format, which divides the journal into research and non-research based articles providing flexibility for submissions such as commentary and editorials. The new format with broader categories welcomes authors to submit to the journal without necessitating a particular 'fit' into the former, relatively narrow sections of the *Basic Science Educator* and therefore will allow JIAMSE to more accurately represent the diverse interests of our readership.

A renewed commitment of JIAMSE to our authors and readers is centered on increased communication. As the Editor-in-Chief, I will serve as the contact person for all of JIAMSE authors. It is our goal to have one individual responsible for the tracking of submissions to JIAMSE in order to ensure accurate and efficient communication between our Editors, Reviewers and Authors. In order to further maximize the benefits and efficiency of having one contact person, all submissions to JIAMSE, regardless of type, should be submitted directly to the Editor-in-Chief.

As further indication of our renewed commitment to openness and communication we have updated and revised all other aspects of the journal including the duties of the Editorial Board, Reviewers and instructions for our Authors. All of these changes are readily accessible to anyone wishing to submit to JIAMSE or to learn more about our journal by using the links available on the IAMSE website (http://www.iamse.org/jiamse/index.htm)

Finally, we have developed a new process through which we hope to expand our reviewer pool. This begins with a general call for individuals to apply to become reviewers by using a simple, online application form. We hope to expand our reviewer pool to include a larger and more diverse cross-section of our membership and use this as yet another avenue for our members to get more involved in the organization as a whole.

In closing, I hope that you will share our excitement in welcoming the many changes to our journal, which go far beyond just a new name, but represent a new philosophy that encompasses all aspects of the journal. I hope that these changes reflect a new commitment to communication and efficiency that will help propel JIAMSE forward to becoming one of the premier medical education journals in the world. It is my sincere desire that you will join with me, the Executive Committee, the Editorial Board and our Reviewers and Authors in realizing this goal.

The Medical Educator's Resource Guide

John R. Cotter, Ph.D.

For some time now, our school has been investing in high-technology equipped classrooms and workshops that train the faculty in the use of presentation software and other computer applications. The result is that many instructors have digitized their lecture materials and stored them on CD-ROM, Zip™ disks, personal computers or local networks.

As a morphologist who has assembled a number of 35 mm projection slide-based presentations, the convenience of storing and organizing, or for that matter reorganizing lecture materials in digital formats was appealing. So, this summer I spent a considerable amount of time preparing lectures on the structure of the cell, and restructuring and adding to a lecture on microscopy that was previously created with Microsoft® PowerPoint®.

The lecture on microscopy had incorporated time-lapse videos from **CELLS Alive!** The videos showed bacteria dividing, and cells moving and ingesting other cells. The idea was to drive home the point that the cells and tissues discussed in lecture and viewed in the histology laboratory should be thought of as living things, not pieces of dead tissue that had been preserved, processed, stained and mounted on glass microscope slides.

The lectures on the structure of the cell contain a large number of images, some of which are from a personal collection of photomicrographs. Most are from the CD-ROM of the 4th edition of Wheater's Functional Histology by Barbara Young and John W. Heath. Not surprisingly, the images of cells are static images that illustrate the substructure of the cell as it is seen when viewed with a standard microscope or an electron microscope.

As the lectures on the cell took shape, I wondered if there was something on the World Wide Web that would once again illustrate the vitality of living cells and processes that occur in living tissues. Revisiting **CELLS Alive!** (reviewed below), I found animations for a portion of one of the presentations. By hyperlinking to the **CELLS Alive!** Web site, animations of the cell cycle and mitosis were added to illustrate the timing of phases in the cell cycle and the morphological changes that occur during mitosis. In addition, I found an on-line karyotyping exercise that was incorporated into the portion of the presentation dealing with meiosis. By hyperlinking to **The Biology Project: Human Biology** (http://www.biology.arizona.edu/human_bio/human_bio.html), the karyotyping exercise was used to demonstrate how homologous chromosomes are matched and disorders diagnosed through the creation of a patient's karyotype. If you have also used on-line materials for lecture, please consider sharing your experience with our readers by submitting a review of the sites that you are using to The Medical Educator's Resource Guide.

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

Anatomy of the Pelvis and Perineum: Multimedia Textbook and Teaching Module. Virtual Hospital®. University of Iowa.
http://www.vh.org/Providers/Textbooks/pelvis/pelvis.home.html

The Virtual Hospital **Anatomy of the Pelvis and Perineum** is one of several anatomy sites at the Virtual Hospital, a digital medical library designed at the University of Iowa. Since the pelvis and perineum are particularly complex and difficult anatomical regions to understand, anatomy students will benefit from the unique views and perspectives this site offers. The site has five sections. While most of the sections are amply illustrated, more attention is given to pelvic structures than to those of the perineum. "Osseous Anatomy" and "Ligamentous Anatomy" use color-coded and labeled photographs of the pelvic bones with superimposed drawings of the ligaments to illustrate relevant features and concepts. In contrast, "Muscular Anatomy" is a detailed series of MRIs of the region with highlighted structures and labels. These MRIs are particularly useful in that they provide different views of the muscles from those illustrated in standard textbooks and atlases. "Functions of the Pelvis" are discussed only briefly. This section would benefit from a more detailed discussion of clinically important concepts, e.g., birth trauma, uterine prolapse, and hypertrophy of the prostate gland. The final section "Defecation" focuses on one clinically relevant pelvic function in detail. This site will clarify anatomical relationships that students find difficult to understand. It illustrates the anatomy by using radiological techniques thus complementing conventional illustrations used to teach this region. (*Reviewed by Judith M. Venuti, Ph.D., Louisiana State University Health Sciences Center.)*

Cancer Teaching and Curriculum Enhancement in Undergraduate Medicine (CATCHUM). University of Texas Medical Branch Educational Cancer Center.
http://www.catchum.utmb.edu/index.htm

CATCHUM is an evolving resource for Cancer education. Developed by a consortium of eight Texas Medical Schools, the **CATCHUM** site provides a plethora of high quality teaching materials and links for cancer education. The Educational Resources tab opens a menu for the most valuable components. The SAP (Standardized Assessment Project) exams are a database of quality multiple-choice questions relating to cancer- biology, prevention, diagnosis and treatment. The OSCE menu provides well developed cases for use in OSCEs. Learning objectives and an assessment checklist, by cancer type, are available under the Ambulatory Care menu. The PBL menu currently contains 12 superbly written cases developed in a PBL format, including time frames. Each case includes both a facilitator's guide and student case. The facilitator's guide includes learning objectives, learning issues, discussion questions and possible answers as well as the complete case. The cases make good use of images, color and black/white. Accurate and authentic reports add credibility to the cases. These cases are well designed and comprehensive. These cases can be used in a variety of settings. Registration is required to access the cases, though they are free. The **CATCHUM** staff is very helpful and responsive. They will contact you for information on your impressions and how you used the cases and exams. (*Reviewed by Edward P. Finnerty, Ph.D., Des Moines University.*)

CELLS Alive! James A. Sullivan. Quill Graphics®.
http://www.cellsalive.com/index.htm

Lights, camera, cells alive! The graphics on this site convey the vitality of an eclectic collection of cells and small organisms that should get the attention of all who partake. Many topics, which are of interest to cell biologists, including phagocytosis, locomotion, chemotaxis, apoptosis, mitosis, the cell cycle, and inflammation, are briefly considered using time-lapse video capture, video animation and animated GIF images. In addition, there are images of crystals, images of specimens that were taken with different kinds of microscopes, and an introduction to cell structure. By far the best thing about this site is that many of the graphics, if not used outside of the classroom, can be used for educational purposes. (*Reviewed by John R. Cotter, Ph.D., State University of New York - Buffalo.*)

Pathology of the Kidney: Glomerulonephritis. Donna J. Lager. The University of Iowa: Virtual Hospital®.
http://www.vh.org/Providers/Textbooks/GN/GNHP.html.

This site concisely summarizes the abnormal morphology and clinical findings that are associated with diseases of the glomerulus. Morphological changes in the structure and cellular composition of the glomerulus are illustrated with silver stained sections, immunofluorescence, and transmission electron microscopy. The use of labels and the enlargement of some of the electron photomicrographs would enhance this site's high quality images. In their absence, those without a background in renal pathology may have difficulty interpreting the images. For this reason, the site is highly recommended but only to students who have been previously introduced to the histology and pathology of the glomerulus. (*Reviewed by John R. Cotter, Ph.D., State University of New York-Buffalo.*)

COMMENTARY

Why the Basic Sciences?

Edward P. Finnerty, Ph.D., SC (ASCP)
Department of Physiology/Pharmacology
Des Moines University
Des Moines, IA 50312 U.S.A.

Phone: (+)1–515-271-1649 Fax: (+)1-515-271-7149 E-mail: edward.finnerty@dmu.edu

In any field of endeavor requiring manual skills and cognitive judgment, there are two large categories of people. The first are the technicians. They are highly trained in the operation of the equipment or performance of various procedures. Their knowledge and experience is limited to the operational aspects pertinent to their jobs. Though they are quite adept in their job-performance, they are not expected to know or understand the why or how of what they are doing. Their role is simply to follow the recipe or flow chart.

In a clinical setting, the technician generates data or performs a routine, repetitive, standardized procedure. They are neither responsible nor expected to determine what procedures or data is indicated nor to interpret the data generated. The technician does not develop the procedures or tests or establish their potential usefulness. Admittedly, with experience they do develop an intuitive understanding of the indication and interpretation of the tests and data, but they are still expected to confine their role to collection of the information.

The technologist represents the second group. These people by virtue of education, training and experience are the ones who are responsible for the technicians. Though they both work as a team and complement one another in their knowledge and skills, the technologists are necessary for the direction and supervision of the technicians. As such, the technologist must know *and* understand the how and why. They must be able to determine if results gathered are correct or not, if one procedure is indicated over another, and how to perform it properly. They need to be able to think through a problem when it deviates from the typical or expected. The technologists are the ones who develop the protocols, recipes, and/or flow charts. To accomplish this they need a comprehensive *understanding* of their domain.

In a clinical setting the physician is a technologist. Though there are others in the health care team that are deemed technologists, the physician must be the ultimate technologist as the physician has the final responsibility for the patient. The physician, as the ultimate technologist, must *understand* the working of their domain, the human organism, in order to provide the requisite leadership and direction.

The basic medical sciences are the crucial foundation for understanding the operation of the human body in health and disease. To solve the problems that are present, whether typical or not, requires understanding of what is happening and how to correct it. This understanding of "basic sciences" is used each day when a physician confronts a patient and attempts to generate a diagnosis and treatment plan. The signs and symptoms displayed are the initial clues. These clues can and are assembled and interpreted as the body's response to some anomaly. The understanding of how the system works (basic science) allows the physician/technologist to correctly solve the mystery (diagnosis) and establish an appropriate treatment plan. If things go awry (deviation from the flow chart/recipe) the physician/technologist can then adjust accordingly.

Examples of this abound, such as acid-base physiology, encompassing renal, respiratory, CNS, GI, and metabolic systems. Consider a child with the flu. Nausea and vomiting are common occurrences. They can quickly produce dehydration and metabolic acidosis. What happens next? What will dehydration produce? How? What steps can be taken to combat these effects? Why? The technician knows the list of signs and symptoms and the appropriate response for each (recipe/flow chart), while the technologist understands the why and how. The technologist will develop and refine the flow charts. The technician will blindly follow the orders.

The final question then is simply should we be training our students to be technicians or educating them to be technologists? The basic medical sciences, the why and how, are the foundations for clinical medicine. Clinical medicine is the application of the *understanding* of the science basic to medicine to attempt to achieve a desired outcome. The technologist understands when, why, and how to manipulate the system. The technician knows only to follow the flow chart. Which would you want directing your medical care?

United States Medical School Financing: Beyond the Black Box

Barbara Barzansky, Ph.D
Secretary
American Medical Association Council on Medical Education
515 North State Street
Chicago, IL 60612 U.S.A.

Phone: (+)1-312-464-4690 Fax: (+)1-312-464-5830 E-mail: barbara_barzansky@ama-assn.org

Medicine is expensive to teach. It can in no event be taught out of fees.
(Abraham Flexner, 1910, pages 141-142)[1]

INTRODUCTION

During the second half of the twentieth century, medical school financing in the United States underwent major changes as research and then clinical practice became significant sources of revenue. The availability of these revenue sources was associated with a steady increase in the size of the medical school faculty. The medical student teaching program was subsidized, in term of faculty time and financial support, from the other medical school missions. This "black box" of cross subsidy has been challenged by the emergence of "managed care" in the 1990s. Faculty members are under pressure to be increasingly productive in research and clinical practice, which affects the amount of unreimbursed time that they can devote to teaching. As a response, some medical schools are working to develop systems to cost out and to reimburse the various missions of the medical school (teaching, research, and clinical service) through distinct revenue streams. This article summarizes medical school financing during the twentieth century and describes the new financing models that are emerging.

Changes in Medical School Financing

As part of his landmark report[1], Abraham Flexner considered how to finance a medical school that had the faculty and facilities necessary to provide an excellent medical education program. He concluded that student fees (tuition) would not be sufficient and that other sources of revenue, mainly university support and income from endowment, would be needed. Flexner concluded that the costs of developing the physical plant for a medical school could not be covered by ongoing medical school revenues. As part of his financing model, he stressed that faculty members in the basic sciences and clinical disciplines should be paid by the medical school to engage in full-time teaching and research, so as to protect them from the "distractions of successful practice." Medical schools should either own their hospitals or provide financial support for the teaching budget of affiliated institutions.

During the middle of the twentieth century, the Flexnerian concept of medical school financing began to change as new revenue sources emerged. Table 1 illustrates the percent of medical school revenue derived from selected sources between 1965 and 1999.

Two revenue sources, biomedical research funding and clinical practice income have had significant effects on medical schools. Federal funding for biomedical research became available in the mid-1940s, and expanded rapidly over the next 20 years (from $8.3 million in 1947 to $1.7 billion in 1974).[2] In 1965 (Table 1) about 40% of total medical school revenue came from federal research funding, the great majority from the National Institutes of Health (NIH). By 1999, federal research funding had dropped to about 19% of total revenue, due mostly to the growth of revenue from clinical income. Research funding from the NIH is becoming even more concentrated in certain institutions. Between the mid-1980s and the mid-1990s, the proportion of total research awards going to the 10 most research-intensive medical schools increased (from 24.6% to 27.1%).[3] This "concentration" phenomenon was greater among clinical departments and among principal investigators with an MD degree, which may have been due to the greater difficulties that clinical faculty in the less research-intensive schools had in competing for grants due to clinical practice pressures.[3] During the 1990s, there was an inverse relationship between growth in NIH funding in medical schools and managed care penetration.[4] That is, medical schools in regions with high managed care penetration experienced a slower rate of growth of NIH funding to clinical departments.

TABLE 1 – U. S. Medical School Revenue Sources
(Percent of Total Revenue)

Sources	1965/66	1985/86	1995/96	1999/00
Federal/State/ Local Gov't	13.6	18.8	9.6	8.3
Tuition/Fees	4.6	5.7	4.1	3.6
Endowment/Gifts	5.2	2.3	3.9	4.4
Federal Research (Dir and Indir)	40.9	20.9	18.1	19.1
Other Grants/Contracts (Dir and Indir)	23.3	15.3	11.5	11.5
Hospital/Medical School Programs	3.5	10.3	14.9	14.0
Practice Plan	2.8	21.2	33.5	34.3
Other	5.9	5.4	4.5	4.7
Source: *AAMC Databook*, January 2002 (Data from LCME Annual Financial Questionnaires)				

A study of medical education done in the late 1940s reported that "use of the earnings of clinical faculty members to provide income for the support of the medical school is a relatively new development."[5] The advent of federal programs of reimbursement for patient care in the mid-1960s, especially Medicare, led to increases in faculty practice earnings (Table 1) and faculty practice plans began to be created.[6] Faculty practice plans channeled a proportion of their revenues to support medical school academic programs either directly, through transfer of funds to the central medical school administration (dean's tax) and to departments or by underwriting faculty time spent in academic activities.[7] As the health care system moved toward managed care, practice plans adapted by, for example, opening satellite health care centers, building ambulatory health care facilities, and negotiating managed care contracts involving multiple clinical departments.[8] The increasing complexity of the medical school's clinical enterprise has had far-reaching consequences, as will be described below.

Medical School Faculty

Table 2 illustrates the number of medical schools, full-time medical school faculty members, and medical students between 1965 and 1999.

The total number of full-time medical school faculty members increased almost 500% between 1965 and 1999. Basic science faculty numbers increased about 200% while clinical faculty numbers increased almost 650%. The faculty to student ratio shifted from 0.52 in 1965/66 to 1.54 in 1999/00. As illustrated in Table 2, the number of medical students has remained about constant since the mid-1980s, while the number of full-time faculty members, especially in the clinical departments, has steadily risen.

With the increased reliance on clinical faculty members to produce revenue through practice, multiple faculty tracks began to emerge. By the mid-1980s, about half of schools had clinical tracks (one or more non-tenure tracks for full-time faculty members whose major role was patient care). The number of schools with clinical tracks increased to about three-quarters of the total by the mid-1990s.[13-14]

The concept of tenure also was changing. A survey in the mid-1990s showed that five medical schools were not awarding tenure and six were limiting tenure eligibility to basic science faculty members. Most schools (85% for basic science faculty and 82% for clinical faculty) included some financial guarantee along with tenure. However, only a minority (29%) of those with tenure guarantees included total salary/compensation from all sources in the guarantee for basic science faculty. For clinical faculty members, the portion of compensation derived from practice earnings typically was not included in the tenure guarantee.[14]

New Financing Models

In general, there has been no clear picture of what each of the three medical school missions -- research, education, and patient care -- cost or of what sources of revenue are used to support them.[15] In the past, cross subsidy was common, especially with respect to faculty time. Now, there is a move to be more explicit about the revenue streams that are used to fund various faculty activities, especially teaching. For example, changes in the health care system require increased clinical faculty productivity, so that pressure to provide clinical service is competing with the time available for teaching. In order to maintain the educational program, it has been deemed important to develop and fund a separate educational budget. Mission-based management is a system that aims to reimburse faculty effort for each mission, based on faculty effort.[15-17] The concept of developing an explicit budget for medical education is not new. The Association of American Medical Colleges report on the General Professional Education of the Physician (GPEP) recommended this in 1984.[18]

TABLE 2 –Medical School Faculty and Students (1965 TO 1999)[7-12]

Group	1965/66	1985/86	1995/96	1999/00
Basic Science Faculty (FT)	5,660	14,194	16,972	17,627
Clinical Faculty (FT)	11,489	47,178	74,479	84,819
Total FT Faculty	17,149	61,372	91,451	102,446
Students	32,825	66,604	66,906	66,500
Schools	88	127	125	125

FT = Full Time

A major step in implementing a mission-based management system is to measure faculty effort/productivity. A recent survey identified over 40 medical schools or medical school departments that were quantifying faculty activity and productivity in teaching, either using total contact hours or some type of relative value method.[19] Relative value methods, based on the resource-based relative value scale used for clinical activity, assign a weight to each teaching activity and use an hours multiplied by weight metric for faculty teaching activity.[19] In either case, a department's contribution to teaching is the sum total of faculty effort, and in a mission-based management system this should determine the department's share of the teaching budget.

A major question in mission-based management is what source(s) of funding should be used to support the educational mission. As Flexner noted almost 100 years ago, tuition alone will not suffice. Recent studies have estimated that the cost of educating a medical student is about $40,000-50,000 per year.[20] While some institutions have used a mission-base management system to allocate funding for medical education funding to departments, there are difficulties to be overcome. For example, state funding may be tied to specific salary lines, constraining the ability to reallocate those dollars.[19]

CONCLUSION

At the beginning of the twentieth century, Abraham Flexner envisioned a medical school where faculty members would be able to participate in education and research protected by stable funding from the need to generate revenue for the medical school.[1] At the beginning of the twenty-first century, we see many medical schools where faculty are expected to generate a substantial portion of their own income.

The very definition of faculty is changing. At one time, it was believed that faculty members should be deeply involved in education, research, and, if physicians, clinical service. The emergence of multiple faculty tracks underscores the difficulty of comprehensive involvement in all three medical school missions. Faculty members hired to provide patient care or conduct research may have little involvement in medical student teaching, but still bear a faculty title.

It is unclear what effects the movement to make the "black box" of medical school financing more explicit will have. Certainly, attempts to quantify faculty effort will give more visibility to the teaching mission, and that will be to the good.

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Medical Student Use of Computers Correlates with Personality

John A. McNulty[1], Ph.D., Baltazar Espiritu[2], M.D., Martha Halsey[3], M.S.
[1]Department of Cell Biology, Neurobiology and Anatomy
[2]Department of Medicine
[3]Learning Assistance Center
Loyola University Stritch School of Medicine
Maywood, IL 60153 U.S.A.

Phone: (+)1-708-216-5161 Fax: (+)1-708-216-3676 E-mail: jmcnulty@lumc.edu

ABSTRACT

A recent study evaluating utilization of computer-aided instruction revealed a wide disparity among individual medical student use of computer resources. We tested the hypothesis that the frequency and length of medical student logins to the school's computer network correlated with their personality preferences. Personality preferences of students (n=236) were obtained using the Myers-Briggs Type Indicator (MBTI) test. Computer utilization was quantified from network logs that recorded frequency and length of logins to the network. Individual login data were sorted by personality preference and statistically analyzed. Students with personality preferences that included **I**ntroversion (vs. **E**xtroversion), i**N**tuition (vs. **S**ensing), **T**hinking (vs. **F**eeling) and **P**erceiving (vs. **J**udging) tended to use computers the most. Groupings of preferences revealed that "**ITP**" types logged in significantly more often than "**EFJ**" types regardless of the **N/S** dimension. "**NTP**" types logged in for significantly longer time than the "**SFJ**" regardless of the **E/I** dimension. These results suggest that using computers is not a natural inclination for many students, which may account for the wide disparity in student use of computer-aided learning.

INTRODUCTION

Computer-aided instruction (CAI) and other technological resources are increasingly used in the medical curriculum,[1,2] a trend that has accelerated with the development of Internet applications and the rapid distribution of curricular content through networks. However, a recent study evaluating utilization of web-based CAI in a basic science course revealed a wide disparity among individual medical student use of the computer resources that were developed to specifically facilitate instruction of the subject matter.[3] Based on earlier reports that learning preferences are correlated with personality types,[4,5] we hypothesized that the degree to which individual medical students use computer technologies is related to their personality preferences as measured by the Myers-Briggs Type Indicator (MBTI) test.

The MBTI is a widely accepted psychological instrument, and has been used extensively to examine the personality preferences of medical students with particular attention to specialty choices.[6-9] Eight personality preferences are described within four separate dimensions. **E**xtroversion vs. **I**ntroversion is the dimension that measures whether one's preferred source of interest is focused on the outside world or on the inner self. I**N**tuition vs. **S**ensory is the dimension that measures whether an individual prefers to process information by focusing on the relationships between facts or the facts themselves. **F**eeling vs. **T**hinking is the dimension that measures whether there is a preference for making decisions subjectively and personally or objectively and impersonally. The fourth dimension, **P**erceiving vs. **J**udging, discriminates those individuals whose preference is to be spontaneous and flexible from those whose preference is to be decisive and orderly. The MBTI reports a 4-letter code reflective of individual preferences in each dimension resulting in 16 distinct personality types (i.e., ENTJ or ISFP).

This report describes the results of a study correlating the personality preferences of freshman medical students as measured by the MBTI with how often and how long individual students logged into the school's computer network.

METHODS

Administration of the MBTI

All students matriculating at Loyola University Stritch School of Medicine (SSOM) were offered an opportunity to take the MBTI test through the Office of Learning Assistance. For administrative reasons, the MBTI test was not administered in 1999. The class size for each year equaled 130 students, although not all students elected to take the MBTI.

Login statistics

The study included network log data collected from two separate years (1998 and 2000) during the period when the first year medical students were enrolled in the Structure of the Human Body course. All the computer workstations in the medical school utilize the Windows NT 4.0 operating system, which requires students to log in before accessing the network. Data from each individual login were stored in an entry log. This log was used to construct a user database on the number of logins and length of each login for each student by date. Total login time for individual students was calculated by adding the time spent for each login.

All data were entered into Excel spreadsheets. Once the data for individual students were entered, the names of students were deleted from the database prior to further analyses in order to maintain the confidentiality of individual students.

Statistics

Means and standard deviations were calculated for each of the login variables and differences between means were evaluated by the Student's t-test. Differences between groupings of personality preferences were also compared by the Student's t-test. Analysis of variance (ANOVA) was used to test for effects of the 16 different personality types on each variable. Correlation coefficients were calculated by regression analyses.

RESULTS

The number of students who elected to take the MBTI was greater in 1998 (125/130) than in 2000 (111/130). Examination of the eight MBTI personality preferences in each year (Table 1) showed a reasonably consistent pattern with the majority of students exhibiting preferences for **E**xtroversion (57-62%), i**N**tuition (59-61%), **F**eeling (58-62%), and **J**udging (66-71%). The most common of the 16 types in both years were ENFJ (12-17%) and ESFJ (12-14%).

The network entry logs revealed that the average number of logins was higher in 1998 compared to 2000 while the average length of each login was lower in 1998 compared to 2000 (Table 1). The total mean time that each student was logged into the network was greater in 2000 compared to 1998. However, none of these differences was significant (Student's t-test).

When each of the login variables was compared between personality preferences, the greatest differences occurred in the class of 1998 (Tables 2-4). Specifically, the **I**ntrovert and **T**hinking preferences had a significantly greater number of logins than the **E**xtrovert and **F**eeling preferences, respectively, in 1998 (Table 2). The **I**ntroverts also had significantly shorter logins compared to the **E**xtroverts in 1998 (Table 3). There were no significant differences in either year between any preferences for the total mean login time (Table 4).

Table 1. Means (± SEM) for login data in each year of the study. The number and percentages of students in the different personality preferences and individual types are also provided for each year.

	1998	**2000**
Number of logins	95.0 (± 4.0)	85.4 (± 3.5)
Hours per login	0.61 (± .04)	0.74 (± .07)
Total time (hours)	52.9 (± 3.5)	56.2 (± 3.8)
Extrovert	71 (57%)	69 (62%)
Introvert	54 (43%)	42 (38%)
I**N**tuition	76 (61%)	65 (59%)
Sensing	49 (39%)	46 (41%)
Feeling	72 (58%)	69 (62%
Thinking	53 (42%)	42 (38%)
Perceiving	36 (39%)	38 (34%)
Judging	89 (71%)	73 (66%)
ENFJ	15 (12 %)	19 (17 %)
ENFP	11 (9 %)	10 (9 %)
ENTJ	13 (10 %)	8 (7 %)
ENTP	3 (2 %)	3 (3 %)
ESFJ	17 (14 %)	13 (12 %)
ESFP	2 (2 %)	4 (4 %)
ESTJ	9 (7 %)	10 (9 %)
ESTP	1 (1 %)	2 (2 %)
INFJ	9 (7 %)	6 (5 %)
INFP	10 (8 %)	11 (10 %)
INTJ	11 (9 %)	4 (4 %)
INTP	4 (3 %)	4 (4 %)
ISFJ	6 (5 %)	5 (5 %)
ISFP	3 (2 %)	1 (1 %)
ISTJ	9 (7 %)	8 (7 %)
ISTP	2 (2 %)	3 (3 %)

Analysis of variance (ANOVA) among the 16 different personality types was conducted for each login variable, but it did not reveal any significant effects, due to the large number of groups and the large variability among individuals in each group.

Consistent year-to-year trends of computer use associated with specific preferences (bolded numbers in Tables 2-4) suggested that login variables could be further sorted and analyzed based on groupings of preferences. For instance, when data for the average number of logins for both years were pooled, the "ITP" types logged in more frequently than the "EFJ" types (T-test, $p<0.009$) regardless of the N/S dimension. Grouping and sorting of preferences for total login time showed that "NTP" types logged in for longer time (T-test, $p<0.002$) than the "SFJ" regardless of the E/I dimension.

Table 2. Means (± SEM) for total number of logins for each personality preference by year and for both years combined. Significant differences between personality preferences were identified by the Student's t-test. Preferences where the mean values showed similar trends in 1998 and 2000 are bolded. N = number of students.

NUMBER OF LOGINS			
	1998	**2000**	**Combined Years**
Extrovert	87.9 (± 5.9) n = 71	84.8 (± 4.8) n = 69	86.3 (± 3.7) n = 140
Introvert	**104.9 (± 6.2) *** n = 54	**86.9 (± 6.8)** n = 42	**97.5 (± 4.8)** n = 96
i**N**tuition	95.1 (± 5.4) n = 76	86.6 (± 5.1) n = 65	91.4 (± 3.8) n = 141
Sensing	95.6 (± 7.1) n = 49	84.2 (± 6.1) n = 46	90.2 (± 4.7) n = 95
Feeling	86.7 (± 4.8) n = 72	84.2 (± 5.1) n = 69	85.5 (± 3.4) n = 141
Thinking	**106.9 (± 7.5)**** n = 53	**87.9 (± 6.1)** n = 42	**99.9 (± 5.3)***** n = 95
Perceiving	**104.1 (± 9.4)** n = 36	**86.1 (± 7.7)** n = 38	**95.0 (± 5.9)** n = 74
Judging	91.3 (± 4.7) n = 89	85.3 (± 4.5) n = 73	88.9 (± 3.3) n = 162

* = $p < 0.05$ for **E** vs. **I** in 1998 ** = $p < 0.03$ for **F** vs. **T** in 1998 *** = $p < 0.02$ for **F** vs **T** for combined years.

Table 3. Means (± SEM) for number of hours per login for each personality preference by year and for both years combined. Significant differences between personality preferences identified by the Student's t-test. Preferences where the mean values showed similar trends in 1998 and 2000 are bolded. N = number of students.

HOURS PER LOGIN			
	1998	**2000**	**Combined Years**
Extrovert	0.71 (± 0.08) n = 71	0.73 (± 0.05) n = 69	0.72 (± 0.06) n = 140
Introvert	0.47 (± 0.04)* n = 54	0.81 (± 0.07) n = 42	0.61 (± 0.07) n = 96
i**N**tuition	**0.66 (± 0.07)** n = 76	**0.80 (± 0.08)** n = 65	**0.72 (± 0.06)** n = 141
Sensing	0.54 (± 0.06) n = 49	0.70 (± 0.09) n = 46	0.61 (± 0.06) n = 95
Feeling	0.58(± 0.05) n = 72	0.64 (±0.07) n = 69	0.61 (± 0.06) n = 141
Thinking	**0.65 (± 0.09)** n = 53	**0.72 (± 0.07)** n = 42	**0.67 (± 0.06)** n = 95
Perceiving	0.58 (± 0.08) n = 36	0.96 (± 0.09) n = 38	0.77 (± 0.11) n = 74
Judging	0.63 (± 0.06) n = 89	0.65 (± 0.05) n = 73	0.63 (± 0.04) n = 162

- = $p < 0.02$ for **E** vs. **I** in 1998.

Further examination of the combined data for both years suggested that those preferences that included the larger numbers of students (e.g., **F**eeling and **J**udging) were also those preferences that included students who tended to use computer technology more sparingly. This trend was confirmed by regression analysis of the number of students in each of the eight preferences and the average number of logins for students in those preferences (Fig. 1). Similar trends were observed when the number of students in each preference was correlated with the other variables (average length of login and total login time), but the correlation coefficients were not statistically significant for these variables.

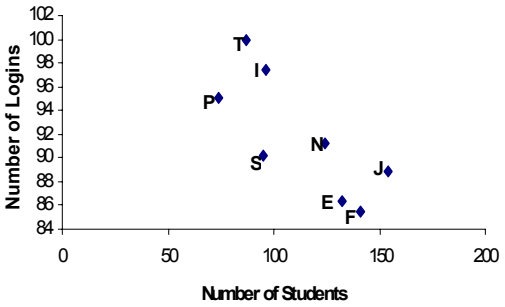
DISCUSSION

The principal finding from this study is that the degree to which medical students use computers is related to personality preferences, defined by the MBTI classifications. The most consistent differences were between the logical, analytical **T**hinking types, who used computers more frequently than the compassionate, subjective **F**eeling types. The **IN**tuitive and **P**erceiving characteristics also contributed to the increased utilization of computer technology. This observation is in general agreement with Smith et al.[10] who reported that i**N**tuitive-**T**hinking types of teachers were more likely to use technology than the **S**ensory-**F**eeling types. Francis et al.[11] described an inverse relationship between more positive student attitudes toward computers and lower scores on the extraversion scale. Consistent with this observation is the present finding that **I**ntrovert types exhibited significantly greater number of logins compared to **E**xtrovert types in 1998 with a similar tendency in the 2000 class.

Recent studies of several schools revealed that medical students tend to demonstrate stronger preferences for **E**xtroversion, i**N**tuition and **J**udging,[8,12] which is consistent with the findings in this study. However, SSOM students tended to have a preferred dimension of **F**eeling over **T**hinking, in contrast to other medical schools.[9,12] This may reflect the type of student who attends a Catholic Jesuit medical school and is subsequently selected by the admissions committee, as was previously demonstrated for another medical school.[12] The **F**eeling-**T**hinking dimension is the only one reported linked to gender (females have predominantly **F**eeling preferences).[13] Although the factor of gender was not included in the present analysis, the observation that 58-62% of SSOM students had **F**eeling preferences could not likely be entirely accounted for by gender since females comprised only 45% of both classes.

Differences in the overall use of computers between the class of 1998 and 2000 may have had potentially important confounding effects in the present study, especially when data for both years were pooled. Students in the 2000 class

Figure 1. Plot of number of students for each personality preference (1998 and 2000 combined from Table 1) vs. the mean number of logins for each personality preference (1998 and 2000 from Table 2). Regression analysis gave a p = 0.028.



See Table 1 for listing of abbreviations for personality preferences.

tended to login less frequently, but for longer periods of time than did students in the 1998 class. These differences may have been related to the increased amount of computer-aided instructional materials in the course as well as increased experience and familiarity of students with computers. It is intuitive that the level of confidence of medical students with computers is directly related to their attitude and use of computer-aided learning as previously demonstrated.[14]

The present study contrasts with some other studies that utilized questionnaires to obtain information on the participants' attitudes and preferences related to computer use.[5,10,11,15] Assuming a direct correlation between the frequency/length of logins and positive attitudes toward computers, there are two important advantages for the use of network login data. First, it spreads the sampling of individuals over a longer period of time, to provide a better statistical measure of individual use. Second, it is a more objective measure of "attitudes" toward computers compared to subjective data obtained from questionnaires. The advantage of network entry logs was demonstrated recently in a study correlating computer-assisted learning with individual student comprehension of anatomy.[3]

CONCLUSION

The results of this study are particularly relevant to the application of computer-aided instruction in the medical curriculum because the data suggest that use of computers is not a natural inclination for a significant number of students. At SSOM, the majority of students exhibit MBTI preferences that predictably *would not* self-select activities involving CAI. This may account, in part, for the results from our previous study,[3] where a relatively large number of SSOM students either did not use computer-aided learning materials at all, or used them only minimally. Accordingly, faculty who are considering implementing CAI extensively into their courses should consider one of the more established principles of teaching and learning – know your audience.[16] In view of the increasing reliance of the practice of medicine on technology, further studies are warranted to investigate the relationships between personality preferences and utilization of specific applications (e.g., tutorials, online discussion groups, electronic medical record, etc).

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Assessment of an Online Learning Objective Answer Database

Douglas J. Gould, Ph.D. and Brian R. MacPherson, Ph.D.
Educational Technology Development Group
Department of Anatomy and Neurobiology
University of Kentucky
MN 225 Chandler Medical Center,
Lexington, KY 40536-0298 U.S.A.

Phone: (+)1-859-323-5484 Fax: (+)1-859-323-5946 Email: djgould@uky.edu

ABSTRACT

The objective of the present study was to create and evaluate an on-line learning objective answer database. The goal of the answer database was to make information about, and/or answers to, learning objectives that students were provided with in their lecture notes available to them anytime. Our hypothesis was threefold: i) that student satisfaction with the availability and access to the learning objective answers would be high, ii) that having the answers made available to them would not affect student performance in the course, raising or lowering, the class average artificially, and iii) that less instructor time would be spent discussing routine issues/questions, freeing up office hours to deal with students with more serious problems with the course content. The answer database was created using *Filemaker Pro* 4.1 ® and housed on Macintosh computers in faculty members' offices. The effectiveness of the database was evaluated over a 3-year period and compared with the previous 3-year period in which the database was not used. Evaluation methods included student and faculty surveys and numerical assessments of overall course and database rating and average course grades. Results indicate that there is no significant difference in student satisfaction and grades with or without the database, while faculty time spent in office hours and answering routine questions is decreased.

INTRODUCTION

Learning objectives are widely considered to be a valuable tool for both instructor and student [1, 2, 3]. Ferguson states that learning objectives are statements of desired, observable, teachable, and learnable behaviors that are evidence of learning.[3] Wyte *et al*. claim that learning objectives describe in precise, measurable terms what learners must do to meet course objectives, and that they can improve general education instructional outcomes.[2] Properly constructed objectives represent relatively specific statements about what students should be able to do following instruction [4]. Instructors use learning objectives to guide lectures, prepare lecture notes and formulate test questions. Educators identify certain benefits from the use of objectives. Used as statements of intended learning outcomes, they provide direction of intended learning opportunities and aid in selection of appropriate teaching strategies and materials[3]. For students, learning objectives are often relied upon to guide studying by focusing attention on critical areas and serve as a summary tool for exam preparation. A learning objective describes what students should do to demonstrate that they are competent in an area[5]. Objectives can serve as educational guidelines that help students organize information, establish priorities and assess progress[1].

However, the literature does contain criticism in the use of learning objectives. Results of a study by Wyte *et al*., indicated that learning objectives do not augment core content retention of material.[2] Other criticisms suggest that learning objectives are too restrictive and may inhibit students' future learning, that they may focus teaching and evaluation efforts on items of a trivial, but easily defined nature, that a large, carefully defined list of objectives may be to cumbersome and inflexible to be used effectively[1]. It is this latter criticism that would seem to be the key to making learning objectives beneficial to both instructor and student alike. The stated criticisms are valid if learning objectives are approached dogmatically and rigidly and if insufficient time and effort are expended in their formulation. Some feel that learning objectives must be continually refined based on careful evaluation of curricula and discussion with colleagues and students[1].

The practice of continually refining and updating learning objectives renders the majority of the criticism of their usefulness irrelevant. It is also the same need for continual and ongoing refinement that makes distribution, presentation and discussion of objectives via the internet a logical choice. Material made available via the web is easily distributed to a wide audience, allows for a great deal of flexibility

regarding presentation method and is modifiable by one central individual - the instructor. One aspect of learning objectives that may lend itself particularly well to online distribution is the answers to, or discussion of, the objectives.

A further benefit of providing the answers to learning objective online is the ability of an instructor to provide students with information about specific objectives. In addition, following the initial creation of the information database, instructor time devoted to learning objectives and student concerns about the answers is greatly reduced. Students consistently indicate their desire to be provided with the answers to learning objectives. Instructors on the other hand are somewhat reluctant to give them the answers *en mass* knowing that simple memorization is generally the result – without the student understanding the material and being capable of deductive reasoning or extrapolation through use of the critical information the objectives were designed to ensure the student understood. Instructors often prefer that students seek out the answers from their texts and lecture notes. While there is considerable merit to this faculty strategy, such as promoting active learning, it does not increase students' opinion of the course and often increases student visits to the instructor, often to obtain answers that do not require elaboration, extensive discussion, or consultation with an instructor. In addition, many students simply want each answer they provide verified by the instructor.

Databasing software such as *Filemaker Pro*® or Microsoft *Access*® make it possible to enter answers and points of discussion related to specific learning objectives into a searchable online database for students. While the initial investment of time taken to master the database software, create a user interface, and enter the data, can be significant, modifications to, and refinement of, the data set are easily accomplished on a continuing basis and are immediately available to all users. Memorization of learning objective answers is facilitated by students simply printing out the database. In an effort to stem the rush to print out the answers, the database can be configured such that answers can be displayed only one item at a time. In addition, it should be reasonable to expect that the average student has no rational reason to have to check every answer (although some do). Displaying individual learning objective answers makes accumulating an entire list of answers a cumbersome and time-consuming process, thereby increasing the likelihood that students will only use the database for the most difficult objectives and only after they have failed to answer the question by searching their notes or text. This approach to optimal use of the learning objective database demonstrates that the instructor wants to provide a high level of active learning to the students.

The purpose of the present study was to create and evaluate an online learning objective database. The goal of the database was to make information/answers about the objectives, that students were provided for each topic in the course in their lecture notes, available to them anytime. Our hypothesis was threefold: i) that student satisfaction with the availability and access to the learning objective answers would be high, ii) that having the answers made available to them would not affect student performance in the course, raising or lowering, the class average artificially, and iii) that less instructor time would be spent discussing routine issues/questions, freeing up office hours to deal with students with more serious problems with the course content.

MATERIALS AND METHODS

A database consisting of 945 individual records was created using Filemaker Pro™ 4.1. Each L.O. has a unique identifying ascension number. The database was hosted on an older Power Macintosh CPU provided with an active Ethernet port. Filemaker Pro™ version 4.1 has an important advantage over version 5.0 in that it does not limit the number of users who can access the database via the web at any given time. The web companion feature of Filemaker Pro™ makes the database instantly accessible via the Internet. To prevent students from accessing the entire database and printing a single list of all the answers, access to the database was created through a Filemaker (Claris) Homepage™ HTML interface. This allows users to search for, and display, only one L.O. answer at a time. Links to the database were supplied to students from the course website as well as having the URL provided at the top of each L.O. page in the lecture notes.

The database was created for undergraduate (ANA 209) and professional undergraduate level (ANA 530) students enrolled in our anatomy courses. There are an average of 40 lectures per course and 23 L.O.s per lecture, which are all represented in the online database. Each individually numbered L.O. answer is created as a separate file in the database. The files contain short, succinct answers to the L.O.s provided at the end of each lecture. The L.O.s used, especially those in the undergraduate course, are focused and specific, making them more amenable to definitive answers for the use in the database. For example, rather than an integrative L.O. indicating that students should understand taste, a combination of focused L.O.s written to accomplish the same goal include: 1) What structures receive taste sensations?, 2) Where are the structures that receive taste sensations located?, 3) Which cranial nerves are involved in taste sensation?, and 4) What is the function of the serous glands at the base/between the lingual papillae?

Beginning in 1999, the effectiveness of the L.O. answer database was assessed via targeted questions on student course evaluations. A series of questions dealing with its perceived effectiveness to users were asked to four student groups (ANA 209; 1999, 2000, and 2001 fall semesters and ANA 530; 2000 fall semester). These questions focused on whether the L.O. answer database was a good way to obtain answers to the learning objectives, the effectiveness of the L.O.s themselves, and how the students rated the course overall. Each question was answered using one of the following 5 rating levels: 5 = strongly agree; 4 = agree; 3 = not sure; 2 = disagree and 1 = strongly disagree.

Starting at the beginning of the spring 2001 semester, a 'hit counter' (Nedstat®) was used to record each time students accessed the database. The counter was incorporated into the page that linked to the database. Incorporation of the counter immediately 'upstream' of the actual database counted the number of times the students visited the database, not the number of L.O. answers searched with each visit. The web log feature of Filemaker Pro™ can track each user through their access IP address, which L.O.s were accessed and the time taken to respond to their search request with a response from the database.

RESULTS

Analysis of the database was composed of five main themes: 1) student satisfaction, as measured using student opinion surveys, 2) student use, as measured using the Nedstat® counter, 3) pattern of student use as assessed by the Web Log feature of *Filemaker Pro*®, 4) student success, as measured by comparing course averages from groups who used the database vs. groups who did not, and 5) faculty time saved, as measured by a survey of faculty involved in courses using the database.

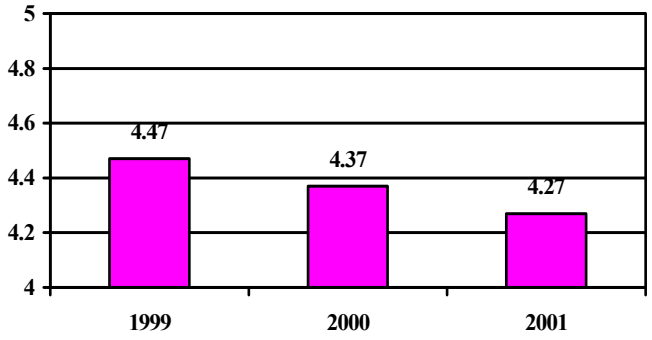

Figure 1. Answer Database Rating. Student response to *The L.O. answer database was a good way to obtain answers to the L.O.s.* 5 = strongly agree; 4 = agree; 3 = not sure; 2 = disagree and 1 = strongly disagree. 1999 N=135, 2000 N= 224, 2001 N=212.

The numerical data presented here was gathered from a large (~200 students per semester) undergraduate basic human anatomy course at the University of Kentucky – ANA 209. Written comments were selected from the student evaluation (opinion survey) of the course and its features, carried out at the end of each semester. Included in the evaluation are several questions that address the effectiveness of the learning objectives in general and the online component of the course (syllabus, learning objective answer database, announcements, grades, *etc*.). The numerical assessment of two survey items; i) The online learning objective answer database was a good way to obtain answers to the learning objectives (Figure 1), and ii) How would you rate this course overall (Figure 2), are presented here.

Figure 1 illustrates the student rating of the usefulness of the learning objective database (1 = strongly disagree, 5 = strongly agree). While the database has been continually rated in excess of 4 (agree) since it's inception in 1999, there has been a slight decline in student assessment of its usefulness. The evaluation also allows space for specific comments about features of the course being evaluated by the instructor. Selected comments (occurring more than twice) on the usefulness of the online database are: "I think the online learning objective answers are very helpful/useful", "Online learning objectives on the Internet were fantastic/wonderful", "Pros – Online learning objective answers". Overall, student satisfaction with the online learning objective answer database is high. Criticisms primarily center on it's inherent design - the inconvenience of not being able to print/view all of the answers in a single list.

Figure 2 compares overall satisfaction with the course from two separate groups of undergraduate students. Group 1 (n=90), is composed of students selected at random from each of the three years prior to incorporation of the answer database: 1996 (n=30), 1997 (n=30), and 1998 (n=30). Group 2 (n=90), is composed of students selected at random from each of three years after incorporation of the answer database: 1999 (n=30), 2000 (n=30) and 2001 (n=30). Regardless of the availability of the answer database, students continually rate the course in excess of 4.0 (high). The difference between groups was not significant using the unpaired student's t-test with significance set at $P<0.05$.

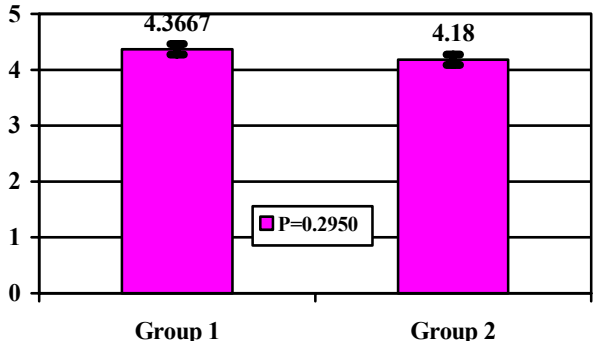

Figure 2. Course Satisfaction. Overall course satisfaction without (Group 1) or with (Group 2) the incorporation of the online L.O. answer database. Group 1 (N=90), composed of students selected at random from 1996 (N=30), 1997 (N=30) and 1998 (N=30). Group 2 (N=90), is composed of students selected at random from 1999 (N=30), 2000 (N=30) and 2001 (N=30). 5 = strongly agree; 4 = agree; 3 = not sure; 2 = disagree and 1 = strongly disagree.

Figure 3 illustrates the average academic performance levels for students in the course. Again, the two student groups were compared. The average final grade of students in Group 1 (those from 1996 through 1998) that did not have access to the answer database was compared to students in Group 2 (those from 1999 through 2001) who did have access to the database. The average final grade in Group 1 was 75.15% over the three-year period. After integration of the database, the average final grade in the course was

75.11%. The difference between groups was not significant using the unpaired student's t-test with significance set at $P<0.05$.

Analysis of the data accumulated in the Web Log tracking feature of *Filemaker Pro*® indicated that roughly half of the students that used the database (identified by IP address) sequentially checked every learning objective answer. The other half checked only answers they were unsure about. The Nedstat® hit counter recorded student visits to the answer database, from the course web site, over a three semester period (Figure 4). There were 1,224 visits during the spring 2001 (N = 212 students), 1,570 visits during the fall 2001 (N=185 students) and 1,161 visits during the spring 2002 (N = 185 students) semesters. An interesting fact the counter brought to light was that the most active day of the semester accessing the database occurred the week prior to the second exam (that point at which the student can still drop the class and not have it appear on their transcript).

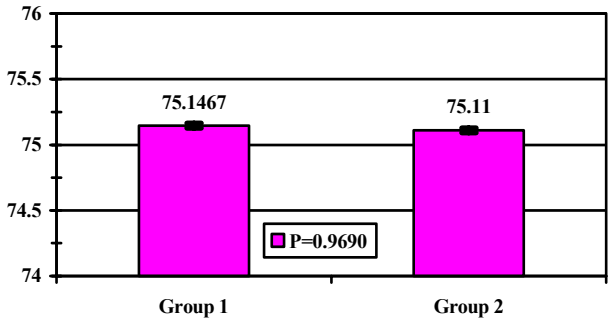

Figure 3. Course Grades. Overall course grades without (Group 1) or with (Group 2) the incorporation of the online L.O. answer database. Group 1 (N=90), composed of students selected at random from 1996 (N=30), 1997 (N=30) and 1998 (N=30). Group 2 (N=90), is composed of students selected at random from 1999 (N=30), 2000 (N=30) and 2001 (N=30).

Instructors in this large undergraduate course who have taught over the six-year period with and without the online learning objective database were asked several questions regarding student visits during office hours. Instructors indicated that there were substantially fewer student visits. Furthermore, instructors felt they were able to spend more time with the reduced number of students who did visit their office experiencing substantial problems with the course or concepts covered in it. The general sense of the instructors is that routine verification of learning objective answer visits have been eradicated with the presence of the answer database. An instructor survey listed the following as the top three benefits of the learning objective answer database. 1) Time is spent with students that are in more need of attention; 2) Questions from these students tend to require more in-depth discussion/explanation; and 3) That while the initial expenditure of time in becoming familiar with the software and creating the database is significant, the ease of maintenance, modification and distribution of the material frees up instructor time for students more in need of their attention.

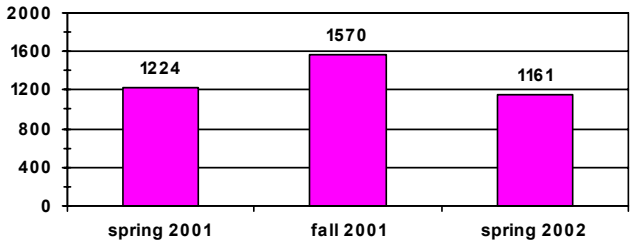

Figure 4. Database Use. Database use as measured using the Nedstat® hit counter over a 3-semester period. Spring 2001 (N=212), fall 2001 (N=185) and spring 2002 (N=212).

DISCUSSION

The results of student opinion survey indicate that student satisfaction with the online L.O. answer database is high. Written comments show that students in the courses in which the online database is used were pleased to have unlimited access to the answers to their L.O.s, used the database, and felt that it was generally helpful. Further, there is no significant difference in satisfaction with the course since the inception of the database (Fig. 2). Thus, the database is a tool that is widely used, accepted and valued by students. Results from use of the NedStat® 'hit counter' indicate that the database was used often by students (Fig. 4), particularly prior to the exam immediately before the last day to drop the course. It is not possible to determine the average number of times a single user used the database. It may be the case that a large number of 'hits' were from the same user, repeatedly accessing the site. However, this is not particularly important because regardless of the user the database was accessed often, especially before exams and was therefore a heavily utilized resource for students.

The inclusion of the database had no significant effect on average course grades between students who used the database and those who did not (Fig. 3). This information becomes more significant when presented in the context that the faculty of the courses using the database felt that less time was spent answering questions during office hours after inclusion of the database as part of their course. It is likely that a large number of students received answers to their questions from the database.

Further, faculty felt that the nature of student office visits has also evolved after adding the database. While fewer students are visiting faculty offices, the visits now regard more in-depth questions or are more likely from students who are in much need of assistance. Overall, faculty felt that simple, straightforward questions were now being addressed online by students. In addition, faculty indicate that another probable benefit of the relative anonymity of the online answer database is that students who would otherwise

be reluctant to seek help from a faculty member, now have a resource through which to have their questions answered.

Faculty acknowledge that the initial input of time necessary in order to create the database (learning software, entering data, etc.) is larger than to compile paper versions of the L.O.s. However, after the initial investment of effort, it takes almost no time to maintain and alter the database (correct mistakes, add/delete items, etc.). So, while student grades and active learning are maintained, student satisfaction is high and faculty time is saved.

L.O.s may lend themselves particularly well to administration via the Internet. An online, digital L.O. answer database is capable of maintaining all of the benefits associated with providing students with answers to L.O.s, minimizing faculty effort and increasing flexibility in order to accommodate change. Proper and thorough evaluation leads us to conclude that this is a valued new tool for inclusion into the curriculum. As faculty rush to incorporate a multitude of course materials into online presentations, critical evaluation of their value becomes of increasing importance.

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Neuropharmacology of Selected Herbal Substances: A Learning Module for Patient-Physician Interaction and Interviewing Course

Gloria A. Casale,[1] M.D. and Harold H. Traurig,[2] Ph.D.
Association of Teachers of Preventive Medicine[1], Washington, DC, 20036 and The Department of Anatomy and Neurobiology, University of Kentucky[2], Lexington, KY, 40536 U.S.A.

Fax : [1](+)1-301-443-4425; [2](+)1-859-323-5946 Email: [1]gloria_casale@msn.com; [2]traurig@uky.edu

ABSTRACT

The content and outcomes of a learning module, which focuses on the issues of patient self-medication and physician–patient communication, is described. The stimulus for discussion examines patient self-medication with herbal substances commonly used to address neurological complaints. The module is best employed in small group settings with a faculty facilitator. Student learning outcomes are: recognize the importance of patient self-medication behaviors and of obtaining a complete medication history, understand the concept of untoward effects of medications, recognize the quality of clinical data available on alternative and complementary drug therapies, and understand the physiological effects of four herbal substances commonly used by patients for self-medication.

INTRODUCTION

Most medical education programs include a course in which one learning outcome goal is developing appropriate patient-physician interaction and interviewing skills. Included is the importance of obtaining an accurate medication history. To achieve this goal it is important to identify topics for discussion and illustration that will underscore the importance of developing communication skills, provide insights into patient behaviors that affect their health and provide relevant information about medical or public health issues that may not be adequately addressed elsewhere. One such topic is patient self-medication with "over the counter" preparations, "natural" products –including herbal substances, and dietary supplements.

A faculty facilitator leads student discussions on the issue of patient self-medication with herbal substances and physician responses to this behavior. The objectives of these discussions are as follows:

- Introduce students to the range of alternate therapies.
- Consider how patient safety can be assured and how the potential dangers in self-medication with herbal or other substances can be identified.
- Discuss physician resistance to the use of efficacious herbal therapies.
- Understand the dynamics of patient self-medication behaviors.
- Appreciate the significance of scientifically sound pharmacological and clinical data.
- Understand the necessity of assessing the safety and efficacy of a therapeutic regimen.

Introduction to the Learning Module

The learning module described here focuses on the issue of patient self-medication with herbal substances, specifically St. John's Wort (SJW), Feverfew (FF), Ginkgo biloba (GB) and Valerian (VAL), four herbs commonly used for nervous system complaints.

Biochemistry and pharmacology courses usually provide little, if any, well-documented scientific or clinical information about herbal medications. Because herbal preparations are advertised as natural products and classified as dietary supplements by government regulatory agencies, most patients and many clinicians do not equate herbal preparations with conventional prescription drugs. Additionally, they assume that substances called "natural" are therefore safe. However, numerous studies document that herbal substances can evoke untoward side effects and important drug interactions. Patients frequently will not readily reveal their self-medication behaviors to interviewing physicians for fear of ridicule or because they do not consider herbal products as "medicine".

Herbal medications have been used to treat neurological symptoms since ancient times and in recent years their use as self-medication preparations has greatly increased. Current research results indicate that some herbs contain specific, pharmacologically active compounds and can be appropriate treatments for selected patients with neurological complaints. Importantly, there is mounting evidence of significant dangerous side effects and drug interactions for some patients taking herbal medications (See

references below). This learning module will introduce students to available evidence describing the efficacy, mechanisms of actions and safety of the active compounds in SJW, FF, GB and VAL in treating neurological complaints.

Many herbal medications are reported to alleviate neurological conditions by affecting cerebral blood flow while others may interact with neurotransmitter and neuropeptide receptor mechanisms. For example, the hypericin in SJW is effective in treating mild to moderate depression, the parthenolide in FF relieves migraine in some patients, the glycoside quercetin in GB has been shown to increase cerebral blood flow and augment cerebral function, and the valepotriates, valeric acid and sequiterpenes in VAL exert a sedative effect. Relevant references to pharmacological and clinical studies on the usefulness and safety of herbal medications are summarized below. Images and chemical formulae of the herbal medicines appear in the appendix.

Learning Module Discussion Points

GINKGO BILOBA
(Maidenhair tree, Kew tree)

Active ingredients
Quercetin & Quercitrin, Ginkgolides A and B and Bilobalide, a terpinoid.

Clinical use
Cerebrovascular insufficiency syndrome, [1, 2, 3, 4, 5]
Dementia and Alzheimer syndrome. [1, 4, 6, 7, 8, 9]

Significant pharmacological actions proven in human studies.
1) Increases cerebrovascular perfusion.[1, 5, 6, 9, 10, 11`]
2) Decreases blood viscosity. [5, 6, 10]
3) Platelet activating factor antagonist. [12, 13]
4) Decreases cytotoxicity produced by free radicals and oxidative stress.[14, 15, 16, 17]

Pharmacological actions demonstrated in laboratory.
1) Diminishes cytotoxic nitric oxide metabolites released from human endothelial cell cultures. [17]
2) Attenuates neuronal apoptosis following oxidative stress in rat tissue *in vitro*. [16, 18]
3) Bilobalide is a potent inhibitor of NMDA (N-methyl-d-aspartate) receptor-induced phospholipase-α_2 and associated degradation of brain phospholipid in rat hippocampus.[19]
4) There is dose-dependent excitation by Bilobalide of rat hippocampal CA_1 neurons by disinhibition of GABAergic (gamma aminobutryic acid)transmission. [20]
5) Augmentation of GABA and glutamic acid has been demonstrated by Bilobalide in mouse cortex and hippocampus. [21]
6) MAO (monoamine oxidase) inhibition has been reported in laboratory studies[22] however, PET scan studies have not substantiated this effect in humans.[23]

Favorable Clinical effects.
1) Improved vigilance and attention.[1, 2, 3, 4, 5]
2) Slowing of cognitive function and memory decline in elderly patients.[1, 2, 3, 4,5]
3) Slowing of decline of cognitive function in Alzheimer patients.[6, 7, 8, 9]
4) Stabilization and improvement in social functions in Alzheimer patients.[9]
5) Potentiation of EEG α waves.[5, 24]
6) Diminished EEG δ, β and θ waves.[5, 24]

Warnings
1) Should not be combined with anticoagulant therapy or aspirin therapy.[24]
2) Safety during pregnancy unknown.

FEVERFEW
(*Tanacetum parthenium*, Bachelor's Button, Mutterkraut, Chamomile grande)

Active ingredients
Parthenolide (sesquiterpene lactone).
Parthenolide must be present in sufficient quantities (600µgm) to be effective.

Clinical use
Migraine prophylaxis.[25, 26]

Significant pharmacological actions – proven in human studies.
1) Inhibits vasodilatation and other inflammatory responses by:
   a) Inhibition of the Serotonin release from platelets.[27, 28, 29]
   b) Inhibition of leukocyte functions.[28, 29, 30]
   c) Inhibition of leukotriene synthesis.[28, 29, 30]
   d) Inhibition of prostaglandin synthesis. [28, 29, 31]

Favorable Clinical effects
1) Decreased frequency and severity of migraine attacks.[25, 26, 32]
2) Decreased nausea associated with attacks.[25, 26, 32]
3) No reported long-term (4-month) adverse effects.[26]

Warnings
1) Not recommended for patients with a history of clotting disorder.[26, 27, 28, 32]
2) May interact with non-steroidal anti-inflammatory drugs.[31]
3) "Post-Feverfew syndrome", a condition which occurs in some patients when they abruptly terminate FF medication may occur, it includes mild anxiety, tension headache, insomnia and joint discomfort. [26, 32]
4) FF is an abortifactant. It is contraindicated for use in pregnant patients, may induce uterine contractions.[32]
5) Not recommended for patients sensitive to plant products.[32]

6) Patients may develop oral ulcers with extended use.[25, 26]
7) Patients may develop gastric discomfort.[25]
8) Its unpleasant taste may lead to noncompliance.[26, 32]
9) No safety data available to support use in children.[26, 32]

Note: Reports that FF mitigates symptoms of rheumatoid arthritis have not been substantiated.[26, 27, 32]

ST. JOHN'S WORT

(*Hypericum perforatum*, Johanneskraut, Blutkraut, Herrgottsblut, Walpurgiskraut, Hexenkraut)

Active Ingredients[33]

Hypericin, Pseudohypericin (naphthodianthrones), Hyperforin (phloroglycinol), Quercetin and Quercitrin (flavonoids).

Clinical use

1) Treatment of mild to moderate depression equivalent to TCA (tricyclic antidepressent) and SSRI (selective serotonin re-uptake inhibitor) drugs based on the Hamilton Depression score. SJW components appear to be free of the side effects associated with TCA or MAOI (MAO inhibitor)classes of drugs.[34, 35, 37, 38, 39, 48, 49]

2) Treatment for seasonal affective disorder. [(34, 38, 40)]

Note: Hyperforin in Hypericum extract exerts the most prominent anti-depressant effect.[38, 42, 43]

Significant pharmacological actions – proven in human studies.

Hypericum (SJW) extract often contains a mixture of several compounds which have different actions.[33]

1) Hypericin, Pseudohypericin, Hyperforin:
   a) Inhibit the re-uptake of serotonin in a dose-dependent manner.[35, 41, 42]
   b) Inhibit the re-uptake of dopamine, GABA and norepinephrine.[41, 43]
   c) Promote the release of serotonin and norepinephrine.[41]
   d) Produce a weak inhibition of monoamine oxidase activity.[44, 45, 46, 47]
   e) Contribute to antiviral activity, including that of the HIV(Human Immunodeficiency Virus) through the inhibition of protein kinase-C by Hypericin.[41, 44]
   f) Induces hepatic cytochrome-P450 enzymes.[44] This action possesses a significant problem because it lowers the serum concentration of many commonly used medications.[47] For example: interferes with a cancer chemotherapy drug and with Idiniver, an important HIV drug.[47]

Pharmacological actions demonstrated in laboratory.

1) Induces the drug transporter P-glycoprotein in the gut.[48]
2) Hyperforin augments ionic conductance in rat hippocampal neurons and GABA receptor-mediated responses.[48]
3) Hyperforin is an NMDA receptor antagonist.[48]
4) Quercetin and Quercitrin are reported to inhibit MAO.[44, 46] **Note:**one study disputes the validity of MAO inhibition.[33]
5) Interacts with GABA receptor.[43, 45, 46]
6) Inhibits protein kinase-C activity.[41, 44]

Warnings

The drug interactions and contraindications associated with St. John's Wort are important and varied.

1) It is contraindicated with concomitant use of the following drugs: SSRI or MAOI drugs, lithium, ympathomimetic amines, anticholinergic drugs, barbiturates, non-prescription cold remedies and diet aids.[34, 35, 36, 45, 46, 50]
2) Reduces plasma levels of:
   a) Digoxin.[51]
   b) Anti-rejection drugs (Ciclosporin, Cyclosporin).[53]
   c) Anti-AIDS drugs (Idiniver).[54]
   d) Warfarin (Coumadin).[55]
   e) Contraceptive steroids in humans,[55] probably by induction of hepatic cytochrome P450 enzymes [44, 51, 52, 53, 54, 55] and of drug transporter P-glycoprotein in the gut.[49, 53, 55)]
3) Drug interactions or ingestion of large amounts of St. John's Wort extract may produce "serotonin syndrome": severe myoclonus, hyperpyrexia, sweating, seizures and coma.[45, 46]
4) Phototoxicity has been reported after long term use of large doses.[34, 36]
5) Dry mouth, gastric distress and insomnia may occur.[44]
6) The safety of SJW has not been demonstrated for pregnant and nursing mothers or for children.

Other important considerations

In contrast to most psychotropic medications there is no evidence that SJW will interact with ethanol.[34, 36]

VALERIAN

(*Valeriana officinalis*, Katzenkraut, Baldrianwurzel)

Active ingredients

Valerenic acid, Valeranone, Homobaldrinal, Kessyl glycol (sesquiterpines, valepotriates), Borneol (monoterpene)

These components all hydrolyze readily, raising concern about the availability of active compounds in therapeutic preparations.[56]

Clinical use

1) Relieves insomnia and sleep pattern disturbances.[56, 57, 58, 59, 60]
2) Relieves anxiety and produces mild sedation.[59, 60]

Significant pharmacological actions proven in human studies.

1) Exerts a benzodiazepine-like effect.[62]
2) Activates $GABA_A$ receptors.[63]

Pharmacological actions demonstrated in laboratory.
1) Inhibition of GABA re-uptake.
2) Potentiation of potassium stimulated calcium dependent GABA release (rat tissue).[61, 62]

Favorable Clinical effects.
1) Anxiolytic effect,[57, 59] which is as effective as benzodiazepines.[58]
2) Normal sleep patterns are restored.[56, 57, 58, 59, 60, 64]
3) Sedative effect without "hangover".[60, 64]
4) Asian Valerian species contain kessyl glycol, which is more efficacious as a smooth muscle relaxant.[56]

Pharmacological actions demonstrated in laboratory.
No carcinogenic effect in mice.

Warnings
1) Competes with benzodiazepines and barbiturates, but does not interact with ethanol.[60, 64]
2) Clinical data following extended use are not available.
3) Safety for pregnant patients and children not available.
4) Patients are advised not to operate vehicles or machinery while using VAL
5) Some evidence of liver damage following extended use.[65]

Utilization
The following are examples of scenarios that could be used to facilitate small group discussion. They can be easily adapted for Patient Based Learning modules. Alternatively, the scenarios can be provided to the students in advance to stimulate discussion in a larger classroom setting. The scenarios are designed to incorporate many other discussion issues regarding patient education, treatment and concerns.

The first class session should consist of the faculty facilitator briefly introducing the topic of alternative and complementary medicine. This emphasizes the fact that patients are using many herbs and dietary supplements and that they are frequently hesitant to discuss these treatments with their physician.

The students are asked to take an anonymous written poll to disclose what alternative and/or complementary medications they or close family members are currently using. Collecting this information in class and tabulating the results will emphasize the widespread use of these products. The results of the poll are discussed, including voluntary disclosure of how they became aware of the products or who recommended them. Subsequently, the facilitator introduces the objectives of the learning module. The rationale for selecting St. John's Wort, Feverfew, Valerian, and Ginkgo Biloba as self-medication examples is described in the introduction to the learning module.

A brief presentation of the chemical and trade names for these four herbal compounds, their active chemical ingredients and their purported effects are described (See "Introduction to the Learning Module"). This can include a discussion by the class of the information on the labels of the products, as well as why they continue to be considered dietary supplements and are not regulated by the Federal Food and Drug Administration (See "Learning Model Discussion Points").

Subsequently, subgroups or individual students are assigned key references describing pharmacological actions, favorable clinical effects and warnings regarding safety for each herbal remedy. Students are instructed to summarize assigned articles for presentation and group discussion in subsequent classes paying particular attention to the adequacy of the reported data, side effects and cost of recommended dosages/month. (See Learning Model Discussion Points")

Following the class reports described above students are given copies of the four clinical presentations below. Each history is read aloud. The facilitator guides the discussion of the clinical use and safety of the herbal substances given in the history provided by the patient or family. Students decide what advice should be conveyed to the patient and family. Students are asked to explain the rationale for their advice based on their understanding of the pharmacological effects and hazards of self-medication and information obtained from the summaries of relevant references.

A discussion of the physician's attitudes regarding these substances follows. It is important that the physician become knowledgeable about these medications and equally important that they build trust in their patient-physician relationship to assure that patients disclose all pharmacologically active substances they are consuming.

FEVERFEW

A 21-year-old college student presents to the student health services because she tested positive on two home pregnancy tests during the past week. Her menses are overdue by 14 days. She is sexually active and is not currently taking contraceptives. She states that she uses contraceptive foam "most of the time". She is a good historian and provides a long history of severe migraine headaches. She reveals that on the advice of a friend who works in a health food store she has been taking Feverfew daily for the past two years. The duration, intensity and frequency of her headaches have been significantly reduced over that time. She is unsure about continuing this pregnancy and asks your advice.

GINKGO BILOBA

A 72-year-old male is brought to the Emergency Department with a complaint of melena. Approximately three years ago he was diagnosed with mitral stenosis. Following a thrombotic CVA he was placed on Coumadin. He has been stable on 5 mgm of Coumadin for the past year. Until recently he had clotting studies checked on a routine basis. His recovery from the CVA has been complete and he has no discernible residual difficulties.

Because his children were concerned about him living alone in a fairly distant city they convince him to move in with one of his children. He has been with his oldest son and daughter-in-law for about three weeks.

The patient is a good historian and is able to give a very complete history of his prescriptions. When asked about over the counter medications he denies taking aspirin or NSAIDS but indicates that the daughter-in-law has been giving him "some vitamins".

Questioning of the daughter-in-law yields the information that she has supplemented his medication regimen with Vitamin C and Vitamin E. She tells the doctor that she knows those will help her father-in-law ward off disease and 'think better'. The doctor asks her if she is giving him any other supplements and she replies, "Yes, my husband and I take ginkgo tablets every day so we don't get senile and we give Dad some too."

ST. JOHN'S WORT

A 17-year-old female is brought to your office by her grandmother. Her history includes amenorrhea, weight loss and complaints of exhaustion. Her grandmother states that she cries a lot and rarely leaves the house. She has done everything she can think of but the child will not "get over it". Further questioning reveals that the girl's boyfriend was killed in an automobile accident after graduation this spring. She has been at the grandmother's house in Pikeville, KY for three months. Because of her profound sorrow immediately after the boy's funeral and her loss of interest in taking care of her personal needs, eating or socializing, the family felt it might help if the girl was in a different environment. The girl and the grandmother had always had a close and loving relationship. Quite incidentally the grandmother tells you that even the special tea she has been making for her has not helped.

VALARIAN

A 50-year-old woman in good health comes to your office for her yearly GYN appointment. In answer to your inquiry about her current medications she discloses that she drinks a cup of tea with Chamomile and Valerian before she goes to bed every night because it helps here sleep a little better. She also lists Vitamin C, Vitamin E and Glucosamine with Chondroiton as daily medications. The woman states that she is pleased that she has taken far fewer doses of Ibuprofen or Naprosyn since she started this regimen. Additionally, she reveals that she occasionally uses Kessyl Glycol as needed for muscle strain.

Evaluation

The students will be expected to include specific questions about patients' self-medication behaviors in their subsequent exercises in patient interviewing. Additionally, they will be expected to demonstrate an understanding that while herbal medications and other alternative medications can exert useful pharmacological actions, they can have dangerous side effects and may compete or enhance the effects of allopathic medications.

CONCLUSIONS

Learning module on herbal medications will:

- Emphasize the necessity for physicians to obtain a full medication history from each patient specifically inquiring about use of herbal medications, dietary supplements and "over-the-counter" preparations.
- Encourage students to consider evidence presented in well-controlled basic and clinical studies that demonstrate the advantages and dangers of herbal medications.
- Provide students a better understanding of the cellular and molecular mechanisms of action of herbal medications.
- Alert students to important untoward effects and significant interactions that can occur when herbal medication is combined with conventional drug therapy.

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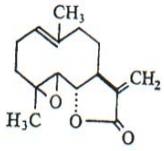
Feverfew

(Tanacetum parthenium, Bachelor's button, Mutterkraut, Chamomile grande)

Active ingredient

Parthenolide
(sesquiterpene lactone)



Indications

Migraine prophylaxis[1,2]

Mechanism of action

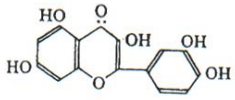
Inhibits vasodilation and other inflammatory responses by inhibition of:
- Serotonin release from platelets[3, 4, 5]
- Leukocyte functions[4, 5, 6]
- Leukotriene synthesis[4, 5, 6]
- Prostaglandin synthesis[4, 5, 7]

Ginkgo biloba

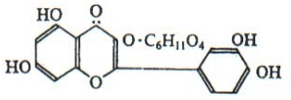
(maidenhair tree, kew tree)

Active ingredients

Quercetin & Quercitrin
(flavonoids)

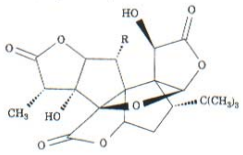


Quercetin

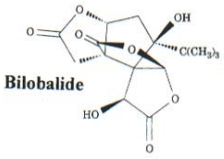


Quercitrin

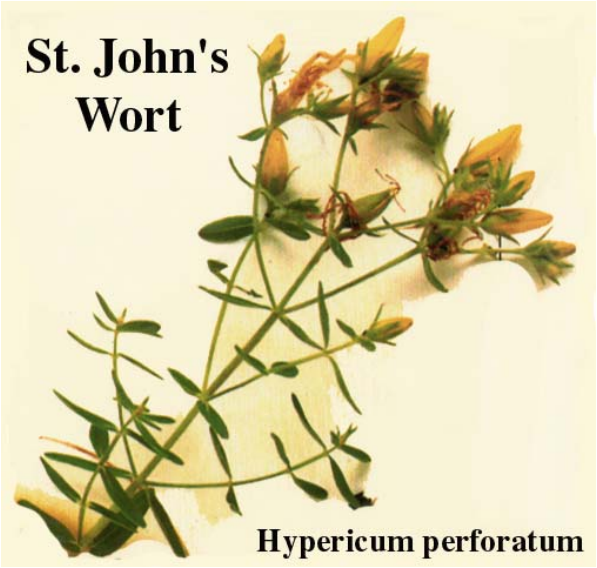
Ginkgolides
Bilobalide
(terpenoids)



Ginkgolides A and B



Bilobalide

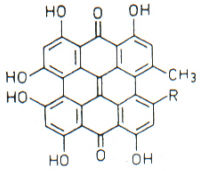


St. John's Wort

(Hypericum perforatum, Johanneskraut, Blutkraut, Herrgottsblut, Walpurgiskraut, Hexenkraut)

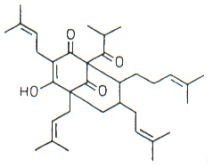
Active ingredients

Hypericin [1]
Pseudohypericin
(naphthodianthrones)



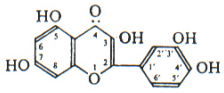
Hypericin
R = CH
Pseudohypericin
R = CH_2OH

Hyperforin
(phloroglcinol)

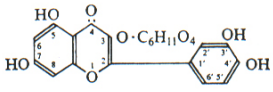


Hyperforin

Quercetin
Quercitrin
(flavonoids)



Quercetin



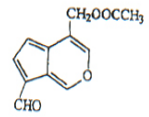
Quercitrin

Valerian

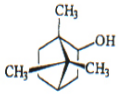
(Valeriana officinalis, Katzenkraut, Baldrianwurzel)

Active ingredients

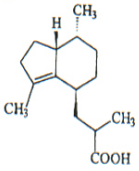
Valerenic acid, Valeranone, Homobaldrinal, Kessyl glycol
(sesquiterpines, valepotriates)
Borneol (monoterpene)
All hydrolyse readily raising concern about availability of active compounds in therapeutic preparations. [1]



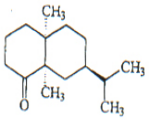
Homobaldrinal



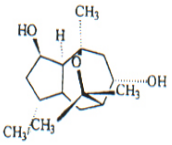
Borneol



Valerenic acid



Valeranone
(1, 2, 3, 4, 5)



Kessyl glycol