PHYSIOLOGY TEACHING IN THE DEVELOPING WORLD: MODELS FOR QUALITY LEARNING

An important initiative to develop higher education and physiology teaching was launched when recommendations were deliberated at the concluding session of a four-day international workshop, Physiology Teaching in the Developing World: Models for Quality Learning, held April 5–8, 1999, at the Aga Khan University, Karachi, Pakistan. The event was organized under the auspices of the International Union of Physiological Sciences (IUPS), Pakistan Physiological Society, and Aga Khan University. Among other major sponsors, the Islamic Development Bank, Islamic Educational Science and Cultural Organization, Third World Academy of Sciences, and Pakistan Science Foundation were prominent.

The main theme of the workshop was “Interactive Teaching.” The panel discussion on that topic then led to the formation of working groups on interactive teaching to large groups, mentorship and motivation, development of competence, and selective teaching and self-learning. The other two panel discussions, “The Role of Basic Scientists in Physiology Teaching” and “Evaluation and Assessment,” were also of considerable interest for the participants. The workshop also included a number of plenary and demonstration sessions. Among these, the most lauded demonstrations were the sessions on problem-based learning, integrated lecture, usefulness of experiments in lectures, and computer-assisted learning.

Introducing the workshop, Dr. Arif Siddiqui, General Secretary, Pakistan Physiological Society, said that over 80 physiologists and medical educationists from 19 countries had congregated to discuss novel ways to improve teaching and learning of science in medical colleges.

In his welcome address, Dr. Roger Sutton, Dean of the Faculty of Health Sciences, Aga Khan University (AKU), highlighted the initiative taken by AKU in improving research and education infrastructure. He said that organization of the workshop would be considered as an important contribution to developing higher education and physiology teaching in the region.

In her introductory remarks, Dr. Ann Sefton, Chairperson, Commission on Teaching Physiology, International Union of Physiological Sciences (IUPS), said that the old-fashioned teaching methods have been challenged by the new generation of students. The resources in the world are limited, therefore necessitating cooperation and sharing of knowledge, and practical solutions to new challenges are required for better results.

In his keynote address, Dr. Bashir Hamad, University of Gezira, Wad Medani, Sudan, and a World Health Organization (WHO) expert on medical education who also served in the WHO country office in Islamabad, highlighted the importance of physiology education, which, he deemed, must enable doctors to have a better awareness of the underlying mechanisms and management of various diseases. He also presented guidelines for the design of modular teaching.

Deliberating on “Developing the Adult Learner,” Dr. Camer W. Vellani, AKU’s Rector, presented thought-provoking ideas on how to develop adult learning. He discussed the capabilities and capacities to think and reflect, which could be connected to the development of the brain in the first three years of life.

Later, four working groups led by experts Dr. A. Sefton (IUPS), University of Sydney, Australia, Dr. R. G. Carroll, East Carolina University, Greenville, North Carolina, Dr. U. Nayar, Arabian Gulf University, Bahrain, and Dr. G. Holsgrove, Cambridge Medical Education Consultants, Cambridge, United Kingdom, respectively, presented recommendations for improv-
ing the quality of physiology teaching in Pakistan and other developing countries of the region. The first set of recommendations was made by the working group considering interactive teaching in large groups. The recommendations were important because in most of the country's institutions there are large groups that are taught by a handful of faculty. The recommendations state that a teacher must be a facilitator of education and not necessarily a source of all knowledge. A teacher should therefore guide the students as to where they can find the required information instead of trying to spell it out him- or herself, because this limits his or her role drastically. The students should be made to understand this process through an orientation program. A lot of planning is needed if a program of interactive learning is to achieve its objectives, according to the recommendations, stating that research has shown that students respond in a positive manner if interactive teaching methods are adopted.

The problem of large groups could be solved by allowing senior students to teach and coach students belonging to junior classes, state the recommendations. The group called for identification of individuals who could act as mentors. These individuals would try to help out the students in their personal and academic matters. The mentor would be required to analyze the students' problems in addition to consoling them in their hour of need. This sort of arrangement could begin with the introduction of the nominated mentors to the students. The two parties could discuss expectations and the frequency of their meetings.

The set of recommendations on mentorship and motivation of teachers and students illustrated that the motivation of the teachers could be gained through job security and other incentives. The students, on the other hand, could be motivated by allowing them to participate in the program.

Competence could be developed and cultivated in the teaching staff if they have proper knowledge, skills, and attitudes. These could be enhanced through the use of libraries, conferences, study leave, and other opportunities for faculty development. The selection of proper teaching staff is of great importance because changes in attitudes cannot always be easily brought about.

The development of competence in the students could be enhanced by employing a proper mix of assessment methods, according to the working group. The theory, practical and continuous methods, and models of assessments may all be used by the teachers to assess the competence of the students.

Modes of assessment such as OSPE (objective-structured practical examination) and multiple-choice questions, etc., can be used to assess the student's competence. A balanced mix of the methods of assessment could be planned to suit the needs of a country or region, said the group.

The students should be trained to learn many of the topics themselves. In this way the responsibility for learning is shifted from the teachers to the students. The students can be expected to learn if they are given access to libraries, the Internet, and research journals, etc.

The recommendation of the group on selected teaching and self-learning underlined the need for defining learning objectives and also emphasized the need for focusing on relevant concepts, problems, and solutions. The workshop also highlighted the importance of extending proper guidance to self-learning.

The workshop also included panel discussions on "The Role of Basic Scientists in Physiology Education," "Interactive Teaching," and "Evaluation and Assessment." Prof. Robert G. Carroll, East Carolina University, Greenville, North Carolina, in summarizing the recommendations on the role of basic scientists in physiology education, said that the basic medical science subjects make up the foundation of clinical subjects. These subjects help students to understand underlying mechanisms of the disease.

He further said that teachers of basic medical sciences serve medical colleges on merit based on academic qualification (DSc/PhD/MPhil/MBBS), teaching experience, research, and publication. The faculty serving this discipline have financial difficulties and therefore must be given incentives to enable them to work with zeal. The workshop emphasized that teachers of basic medical sciences serving in medical colleges and universities should collaborate with each other to
promote teaching and research. Competence can only be assured by developing a research culture.

In the concluding session, Prof. Bashir Hamad from the WHO country office in Sudan addressed delegates representing 19 countries of the region and 25 different medical and science institutions in Pakistan. Prof. Hamad, who also has served as a WHO expert on medical education in the WHO country office in Islamabad, said that a vast number of public sector medical colleges in Pakistan seem lacking in initiative in introducing innovative teaching methods. He stated that the Pakistan Medical and Dental Council (PMDC) provides enough flexibility to allow innovative approaches to basic science education. This becomes important, because conventional teaching methods such as didactic lecturing are being challenged by upcoming generations of students and teachers. Sticking to older methods may not only impair scientific competency but also may increase reluctance to adopt global trends in teaching. He also opined toward a general lack of awareness of the flexibility offered by PMDC in physiology education in medical colleges. However, he mentioned that some institutions in the private sector have already successfully moved toward the introduction of modern learning modes.

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SELECTED ABSTRACTS

Group-oriented learning strategy as an effective mode of transmission of physiological concepts  
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The strategy formulated in this study was felt necessary to replace the traditional chalk and talk way of imparting education to medical undergraduates (practiced in Government-run medical colleges) with a new advanced approach where there is a closer teacher-student interaction. In our institute, the strength per class is 50. The students were divided into 5 groups (n = 10). Each group was assigned a leader selected on the basis of educational achievements and leadership qualities. The senior teachers of the department briefed on the objectives of lectures, followed by an explanation of important concepts, which were simultaneously reinforced by relevant laboratory exercises. Each group then made a 10-minute presentation to focus the assigned objectives in the weekly tutorial sessions. Coordination in the teaching schedule among the various basic science departments was ensured wherever possible. The encouraging feedback was evident in the terminal examination results where the students appeared more confident with a conceptual approach toward the subject, proved by 35% distinction in the subject compared with the previous year’s 15%, i.e., a rise of >100% in the theory part alone. The overall result showed a rise in pass percentage from the previous year’s 74% to the current year’s 94%. In our opinion, this system can give astonishing results if the undue constraints on other integral factors are also dealt with accordingly.

The PhysiTutor as a complete tutoring system in physiology teaching  
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PhysiTutor I was designed by the Dept. of Human and Animal Physiology and Central Electronic Services of the University of Stellenbosch to replace outdated oscillographs. The system was commercialized by ProMach, Hong Kong, as PhysiTutor II for international marketing in 1999. This tutoring system operates in Windows 95/98 and uses animal and human models with invasive and noninvasive experiments for application in the fields of medical, veterinary, zoological, and pharmacological sciences. Measurement of basic parameters is possible in the following fields: isotonic muscle contraction (animal), blood pressure (invasive and noninvasive), isometric muscle contraction (animal), electrophysiology, electromyogram (EMG; human), electroneurogram (ENG; human non-invasive), lung functioning, and electrocardiogram (ECG; human). Each experiment briefly explains the underlying physiology, followed by experimental
setup, assignments, results, and a tutorial. The system also offers interactive web tutoring as an alternative choice. Features, among others, include real-time graphic displays that can be calibrated, paused, auto-scaled, and printed. Data can be recorded for up to 200 seconds in spreadsheet format. Because it is in a Windows format, it can also run other additional simulation software and multiple-choice questions. It is believed that the PhysiTutor II system is one of the best cost-effective tutorial systems currently available. It uses the didactical interactive principle of “seeing and doing” so that maximum learning of physiology can take place.

Combination of didactic lectures with problem-based learning sessions in physiology teaching in a developing medical college in Nepal
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Physiology teaching as an essential part of medical education faces tremendous criticism regarding curriculum design, methods of implementation, and application of the knowledge in clinical practice. In the traditional method of medical education, physiology is taught in the first year and involves little interdisciplin ary interaction. The Manipal College of Medical Sciences, Pokhara, Nepal, started in 1994 with an integrated curriculum. Physiology is taught for the first two years of the four and one-half year MBBS course. For a particular topic, objectives are clearly defined and priority content areas are identified. An overview is given in a didactic lecture class to the entire batch of 100 students. Tutorial classes are then conducted with smaller groups of students. In these, a problem is presented to the students as a focus for learning or as an example of what has just been learned. A questionnaire sought student opinions on the usefulness of this approach, the relevance of the PBL and tutorial format, and the perceived value of the approach. Eighty percent of the students were of the opinion that a judicious mixture of the didactic lecture and problem-based learning in the physiology tutorial classes was very useful in understanding the system that they were currently studying. Only 7% felt that this combination was not useful. More than 60% felt that small group discussions led to better exchange of ideas and may have helped them to perform better in the final examination. More than 70% of the students opined that the physiology tutorial classes were helpful in the context of relating the clinical condition to the basic mechanism. This judicious mixture of didactic lectures and problem-based learning sessions ensured that the students are not only recipients of information but also motivated toward self-learning to get more experience in the application of pathophysiology of various diseases, which will ultimately be beneficial for their entry into the clinical phase and finally patient management.

Problem-based learning: an approach to improve insight into the medical sciences
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In Punjab Medical College, the present method of teaching is conventional and course oriented. The purpose of this study was to find out any improvement in students as far as insight into the medical sciences is concerned. Moreover, we also evaluated the overall behavior of students in a disciplined environment in a fairly good student-teacher relationship and in extracurricular activity. Fifteen willing students, 9 female and 6 male students from the second year, were evaluated and three groups formed. They were evaluated on a questionnaire. Each group was given a problem. They planned, executed, and deduced the solution for the given problem. They presented their work a Pakistan Physiological Society platform in their final year. Again, they were evaluated by questionnaire. There was improvement in the teacher-student relationship. The students developed a highly curious nature and learned about reasoning. There was significantly more knowledge about biostatistics, medical journals, synopsis/proposal writing, and media projection systems. All the students appeared in four professional examinations and only one had to reappear for one subject. We conclude that problem-based learning, whether curricular or extracurricular, improves the student-teacher relationship.
and provokes interest in students for medical science, and they enjoyed learning.

**PBL in physiology in a community-oriented integrated curriculum**

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The Faculty of Medicine, University of Gezira, Sudan, has adopted the community-oriented integrated problem-based learning (PBL) curriculum since its establishment in 1975. The physiology teaching in such a curriculum has been largely lecture based as part of clinical problem solving. We have introduced proper PBL in physiology, initially in the course of man and his environment. A problem was set around edema, and the students classified the problem and put forward the learning objectives. The class was then divided into groups. Student facilitators were used as tutors in one batch and staff members in another batch. A questionnaire was given to the students. The students preferred the PBL and found it a good experience. Despite the minimum resources and facilities available to apply PBL, results in the examination were as good as previous results. Retrieval of knowledge will be compared between PBL and lecture teaching. We think this experience should be extended to the whole basic sciences in the curriculum.

**Effectiveness of problem-based learning in teaching physiology to diploma nursing students at AKUSON**

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Problem-based learning (PBL) is one of the effective teaching strategies that motivate learners to understand physiological concepts at the Aga Khan University School of Nursing (AKUSON). At AKUSON, a number of programs are offered such as post-RN BSCN, generic BSCN, and diploma nursing. One of the important disciplines in the nursing curriculum is physiology, in which nurses require competency to work efficiently. A number of strategies are being used to teach physiology at AKUSON. This study was designed to explore the effectiveness of PBL in teaching physiology at AKUSON. The target group was year I students of the diploma nursing program. Sixty students were divided into two groups of thirty each randomly. One group received didactic instructions, and the other group was taught by the PBL approach. It was a comparative study, in which a quantitative/qualitative approach was utilized for collecting data and the relevant information. The instrument consisted of a pretest and a posttest. The tests were administered to both groups simultaneously. The results of the study show that 86% students of the PBL group scored >50% marks in the posttest, whereas about 29% of students who were given didactic teaching scored >50% marks. This shows that PBL is an effective method of teaching physiology to the diploma nursing students.

**Problem-based learning: the experience in Pakistan**

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Problem-based learning is one of the main curricular strategies employed by Ziauddin Medical University soon after its inception in 1996. During a term of about 8–12 weeks the students are given between 5 and 8 problems that are prepared by the faculty members, relevant to the course objectives. This study is based on one of the five problems given to batch III students of the University during their term on the respiratory system. Of the 64 students in the class, 61 (95%) indicated that the problem was relevant to the course objectives and scheduled appropriately. When asked about the time allocated for self-study and overall time given for the problem, all 64 students (100%) indicated that the time allocated was adequate. When questioned about the books they referred to, 49 (78%) students responded that they had consulted both clinical as well as basic medical science books. However, in the opinion of five of the six tutors (83.33%), the discussion in their group
primarily covered basic rather than clinical aspects of the subject under discussion.

Impact of basic scientists on physiology education

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Because of the difference in civic facilities in less developed rural towns of Sindh Province of Pakistan and its cosmopolitan city, Karachi, there is a deficiency of qualified basic scientists in rural based medical colleges. This study is based on data collected over 10 consecutive years in 3 medical colleges of Sindh Province of Pakistan. College A and college B are located in the rural and less developed areas of the province, whereas college C is located in metropolitan Karachi. In college A, there was not a single basic scientist available to teach physiology and in college B there was only one basic scientist, whereas in college C there were a considerable number of basic scientists actively involved in physiology teaching. College A admits about 350 students per year and college B admits 120 students, whereas college C admits about 425 students per year. The data reflect the pass percentage of the students belonging to each medical college mentioned above. The results were analyzed first at undergraduate levels, and then the records of postgraduate studies were also looked at. When the results were compared among all three medical colleges, the differences were insignificant (this may be because examination and evaluating systems exist there that involve the local teachers as decisive examiners), but the results at the postgraduate level showed that the success rate of the students belonging to the rural based medical colleges was much lower than the success rate of the students who belonged to college C. The success rate of this college was far greater than that of colleges A and B. The difference was highly significant ($P < 0.001$). It is therefore concluded that basic scientists deliver better and more comprehensive understanding in physiology education than the others.

Teaching physiology to engineering students

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Three cohorts of students from the Rehabilitation Engineering Center registered in the program of BSc (Honors) in Prosthetics and Orthodontic were involved in this study in three consecutive years. The high school academic background of these students varied, but most of them were strong in physical sciences. Out of the total student population of 75 studied, only about 10% had advanced level (AL) biology qualifications. The rest had no biology or human biology education at all. All the students had to pass the subject “General physiology” in their first-year curriculum before they were promoted to the second year. Examination results composed of written tests, and continuous assessment in practical work in physiology were used as indicators for comparing the performance between the two groups of students as well as between the engineering and paramedical students. The later group had exposure to AL biology before being admitted to the respective programs offered by the University. Our findings reveal that non-biology-supported engineering students had difficulties in (1) remembering the biological medical terms, (2) setting up experiments for in vivo studies, and (3) appreciating the integrative functions of the various body systems. Also, individual examination results were either excellent or well below the average, whereas the biology-supported groups had average performance. Nevertheless, all engineering students, as expected, could handle electrophysiology experiments more smoothly and were better at presenting the collected data graphically.

CHANGING PATTERNS OF COMPUTER USE AT THE AGA KHAN UNIVERSITY MEDICAL COLLEGE, KARACHI, PAKISTAN

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This cross-sectional survey investigated the undergraduate medical students’ familiarity with computers at the Aga Khan University. This study aimed to determine the need for support strategies to ensure that all...
medical graduates are capable of using computers for learning, professional practice, communication, and research. The study evaluated computer competencies of the class of 1997 and 1998 at graduation and for the class of 2003, one month from entry to the Medical College. For the latter, the questionnaire was modified to elicit similar information. The availability of computers in the Learning Resource Centre (LRC) from 1995 to 1998 was noted. For the classes of 1997, 1998, and 2003, 62.96%, 93.67%, and 24.3% students were using computers for word processing; 27.78%, 65.82%, and 23.7% for preparation of presentations; 5.56%, 39.24%, and 18.8% for literature search; and 40%, 44%, and 61% for E-mail, respectively. The number of students capable of using the computers has increased in the ensuing years. The study depicted that students are using computers more frequently for word processing, data analysis, presentations, and E-mail than for searching for additional information. The increased use of computers by the class of 2003 (new entrants) may be the result of a combination of home-acquired computer skills, availability of more computers in the LRC, and an increase in the number of instructional strategies requiring discovery of information.

Testing an objective-structured integrated practical examination (OSIPE)

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To assess students’ laboratory skills and abilities to integrate these with knowledge of basic and clinical sciences, a tool was designed at the Aga Khan University in 1997. This paper discusses the development, administration, and refinement of this tool. The model of the Objective-Structured Clinical Examination (OSCE) with multiple timed stations was adopted. Each station objectively tested a standard procedural skill and asked restricted response (with predetermined key) essay questions related to the interpretation of results obtained and application of the underlying concept to arrive at a conclusion. Two separate voluntary practice mock examination sessions were arranged at an interval of 12 weeks. Of the total 72 students of the third year, 61 participated in the first exam and 55 in the second. Those 47 students who took both examinations were included in this correlational study. The scores of OSIPE were correlated with the scores obtained in the total and viva component of the certifying examination and OSCE held at the end of the third year. The internal consistency (reliability) of the two examinations was determined. The mean scores of OSIPE I, OSIPE II, combined OSIPE I and II, certifying examination, and OSCE were 58 ± 19.8, 48.5 ± 15.7, 52.7 ± 14.1, 69.5 ± 8.7, and 67.0 ± 9.1, respectively. The internal consistency for the first OSIPE was 0.47; for the second examination it increased to 0.85. The internal reliability for the two OSIPEs combined was 0.71. Scores of OSIPE II and combined scores of OSIPE I and II showed a correlation of 0.413 and 0.445 (P = 0.004 and 0.002) with the scores of OSCE. However, a weak and nonsignificant correlation was found with the scores obtained in the certifying (comprehensive) and viva-voce examination. Verbal and written comments from the students illustrated that although they liked the form of the test, it was difficult. They also felt that there was a discrepancy between the overall instructional strategies and this test. Results indicate that there is a need to explore and refine this tool further before it can be considered for implementation in university examinations. The attributes that are being actually tested by this instrument should also be ascertained.

Discipline-based evaluation in an innovative curriculum

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The Faculty of Medicine at Omdurman Islamic University was established in 1990. It adopts problem-based, community-oriented medical education. Its curriculum is divided into three phases: phase I, Introduction to Medicine; phase II, Structure and Function (normal and abnormal) 80%, with Introduction to Clinical Sciences 20%; and phase III, Clinical Clerkships (80% clinical and 20% basics). [N.B. Community medicine is taught longitudinally throughout the three phases.] It was assumed that basic medical sciences (including physiology) can be assessed by the traditional way (separately) despite being taught in an integrated (PBL) way.

Method of assessment: At the end of each module, there is an integrated end-of-course examination. This
accounts for 30% of end-of-phase II examinations. At the end of phase II, there is a certifying exam (first MBBS). This is a discipline-based examination. Each of the five basic medical sciences is evaluated separately (MCQ’s, essays, OSPE and orals).

Results of first MBBS: This exam was held for two batches, and the results are shown below.

<table>
<thead>
<tr>
<th></th>
<th>Total No.</th>
<th>No. Passed</th>
<th>No. Failed</th>
<th>% Passed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Batch I</td>
<td>275</td>
<td>127</td>
<td>148</td>
<td>46.2</td>
</tr>
<tr>
<td>Batch II</td>
<td>673</td>
<td>384</td>
<td>289</td>
<td>57.2</td>
</tr>
<tr>
<td>Original Batch I</td>
<td>48</td>
<td>46</td>
<td>2</td>
<td>95.8</td>
</tr>
</tbody>
</table>

It seems that it is quite possible to assess the five basic medical sciences separately, although they are taught in an integrated way by applying PBL.

Conclusion: In this way our school could accommodate a traditional value to support innovation in medical education.

A critical analysis of proportionate learning and evaluation of physiology for undergraduates

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Teaching and examinations dominate the lives of medical students. Even in the innovative and forward-looking medical colleges across Pakistan, much of the good intention is neutralized by the powerful steering effect of a traditional assessment system. Examinations are indeed the true masters of the curriculum. The present study was conducted to analyze whether the proportionate weighting of teaching and evaluation of each system in physiology was accorded in the curriculum of the Army Medical College, Rawalpindi (Pakistan), from 1995 to 1997. Of a total of 450 hours allocated to learning physiology spread over an 18-month curriculum, 283 hours were specified for formal lectures, 67 hours for tutorials/seminars, and 100 hours for practical skills. In this way, 77.5% weighting to theory teaching and 22.5% weighting to learning experimental skills were accorded. In the evaluation, 62.5% weighting to assays/short answers, 7.5% weighting to performance of experiments, 20% weighting to oral/viva voce, 2.5% weighting to objective-structured practical examination (OSPE), and 7.5% weighting to continued assessment (internal evaluation) were accorded. The overall proportionate percent weighting of physiology learning during the preclinical years and evaluation of each system during the university examination is given as follows:

<table>
<thead>
<tr>
<th>System</th>
<th>% Learning Weight</th>
<th>% Evaluation Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell/neuromuscular</td>
<td>10.00</td>
<td>14.50</td>
</tr>
<tr>
<td>Hematopoietic system</td>
<td>12.50</td>
<td>11.75</td>
</tr>
<tr>
<td>Cardiopulmonary system</td>
<td>23.50</td>
<td>20.30</td>
</tr>
<tr>
<td>Renal and GI systems</td>
<td>11.00</td>
<td>15.05</td>
</tr>
<tr>
<td>CNS/sensory systems</td>
<td>23.50</td>
<td>19.45</td>
</tr>
<tr>
<td>Endocrine and reproduction</td>
<td>15.50</td>
<td>13.05</td>
</tr>
<tr>
<td>Physiology of unusual environments</td>
<td>4.00</td>
<td>5.90</td>
</tr>
<tr>
<td>Total</td>
<td>100.00</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Our present system depicts a reasonably good proportionate weighting accorded to physiology learning and evaluation. However, the existing examinations are not designed to stimulate critical self-learning. A very regular and hard working student may fail to give a good presentation for any reason at the annual examination. There is a need to lay more emphasis on OSPE and continued assessment and to render the theory papers more objective.

New assessment techniques to improve natural science physiology majors year marks

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Over a period of several years, the final year students’ marks were not considered to be a true reflection of their physiology knowledge. Possible reasons for the seemingly poor performance was that student unrest on the campus would invariably affect at least one of the four scheduled theory tests and/or the two practical tests. Students were therefore entering the final examination with a year mark that put them under considerable stress to attain the required 50% to attain a credit in Physiology 300. In an attempt to assist the students, it was decided to introduce new strategies that could be used to assess the students and allow them to sit for their final examinations with the knowledge that they were being accurately assessed.
The course was carefully examined, and the practical course in particular received a major change. Students were required to undertake a mini microtechnique project. Students would choose from a series of rabbit tissues and, after removing them from the animal, would work through the semester toward submitting a series of slides utilizing different stains to highlight certain aspects of the chosen tissue. Students were also given the opportunity to write two “optional essays” on selected theory topics. Five topics would be presented to the students, and the total number of registered students was divided by five to ensure that all essay topics would be covered. Topics were chosen randomly by drawing numbers from a hat. The average mark for the two essays comprised a portion of the practical year mark. Finally, it was decided to calculate the student’s theory year mark using an \( (n^2 - 1) \) principle, which amounted to the best three tests counting to calculate the theory year mark. After four years of the new system, the students showed a greater keenness toward their physiology studies. This was borne out by the fact that the optional essays very soon became compulsory from the students’ side as they saw them not only as a way toward attaining a better year mark but also as a means of achieving a greater understanding of the theory work. The average year mark of students increased substantially, which resulted in a better overall pass rate for the class based on the number of registered students. It did not, however, produce a greater number of distinction students, but rather the class average only increased marginally.

Rating system in estimation of students’ knowledge in The First Tashkent Medical Institute

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A rating system for the control of knowledge is an integral part of the Governmental Standard of Higher Education. In the First Tashkent Medical Institute it was introduced into the teaching process in 1993. During this time the rating system has annually been improved and has become a general practice, making great demands on students, and stimulating their cognitive abilities and desire for systematic preparation. The rating system avoided egalitarianism, increased the role of self-education, and created conditions for full realization of students’ abilities. The research was done with the second-year students at the Department of Normal Physiology. Rating of the department is 198 scores according to hours given for the subject. The level of students is estimated on every lesson (60% of rating) and at the end of every four sections during a year (40% of rating). Scores for every section are proportional to complexity and the number of hours. Total rating for four sections is a quantitative index of students’ progress in studies. Absence of the concluding examination makes students prepare for every lessons and increases their sense of responsibility. Analysis of results before (1990–1993) and after (1995–1998) introducing the rating system revealed significant progress in studies, from 82.5% to 98%, a survival rate of knowledge from 30–50% to 60–70%. The rating system increases the quality of the pedagogical process, decreases the number of absentees, and increases the level of knowledge.

Evaluation of a test to assess integrated learning

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Objective: To evaluate students’ performance on test questions developed for assessing the students’ ability to integrate knowledge.

Materials and methods: Questions requiring one best response to a descriptive scenario and testing the ability to integrate knowledge across disciplines were administered as a mock examination to students in the third and fifth (final) year at the end of certifying exams. Students’ performance and internal consistency of the tests were determined. Scores obtained in the mock examinations were correlated against mean scores in certifying examinations and in different subjects.

Results: The responses of 60 (88%) of the third-year students and 54 (91%) of the final year students were complete and included in the study. The difficulty
index of the integrated questions ranged from 26% to 75% and was higher than that of the certifying examinations. None of the integrated questions showed negative discrimination. Scores of the final year students in the mock test showed a weak correlation ($r = 0.33, P = 0.01$) with the certifying examination scores. The correlation was weaker for third-year students ($r = 0.23, P = 0.37$). For final year scores, the paired t-test for correlated means was significant ($P = 0.19$) as was also the correlation of integrated scores against individual disciplines (one-way ANOVA $F = 6.377; P = 0.01$). The internal consistency of the test was 0.69 for the final year, whereas it was 0.45 for certifying exams.

Conclusions: Students found integrated questions difficult. The improved integrating ability of final year students may have resulted from exposure to patients. As evaluation drives learning, appropriate tests of integration should be used in the assessment of students.