

There are still some limitations with regard to the microscopic image and the size; the direct reading of a slide also requires a high power connection such as ATM, and the costs of such high power lines are still considerable. However, technical developments occur quickly and will be able to overcome these shortcomings in the near future.

Conclusions

New communications technologies facilitate many tasks in the current work of pathologists. This includes education, routine diagnostic work and answering scientific questions and involve the following possibilities:

- i) General and surgical pathology can be taught in a more direct and fascinating way.
- ii) The exchange of experiences on histology, new technologies etc. is facilitated.
- iii) A second opinion can be achieved easily and quickly, thus leading to greater safety for the patient and physician.
- iv) New diagnostic standards can be widely and quickly distributed.
- v) All these improvements can be attained independent of geographical distance.

References

- wolf C, Petersen I, Dietel M. *Microscope remote control with an internet browser*. Anal Quant Cytol Histol 1998a; 20: 127-132.
- Wolf G, Petersen D, Dietel M et al. *Telemicroscopy via the Internet*. Nature 1998b; 391: 613.

New approaches to testing medical students

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Multiple-choice questions are widely used for testing knowledge of medical students in North America, while oral examinations and written, essay type examinations, remain the standard means of assessing students in Europe and other parts of the world influenced by the European approach to medical education. Each of these two modalities seem to offer some advantages and some disadvantages. Multiple-choice examinations are more suitable for simultaneous testing of large numbers of students, and are easier to standardize. On the other hand, individual oral or written examinations can be customized more easily and are thought to more accurately assess students' 'real' knowledge and understanding of concepts. Multiple choice questions often deal with minutia and by design, the answers are preselected by the examiner. Such questions favor recognition and are more suitable for testing knowledge of facts rather than concepts. These tests are considered by many educators to be far removed from real life situations in which the

practicing physician will not be given a preselected list of possible choices but rather complex problems that cannot be reduced to five choices. Oral examinations could, however, be rather subjective and the criteria could vary considerably from one examiner to another. The number of topics covered in a typical oral examination is small in comparison with the broad range of topics that can be included in a multiple-choice examination.

In an effort to retain some of the advantages of standard multiple-choice examinations but also expand their scope and introduce more flexibility in their application, we have explored new modalities of testing medical students. To provide data that such new testing methods give acceptable results, we have compared new testing formats known as "extended matching" and open-ended "uncued questions" with multiple-choice questions. We have also introduced computer-based testing and have devised new ways of testing students' knowledge of microscopic and macroscopic pathology.

Over a period of 10 years we performed a series of studies at Jefferson Medical College in Philadelphia, and the University of Kansas School of Medicine, Kansas City, and have shown that new modalities of student testing can increase the psychometric validity and reproducibility of examinations. Examinations based on uncued questions and extended matching proved to be superior to those based on multiple-choice questions.

The popularity of new testing modalities varied considerably among students. Most students were opposed to open-ended uncued questions, which were, however, considered by the faculty to reflect best the "real knowledge". Extended matching questions and computer-based testing were received well by students of both medical schools.

We have also noticed a change in students' approach to studying pathology and their ability to integrate their knowledge of this discipline with other basic science subjects. Computer-based examinations stimulated students to actively use their computers during the course and have increased their computer literacy and enthusiasm for informatics and use of computers in medicine.

The response of the faculty was mixed, but over a period of time most instructors became familiar with constructing questions in the new formats and became more enthusiastic about the novel testing system. New computer-based courses were developed and with some modifications, one of them was transferred to the University of Zagreb School of Medicine, Zagreb, Croatia.

The results gained by introducing new testing modalities have shown that the testing methods currently used for assessing students' knowledge can be improved. The introduction of new testing methods could have a positive effect on students' approach to studying pathology.

References

- Damjanov I, Fenderson BA, veloski JJ et al. *Testing of medical students with open-ended, uncued questions*. Hum Pathol 1995; 26: 362-365.
- Dominis M, Nola M, Jukic S et al. *Computer-based teaching of pathology at the University of Zagreb School of Medicine*. Groat Med J (in press).
- Dominis M, Nola M, Jukic Set al. *Computer-based teaching of pathology at the University of Zagreb School of Medicine*. Groat Med J (in press).
- Fenderson BA, Damjanov I, Robeson MR et al. *The virtues of extended matching and uncued tests as alternative for multiple choice questions*. Hum Pathol 1997; 26: 526-532.