EDITORIAL

MULTIMEDIA ASSESSMENT OF REALISTIC KNOWLEDGE AND SKILLS (MARKS)

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'Assessment drives learning' is a famous adage attributed to the great medical educationist Professor George E Miller (1919-98)[1]. Assessment has a deep impact on student behavior and the learning strategies they adopt[2]. Hence, the covert but powerful potential of assessment to mold student behavior needs to be exploited in a strategic way[3]. Today's student is tech-savvy and feels more comfortable while using computer for educational purposes[4]. Although, computers are being used in teaching and learning extensively, however, their use in examination, as yet, is limited[5]. Modern education has to combine with modern technology to come up with best results[6]. Computer based testing (CBT) is an emerging technology that is slowly replacing the traditional paper and pen-based testing due to its multiple advantages and the COVID-19 pandemic has fostered this phenomenon. Computer based testing refers to presenting assessment material to students through computers instead of paper and pen[7]. It offers a unique opportunity to link observation and interpretation using multimedia-based questions which require complex analytical reasoning and critical thinking skills[8].

Considering the tremendous influence of assessment on student learning behavior and undeniable role of computers in modern education, Principal Army Medical College envisioned a specialized computer-based testing system with the capacity to deliver multimedia based questions. At present, all the multiple-choice question (MCQ) tests whether computer based or paper and pen-based include text-based questions only. This puts a large restriction on the assessment capacity of MCQs. Inclusion of multimedia-based questions like images, audio and video moves the MCQ testing up the ladder enhancing its utility beyond the simple text-based MCQs. The idea was formally presented to higher offices including National University Medical Sciences (NUMS) and was much appreciated and approved. Principal assigned the project to Information Technology (IT) Department of Army Medical College. The project was highly challenging as it was totally new and one of its kind in the country. Lockdown due to COVID-19 pandemic added fuel to the fire. However, with the grace of Allah, within about four months the dream of multimedia-based MCQ testing system became a reality. Army Medical College used its own resources and completed the project in about one third the cost that would otherwise incur if the project would be outsourced. The system was named as 'Multimedia Assessment of Realistic Knowledge and Skills (MARKS)' considering the important role of multimedia-based questions. The rationale of instituting MARKS at Army Medical Collegeis as under.

1. **Multimedia-based questions to assess practicality of knowledge:** A unique feature of MARKS is the use of multimedia-based questions like video, audio and graphics in addition to conventional text-based questions. This makes MARKS different from other such systems which use typical text-based multiple-choice questions only. Addition of multimedia-based questions is a revolutionary step in medical examination which enables the institution to assess higher order cognitive skills involving some part of the practical component of examination. Practicality of knowledge is assessed by adding multimedia-based questions for short cases in clinical sciences whereas interpretation of experimental results in Basic Medical Sciences[9]. The MARKS has capacity to conduct unobserved 'Objective Structured Practical Examination' (OSPE) and 'Objective Structured Clinical Examinations' (OSCE)[10] or 'Task-Oriented Assessment of Clinical Skills' (TOACS) using multimedia-based questions.

2. **Paper free environment:** MARKS replaces all kind of stationery with computers. A question paper comprising 25 MCQs generally requires 2 pages, making a total of 400 pages for a class of 200 students. More number of MCQs (as is the plan of the university) and/or a greater number of scenario-based MCQs will need even more pages. Apart from the question paper, 200 OMR (Optical Marks Recognition) sheets are also required for the complete class. This makes a huge stuff of papers for each examination.
3. **Cost effectiveness:** A lot of examinations are conducted for 9 classes of MBBS and BDS each year at Army Medical College, consuming a lot of stationery. MARKS will reduce the huge cost that is incurred on stationery each year. The cost incurred in setting up experimental models and clinical scenarios in TOACS, OSCE and short cases is also substantially reduced.
4. **Student friendly:** The MARKS software is self-explanatory and user friendly. Just clicking the correct option on tablet computer is far easy as compared to blackening the small circles on OMR sheet. Erasing the already blackened option (if a student wants to change the answer) takes time and creates fear in student as an option which cannot be erased properly may be read by OMR machine along with blackened option making the question null and void. There is no such issue in MARKS, just one click will change the option.

   Students access the question paper by logging into their accounts using the tablet computers provided by Army Medical College. The Graphical User Interface (GUI) is simple and easy to understand where number of all the questions keep displaying in red colour all the times. Number of attempted questions becomes green in colour whereas that of unattempted remains red. Students may skip a question and move to the next questions. They have the option to come back to the skipped question anytime by clicking its number which appears in red. Students even have the option to come back to attempted question, review it and change the answer. Students have the option to attempt any question by clicking on its number, if they don't want to follow the sequence. A timer keeps displaying on the top of screen showing how much time is left. The paper is automatically submitted at completion time if the student did not click on 'submit paper' before that. Result along with post exam item analysis is prepared instantly after the paper is submitted.
5. **Ease of examination:** MARKS will enhance ease of examination not only for students as mentioned above but also for the institution/ invigilating staff. The process of distributing question papers and OMR sheets to students and then collecting back the same and delivering them to examination branch will be abolished. At 'finish time' the paper will be submitted automatically and the examination will be over. There will be no scene of invigilator snatching the paper from student and the student resisting. Instead of keeping a sharp eye on students and keep roaming around them, the main purpose of invigilating staff will become to facilitate them in case they face any technical or other problem. MARKS will bring a paradigm shift regarding conduct of examination for both, the students and the institution. At the end of examination, all the invigilating staff will leave examination hall empty handed instead of holding bundles of papers, stationery and other stuff used for the examination.
6. **Cheating:** Questions and options, both, are shuffled for each student by computer automatically, leaving no room for cheating. The shuffling of both, the questions and the options is equivalent to each student having a different question, making cheating almost impossible. All the programs, other than, MARKS are removed or blocked in the tablets

and students cannot use the tablets in any way other than using for examination.

7. **Less staff required for invigilation:** As no paper and almost no cheating is involved, hence less staff is required for invigilation. Even a single person may be able to conduct the exam for the whole class.
8. **Automatic and quick result processing:** Result is prepared immediately after the students submit the paper; however, it may be declared as per the policy of the institution.
9. **Post exam item analysis:** Post exam analysis is an essential part of any examination especially those based upon MCQs. Post exam item analysis is carried out by MARKS immediately after the students submit their paper. The analysis report is used to improve quality of the MCQs.
10. **Training of students:** Various international medical institutions including the College of Physicians and Surgeons, Pakistan (CPSP) are using online examination system[11,12]. Use of MARKS will make Army Medical College students confident for later use of such online examinations.

Requirements: The three main requirements for launching the MARKS are hardware, software and examination hall. We are highly indebted to NUMS for providing MARKS software which has been extensively customized as per the needs of Army Medical College. The existing examination hall of Army Medical College, 'Ejaz Hall' is used for setting up the hardware. Hardware for MARKS requires a server, a switch, access points and tablets computers (equal to the number of students). A dedicated server located within the examination hall in a separate 'server room' is used to conduct MARKS. The server room acts as 'strong-room' and is under the custody of examination branch. A separate 'moderation/secrecy room' is also established within the examination hall where question papers are added into the system.

Concluding Remarks: Army Medical College is pioneer in launching the MARKS in the country. Inclusion of multimedia-based questions in MARKS has added a new dimension to MCQ testing with enhanced usability. This is especially relevant to the assessment of medical students where multimedia-based MCQs can be used as 'simulations' as an alternative to real clinical scenarios. This would certainly have a profound and long-lasting impact on student learning behavior leading to better outcomes. MARKS can be considered a wonderful blend of medical education and technological advancements. In this digital era, use of information technology in educational processes is essential otherwise today's student will remain deprived of the fruition of digital revolution.

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