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Original article

DIDACTIC APPROACHES TO PRECLINICAL E-TESTING FOR MEDICAL STUDENTS

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ABSTRACT:

There are three specific and key unknowns to e-testing didactics (e-testing) that distinguish it from traditional test didactics and must be addressed in the preparation of electronic tests: (1) does it test the one it needs to test (security), (2) does it test what it needs to test (validity), and (3) does it use the most appropriate tools (design). E-test didactics emerges as a distinct field combining classical test theory with contemporary digital methodologies. It entails the science of theoretical and practical teaching of assessment forms supported by e-learning platforms and test-generation software, with emphasis on objective, valid, and standardized procedures. Instructors must be trained to align assessment content with learning objectives, utilize platform functionalities effectively, and construct test items that support reliable evaluation of knowledge and skills. Our case study at Medical University – Varna illustrates the benefits and challenges of implementing e-testing in preclinical disciplines. The transition from conventional to digital assessment revealed discrepancies between teaching content and assessment tools, arising primarily from mismatches in content mapping, constraints imposed by platform functionalities, and the demand for systematic didactic training when switching from traditional paper-based tests to their digital counterparts. Despite that the study highlights the advantages of e-assessment for students and faculty: increased efficiency, immediate feedback, greater objectivity in grading, and analytical insight through digital tracking and data analysis. Common task types used in preclinical e-testing, such as multiple-choice, matching, and cloze tests, demonstrate how e-tests can measure not only factual recall but also application and comprehension. The findings suggest that e-testing, when pedagogically grounded, enhances assessment quality and supports the evolving needs of higher education.

Keywords: E-assessment, E-didactics, Test items, Quality criteria,

INTRODUCTION

Digitalization gradually encompasses all stages of higher education and shifts away any analogous process if possible. Assessment, evaluation, and certification methods are essential to the educational process and lag behind this development. The invasion of e-testing is in direct relation to the democratization of the universities, the avalanche of students' numbers in all higher education institutions, as well as to the modernization of the distance learning programmes, and the expansion of MOOC courses. Within such a context, the implementation of standardized structure and content in e-testing may become an effective prerequisite in comparison to analogous test formats.

The increasing importance of electronic examinations for educational institutions and all aspects of community life reflects the need for a theoretical and objective evaluation, as well as a detailed investigation of this phenomenon in the form of a new scientific discipline – the didactics of electronic testing as a logical continuation of test methodology and didactics.

Specifics of e-testing didactics

When discussing and conducting electronic exams in higher education institutions, we often see absurd contradictions between the wishes and perceptions of teachers regarding the content and format of the relevant electronic exam and the capabilities and characteristics of the electronic platform and examination software. In other words, the question that arises is whether the planned learning objectives (learners' knowledge and skills) can be adequately tested with the tools of electronic test platforms and various types of tests [1]. To address this challenge in practice, specific technical and didactic measures were implemented to validate security and reduce validity risks such as the use of Responus LockDown and Safe Exam Browsers for remote examinations; randomization of questions; setting strict time limits for completing tests; and identity-preserving procedures integrated into the plarform workflow.

Therefore, we believe that an independent discipline that links learning objectives (based on teaching content) with the specifics of e-testing is emerging, i.e.

e-testing didactics as part of the more general test methodology and didactics.

The computer-based exam is a test in essence – on the one hand, it replaces the widely used paper-based examinations, eliminating many of their shortcomings, and on the other hand – it adheres to the requirements and conventions of the classical test theory.

Thus, e-testing didactics is viewed as a point of intersection of examination didactics and classical test theory. The suggested definition of e-testing didactics states that the science of theoretical and practical teaching of testing methods and evaluation forms, facilitated by electronic and communication technologies and in accordance with the principles of the classical test theory, is characterized by a maximum degree of objectivity, methodological validity and level of standardization.

Such a definition is broad enough to encompass the study, theoretical summary and teaching methods for conducting all examination formats based on and facilitated by digital technologies (training platforms, exam software or task and test generation programs), e-assessment by electronic devices, regardless of the circumstances of conduct (online, offline, remote, attendance).

Lecturers in the various specialized disciplines (mathematics, history, physics, anatomy, etc.) are the target group of this scientific discipline, as they are in the role of both teachers and examiners. E-test didactics deals with educational measurement and assessment, i.e. with computer-based/electronic tests incorporated into the learning process and exams as independent components of it. Therefore, an electronic exam can be taken after a traditionally attended in-person training course, as is the case with medical specialties.

MATERIALS AND METHODS:

Advantages of e-testing and assessment

Definitions of e-assessment fall into two categories – the first focuses on the process of conducting the exam, and the second – on the didactic application spectrum.

We may refer to the commonly cited general definition of the UK organization JISC (Joint Information Systems Committee) for digital solutions in education and research that e-assessment ensures *end-to-end* e-testing, whereby information and communication technologies are used both for conducting the exam and for registering the results [2].

Defining this type of assessment gradually encompasses the didactic aspect that comes to the fore as e-testing. Å-assessment is interpreted as the use of digital technologies to create, distribute and assess formative, summative or diagnostic tests, analyze the learning outcomes achieved by using a computer, laptop, tablet or another electronic device [3].

The definition takes into account the electronic nature of the process, but the didactic application of electronic testing is also reconsidered, based on the broad range of meaning of the term E-assessment. It also describes the areas of application of electronic assessment – for diagnostic, formative and summative purposes [4], i.e. for selection by means of entrance tests, for monitoring and managing knowledge acquisition in the course of given training, for final examination, as well as for comprehensive assessment of students. Summarizing the two approaches, Shrivastava and Shrivastava emphasize that electronic assessment encompasses a comprehensive process – from defining learning outcomes to implementing evaluation tools, documenting performance, and offering structured feedback — particularly vital in digital learning environments [5]. On the basis of this definition, we can also formulate the different characteristics of electronic assessment:

- conducted entirely using digital technologies;
- coordinated with predefined learning objectives;
- encompassing the entire process of evaluation (incl. documenting and providing feedback).

It is designed for:

- selection and entrance level determination
- monitoring the current level of subject matter acquisition
- establishing an end result from a completed training.

The history of the exam as an element of training together with theoretical generalizations and empirical studies clearly indicate that the trend naturally leads to the establishment of e-testing as the primary method for conducting diagnostic, formative and summative exams in tertiary educational institutions, as it automatically eliminates all sources of errors and distortion of results [6].

E-assessment encompasses the use of digital technologies to create, distribute, and evaluate formative, summative and diagnostic tests. In operationalizing these principles at MU-Varna, two platforms – Blackboard and Webex – are used as they allow secure test delivery, integration of multimedia and flexible task design. Blackboard offers the full spectre of e-assessment functions, including question banks, automated scoring, randomization, and detailed analytics, while Webex supports synchronous proctoring and interaction during remore assessments.

Quality criteria for electronic tests

The criteria for analyzing the quality of electronic tests are similar to those for traditional exams and largely correspond to the classical test theory. Compliance with these criteria is mandatory during test development, conducting a test and subsequent assessment. In spite of some differences in theoretical developments, they all may be combined around three main quality criteria of an electronic test – reliability, validity and objectivity [7].

Reliability of a given test (including an electronic test) is a characteristic that indicates the degree of con-

sistency of the test results according to TQC. The reliability analysis provides information on how precisely and securely an assessment scale reflects an indicator, i.e. predefined learning objectives.

Validity is the most important criterion for the quality of a given test as it is aimed most explicitly at the meaningful benchmark, which, on the other hand, lends itself least well to monitoring. The validity of the test or exam is defined as a characteristic indicating the degree to which a given test actually measures what it is supposed to measure, i.e. the test is valid when it measures the indicator it should measure, and not another one [7].

Objectivity of a given exam is guaranteed when different examiners receive the same results, and the assessment depends not on intersubjective influences, but solely on the examinee's answers. Thus, the objectivity criterion becomes a measure for the successful standardization of the overall examination process.

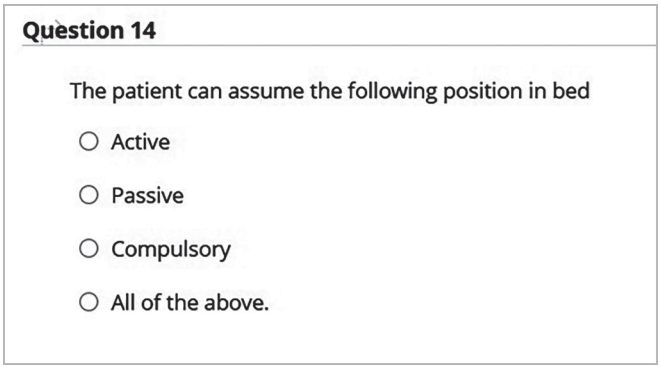
RESULTS:

Experience of electronic exams in preclinical disciplines at MU – Varna

Assessment tasks in higher education are a reflection of a diverse set of needs for a variety of stakeholders, including students, lecturers, institutions and prospective employers. The design of a meaningful task for an electronic exam is a time-consuming process and involves "planning, discussion, consensus building, reflection, measurement, analysis and improvement based on the data and artifacts collected for the educational objective" [8]. To ensure that the student taking the test is the intended one, LockDown Browser or Safe Exam Browser (for remote settings) were incorporated, as well strategies such as automatic randomizations of questions, use of distractors, and time-restricted tasks to reduce unauthorized collaboration.

Multiple choice questions (MCQs) are the most popular tasks when preparing and implementing electronic exams because, from a purely technical point of view, these are the easiest to produce and program in the educational platform, and at the same time, they are applicable in almost all disciplines. Despite the numerous criticisms claiming that they oversimplify the examination process, reducing it to mere reproduction of facts, studies show that MCQs tasks provide many options for a thorough examination of skills, knowledge transfer, as well as combinability. Most disciplines at Medical University – Varna use predominantly the conventional MCQs, for example, tests consisting of 25 multiple-choice-tasks each, are designed for Bulgarian students and the students in the English-taught program in Propaedeutic of Internal Diseases, which obviously test factual (declarative) knowledge. (fig. 1.)

Fig. 1. A task from the Propaedeutic of internal diseases test (MU-Varna)



Twenty four test banks with a total of 389 questions have been created for the discipline of Anatomy, covering all body systems (cardiovascular, peripheral nervous system, etc.) as a source for generating various theoretical electronic exams, which always comprise 18 questions, 15 of which are MCQ. (fig. 2., fig. 3.)

Fig. 2. Types of MCQs in a theoretical and practical exam in Anatomy

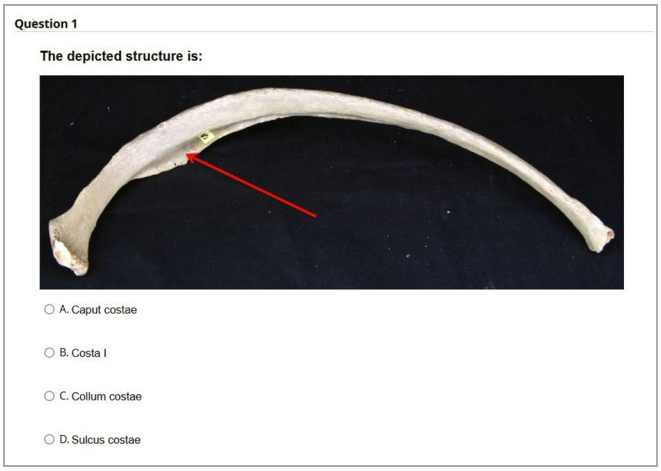
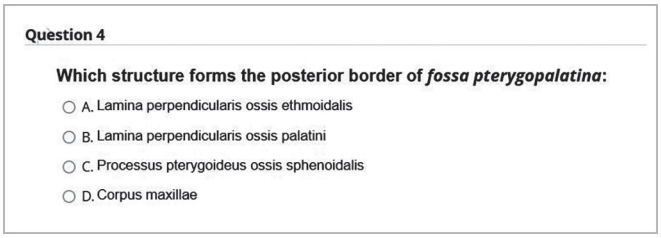


Fig. 3. Types of MCQs in a theoretical and practical exam in Anatomy



At the practical exam, only 60 MCQ-type tasks are used, but this time an image is inserted in the formulation of the task, and in this case, we believe that this is

not just a reproduction, but also an application of the gained knowledge and skills. As seen in the examples, the possible answers are 4, which reduces the possibility of guessing the answers, and in a test consisting of 60 tasks (Anatomy), the chance of successfully passing the test with guesswork is negligibly small. The dependence of guessing on the number of alternative answers is also included in the instructions for conducting MCQ tests.

The second most prevalent task type in electronic tests, especially in language teaching, is matching or correspondence tasks. The test taker is required to match different terms, images or other symbols to each other or to a definition or a description. In electronic testing, this can be performed in two ways – either by using the drag and drop function, where items are moved into target fields with the help of the mouse or by making a choice from a drop-down menu located near the target part of the terms (fig. 4., fig. 5.), image or text or as in the Blackboard platform – some of the items are assigned numbers or letters, which should be selected from a drop-down menu to each of the other items.

Fig. 4. Matching task with selection of a number from a drop-down menu

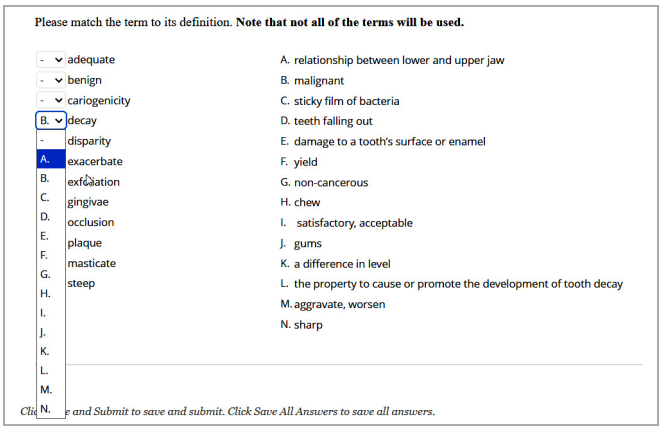
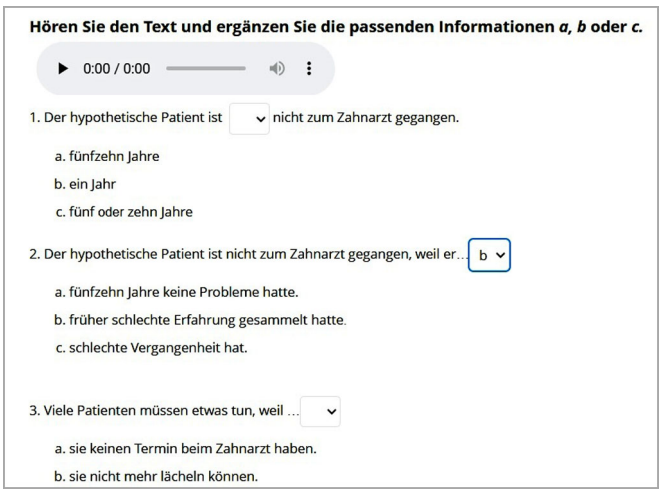


Fig. 5. Listening task with a drop-down answer menu



In electronic tests, conducted at MU-Varna, matching tasks are not equally distributed. Anatomy tests contain mostly ÌÑQ tasks (15 out of 18 tasks in the theoretical part) and 1/6 tasks with matching answers (3 out of 18), while in specialized foreign language tests – English, German and Bulgarian for foreign students, they amount to almost half of the test questions.

Like every constructed response task, matching or correspondence tasks can be used to measure knowledge (of facts, terms, descriptions, etc.), comprehension of a given topic (especially useful in foreign language teaching to test reading and listening comprehension skills) and application of the acquired knowledge in a new context (e.g. specialized vocabulary) but cannot be used to check creative attitude to the covered material (analysis, synthesis and evaluation), and writing an original text on a given topic (portfolio or essay-writing tasks).

Cloze-text tasks are used very often, both in traditional paper-based exams and in electronic foreign language exams. In essence, these tasks can be open-ended (the test taker writes a word or phrase into the blank field) and tasks with a structured response, insofar as they can contain a drop-down menu from which a word or phrase to be chosen or drag and drop function can be used **(fig. 6.).** This task type can be selected for measuring content acquisition, such as facts and other information, as well as knowledge of grammatical rules and items, depending on the construct and other learning objectives when achievement is to be tested.

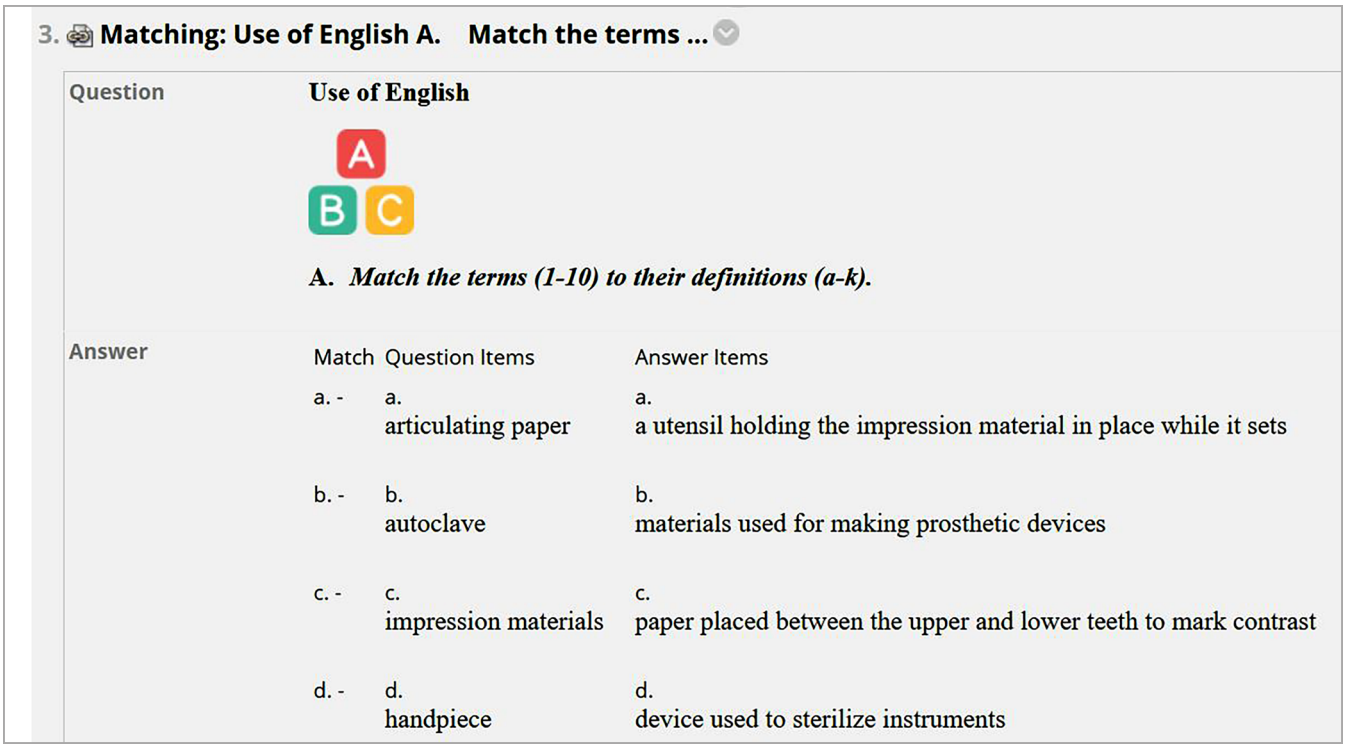
As seen from the example, the largest variety of tasks can be found in Bulgarian, Latin, English and German tests because in these subjects the examination is complex in nature – it assesses knowledge, skills and competences in the form of oral and written communication skills.

DISCUSSION:

Advantages for students

Initially, students demonstrated mixed reactions to electronic exams, especially if an insufficient number of tests had been piloted, which could have given them the opportunity to adapt to the new format. However, they gradually began to value the advantages an electronic exam offered, because it corresponded to their customary approach to learning, searching for information, communicating, provision of sufficient materials for self-preparation, including sample tests, exercises and resources in various media formats [9]. The instructions were clear and easy to understand, and allowed them to manage the examination procedure independently within the time set by the teacher. It also proved stimulating for students who were better prepared because it minimized the possibility of fraud and cheating and provided immediate access to the results after the end of the exam, and ensured the utmost objectivity of the grading process. In November

Fig. 6. Matching terms and definitions in English for Dentistry



3. Matching: Use of English A. Match the terms ...

Question

Use of English

A. ***Match the terms (1-10) to their definitions (a-k).***

Answer

Match	Question Items	Answer Items
a. -	a. articulating paper	a. a utensil holding the impression material in place while it sets
b. -	b. autoclave	b. materials used for making prosthetic devices
c. -	c. impression materials	c. paper placed between the upper and lower teeth to mark contrast
d. -	d. handpiece	d. device used to sterilize instruments

2025, a survey of 200 MU-Varna students evaluated satisfaction and practical use of the Blackboard platform. Over 60% of the respondents provided high ratings for its flexibility, convenience, material quality, and course organization. Average ratings (24-25%) reflected differences between disciplines and insctructional practices. Low ratings (11-15%) were mostly associated with local and individual difficulties rather than system drawbacks. These data confirm that Blackboard effectively supports the learning process, while also indicating the need for continued harmonization of digital materials across disciplines.

Advantages for lecturers

Electronic testing via a learning platform or specialized testing software offers a number of advantages for examiners. The benefits are related to all three phases of the exam – preparation, conduct and processing of results. Recent studies emphasize the importance of capacity building and structured training programs aimed at equipping lecturers with the necessary competencies for online assessment [5]. Electronic tests require lengthy preparation to create the largest possible number of questions, but – once created – question banks can be used repeatedly, and their contents constantly supplemented and expanded. In constructing the electronic tests, lecturers have at their disposal the greatest possible range of tools for creating tasks and additional digital materials (video, audio, text, photographs, charts, etc.) for innovative design of the tests, so that they can test not only knowledge but also competences for dynamic problem solving that goes beyond the capacity of traditional written exams. Electronic tests allow lecturers to set a random order for questions and answers every time the test is attempted, resulting in the creation of a unique combination of questions for every test taker.

In processing the results, some advantages over traditional exams are also found because speed, accuracy and objectivity of marking are guaranteed. For tasks with predefined correct answers (e.g., single-best-answer MCQs, matching items with fixed keys), the scoring process is fully automated. In contrast, open-ended or written tasks require manual grading and an average time for correction and individualized feedback of approximately 15 minutes per student. There are no differences between grades assigned by different examiners, which increases the quality of the examination process as a whole. Results can be transferred, archived quickly and easily, and their electronic format allows for statistical processing and quick evaluation of the examination procedure.

Advantages and disadvantages for administrative bodies

It is still not possible to say that the administrations of the various deans' offices can derive special benefits from the mass influx of electronic exams in the educational process. In the present paper, we discussed specifically the experience of Medical University – Varna and assumed that in other universities, things are perceived differently. The added value of the implementation of electronic testing for the administration is the possibility of immediate and automatic (or controlled) submission of test results to the deans' offices and their availability in

the electronic profiles of individual students, and hence available as information in the student portal, where all students can check for exam results. Such an organization would make it possible to automatically generate statistics concerning the course of the educational process in the institution. Thus, electronic assessment saves time, provides accurate and reliable results not only for lecturers and students but also for the university administration.

CONCLUSION:

The advantages of electronic assessment are visible and tangible for both faculty and students, but their didactic validity and accuracy leave room for improvement and variety. Security and validity safeguards such as Safe Exam Browser and LockDown Browser, randomization procedures and time-limited tasks already strengthen the reliability of digital exams, yet systematic training for university lecturers on how to produce a didactically correct, valid and reliable electronic tests remains essential. It is especially important for educators who design tests in their subject fields to take into account the interrelation between learning objectives, the electronic exam format and the provided training to ensure that the final construct is didactically grounded and effective.

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