



E-Learning and E-Assessment: Two Big Challenges of Medical Education Management in Romania

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Abstract: Background – digitalization in eastern European medical education is a stringent need of teaching and assessment processes, which must be updated to challenges continuously launched by medical students. In this context, our university implemented an e-learning and e-assessment system in histology, a preclinical education subject. Aim – to evaluate the impact of replacing a classic learning and assessment methods with a completely digitized one. Methodology – the new system impact on students' skills and teacher's performance, was evaluated by using an opinion pool questionnaire including as assessment criteria system compliance, student-teacher interaction, online access improvement and new facilities regarding e-assessment and time management was performed. Results – "computer gaming" was delightful for students. Management of information's given to students was improved by a higher standardization and this, helped them to pass evaluations easier. Better stress management of examination induced the increase of attendance to first presentation. Graduation percentage and students' confidence in the accuracy of the exam results were improved. Time for evaluation was significantly reduced giving to teachers the opportunity for a better management of their time dedicated to research or academic development. Teaching and exam module software was periodically updated, being adapted to our curriculum. Conclusions – e-learning and e-assessment had a quick positive impact on students and teacher's despite of controversial issues which commonly come with any change.

Keywords: e-learning; e-assessment; exam management; assessment.

JEL: I21, I23

E-izobraževanje in e-ocenjevanje: dva velika izziva upravljanja zdravstvenega izobraževanja v Romuniji

Povzetek: Ozadje – digitalizacija v vzhodnoevropskem medicinskem izobraževanju je temeljna potreba v procesih poučevanja in ocenjevanja, ki ju je treba posodobiti. V tem okviru je naša univerza uvedla sistem e-učenja in e-ocenjevanje v histologiji, ki je predklinični

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predmet izobraževanja. Namen – oceniti učinek zamenjave tradicionalnih metod učenja in ocenjevanja s popolnoma digitaliziranimi. Metodologija – nov sistemski vpliv na veščine študentov in uspešnost učitelja je bil ovrednoten z uporabo vprašalnika, ki je vključeval skladnost sistema za ocenjevalne kriterije, interakcijo med študentom in učiteljem, izboljšanje dostopa do spleta in nove pripomočke glede e-ocenjevanja in upravljanja s časom. Rezultati – “računalniško igranje” je bilo za študente navdušujoče. Upravljanje z informacijami, ponujenih študentom, je izboljšala višja standardizacija, kar jim je pomagalo pri lažji presoji ocen. Boljše obvladovanje stresa pri izpitu je povečalo udeležbo na prvi predstavitvi. Izboljšana sta bila odstotek dokončanja predmeta in zaupanje študentov v natančnost rezultatov izpita. Čas za evalvacijo je bil znatno zmanjšan, kar je učiteljem omogočilo boljše upravljanje njihovega časa, namenjenega raziskovanju ali akademskemu razvoju. Programska oprema za učni in izpitni modul se je sproti posodabljala in se prilagajala učnemu načrtu. Sklepi – e-učenje in e-ocenjevanje sta hitro pozitivno vplivala na študente in učitelje, kljub vprašanjem, ki se pogosto pojavljajo s kakršno koli spremembo.

Ključne besede: e-izobraževanje; e-ocenjevanje; upravljanje izpitov; ocenjevanje.

JEL: I21, I23

1. Introduction

Eastern and Western Europe strongly differ not only by geographical and political issues but also regarding medical education management. During the last 20 years, a lot of efforts were done to change medical curricula in Romania (Muresan *et al.*, 2019). This was really needed for an easier recognition of our curricula as being equivalent to Western Europe but, unfortunately no significant improvement of teaching, learning and evaluation tools has been reported.

Competency based medical education considers that basic sciences, must be improved as a support for future clinical, intellectual and research abilities of doctors (Banerjee *et al.*, 2018).

Students from the present are called generations-Y medical students since electronic devices are one of the most important part of their lives and communication between students and teachers was significantly improved by using them. Medical students from preclinical years preferred to use social media apps as You Tube or WhatsApp as an effective tool for dissemination of lectures and thus a new wave called „twitterism” seems to be developed during last years between students. They are interested to use new learning tools which are modern and less time consuming and to facilitate comprehensive and deeper understanding. A specific social media apps for undergraduate medical education does not exist in this moment but this is imperative to appear (Banerjee *et al.*, 2018).

Generations-Y medical students ask for easy and fair assessment methods and they are interested to obtain better and more objective results. These students’ requests come in the context of several economic and political challenges including the increase of „medical migration” to the Western part of the Europe. This change demand them to become well-trained future doctors by using, during their medical education of the latest teaching and assessment methods.

The gap created by the use of old methods and the demands of students who need and ask for modern methods in their medical training during undergraduate training must be bridged by changing not only methods and techniques but also by changes in the mentality and psychology of both professors and students (Baumann *et al.*, 2011).

Few Romanian universities were receptive to the change, most probably due to the Eastern European mentality, customs, and social media. Unfortunately, not all teachers are opened to such a change and thus the gaps between generations were sometimes deeper than we expected.

Thus, to propose the digitalization of medical education tools represents a big challenge for Romanian medical universities.

In Romania, preclinical medicine includes histology, pathology and cell biology subjects that usually require microscopes and glass slides. The use of microscope requires some special abilities and not all students are able to work properly with it. Moreover, when the students leave conventional histology lab room, they are limited regarding the opportunities to review the data given to them by the teachers. The consequence is an inadequate preparation and subsequently an increased level of anxiety at the exam followed by a lower rate of success. The solution: for the generation of students today, the option of using a computer that has all the functions of a microscope is extremely attractive.

A complete digitalized e-learning and e-assessment system was implemented in the Department of Histology from Victor Babes University of Medicine and Pharmacy Timisoara, Romania starting from 2017. This implies the replacement of classical microscopes with computers having installed a software which accurately reproduce all features of classical microscopes and, moreover giving more facilities regarding the teaching and learning methods as a digital scanned slides library able to be access from worldwide. The new system includes performant tools for student's assessment, also.

The implementation of this new system had a strong impact on both students and professors. The analysis of this impact from both students and teachers' point of view represents the aim of the present paper which propose to highlight the challenges impact given by this radical change of teaching, learning and assessment in histology during last three years.

2. Methods

2.1. E-learning and e-assessment system description

We started to implement the new teaching, learning and evaluation system in September 2017 by the use of e-School System including a Slide Scanner, a Virtual Microscopy Module for teaching and students self-training and an Exam Module (version 1) for students' evaluation (3DHitech, Budapest, Hungary). The system was composed of two management computers (for administrators and moderators use only). Conventional microscopes were replaced by 60 computers which have installed a special teaching and evaluation software and a special Web Slides Library called Case Center where the scanned images of our glass slides were stored Figure 1a, b). Also, the new system includes two servers: a highly secured one for internal use exclusively and a second one, which can be accessed anytime, anywhere from any location in the world for self-study. A multidisciplinary team is required including professors with different levels of accessibility of the system (administrators, moderators, tutors) and two engineers for administrative purposes and for the technical assistance to the system. We have settled accounts for: three administrators (having full access to all three modules of the system), moderators and tutors (partial access, able to see and use the scanned slides and to make annotations but with no access to the exam module), students (restricted access, able to see and review the slides but not able to make any changes in the system). Three administrators were designated, one for security issues, one for technical issues and maintenance and the third one (a professor) responsible for the quality of the exam questions as well as the exam schedule and organization.

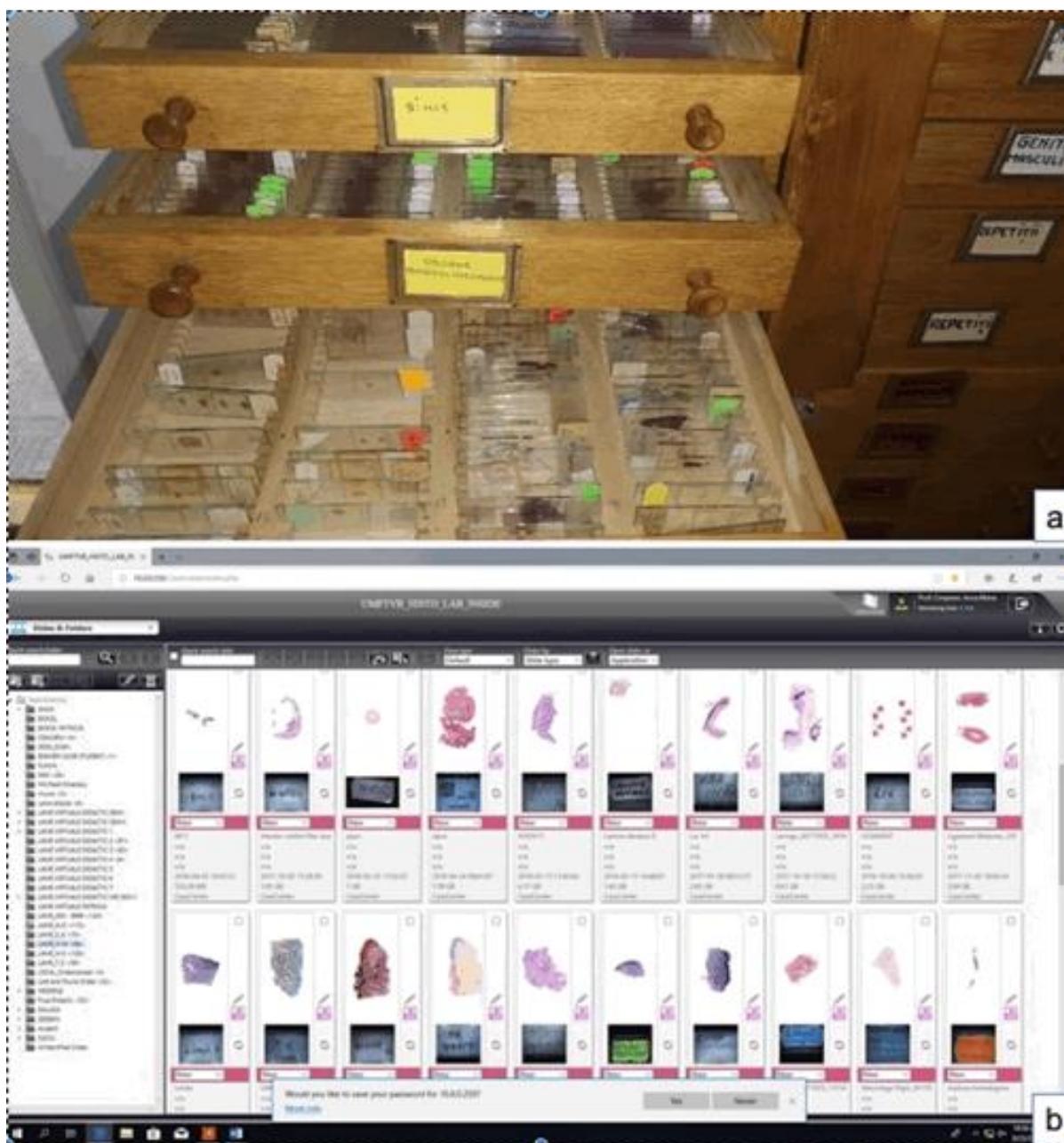


Figure 1: Classic glass slides previously used together with conventional microscopes (a). Scanned glass slides uploaded into Case Center which are used nowadays for histology labs (b).

2.2. Methods assessing students and teachers' opinions on the new system implementation

During the last 3 years since we introduced the new system in the management of histology, about 1500 (500/year) students from dental and general medicine (Romanian, English, and French sections) were enrolled into the system. The administrator of the system created an username and a password for each student and, by using them, the student is able to login during lab classes to follow teleconsultation (computer assisted teaching method based on an invitation launched by professor to attend a histology lab and to be able to view in a real time manner teacher explanations, onsite and/or online outside from the university) given by the teacher or to login from their homes to review the slides themselves from any location outside of the university as part of the self-study process for the exam.

Also, we included in the present study the members of Histology department directly involved: 2 full professors, 5 associate professors, 1 lecturer assistant and 2 assistants.

To assess the impact of the new system implementation on the students and professors, we applied questionnaires at the end of the first semester (for professors) and then after the final examination (for students). The questionnaires included several questions about the new system on the topics summarized in Table 1.

Table 1: Topics on students and professors' opinions regarding the implementation of the new system.

No.	Student questionnaire	Professor questionnaire
1	Acceptance /not acceptance of the system	Use of computer and multimedia technologies, as a way of pedagogical communication
2	Appreciation of system facilities	Computer Assisted Training (CAT)
3	The need to introduce additional facilities to the existing ones	Computer aided evaluation
4	Student-teacher interaction	Online courses
5	Online accessibility of the e-learning system	E-learning
6	Examination in digital system	Multimedia software (educational)
7	Time allotted for examination	Guiding the student's path from ignorance to knowledge through his own effort and in his learning rhythm
8	Applying the use of the system to other disciplines in the university	Software ability to communicate new knowledge
9		Software ability to do simulations
10		Software ability to test knowledge
11		Software ability to develop practical skill
12		The optimal computer combination of image, sound, and commentary, stimulates the intensity of the student's mental activity
13		The pedagogical potential of the IAC in developing individual planning-organizing skills, stimulating the spirit of initiative, individual skills of non-directed activity of the teacher, increasing self-confidence, storage and statistical processing of individual and group performance of students to be examined by teacher during and at the end of the teaching activity
14		Use of educational software during extracurricular time available to the student
15		Maximizing students' thinking, individualizing the act of learning, and ensuring differentiated activity
16		Elimination of dead or redundant times from student activities
17		The degree of achievement of the student-teacher interaction
18		Changing the relationship of total subordination of students to the teacher, in partnership
19		Pedagogical evaluation of the quality, efficiency, adaptability, limitations, and drawbacks of using CAT
20		Applying this experience and using it on a general scale in the university
21		Nomination of the advantages offered by the CAT application

Data were centralized and analyzed by using all facilities of Microsoft Excel program.

3. Results

3.1. *Teachers and student's perception to the change.* Unexpected reactions have been generated using new e-learning and e-assessment system. Mixed feelings governed teachers during implementation of the new system. They were afraid about the complexity of the system but, when they ruled it, they discovered that all procedures used in a classical teaching process were digitalized but were similar with the methods used before. Communication between teachers and students was truly improved during semester labs and may be extended also outside the routine practical labs when the students requested it by using chat option which works also from outside of the university. Teachers were happy about the decrease of exam duration and about the transparency of the correction. This feature excluded them from the assessment process and thus they did not interfere with students during evaluation step. Any subjective emotional issues interfering with evaluation from both students and professors' sides were totally removed by using e-assessment method. Although professors appreciated the facility to rule the student's examination by computer, 25% of professors did not initially accepted this type of evaluation considering that this may affect the quality of student assessment (Figure 2).

About 3% of professors had complains regarding software ability to develop practical skills for the students. They considered that the replacement of classical microscope with a computer removes the student ability to work with a microscope in the lab and thus, it may affect students' practical skills for their future carrier especially for those who will be pathologists or hematologists (Figure 2).

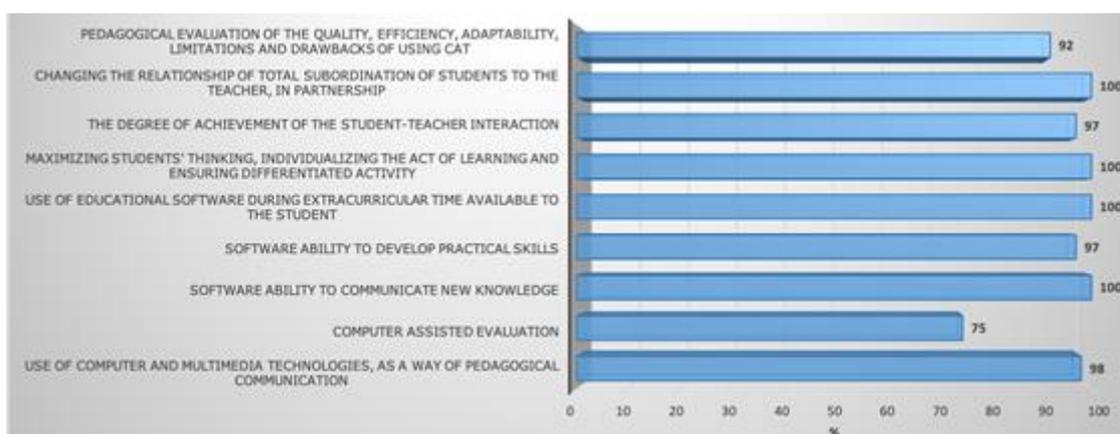


Figure 2: Professors questionnaire components considering most relevant for our purpose.

Implementation of e-assessment drastically decreased the complains from the students regarding exam transparency (Figure 3).



Figure 3: Complains gradually decreased during 3 years of digital system implementation.

Another impact of e-assessment in our department was an increase of the attendance at the first presentation to a partial evaluation (for the first semester, Figure 4). The main reason for this seems to be curiosity for something new but, after several exam sessions the students told us that they are encouraged to come to the exam because of its high grade of transparency which give them a higher self-confidence.

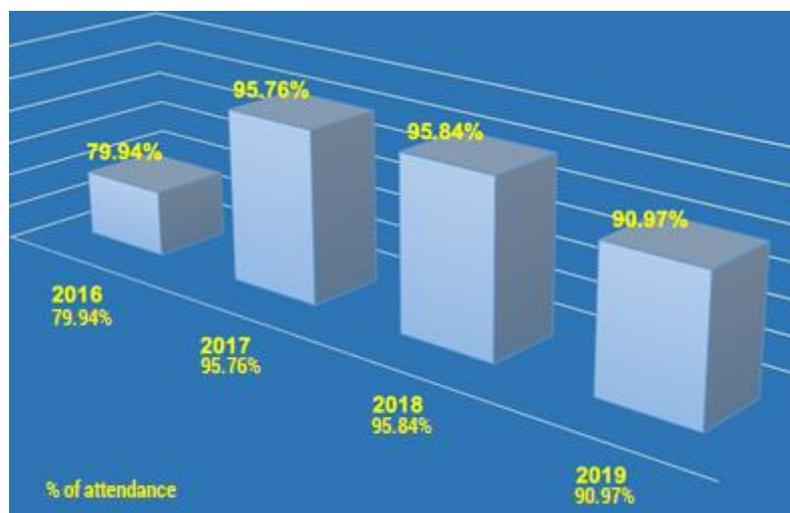


Figure 4: A gradual attendance increase to the first histology exam was recorded after implementation of e-School system because of an increased students' confidence into the transparency of the new evaluation methods.

Working with the computer instead of a classic microscope represented for the students a virtual conversion of histology into a computer „gaming” necessary for their preclinical medical training. All annotations are saved in the system and may be reviewed by the students anytime they want to do this (Figure 5).

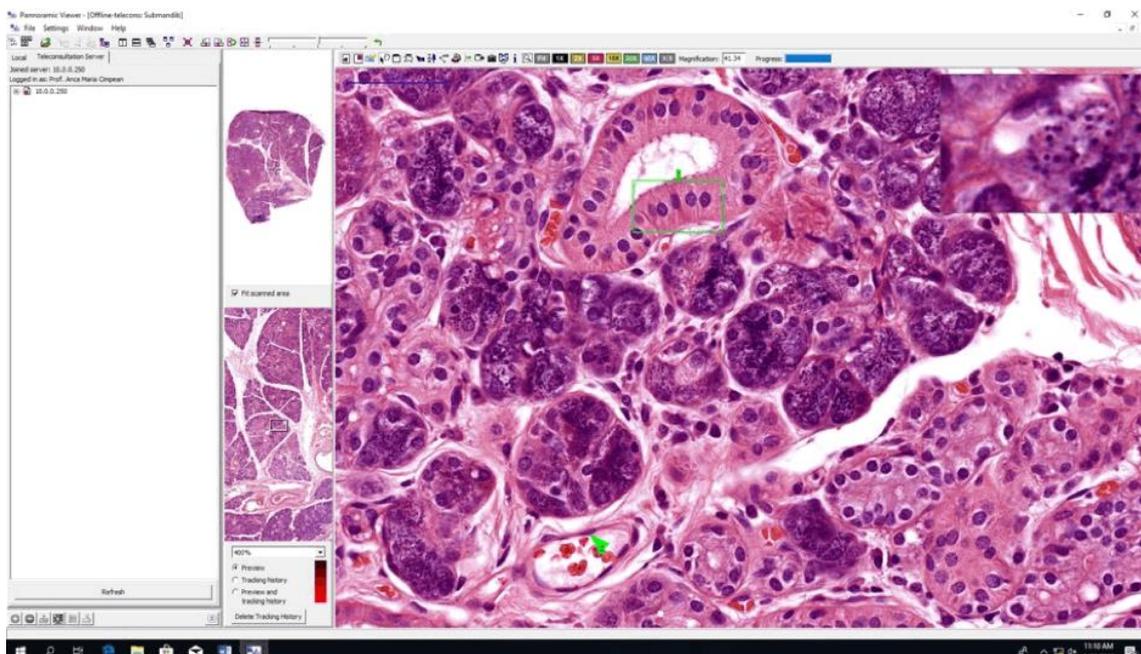


Figure 5: An example showing the possibility of making annotation on the picture and to save them for the future reviewing of the same for exam.

Thus, students became more relaxed in approaching this discipline and this had a direct impact on graduation percentage which continuously increased during 3 years of the use of the new e-learning system (Figure 6).

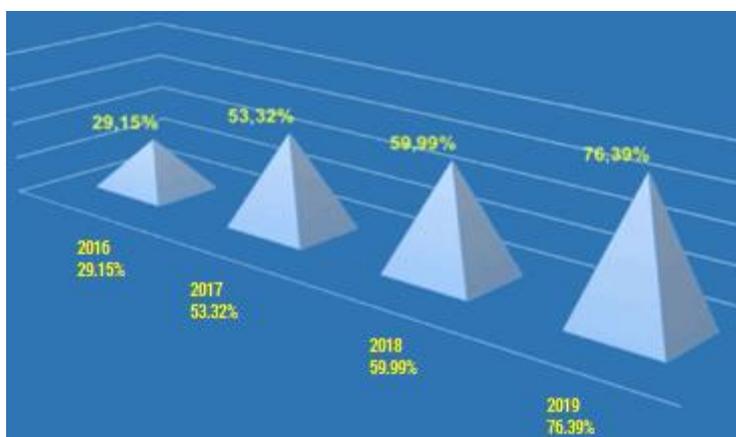


Figure 6: Improvement of histology exam graduation by using e-learning and e-assessment system (2017-2019) compared with the use of conventional learning and examination methods used in 2016.

After final examination, they received a questionnaire based on the topics described in Methods section. Their opinion analysis is summarized in Figure 7.

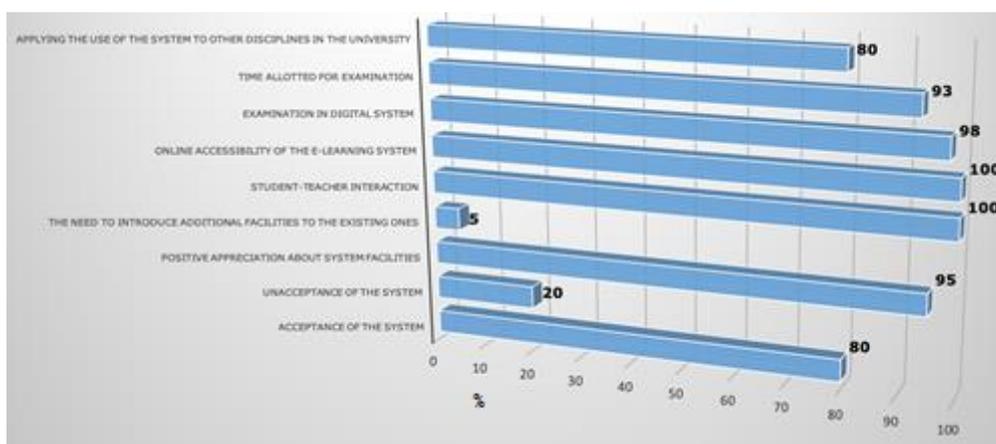


Figure 7: The percentage of positive impact of the new system implementation among the students

Most of the students (80%) accepted the new system implementation and would be happy to have it on other subjects also (80%). From their point of view, the new teaching and learning method did not affect their communication with professors (100%) and it increased their accessibility to the information by using the facility to use and review slides library and professors explanations from outside the university anytime, anywhere they have access to internet. About 93% from the students declared that the time allocated by them to prepare the exam decreased because of such continuous accessibility to the data stored in the system. They used their time more efficiently than before.

Few students (5%) had observations regarding the need to introduce additional facilities to existing ones. One of their proposals was to implement a self-assessment facility which allow them to access a questions pool dedicated to this process and to rule an exam simulation from outside the university. They considered that this facility would help them to fix their knowledges.

4. Discussions and conclusions

The e-learning system (education with digitized support) consists of a planned teaching-learning experience, organized by the university or a discipline within a university that has the ability to provide the student in a digitized format support materials for assimilating a notion or of a group of notions (skills) in a sequential, logical and repetitive order to be approached and assimilated by students with different learning and analysis abilities, in their own way, using a plurivalent, versatile, adapted and adaptable software that aims at the notions transmitted to the student and who can appreciate his capacity to assimilate the new knowledge during their teaching or within the scheduled examination modules. The e-learning system targets not only the student but also the teacher by involving him in the continuous adaptation to the needs of the new generations who are increasingly dependent on the online, virtual environment regardless of whether it is used for personal purposes or during his professional training. The main advantage of the e-learning system is, in fact, the combination of sound, image, text and teacher's explanations that can be archived and disseminated online, permanently, aspects that determine the application and improvement of the interactive nature of information provided to students.

Implementation of our new e-School system induced such controversial reactions between teachers and students, the former ones being somehow reserved about its success. National context and cultural environment strongly influenced professor's perception as it has been reported for other similar situations from abroad (Jippes *et al.*, 2013; Jippes *et al.*, 2008). But this professors fear was contra balanced by the enthusiasm of the students who were really delighted to use it. Our e-learning system may be considered in this moment a kind of social media app specific just for histology subject.

Storage and visualization of the histological slides from anywhere, represent for our students the first step for the future use of telepathology and digital pathology as powerful tools currently used by pathologists for making a good and accurate diagnosis (Banerjee *et al.*, 2019).

Our examination methods represent an e-assessment totally ruled by the computer. By its implementation for student evaluation it drastically decreased the complains from the students regarding exam transparency and fair. Thus, the attendance to the first presentation to exam significantly increased.

Two options of this e-assessment module were really preferred by the students. The first one was that their results instantly are seen on the screen after the end of the exam session. This option gave to the students a high confidence into the evaluation system and reduces the stress induced by waiting the results several hours or sometimes even several days. The second option given by the system and loved by students was the possibility to review their own exam. The students were convinced that professors did not interfere with their results and this, increased the confidence into the transparency of the exam. Practically, the complains of the students regarding the rightness of the exam methodology drastically decreased in number. In this moment we decided to perform examination only inside the university by using the internal server, but this examination would be possible also to be performed online. Based on the previous data (Siegel *et al.*, 2018; Kumar *et al.*, 2013) we decided to do this to avoid some unpleasant technical events as an improper internet access, missed passwords or any breakdown of devices. e-learning and e-assessment methods were really appreciated and used by the students from older years who acts as tutors to our discipline and who got histology final examination by using classical model on paper. They socialized easier with their younger colleagues and they contributed a lot to a successful implementation by explaining to their younger colleagues the benefits of the new system compared with the older, classical one. explain them better than teachers the advantages of the new system.

Other hidden impacts of the new system implementation are referred to the costs for organizing of e-assessment which were significantly lower compared with those allocated for a classic „on paper” exam.

Time for student’s evaluation was reduced. In this moment by using e-learning and e-assessment in histology, we can examine (both for practice and theory) 250 students/day from 8 a.m. to 3 p.m. and the saved time is used for other academic duties.

Despite of the fact that this is the first attempt to use both e-learning and e-assessment in Histology in Romania and also, the first attempt to apply a complete workflow of computer based learning and evaluation in a Romanian medical university it seems that it was well received and tolerated by both teachers and students and eliminated the controversial issues which commonly come with any change. Because of the proved usefulness of the new system in histology, two more disciplines (cell biology and pathology) from the same department were digitalized in the last year and use the same system. By this approach, Department of Microscopic Morphology from Victor Babes University of Medicine and Pharmacy Timisoara is in this moment the most digitalized preclinical department from Romania.

It seems that, what we would expected to be future directions for this new e-learning and e-assessment system proposed to be implemented during next years, became a stringent need in the actual context of COVID 19 pandemic and they were and continue to be quickly implemented to support distance learning and evaluation in our university during this special situation.

Distance teaching and learning methods became familiar to us in a short period of time. Second year medical students from Romanian and English sections continued to study histology from their homes during this period based on the scanned digital slides library and assisted by their professors using teleconsultation combined with a videoconference system. Thus, teaching and learning process was not interrupted in our department during COVID 19 social distancing period.

Because of the persistence of the COVID 19 pandemic, our university adopted a distance online examination procedure. Thus, in a short period of time we will implement distance online e-assessment of the students by using Exam Module described in this paper. Thus, student’s examination will not be affected by the current situation because the students are already familiar with this e-assessment method and they will be able to handle examination as in normal conditions but from their homes in these circumstances.

For all of us, to teach and assess students by using online platforms represented a big and unexpected challenge but also, it opens several perspectives for research in the field of medical education.

We will continue to assess the impact of e-learning and e-assessment in histology by continuous evaluation of students and professors based on questionnaires periodically given to them. Also, our future research will be focused on the improvement of e-learning and Exam Module software based on an analytical overview of the question’s quality used for previous examinations. We consider upgrading the software by adding an option which automatically generate questions by using our writing support of our own lectures.

The use of the Exam Module for online distance assessment of the students in social distancing conditions, challenged us to compare students results obtained on site (inside the university under professors’ supervision) with results obtained by using Exam Module from their homes.

The last, but not the least, we consider that it would be useful to use alternative methods to increase the confidence into the system by stimulating students to access it through gamification methods. Thus, we initiated a contest named Art in Histology which may stimulate the students to use images from Case Center web library slides to create their own artworks. This unusual use of e-learning Module generated a real

competition between students and increased the student's confidence in their abilities of using this new e-learning system.

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