MEDICAL STUDENTS & ELECTRONIC TOOLS IN TEACHING AND LEARNING OF MEDICAL BIOPHYSICS

Eva Kralova*, Michal Trnka

Faculty of Medicine Comenius University in Bratislava, Sasinkova 2, Bratislava 813 72, Slovakia

Abstract

Every day, in the practical life of citizens, but also in the professional sphere, there is usually processing a lot of data that could be lost, damaged, or misused. This could also valid for the electronisation of eHealth in healthcare [Kralova, Kukurova 2013]. Healthcare professionals and eHealth specialists are required to comply with the protection rules of sensitive data. Basic information about data protection should be also provided to medicine students during university study [Kukurova, Kralova, Trnka 2013], [Kralova, Balazsiova 2014]. An anonymous questionnaire was distributed to the respondents, students of the Faculty of Medicine of Comenius University in Bratislava. The knowledge and habits of respondents, students of general and dental medicine in the field of data protection after graduating from secondary school were identified.

After the pandemic uproar, distance education in Slovakia was flexible transformed into distance education in all types of schools. In the paper, the authors describe also their experience and benefits of the LMS Moodle e-learning platform, the MS Teams video conference system, the Open Shot system MS Teams, program that allows the creation of teaching videos and the commented Power Point presentations used in the teaching process at the Faculty of Medicine at Comenius University in Bratislava [Trnka 2013].

Keywords: *medical student, electronic data protection, knowledge and habits, electronic didactic technologies and resources*

1. INTRODUCTION

Data is currently the most valuable economic resource and therefore the European Union put into practice the so-called "gold standard" (GDPR, General Data Protection Regulation). Every day, in the practical life of citizens, but also in the professional sphere, there is usually processing a lot of data that could be lost, damaged, or misused. This could also be valid for the electronisation of healthcare (eHealth). Healthcare professionals and eHealth specialists are required to comply with the protection rules of sensitive data [Kralova, Kukurova 2013].

Universities and faculties in Slovakia are able to realize all educational activities on-line, i.e., they use various distance forms of teaching and learning in daily practice.

Comenius University in Bratislava provides support for MS Teams and LMS (Learning Management System) Moodle. Every teacher or employee of the University can use them for teaching and communication with students. Each teacher, employee and student of Comenius University have its university login and password assigned, the same one uses to access other online services within the University systems such as email, Academic Information System (AIS) etc. [Pisutova 2021].

Institute of Medical physics, biophysics, informatics and telemedicine Faculty of Medicine Comenius University in Bratislava uses in the teaching process for several years: assessment of knowledge by the e-learning platform LMS Moodle, video conference system MS Teams for lectures and seminars, program OpenShot allowing elaboration of teaching videos and commented Power Point presentations. There is an opportunity to use a full implementation of the Microsoft Office 365 e-learning applications [Trnka, Kralova 2020] [Trnka, Kralova 2021].

All these electronic didactic aids help us to increase efficiency of teaching and learning, but the majority of students and also teachers need a direct access to the curriculum and also:

• Contact with the teacher, deadlines, feedback, encouragement.

• Contact with classmates - mutual help, support, the feeling that they are not alone in this.

If teachers work with students online, they are not in the same room, and teachers do not have the opportunity to explain the logistics to the students, to tell them what to do. The main mistake of most people when they start with e-learning is the lack of both information and instructions for students at the beginning of the course. If students feel that they do not know what, how, why, and what to do, they will most likely do nothing. Therefore, it is very important at the beginning to clearly define and explain what is required from the students. The basic principle in an online course is to explain information clearly, factually and simply, and especially repeatedly.

2. MATERIALS AND METHODS

2.1. Survey of Electronic Data Protection

Basic information about data protection should also be provided to medical students during university study. An anonymous questionnaire was distributed to the respondents, students of Comenius University in the Faculty of Medicine of Bratislava. Knowledge and habits of respondents – general and dental medicine students, in the field of data protection after graduating secondary school were identified [Kralova, Trnka 2018].

The respondents (a total number of 185; 30.8% men; 69.2% women; age 19.7 ± 1.5 years; 95% general secondary school graduates) answered the following 4 questions.

1. Name the policies of electronic data protection, sort them according importance (a, b, c, d), and rank them by frequency of use in everyday practice.

2. Have you encountered suspicious emails?

3. Is your computer protected by an antivirus program?

4. How often do you update your login information?

Respondents rank their responses on the scale 0 – 10 (0 - I do not use it at all, 10 - I use it often).

3. RESULTS

3.1. Electronic data protection by medical students [Kralova 2018].

1st question: Name the policies of electronic data protection, sort them according importance (a, b, c, d) and rank them by frequency of use in everyday practice.

75.1% of the total number of respondents answered the question, 24.9% of respondents did not respond at all. It could be assumed that they were unable to name or use any one principle of electronic data protection.

Common ways of protecting electronic data **ranked by importance** according to respondents: 36.7% data backup; 30.9% login update; 28.8% antivirus software; 20.9% secret privacy passwords and privacy data. Others, e.g., provide sufficient security of access passwords, do not open suspicious e-mails, password-protected files, do not visit suspicious sites, etc. are using by less than 20% of respondents. (Table 1.)

Electronic data protection options	**Importance [%]**
Data backup	36.7
Login update	30.9
Antivirus software	28.8

Security of password and personal data	20.9
Sufficient security of password	17.3
Don´t open suspicious e-mail	15.1
Password-protected files	14.4
Do not visit or block suspicious web site, do not open suspicious files	12.2

Table 1. Ways of electronic data protection ranked according to importance by respondents

Other options, such as data encryption (8.6%), software upgrades (6.5%), failure to download materials from unverified sources (5.8%), unsecured computers (5.0%), firewall device or software to ensure separation of networks with different access rights), a good spam filter (3.6%), malware avoidance, non-disclosure of private photos, videos, and cache removal and browsing history were only reported in 0.7%.

Percentage of Ways of electronic data protection ranked by **frequency** of real use by respondents that are often and very often used by respondents: data backup to different media 25.2%; antivirus software 20.9%; confidential login and personal data 18.7%; update of login 17.3%; secure password 13.7% and 11.5% of respondents do not visit or block suspicious web sites and do not open suspicious files. (Table 2.)

Electronic data protection options	**Often a very often [%]**
Data backup	25.2
Antivirus software	20.9
Confidential login and personal data	18.7
Login update	17.3
Password security	13.7
Do not visit or block suspicious web site, do not open suspicious files	11.5

Table 2. Ways of electronic data protection ranked by frequency of real use by respondents

2nd question: Did you encounter suspicious/malicious email content? Answered 183 respondents.

- yes, at least once I received a suspicious email 69.4% (127 respondents),
- yes, suspicious emails I often get 12.0% (22 respondents),
- yes, malicious email has caused the loss of my data 17.6% (32 respondents).

3rd question: Is your computer protected by an antivirus program?

- 74,2% (135 respondents) have a computer-protected antivirus program and continuously update it,
- 20.3% (32 respondents) upgrade antivirus program once a year,
- 2.2% (4 respondents) upgrade the antivirus program at irregular intervals of less than 1 year,
- Only 3.3% (6 respondents) have no computer protected by any antivirus program.

4th question: How often do you update your login data?

- monthly – 3.3% (6 respondents),
- quarterly – 25.7% (47 respondents),
- in another interval – 24.0% (44 respondents),
- does not update the login information at all 47.0% (86 respondents).

4. DISCUSSION

4.1. Survey of Electronic Data Protection by Medical Students

The analysis of the responses of the medical students showed the current state of the readiness of the respondents to protect the electronic data at the beginning of the medical study.

The results indicate insufficient knowledge, information, and caution of most respondents in protecting electronic data, which might be a serious problem in their future medical practice.

In addition, there are currently no conditions for the development, subsequent retention of student knowledge and habits in protecting electronic data in general and dental medicine study programs due to the absence of the corresponding teaching subject in the medical curriculum. This fact could influence the future ability of graduates in the effective use of eHealth tools for the healthcare sector and the well-being of patients.

The lack of awareness of data protection could be compensated for by the practical experience of medical students in the very extensive use of information and communication technologies in teaching in the last three years of pandemics. In the previous pandemic period, the teaching, knowledge assessment and contact with students and teachers were realised online in the MS Teams, MS Moodle and by e-mail.

4.2. e-learning at the Comenius University Faculty of Medicine in Bratislava

In our everyday educational practice, the following platforms [Trnka, Kralova 2020] are used:

1. *Microsoft Teams* - a unified communication and collaboration platform that combines persistent workplace chat, video meetings, distance testing and examination, file storage (including collaboration on files), and application integration. It is used permanently in distance teaching. On-line meetings were realised with both Slovak and foreign students (on-line lectures, practical teaching, and exams). The system allows communicating simultaneously with more than 40 students.
2. *Platform Moodle* - Free of charge Open Source Learning Management System (LMS). Moodle is a software package for creating online e-learning systems and courses. Developed on pedagogical principles, Moodle is used for blended learning, distance education, testing, flipped classroom, and other e-learning projects in schools, universities, workplaces, etc. It is used for continuous knowledge testing, including the final exam test. The prepandemic Moodle system was used mainly as a supplement to the full-time form of teaching.
3. *Open Shot Video Editor* - an open source video editor available on Linux, Mac, and Windows. Using Open Shot, stunning videos, films, and animations were created with an easy-to-use interface and rich set of features.

For continuous and final tests, a database consisting of 5,000 questions/statements was used. Each randomly generated test includes 100 True/False statements. All tests were available on the LMS MOODLE E-LEARNING platform and answered online (Figure 1.).

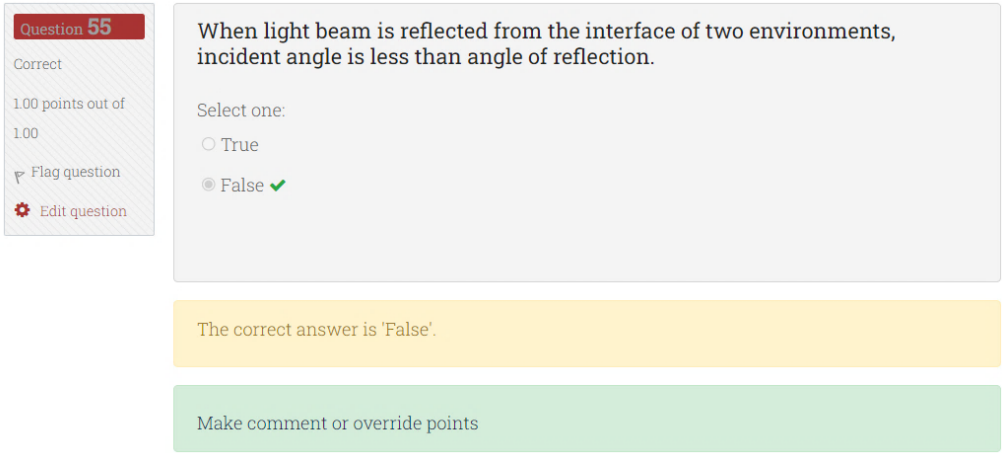


Figure 1. Example of a test question in LMS MOODLE and its corresponding information block (left) [Kralova, Trnka 2021].

Our office prepared a collection of video records (procedures of measurement and their theoretical background) for distance teaching and learning. For correction and finalization of teaching videos, the Open Shot application was used. It allows to additionally edit, save commentary, add figures and texts.

All PowerPoint presentations explaining the theory of laboratory experiments were commented on in both Slovak and English and converted into video format and then uploaded to the video streaming service Microsoft Stream (Figure 2) [Trnka, Kralova 2021].

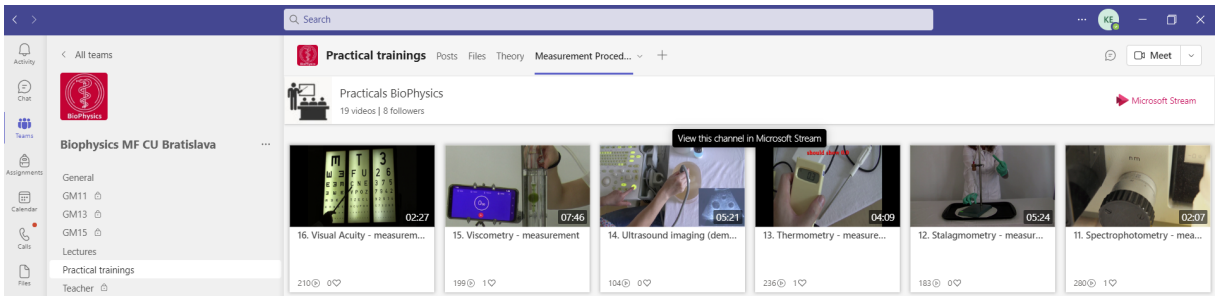


Figure 2. Example of a tutorial video selection screen in MS Teams.

Teaching by videoconferencing system, among other on-line tools, closely simulates classic lectures and exercises, so many teachers feel that this is the easiest way to take their courses on-line. However, it is not as simple. Although it allows direct live contact with students, but with a higher number of students (especially in a situation where many of them turn off their cameras), there are not many opportunities to perceive non-verbal communication and thus find out if they are paying attention or if they understand what you are explaining. Video conferencing software (such as MS Teams) allows screen sharing, text chat, file sharing, whiteboard usage, etc. in addition to video conferencing.

On the other hand, when you are conducting a video conference as a teacher, it is difficult to explain the material at once, watch chats, shared files, and even explain to technically "lost" students where to click. It also happens that students, in addition to technical challenges, do not have time to observe and understand the material or, for various reasons, are unable to participate in a videoconference at a given time. The advantage is that it is possible to record a video conference and then use the resulting video in an asynchronous way, i.e., let the students return to it at their own pace [Pisutova 2021].

Every tool and every approach have their advantages and disadvantages. When preparing a course, all options must be considered, and a suitable combination of the tools chosen.

MS Teams has a powerful video conferencing tool, it allows sharing files in it, students can submit assignments, they can discuss in text, and it is also possible in this environment to let students take a simple test. The Moodle environment does not provide a video conferencing tool; it only offers text chat of synchronous tools, but in addition to sharing materials, submitting assignments, it also has a better structured environment for asynchronous discussions and a well-developed test system for students.

5. CONCLUSIONS

The absolute advantage of using above-mentioned software packages emerged in connection with the need to transition to a distance form of education. Such teaching meets the attributes of modern education, it is effective, interesting and provides students with many impulses to activate, motivate, and raise their level of knowledge [Trnka 2018, Kralova 2017].

In the winter semester of the acad. in 2020/2021 all forms of teaching (lectures, seminars to the practical training, tutorials, knowledge assessment during semester and examination period, oral exam) were guided online using above mentioned didactic tools.

All new prepared didactic resources were available online throughout the semester, and students could use them to study at the appropriate time.

Compared to the previous acad. For the year 2019/2020, it can be stated that the level of distance education was improving. An experience with this type of teaching in recent academic years has been analysed and evaluated in relevant materials from Comenius University in Bratislava [CIT UK 2021].

A large number of teachers realise the perspective of distance education not only as a temporary solution to the current crisis situation, but also perceive this possibility as an alternative and a useful complement to full-time teaching.

ACKNOWLEDGMENTS

The contribution was supported by the GP KEGA Ministry of Education, Science, Research and Sport of the Slovak Republic No 023UK-4/2021 'Implementation of the latest scientific knowledge on the health risks of electromagnetic fields in modern medical education'.

REFERENCES

1. Kralova, E, Kukurova, E 2013. Formovanie kľúčových podmienok vzdelávania pre elektronické zdravotníctvo. (Forming key education conditions for eHealth). In: Formy a prostriedky vzdelávania na podporu prevencie chorôb v podmienkach eHealth. Praha : *Evropská asociacie pro fototerapii*, 2013, p. 145-148. ISBN 978-80-87861-02-8.
2. Kukurova, E, Kralova, E, Trnka, M 2013, ”Basics of medical physics and biophysics for electronic education of health professionals”, Bratislava : *Asklepios*, 2013, 1st Edition, 231 p. ISBN 978-80-7167-177-0.
3. Kralova, E, Balazsiova, Z 2014, ”Preparation of medical students to work in conditions of eHealth”, In: Teaching and learning science at all levels education, Kraków : *Pedagogical University of Kraków*, 2014, p. 155-158. ISBN 978-83-7271-880-8.
4. Trnka, M 2013, ”Možnosti prípravy zdravotníckych pracovníkov na využívanie nástrojov IKT v podmienkach eHealth (Possibilities for the preparation of health workers for the use of ICT tools in conditions of eHealth)”, In: Fragmenty vedeckej práce mladých výskumníkov z vysokoškolských pracovísk v SR. Praha : *Evropská asociacie pro fototerapii*, 2013, s. 89-95. ISBN 978-80-87861-04-2.

5. Pisutova, K 2021, "Ako na online vzdelávanie *(How to learn online),"* 2020. [Internet]. Bratislava (SK): *Comenius University*. Available from: https://uniba.sk/fileadmin/ruk/cit/e-learning/S14-01-Ako_na_online_vzdelavanie.pdf [Last updated 5 May 2021].
6. Trnka M, Kralova, E 2020, „News in didactic technologies in the teaching of medical biophysics in the conditions of COVID-19 pandemic", ICERI 2020 [electronic document] : 13th international conference of education, research and innovation, Valencia : IATED, 2020, p. 5806, ISBN 978-84-09-24232-0.
7. Kralova, E, Trnka, M 2021 "Didactic technologies and resources used at the Faculty of Medicine Comenius University in Bratislava". *EDULEARN 21, 13th annual International Conference on Education and New Learning Technologies. Conference proceedings* [electronic source*]. Valencia: IATED Academy, 2021*, pp. 9039-9242. ISBN 978-84-09-31267-2.
8. Kralova, E, Trnka, M (Ed.) 2015, "Spektrum informačných zdrojov z biomedicínskeho prostredia & výmena teoretických a klinických poznatkov (Spectrum of information sources from biomedical environment & exchange of theoretical and clinical knowledge)", Praha : *Evropská asociace pro fototerapii*, 2015, 282 s. ISBN 978-80-87861-11-0.
9. Kralova E 2018, "The readiness of medical students to the electronic data protection". ICERI2018 Proceedings [electronic document] 11th annual International Conference of Education, Research and Innovation, Valencia : IATED, 2018. p. 8768-8771 ISBN 978-84-09-05948-5.
10. Kralova, E, Trnka, M 2021, "Assessment of student´s knowledge using LMS platform MOODLE". *EDULEARN 2021 Conference Proceedings*, Valencia: IATED, 2021, 9012-9015 pp.
11. Trnka, M 2018, "Theoretical background for the creation of multimedia models and animations for the university teaching of medical biophysics." *ICERI 18 Proceedings*. Valencia: IATED Academy, 2018, pp. 9613-9616. ISBN 978-84-09-05948-5.
12. Kralova, E 2017, "Motivation of medical students to study physical, chemical and biological sciences – survey results". *EDULEARN 17, 9th annual International Conference on Education and New Learning Technologies. Conference proceedings* [electronic source]. Valencia: IATED Academy, 2017, pp. 9220-9223. ISBN 978-84-697-3777-4.
13. Centrum informačných technológií UK v Bratislave (Centre of Information Technologies CU in Bratislava) 2021, "Prieskumy o dištančnej výučbe na UK (Surveys on distance learning in the UK)." [Internet]. Bratislava (SK): *Comenius University*. Available from https://uniba.sk/elearning/. [Last updated 5 May 2021].