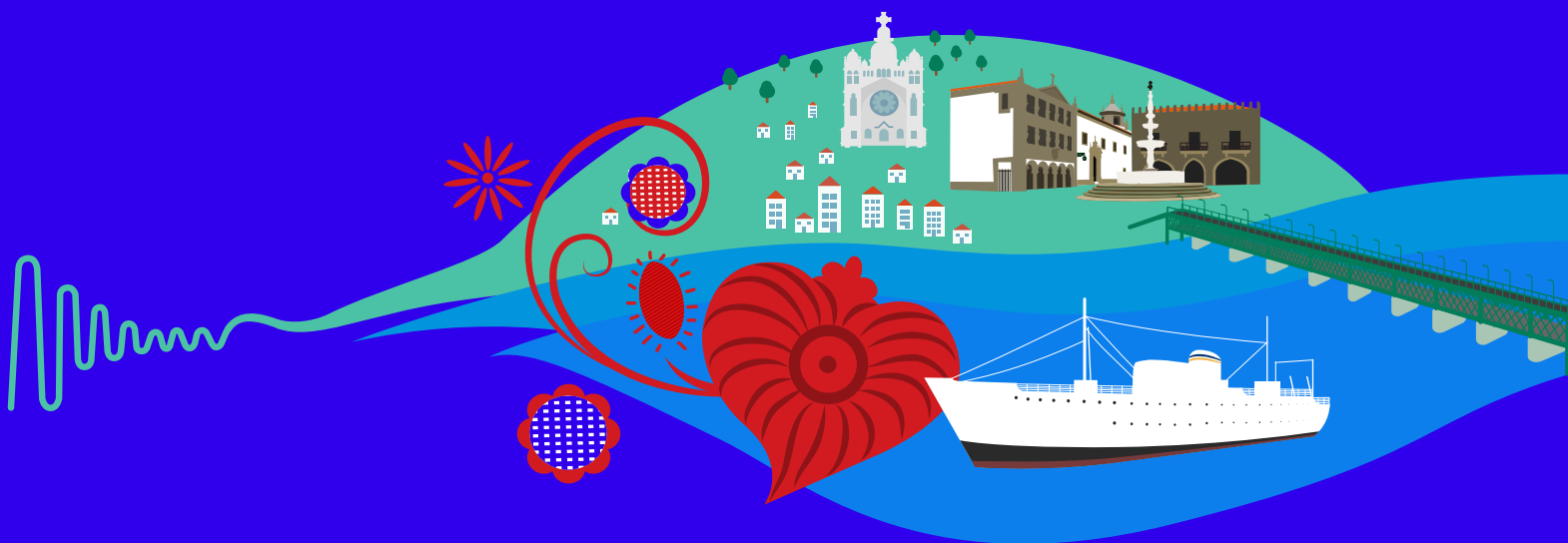
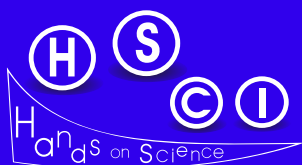


# Hands-on Science

Science Education.  
Discovering and Understanding  
the Wonders of Nature.



Edited by:  
Manuel Filipe P. C. Martins Costa  
José Benito Vázquez Dorrió



The Hand-on Science Network

# **Hands-on Science**

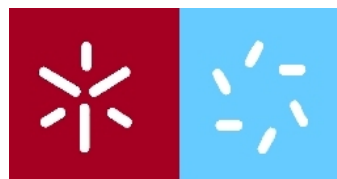
## **Science Education**

**Discovering and understanding the wonders of Nature**

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**Edited by**

**Manuel Filipe Pereira da Cunha Martins Costa, University of Minho, Portugal**  
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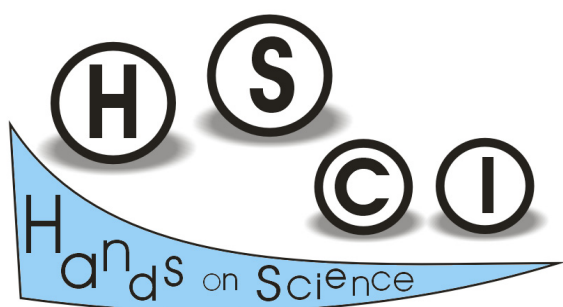


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## Education During the COVID-19 Lockdown: Does the Pandemic Extend the Scope of Distance Learning?

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**Abstract.** The reasons for and importance of readiness for distance learning in higher education are identified, especially regarding some aspects of teaching in higher medical education. The history of introduction of distance learning components in educational process at the I. Horbachevsky National Medical University in Ternopil (TNMU) is shown. Purpose of online cloud services that TNMU has been subscribed to as well as self-hosted by TNMU distance education tools are explained. The experience gained during the implementation of full-scale distance education at TNMU during the COVID-19 quarantine is presented. The analysis of students' performance during the full distance educational period in comparison with a blended part of the Medical Informatics course is presented.

**Keywords.** Distance Education, Learning Management Systems, LMS Moodle, Google Suite for Education, Office 365, Medical Education, Open-Source Software, Scheduler Plugin, Software Development, Version Control System.

### 1. Introduction

Medical education should provide training for specialists who have to be able to effectively use available capabilities of modern medical information systems. To achieve this goal, modern learning tools and technologies must be used in higher medical education [1]. Conceptual approaches to introduce modern information technologies in medical education have included the application of Learning Management information Systems (LMS) which also often provide services of distance education too - as well as learning material

management systems (LMMS or LCMS - learning content management systems).

Latest challenges like threat of bioterrorism and global pandemics (like COVID-19) had introduced new demands and requirements for organization and providing the educational process. Higher education institutions should be ready and capable to migrate into a fully online and remote educational model.

### 2. Distance education solutions at TNMU: history, technologies and tools

Distance Education (DE) technologies were introduced at Ternopil National Medical University (TNMU) in 2006. At that year Learning Management System (LMS) Moodle [2] was introduced to evaluate the results of students' self-preparation for practical classes. The assessment was provided by using the Moodle "quiz" activity only.

The use of the Moodle LMS was continuously expanded during the following years [3-7]. Finally, at the end of 2019, all training materials of all TNMU courses were fully presented in Moodle in various formats of training activities ("workshop", "assignment"), or as Moodle resources ("files" and "folders", typically filled with pdf documents) or even as external links (links to video lectures on YouTube).

Important changes took place in 2012. The Microsoft Office 365 [8] and Google Suite for Education [9] services were introduced almost simultaneously at TNMU.

From 2012 and up to now Google Suite platform is used as a centralized user authentication tool for all TNMU information services. It provides corporate e-mail service for TNMU as well.

Microsoft Office 365 was introduced to provide video conferencing. Skype for Business (former Lync) supported a large number of participants (from 50 to hundreds). This service was replaced with MS Teams now.

New safety and health threat involve new challenges and demands for the organization and implementation of the educational process in higher medical education to improve distance

learning and support a students' self-education mode.

The aim of paper is to present TNMU experience regarding the various aspects of implementating distance education technologies and tools into medical education under global pandemic threats.

### 3. Organization of distance education process at TNMU during the COVID-19 lockdown

Since March 12, 2020, when the COVID-19 quarantine in Ukraine was introduced, TNMU has been using all available distance learning services on a full scale. Students are allowed to:

- use training materials posted on the Moodle platform [10] for training;
- post their answers in electronic form through Moodle activities (“workshop”, “assignment”);
- communicate with teachers through Google services (texting via Gmail / Chat, and have video-conversations via Hangouts / Meet).
- watch educational videos and video-lectures on teachers' YouTube channels (for example [11])

Video-conferencing tools like Google Meet tools [12], MS Teams [13] and even Zoom [14] are used to support academic collaboration during tutoring seminars, training conferences and sessions of academic councils.

As a part of IT general infrastructure development, TNMU Microsoft Office 365 account was finally integrated with TNMU Google Suite platform. It became possible via Single sign-on (SSO) approach based on Security Assertion Markup Language (SAML) for user account data provisioning as it were described in [15]. Finally, it give all TNMU users (students as well as faculty) instant and transparent access to all applications and features of both cloud-based services.

The TNMU Moodle platform [10] is used to perform a final control at the end of 2020 spring semester. Exams were presented in form of test assessment. Unlike previous times, more different types of questions and forms of quizzes were used. For example, an “essay” Moodle question type was used to accept students' answers for “oral” part of exams.

### 4. Teaching the Medical Informatics course at TNMU during COVID-19 quarantine

The Medical Informatics (MI) course at TNMU is offered to 2<sup>nd</sup> year students at the medical school. Currently it includes 14 hours of lectures, 32 hours of practical classes and about 60 hours assigned to self guided work. In fact, the MI course is designed as a “blended” course since LMS Moodle inception at TNMU [16]. Students have to perform some amount of online activities in addition to classroom studies.

As a rule, a topic of the MI course in LMS Moodle includes the elements shown in Fig. 1).

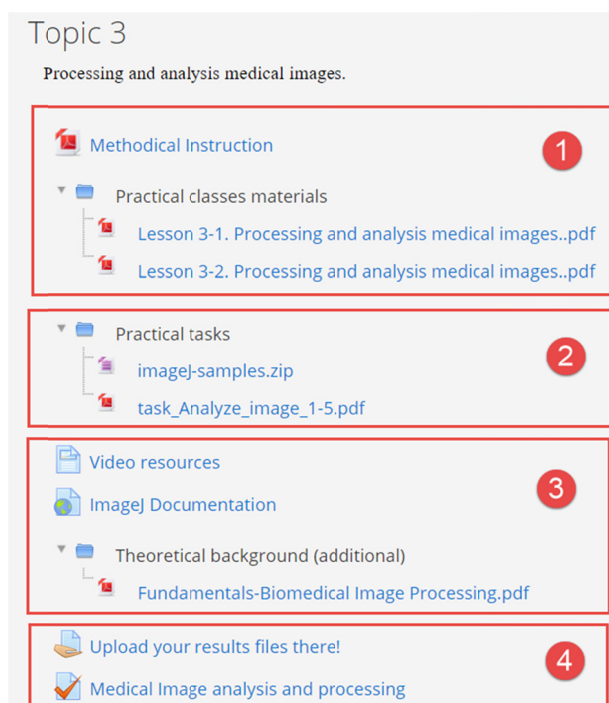


Figure 1. Structure of a topic of the MI course in LMS Moodle

They include:

1. Required practical classes materials and methodical instructions.
2. List of tasks that must be completed (during class hours or individually).
3. Recommended additional educational materials.
4. Assessment tools. Using “assignment” activity students have to submit results of their practical works. A “quiz” activity has been used to perform assessment of theoretical knowledge.

This extensive background allowed easily change from the “blended” mode to a full scale distance education workflow when the lockdown was introduced in Ukraine on March 12, 2020.

Main changes provided in the course to support a full scale online educational process:

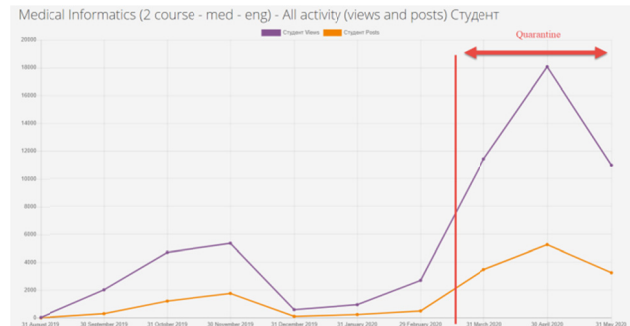
1. Almost all time limitations for quizzes and assignment activities in LMS Moodle were eliminated to make students’ work more comfortable.
2. Extra timeslots for online meetings with groups and / or individual students were introduced by using customized Moodle “Scheduler” module [17]. All appointments were provided with links to corresponding video-meetings, scheduled by MS Teams cloud service.
3. Process of recording of additional video-lessons was initiated and conducted by faculty members. MI department’s YouTube channel [18] was used to host these videos among other video-lectures [19].
4. Usage of online demo [20] and open-source alternate software [21] was introduced to fulfill requirements of specific topics.
5. Gmail-based TNMU corporate email service was used to communicate with students too.

Statistics gathered from LMS Moodle confirms that the activity of students within the platform grew about three times during the quarantine (Fig. 2). It is important to note that about 2/3 of the MI course topics were already completed when the quarantine was introduced (10 topics out of 16).

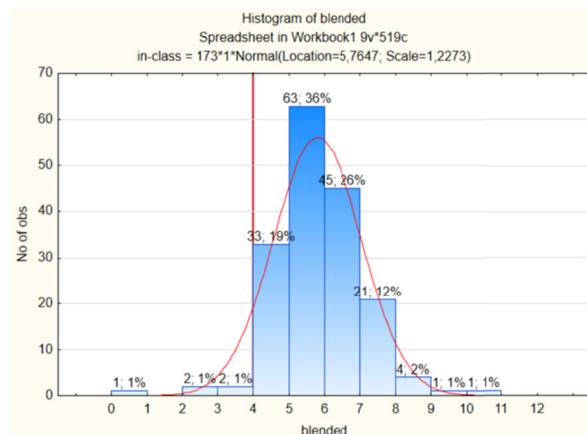
The analysis of results of teaching the Medical Informatics course to foreign students (173 students in 14 groups) is used to present practical outcomes of migrating from the blended education model to full scale DE workflow.

The average scores achieved by students during the blended part (topics 1 to 10) of the MI course in 2019/20 academic year is shown in Fig. 3. The next figure (Fig. 4) presents the average scores for the full scale DE part of MI course during March / May 2020 (6 topics).

Finally, the total MI course average scores are shown in Fig. 5.



**Figure 2. Activity of students studying the MI course in LMS Moodle during 2019/20 academic year**



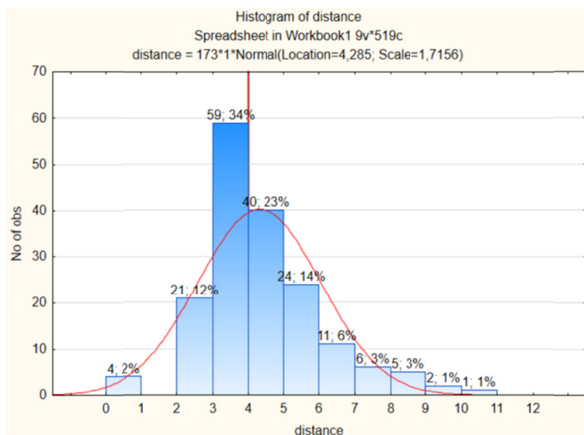
**Figure 3. Students’ average score for the blended part of the MI 2019/20 course (topics 1-10)**

It should be noted that TNMU uses a common Ukrainian academic grading system with 12 levels of students’ achievements, where “4” is a minimal positive grade.

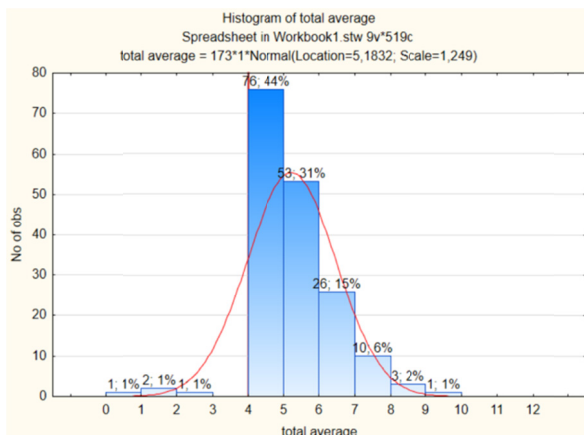
Charts (Fig. 3-Fig. 5) show a relatively low performance of students in the MI course. Migration from the blended mode to the full scale DE educational workflow made the situation worse when about one half of students (84 of 173 or 48%) failed to earn even a minimal positive grade (“4”). Low basic educational skills and poor educational background of foreign students at TNMU may be a possible explanation of above unsuccessful results. This is quite obvious because most students come from developing countries with low income and high poverty (Africa, Middle East and South Asia). Low common digital literacy competencies along with basic computer skills of students provide additional obstacles which make educational



process quite difficult due to significant complexity of the Medical Informatics syllabus.



**Figure 4. Students' average score for the DE part of the MI 2019/20 course (topics 11-16)**



**Figure 5. Students' total average score for the total MI 2019/20 course**

#### 4. Conclusions

The importance of readiness for full scale distance learning in higher education is obvious. This is illustrated by a history of introducing the components of distance learning in education process at the I. Horbachevsky National Medical University in Ternopil. The purpose of online cloud services that TNMU has been subscribing to as well as self-hosted by TNMU distance education tools are explained too. The experience achieved through the implementation of full-scale distance education at TNMU within the COVID-19 quarantine period in Ukraine is presented. The analysis of students' performance during a full distance educational period in comparison with a blended part of the Medical Informatics course was performed. Low performance of

foreign students during online learning of the MI course was noted and explained.

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