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Specificities of Remote Teaching of Traumatology and Orthopedics Course to Medical Students

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Abstract: The paper reports the results of organizing distant learning of Traumatology and Orthopedics course by Bogomolets National Medical University students of the fifth year of study in the conditions of quarantine. The authors present the experience of using Neuron portal developed on the basis of LMS Moodle in combination with MOOCs and videoconferencing and the results of student survey (N=47) after taking the course. 12-item Likert scale was used to assess students' perceptions of on-line learning. The benefits are course efficiency in obtaining necessary knowledge and skills (61,7%), flexibility (80,85%), developing critical thinking (68,09%), creativity (68,09%), problem-solving skills (74,47%), collaboration skills (93,62%), teacher-student interaction (82,98%), self-directed learning (87,23%), enhancing computer literacy skills (80,85%), impact of distance learning on motivation (55,32%), filling the gap between theory and practice (74,47%). The drawbacks are problems with the Internet (38,3%), lack of digital literacy (12,77%).
The research emphasizes the importance of developing collaborative learning skills which is realized by implementing a case-based method in online education, which promotes the development of critical thinking and problem-solving skills. Some recommendations are given for teachers regarding learning process organization. The findings can be used by educators and course developers in Traumatology and Orthopedics in Ukraine and abroad.

Keywords: *Orthopedics; Traumatology; online learning; videoconferencing; MOODLE; MOOCs; clinical case; collaborative learning.*

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1. Introduction

The COVID-19 pandemic 2020 has changed the teaching and learning process considerably. The educators search for the methods and tools which will work in the conditions of quarantine, when face-to-face classes are impossible. It is a challenging task to find the ideal combination of online tools in order to make learning interactive, cooperative and collaborative like real-time communication. Bogomolets National Medical University (NMU) has implemented the platform for distant education Neuron on the basis of LMS Moodle (Modular Object-Oriented Dynamic Learning Environment) as the main learning tool for the period of quarantine. The additional learning platforms recommended for student are MOOCs (on Coursera, EdX, Prometheus platforms), as well as group communication using Viber, Telegram, etc, including videoconferencing.

Multiple researches prove the effectiveness of e-learning in higher education, especially when blended learning approach is applied (Lisetskyi, 2015). Back et al. (2014) claim that blended learning approach improves teaching in a problem-based learning environment in orthopedics, which is important for our study.

The literature review has shown the effectiveness of implementing Moodle for the students of medical universities. For example, Ivanova et al. (2019) have found that all students find Moodle a necessary tool for studying new topics and preparing for the state exams. The results of Avramescu's (2017) study show that e-learning platforms and technologies should not substitute the classroom learning hours completely, but can substantially enhance the skills and knowledge of medical professionals thus making them better prepared for practice and allowing them to tailor their experiences in accordance with their personal learning objectives (Avramescu, 2017, p. 1559). Another study (Peerapolchaikul et al, 2019) reports that Moodle is preferable as a platform to develop students' self-learning skills within a PBL curriculum. However, to use the Moodle platform to the highest benefit, instructors need to upgrade its capabilities, especially those related to student-teacher interaction and the enhancement of students' critical thinking and creativity.

This paper aims to share the experience of teaching Traumatology and Orthopedics to medical students by means of combination of e-learning tools in the conditions of quarantine. We will determine the benefits and drawbacks of different modes of online learning based on interviewing

teachers and students, as well as suggest some recommendations on making the teaching and learning process more efficient.

2. Methodology

2.1. Materials and procedure

Medical students of the fifth year take a mandatory course in Traumatology and Orthopedics at the NMU. The course comprises 5 lectures (10 hours) and 9 practical classes (5 hours each) for the students of medical departments (http://www.kaftravm.com.ua/en/). The course finishes with a module test. The basic textbook is Traumatology and Orthopedics (Golka et al., 2013). In the usual conditions, students attend all lectures and practical classes at the university. The elements of blended learning are used. Among e-learning tools teachers use Power Point presentations, YouTube lectures and cases, recommend additional literature and MOOCs courses.

In the conditions of quarantine, students learn from home. The Traumatology and Orthopedics course was adapted and uploaded to the Neuron platform (http://neuron.nmuofficial.com/). There are 10 Modules, each comprises lecture materials and tests.

This portal offers a set of modules which help to organize teacher-student and student-student interaction: forums and chat rooms, questionnaires, tests, wikis, seminars, etc (more than 35 options). The basic advantages of using Neuron are: creating a well-structured system of methodological tools for students; availability of instruments for evaluation of students' progress; setting up time limits for task performance; integration with other web-services; possibility to use graphic, audio and video files; organization of computer testing; possibility to edit the course at any time (Mykytenko, n.d.).

On the official website of NMU (http://nmuofficial.com/distant-education/) there is a set of guidelines for teachers and students on how to use the portal as well as some additional e-learning tools for the period of quarantine (MOOCs – Coursera, Prometheus, EdX, etc), as well as open resources from on-line library of the Cambridge university.

Beginning from 11 March 2020 the online form of education was adopted in NMU. The Department of Traumatology and Orthopedics worked out the procedure for the interaction in the mode teacher-student, student-student. For the real-time communication the Viber, Telegram or Zoom are used. On the first day of the curriculum a teacher meets students online in real time. The teacher gives instructions, introduces Neuron and

provides students with links and recommendations on how to use the portal. Here they can find theoretical information on each topic and tests for self-evaluation. Additional recourses for learning new material are MOOCs. For example, students are offered to enroll in the course "Applied anatomy of the locomotor system" on EdX platform, which will help to revise the structure and function of bones, joints, and muscles in the human body.

Each lesson starts with the communication in real time; students can ask questions regarding the material they have studied before the lesson from Neuron website. The teacher gives a short lecture and individual or group tasks. One hour later, the videoconference takes place (ideally, using Zoom, but other tools can also be used). Students present their projects and teacher evaluates their performance taking in account the activity on the Neuron portal. In the end of the course students are tested online.

2.2. Research design and data analysis

We have used a mixed methods research design. Quantitative data were measured by a 12-item Likert scale developed for this research, which was proposed to students after taking the online course. 47 students volunteered to take part in the survey.

A qualitative research was realized by interviewing teachers and students about benefits and drawbacks of online learning, as well as the problems the participants faced. They gave their feedback either individually (by e-mails, Viber chats and calls), or in the group discussions on the effectiveness of the proposed system. It was valuable for us to get this feedback, we prefer to be flexible and make some changes in the mode of work if this is required. Nevertheless, no one was forced to participate in the interviews, it was on a voluntary basis.

3. Results and Discussion

Student survey has shown positive perceptions of the course, according to the following criteria: course efficiency in obtaining necessary knowledge and skills (61,7%), flexibility (80,85%), impact of distance learning on motivation (55,32%), critical thinking (68,09%), creativity (68,09%), problem-solving (74,47%), collaboration skills (93,62%), teacher-students interaction (82,98%), independent work (87,23%), enhancing computer literacy skills (80,85%), filling the gap between theory and practice (74,47%).

These results correlate with students' activity in the course on the Neuron portal: 75% of students gained the results ranging from 80% to 95%; 25% of students performed the tests at 70-80% efficiency.

Our observations as well as the feedback from respondents indicate enormous advantages of online learning: flexibility; convenience of use; improvement of quality and success of teaching; enhancement of students' learning abilities, satisfaction and motivation; development of students' critical thinking, creativity and ability for self-directed learning, which is in line with other studies (Avramescu, 2017; Back et al., 2014; Juhi, 2019).

On the contrary, moving a course which has been designed for face-to-face delivery to an online environment is a challenging task. Evidently, technical problems occur. Students indicate problems with the Internet (38,3%); the digital skill gap (12,76%); platform hanging (6, 38%).

We must admit that students come from different regions of Ukraine, the Internet coverage may be insufficient in the rural areas. Students and teachers need some time to learn about all possibilities of the portal, available plug-ins and their functions. But at the same time, although it takes time at the beginning (uploading files, designing tests), it will take less time during the stage of evaluation of students' activity and knowledge obtained and receiving students' feedback.

Working on the Neuron portal is supplemented by everyday videoconferencing with students, which gives the opportunity to communicate in real time. This is a very useful and advantageous tool in the conditions when face-to-face communication is impossible. The benefits of videoconferencing are evident, for instance, collaborative work, document sharing, seeing the person you are communicating with. At the same time, using this tool requires a high bandwidth communication link in order to transmit and receive high quality images, there are restrictions in time (for example free Zoom services allow only 45 minutes group communication). Moreover, high quality and unlimited video-conferencing systems are quite expensive.

To our mind, the most demanding task for the quarantine period is to provide interactive, collaborative, team-based learning, work on problem solving tasks. For these purposes, the case method is used. The teacher offers students a clinical case of a patient with a certain injury. The clinical case is illustrated by X-rays, MRI- or CT-images and a patient history. We subdivide the group into the teams of 2-3 students and propose to solve a problem. The students collaborate online and present their solution via Zoom session. In the course of discussion, students determine the amount of first aid and also exchange views on the options of treating the patient in hospital, specify the period of disability and prognosis. After that, a group discussion takes place, in which a teacher is a facilitator rather than a supervisor. The only problem we face these days is the lack of real

interaction with patients, which usually occurs during Traumatology and Orthopedics course. Some students point out the lack of face-to-face communication with the teacher, which is important for taking a medical course. Nevertheless, students admit that this activity fosters them to find interdisciplinary connections, revise anatomy, neurology, oncology, rheumatology, bone, joint and soft tissue diseases. In addition, it develops creative thinking and collaborative learning skills. The group work experience was positive and productive, students found case method appropriate and helpful (93,75%) which is in line with other studies (Back et al., 2014; Si, 2020). Teachers admit that case-based method improves students' performance, which is supported by Bonney (2015).

The findings allow drawing some recommendations regarding implementation of online learning in a medical university:

1. To gain a better efficiency, a combination of learning tools should be used, as each form of online communication has its benefits and drawbacks.

2. E-education should comprise learning in the modes: teacher-student, teacher-group of students, student-student.

3. Problem-based learning promotes students' collaborative work, develops professional and interpersonal skills, so it should be used in remote medical education.

Our experience can be useful for other countries in a crisis situation, especially when the movement of citizens and communication is limited, for example, during a pandemic, armed conflict, etc. It is important to provide students with effective training to master a future profession and necessary skills. Distance learning can be widely used in educational programs to provide theoretical knowledge, perform assessment and develop students' cooperative and other skills. The issue to work on is the improvement of practical skills, which can be implemented in simulation of three-dimensional reality.

4. Conclusions

In pandemic times we face an important task – to provide students with necessary competencies in the conditions of quarantine, when face-to-face interaction is impossible. The portal Neuron on the basis of LMS Moodle, as well as MOOCs and videoconferencing have proved to be effective tools and got positive feedback from teachers, students and administration. Our research is limited in time and the amount of students involved in the experiment. Further investigations are needed, in particular a

broader research regarding students' and teachers' evaluation of the effectiveness of online learning tools in teaching and learning the Traumatology and Orthopedics Course.

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