

HYGIENIC ASSESSMENT OF THE EFFECTIVENESS OF USING DISTANCE EDUCATIONAL TECHNOLOGIES IN MEDICAL EDUCATION

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The aim of this study was to assess the impact of distance learning technologies (DLTs) on the daily routine and health of medical students during the COVID-19 pandemic. The questions included in the questionnaire were intended to measure the awareness of students about the risks associated with distance learning (DL), elicit their opinion about the organization of the learning process and subjectively assess DL as such. The study was conducted in December 2020. It enrolled 508 medical students of Pirogov Russian National Research Medical University (Moscow) and of Northern State Medical University (Arkhangelsk). Statistical analysis was performed in Statistica 13.0. For categorical variables, the significance of differences was assessed using Pearson's chi-square test. Differences were considered significant at $p \leq 0.05$. The analysis reveals that 80% of the respondents thought that DLTs were implemented effectively. The dynamics of academic performance were used as an objective indicator of content assimilation. No significant differences were discovered in the academic performance of students before, during and after the DL period. Although medical students are ready to use some elements of DLTs in the learning process, there is a need for introducing active teaching methods, refining teaching strategies, perfecting teaching skills and teaching students competencies that can be used to maintain their health in the classroom and in a distance learning setting.

Keywords: students, electronic devices, distance learning

Author contribution: Markelova SV, Fedotov DM — article writing; Khromova AV, Ievleva OV — collection of material, statistical processing, analysis of literature.

Compliance with ethical standards: this study was approved by the LEK Russian National Research Medical University named after V.I. N.I. Pirogov (Protocol № 203 dated 20.12.2020). Voluntary informed consent was obtained for each participant. The online survey for the adult population was conducted on a voluntary basis using an online service. The conducted research does not endanger the participants and complies with the requirements of biomedical ethics.

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ГИГИЕНИЧЕСКАЯ ОЦЕНКА ЭФФЕКТИВНОСТИ ИСПОЛЬЗОВАНИЯ ДИСТАНЦИОННЫХ ОБРАЗОВАТЕЛЬНЫХ ТЕХНОЛОГИЙ В МЕДИЦИНСКОМ ОБРАЗОВАНИИ

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Целью исследования являлась гигиеническая оценка использования дистанционных образовательных технологий (ДОТ) обучающимися медицинского ВУЗа в период пандемии COVID-19. Были разработаны анкеты, содержащие вопросы по уровню информированности обучающихся о факторах риска, связанных с проведением дистанционного обучения (ДО), об организации педагогического процесса в период ДО и субъективной оценке ДО. Исследование проведено в декабре 2020 года. В нем приняли участие 508 обучающихся ФГАОУ ВО РНИМУ им. Н.И. Пирогова и ФГБОУ ВО СГМУ (г. Архангельск). Статистическая обработка данных проведена с использованием Statistica 13.0. Статистическую значимость различий качественных данных оценивали с помощью критерия хи-квадрат Пирсона. Критический уровень значимости принимали при $p \leq 0,05$. Результаты свидетельствуют о том, что положительную субъективную оценку эффективности реализации ДОТ в период пандемии COVID-19 дали 80% опрошенных. В качестве объективного критерия усвоения материала при реализации ДОТ было проведено изучение динамики успеваемости опрошенных. Нами не выявлены статистически значимые различия в динамике успеваемости обучающихся до, во время и после перехода на ДО. Таким образом несмотря на высокую готовность обучающихся медицинского ВУЗа к использованию элементов ДОТ в образовательном процессе, требуется совершенствование форм преподавания, внедрение активных форм, совершенствование умений профессорско-преподавательского состава и формирование у обучающихся компетенций, связанных со здоровьесбережением, которые они могут реализовывать как при очном, так и при ДО.

Ключевые слова: обучающиеся, электронные устройства, дистанционное обучение

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Соблюдение этических стандартов: Данное исследование было одобрено ЛЭК РНИМУ им. Н.И. Пирогова (Протокол № 203 от 20.12.2020). Добровольное информированное согласие было получено для каждого участника. Проведение онлайн-опроса для взрослого населения проводилось на добровольной основе, с использованием онлайн-сервиса. Поведенное исследование не подвергает опасности участников и соответствует требованиям биомедицинской этики.

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The experience of delivering medical education through distance learning technologies (DLTs) during the COVID-19 pandemic which broke out in 2020 is yet to be understood. Although DLTs have been proved to facilitate the learning process, there are still doubts whether students and teachers are ready to use DLTs on a regular basis [1, 2]. According to a recently published

meta-analysis, hybrid education, i.e. the combination of in-person classroom instruction and online learning, results in better knowledge assimilation by medical students in comparison with purely in-person or purely online learning [3].

Maintaining and improving student health is a priority, so the impact of DLTs on student health should be thoroughly

investigated. Higher education institutions play the leading role in shaping the personality of tomorrow's doctors and their competencies, even when faced with the challenges of DL [4, 5].

The aim of this study was to assess the impact of DLTs on the daily routine and health of medical students during the COVID-19 pandemic.

METHODS

The Department of Hygiene (Faculty of Pediatrics, Pirogov Russian National Research Medical University) designed an online survey distributed via Google Forms [6]; the authors of the survey were qualified in general hygiene, hygiene education, hygiene of children and adults, and epidemiology. The questions were intended to measure the awareness of students about the risks associated with DL, assess the organization of the learning process and elicit students' opinion about online education as such.

The study was conducted in December 2020 and enrolled 508 first to sixth year students of Pirogov Russian National Research Medical University (Moscow) and Northern State Medical University (Arkhangelsk). The mean age of the respondents was 20.5 years; 80% of the respondents were females. The study included students who gave informed consent to participate and returned clearly and accurately filled-in questionnaires. Exclusion criteria: not being a student, no informed consent to participate, the questionnaire form filled out incorrectly.

The study was approved by the Ethics Committee of Pirogov Russian National Research Medical University (Protocol No. 203 dated December 20, 2020). The study did not pose any health risks for the participants and met the standards of biomedical ethics.

Statistical analysis was carried out in Statistica 13.0 (StatSoft Inc.; USA). For categorical variables, the significance of differences was assessed using Pearson's chi-square test. The effectiveness of DLT implementation was assessed using regression analysis. Differences were considered significant at $p \leq 0.05$.

RESULTS

The survey revealed that 98% of the respondents did not have any difficulty using DLT because they were initially gadget-savvy and their ICT (information and communication technologies) skills were quite good.

When assessing the benefits of transitioning to DL, the students indicated that they did not have to use public transport and that DLTs were a time-saver (27%); they also found they had more time on their hands that could be spent on studies, sleep (24.5%) and work (20%); 10% of the respondents underscored the convenience of using ICT for learning and the high quality of online lectures.

The downsides of DL included the lack of skill practice (34.5%), declining motivation to study (15%), the absence of in-person communication with faculty and other students (15%), health problems (13%), and technical issues, such as the availability of electronic devices, workstation-related problems, problems with Internet access, poor ICT skills, etc. (5%).

When describing their daily routine and leisure activities during the distance learning period, 60% of the respondents reported they had more free time and 63% of the respondents reported an improvement in their daily routine. Of those respondents who had a part-time job (35.5%), 68.5% reported that it was easier for them to combine work and studies during

the distance learning period. Faculty efforts were positively recognized by 70% of the participants.

A medical student has to master a variety of very complicated disciplines. So, the respondents were asked to name subjects that could not be mastered through purely online education. The list included anatomy, histopathology, biochemistry, pathological anatomy, topographic anatomy, emergency surgery, clinical subjects like internal diseases and pediatrics. DL-related stress and adaptation difficulties were reported by 17% of the respondents; 64.2% of the respondents reported that it took them longer to do their homework during the DL period.

The regression model ($p = 0.017$) describing the subjective assessment of students' emotional attitude to DL (values > 1 point designate positive attitude, values < 1 point designate negative attitude) does not contain variables associated with age, sex, year of study, academic performance, the ability to use electronic devices, and technology requirements for distance learning. The equation contains variables (1) associated with the absence of stress during the transition to DL, appreciation of the form in which learning materials were presented, and relationships between peers and between students and faculty:

$$Y = 0.73 + 0.22X_1 + 0.18X_2 + 0.09X_3 - 0.21X_4 - 0.12X_5 - 0.14X_6 \quad (1), \text{ where}$$

- X1 is the absence of stress during the transition to DL;
- X2 is the appreciation of the form in which learning materials were presented (the high quality of online lectures and classes);
- X3 is the opportunity to combine work and studies;
- X4 is the negative impact on daily routine and less free time due to spending more time on home assignment;
- X5 designates a declining relationship between peers;
- X6 designates a declining relationship between students and faculty.

That said, the quality of distance learning implementation can be inferred from the assessment of its effectiveness by students. The regression model ($p = 0.001$) describing the subjective assessment of DL effectiveness by students (values > 3 points indicate positive assessment) contains variables (2) associated mostly with the organization of the learning process and faculty efforts:

$$Y = 2.76 + 0.13X_1 + 0.21X_2 + 0.22X_3 - 0.14X_4 - 0.19X_5 - 0.14X_6 \quad (2), \text{ where}$$

- X1 is good health (self-assessment);
- X2 is an improvement in daily routine and more free time;
- X3 is the appreciation of faculty efforts;
- X4 is difficulty adapting to DL;
- X5 is a dislike of learning material presentation;
- X6 is a dislike of knowledge assessment formats.

On the whole, 80% of the respondents thought that DLTs were implemented effectively.

The subjective assessment of DLT implementation reflects the student's perception, in the first place. Another important indicator of knowledge assimilation is the dynamics of academic performance. We asked the respondents to evaluate their academic performance before, during and after the distance learning period. The analysis of the obtained data did not reveal any significant differences in the dynamics of the learning process.

The number of students with excellent performance was stable ($7.7\% \pm 1.2\%$). The same was true for the respondents with excellent or good performance ($55.3 \pm 5.0\%$, $64.2 \pm 5.0\%$, $56.5 \pm 5.0\%$; $p = 0.21$). The proportion of students whose performance was different from good or excellent (e.g. satisfactory) remained unchanged, too. However, some students reported poor academic performance during and after the distance learning period. This can be explained by

decreased motivation to study online, difficulty self-disciplining and technical issues.

Of all students who had experienced DL, 78.7% said they would prefer in-person classroom learning, with small additions of DLTs. According to 66.7% of the respondents, the combination of traditional learning formats and DLTs could improve content assimilation. Only 9.8% of the students were opposed to using DLTs in the learning process.

Thus, medical students are ready to use DLTs in the learning process if they are not stressed, experience no adaptation difficulties, do not suffer from declining relationships between each other and faculty, and the learning process is organized (to the greatest possible extent) in a traditional manner (traditional presentation of learning materials, traditional knowledge assessment formats, having an opportunity to interact with teachers). About 47.8% of the respondents mentioned the need for being able to use and incorporating health-friendly technologies in the learning process.

DISCUSSION

DLTs involving the use of stationary and mobile electronic devices that impact students' health are a new element of the learning process [7, 8, 9, 10].

Foreign publications have identified a number of problems in teaching medical students. The integration of DLTs into the

learning process has uncovered the ambivalence of traditional and active teaching methods, which raised concerns about their impact on different aspects of life [11, 12].

It was reported that the majority of medical students felt positive about transitioning to DL; however, this was not the case with small groups, including autopsy sessions. Less than a half of the respondents developed symptoms of anxiety [13, 14].

Active learning technologies allow both students and teachers, who should be able to use them in the learning process, to adapt to online education and offer a few extra advantages that ensure a flexible, dynamic, mobile, sustainable and culturally safe learning environment [15].

Teachers are expected to be competent and skilled in using various online learning platforms [16, 17].

CONCLUSIONS

This study demonstrates that medical students are ready to use some elements of DLTs in the learning process. However, such technologies raise the need for active teaching methods, refined teaching strategies and perfected teaching skills. The special focus should be placed on identifying students who find DLT challenging. It is imperative that students should be taught competencies that can be used to maintain their health in the classroom and in a distance learning setting.

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