Original Research Article

Teaching microbiology- online and offline challenges during COVID-19 pandemic

ABSTRACT

Background. The coronavirus pandemic has caused a general crisis, affecting several sectors of the society, sectors that were not exactly ready to deal with critical situations. This is also the case with education, which was faced a huge challenge: digital, online teaching teaching.
Objectives. The aim of this study is to compare the effectiveness of online microbiology course with a traditional course, taught by the same professors, the students involved are in the first three years of study at the Faculty of Midwifery and Nursing, in the University of Medicine and Pharmacy "Carol Davila " from Bucharest.
Methods. The period of our study was of two years, 2019-2021. The first year had digital classes and the second had face to face classes The study conducted a prospective study. It was used a 10-question questionnaire as a tool for assessing students' perceptions regarding the difficulty of online teaching with every aspect, such as homework's, projects, presentations and online browsing. It was also compared the method of online and traditional education.
Result. Almost half of our participants, 46.9% found the teaching files for the online lectures satisfactory and understandable while 51% of students considered easier to study online than face to face. Regarding face-to-face studying, 67.3% of the responders voted for the face-to-face teaching. Technical issues were reported by 47.2% when connecting or during online classes.
Findings. This study will contribute to future research that investigates students' perceptions of microbiology courses and laboratories to ensure the development of a quality microbiology curriculum.

Keywords: Pharmacy, microbiology curriculum, coronavirus pandemic, Google Meet

INTRODUCTION

The coronavirus pandemic has caused a general crisis, affecting several sectors of the society, sectors that were not exactly ready to deal with critical situations. This is also the case with education, which was faced a huge challenge: digital, online teachingteaching [1].Online learning is an educational process which takes place over the Internet as a form of distance education [2]

As of March 11, 2020, just in one day, following the decision of the Ministry of Education and Research to suspend face-to-face courses, the education system was reoriented towards new communication and cooperation practices to ensure continuity of learning and organizational functioning. If this online technology was no stranger to several universities for medical education was a great challenge. Medicine is by excellence a science in which face to face teaching along with the real-life situations or simulated situations is highly needed.

However, while somemedical subjects may be effectively supported in online classrooms, learning clinical microbiology exclusively onlinewas a challenge, as teaching microbiology requires laboratory practice that cannot be acquired only by lectures, movies, or readings. The

students must learn how to deal with the microscope, how to hold the microbiological loop, or the pippete in the hand and haw to use it. The online teaching classes started in Romania with no preparedness so there was no transitory period. It was compared the online teaching, from 2020 to 2021, with the traditional teaching, the face-to-face teaching, method that was used before the coronavirus pandemic. A lot of meta-analyses affirmed a statistically significant difference between online and offline learning for knowledge and skill [3]

The effectiveness of online learning is influenced by many factors. Some factors create barriers to online learning, such as administrative issues, social interaction, academic skills, technical skills, student motivation, study time and support, technical issues, costs and internet access [4]. Other factors could lead to poor quality online learning, such as inefficient design and arrangement of multimedia materials [5].

The aim of this study is to compare the effectiveness of online microbiology course with a traditional course, taught by the same professors, the students involved are in the first three years of study at the Faculty of Midwifery and Nursing, in the University of Medicine and Pharmacy "Carol Davila " from Bucharest.

MATERIAL AND METHOD

It was conducted a prospective study. It was used a 10-question questionnaire as a tool for assessing students' perceptions regarding the difficulty of online teaching with every aspect, such as homework's, projects, presentations and online browsing. It was also compared the method of online and traditional education. The questionnaire was distributed to first- and second-year students, in the Microbiology Discipline, Faculty of Midwives and Nursing, University of Medicine and Pharmacy Carol Davila from Bucharest. Out of a total of 304, 294 students participated in the microbiology courses in both teaching methods. There was no dropout rate in our study, all students that participate at the classes were recruited and engaged. The sample size was calculated according to the participants of our classes.

The period of study was of two years: 2019-2020- the year before the pandemic and 2020-2021 the year during coronavirus pandemic.

The studiu have the ethical approval of our Ethical Board of the University.

The head teacher of our class is an Associate Professor of Microbiology, Parasitology and Virology, teaches the lectures and she is MD PhD. The teachers that teach the practical classes are also MD, PHD; their grade is Assistant Professor

In 2019, the microbiology courses for first year students was organized in traditional classroom, in the physical manner, in the National Medico-Military Institute of Research and Development "Cantacuzino" from Bucharest. The duration of a physical lecture was 120 munites with 10-minute break at each hour. During the class there was traditional teaching, face to face presentation and the last ten minutes of every hour were used for questions and discussions to clarify some doubts.

In 2020, due to the Covid-19 pandemic, the traditional, physical teaching had to be replaced by online teaching. Thus, for the development of the classes in the microbiological discipline, the free platforms were used initially: free Google Meet, Classroom, You tube movies. After a while, the Universities made arrangements for using several features of all types of internet online teaching.

Google Meet is an application that allows you to make an online meeting, live with students, who can access the application through their electronic devices: phones, tablets and laptops through a link posted by e-mail or Classroom. Our University created institutional accounts for every student and all the meetings became secured and the administration of the classes was possible easier.

Through Google Meet application the university professors were able to make complete lessons: with the theoretical part as well as the practical part, which was conducted by virtual demonstrations of the practical aspects using video and audio files, links tovarious digitized materials or online educational platforms, photos, handwritten and scanned material.

Another digital resource used in the training of our students was the Classroom application itself. This application allows an efficient structuring of the material for students, offering a wide range of tools for digitizing information: power point presentations, text, quizzes, videos, audio files, tables in Word or charts in Excel. Each semester it was formed groups of students which received the information through this application. The information that was displayed was formed by the lecturestaught during the theory classes, the links from the evaluation applications, the announcements, thebooks written in the discipline. Our subjects contained information about medical bacteriology, virology and parasitology.

In online, the connection with the students was maintained by creating closed groups on WhatsApp or Facebookand institutional e-mail.

The medical theoretical content for both educational modes, online and traditional, with physical attendance in the classroom, was identical, as it was taught by the same university professors in the same discipline. The duration of the course remained the same, the difference was the absence of face-to-face interaction.

In order to collect data, to be able to compare the both way medical teaching itwas designed a 10-question questionnaire, excluding questions about gender, age, and aria of residence. Here are the questions:

1. Which teaching method (online or traditional) gave you a better understanding of the course content? UNDERSTANDING
2. Which teaching method (online or traditional) is easier for you to pay attention to in your lectures? ATTENTION
3. Which way of teaching (online or traditional) is more convenient to participate? CONVENIENCE
4. In what way is teaching (online or traditional) is easier to clear up misunderstandings? MISUNDERSTANDING
5. Did you experience technical issues when connecting or during online classes? TECHNICAL ISSUES
6. Are you more likely to attend online courses or traditional classes? ATTENDANCE
7. Is it easier to be distracted during online classes than during traditional classes? DISTRACTION
8. What is your availability to follow the traditional time schedule compared to the online time schedule? REGULARITY
9. Does the lack of face-to-face communication and social interaction with colleagues and teachers influence the interest in participating in online courses? INTERACTION
10. Were the results obtained at the annual verification better in the case of online teaching?

The study was conducted in compliance with the rules of medical ethics, being approved by the Ethics Commission of the hospital, "Ethics Committee of Scientific Research of the Carol Davila University of Medicine and Pharmacy Bucharest, Romania", final approval number: 12812 of 16 May 2022.The questionnaire was peer validated and approved by the Ethics Committee; all the procedures of the study respect the ethical standards of the Helsinki Declaration. The inform consent was compulsory.

RESULTS

A total of 294 students aged between 18 and 50 years old participated in the survey, the average age was 20.66 ± 4.25 years. The majority of the sample are students, no other occupation, they live with their parents and have no personal income.In the studied group, the share ofgirls were majoritar, N=258 87.8% and the boys were 12.2%, N=36. 85.7% , N=252of the students come from urban areas.

Table 1: Questions and answers of respondents

Questions	**Answer**	**Ratingn (%)**
Understanding	Online	N=138 (46,9%)
	Traditional	N= 156 (53.1%)
Attention	Online	N=150 (51%)
	Traditional	N=144 (49%)
Convenience	Online	N=264 (89.8%)
	Traditional	N= 30 (10.2%)
Doubts	Online	N=96(32.7%
	Traditional	N=198 (67.3%)
Technical issues	Yes	N=102 (47.2%)
	No	N=114 (52.8%)
Attendance	Online	N=222 (75.5%)
	Traditional	N=72(24.5%)
Distracted	Online	N=150 (51%)
	Traditional	N=144(49%)
Regularity	Online	N=282 (95.9%)
	Traditional	N=12 (4.1%)
Interaction	Yes	N=209(71.08%)
	No	N=85 (28.91%)
Results	Online	N=204 (69.4%)
	Traditional	N=90 (30.6%)

The results showed that 46.9%, N=138 of the students found the online course materials to be satisfactory and easy to understand, and 51%, N=150 of the students found it easier to pay attention to teachers' online lectures. 67.3% , N=198of students found it easier to clear up their misunderstandings with traditional teaching, while 51% N=150 found it easier to be distracted during online classes. Similarly, 47.2%, N=102 reported experiencing technical issues when connecting or during online classes, as shown in Table 1. Students perceived a difference in the results obtained between the two teaching modes, the percentage of 69.45%, N= 204 being in favor of online teaching, even if the course content was equivalent. The results of the study show that the attendance of classes is higher in the case of online teaching, the availability to respect the traditional class schedule, compared to the online class schedule is only 4.1%, N=12 while 75.5%, N=222 of students were more likely to attend courses online than in traditional classes.

DISCUSSIONS

This study investigated the factors that influenced the students in the faculty of Midwifery and Nurses in both ways of teaching a microbiology: online courses compared to traditional teaching, and less on the effectiveness of the discussed methods.Previous research has focused primarily on the effectiveness of online and in-person teaching and has looked less frequently at students' opinions.

The advantages of online teaching that it was had identified have included a greater willingness to attend classes, the convenience and availability to follow the schedule. It was interviewed 294 students. For most of them, online schooling was a difficult time, which caused tension and frustration, which came unexpectedly. Despite this fact, in our study, in completing the questionnaire, a percentage of 96.71% N=294 , students were involved, 14.3%, N=42 , of the students come from rural areas. This demonstrates the increased interest of students in the distance learning process, being open to modernization, even if online learning was a new and not very available way for them.

An increasing number of studies have found that the versatility of online learning is a convenient and cost-effective approach to education [6]. Students can access online courses from any location, eliminating the cost of study space and materials [7, 8]. Being physically present in a classroom is no longer the only learning option today. As long as it want, it was can have access to quality education anytime and anywhere, the only condition being the existence of a functional computer connected to the internet. The involvement with which teachers teach online and the maturity with which students acquire or not the notions taught will be seen much later in life.

Undoubtedly, the advantages of online learning derive from the fact that online activities can be accessed anytime and anywhere, each student can independently browse the proposed material at their own rhythm. In our study, the response regarding the predisposition of students to participate in online courses was clearly against traditional classes, 75.5%, N= 222,of students preferred online courses.

However, keeping students' attention during online lectures is a rather serious issue [7]. In our study, 51% N= 150,of students admitted that it was easier to be distracted during online classes.

Online learning has many advantages, but also disadvantages, being seen by both students and teachers the solution to the crisis situation in the days of the pandemic, in fact the reality that the whole world has faced. The biggest disadvantage in online medical education is the loss of the

opportunity to go to the laboratory, to practically explore various laboratory works and practical activities.

Online medical teaching is a challenge, as students in microbiology classes need to acquire and develop practical skills. Medical education based on the demonstration of laboratory tests is performed by the presence in the hospital and the practical exploration of various diagnostic methods [8]. E-learning leads to a loss of 'practical' experience which can affect workload [9].

Although, according to some studies, traditional courses offer students an opportunity to learn in a practical environment, with colleagues and an instructor [10], in our study, in the case of 71%, N=209, of participants, the lack of face-to-face communication and interaction social work with colleagues and teachers, influences the interest in participating in online courses. According to another study, increased interpersonal interactions with teachers and colleagues can also lead to increased intrinsic motivation and stimulate additional learning experiences in the form of face-to-face feedback [11].47.2%,N=102 ,of the students participating in our study stated that they faced technical problems in online courses. The speed and adequacy of the internet connection, the availability of technical assistance and the quality of the online course syllabus can also negatively affect the satisfaction of the student attending online courses [12].

69.4%, N=204 , of the students involved in our study stated that they had better results in online teaching. When it was compared online courses with traditional courses, there was a sign of concern about academic integrity in online courses. Because students were not directly supervised when completing their homework and exams, there was a greater opportunity to use other resources in the structure of the online course, such as obtaining external help for homework and exams. This result reflects the observed results for larger meta-analyzes that consider online courses in all disciplines [13].

COVID-19 pandemic came with many changes not only in education but also in other different areas such managing public health and COVID-19 vaccination issues [14]; managing patients with severe comorbidities such as HIV, diabetes and cancers [15-19] and management of the pregnant women [20, 21], changes that reorganized may areas.

The limitation of our study is the size of the studied sample.

We believe that digital teaching must be done together with face-to-face teaching, two methods that may complete each other.

CONCLUSION

The COVID-19 pandemic affected all aspects of human life, and students from the Faculty of Midwifery and Nurses were no exception. Comparing the online teaching method with the traditional teaching method formicrobiology, in the present study, it wasrevealed that both teaching methods have advantages and disadvantages, as there is no preferred teaching method. For face-to-face teaching the main advantage is that you immediately know if the student is attentive and understands; for online teaching the main advantage is that the student may repeat as many times as he/wants the recorded lecture. The main disadvantage of face-to-face teaching may be that the students must be at the class, so they must travel, while in online teaching one great disadvantage is that the teacher cannot control what the students are doing all the time.While traditional methods remain important, the addition of digital pedagogies and new methods of education will further enhance students' learning and development opportunities.

This study will contribute to future research that investigates students' perceptions of microbiology courses and laboratories to ensure the development of a quality microbiology curriculum.

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