

## Article

# The Impact of the Coronavirus Pandemic on Medical Education: A Case Study at a Public University in Romania

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**Abstract:** The spread of COVID-19 in 2020 forced universities around the world to transfer on-site education to a virtual environment. The main goal of this study was to compare the experiences regarding online learning of students in programs that require clinical experiences with those of students in programs that do not require such experiences. The authors hypothesized that the switch to online instruction has affected medical students more profoundly than other students. Using a convenience sample of students at a Romanian university, the researchers explored differences between the two groups related to technical and personal problems, course quality, and instructional strategies used by faculty. The results indicate that medical students who could not participate in clinical experiences were significantly less satisfied with the transition to online learning than students in other programs. One implication of these results is that faculty teaching in medical schools need to improve in three areas related to online course quality: pedagogy, course content, and course preparation.

**Keywords:** course quality; instructional practices; online education; online learning; personal problems; technical problems



**Citation:** Aivaz, K.-A.; Teodorescu, D. The Impact of the Coronavirus Pandemic on Medical Education: A Case Study at a Public University in Romania. *Sustainability* **2022**, *14*, 542. <https://doi.org/10.3390/su14010542>

Academic Editors: Jon-Chao Hong, Chi-Ruei Tsai and Ying Hwa Kee

Received: 30 November 2021

Accepted: 30 December 2021

Published: 4 January 2022

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## 1. Introduction

Online and hybrid delivery models have been part of higher education for almost two decades [1]. However, while these modes of teaching and learning have been present at many universities, their implementation and adoption has been inconsistent, leading to wide differences in student learning experiences across institutions, disciplines, and even courses [2]. As one of the goals of public universities is to ensure equal access to high quality teaching and learning for all students, it is necessary to better understand the factors associated with the successful adoption and use by universities in general, and by faculty and students in particular, of online teaching techniques and methods. By understanding these factors, higher education institutions can better support online teaching and learning (OTL) [3].

The outbreak of the COVID-19 pandemic and the implementation of social distancing protocols led to a rapid transition to OTL between March and April 2020 for most higher education institutions worldwide [4]. The pandemic created a unique opportunity for universities to assess the extent to which administrators, faculty, and students were ready for OTL [5]. Instructors' perceptions regarding their willingness to embrace OTL revealed significant differences in opinions and adoption [6]. This event caused major changes in instructors' teaching practices, and some were reluctant to adapt to the new technologies, which can be explained by a mix of individual, institutional and cultural factors [7].

Students in higher education institutions are not a homogeneous group; important factors that affect one academic program may be completely different for another program, given differences in the experience with OTL and the particularities of each academic

discipline. In order to provide adequate instructional support, it is necessary to understand the reasons faculty adopt or do not adopt new OTL practices [8] as well as how different groups of students perceive the effectiveness of online teaching.

When students at Ovidius University, a public university in Romania, were asked at the end of Fall 2020 to indicate how satisfied they were with online education, only 24.5% of medical and dentistry students said they were satisfied or very satisfied, compared to 50.5% of students in other academic programs. The large discrepancy in satisfaction with online education between the two groups of students, and in general between students who require clinical experience as part of their training and students who do not have such requirements, was the main impetus for this study. Specifically, the authors hypothesized that the switch to online instruction has affected medical students more profoundly than other students. This is primarily because clinical rotations for the upperclassmen were halted with the outbreak of COVID-19, and these students did not have access to hospitals and patients. Additionally, because the General Anatomy class that is taken by first-year students was moved entirely online, learning became extremely difficult even for new medical students, who are not required to participate in clinical experiences.

Rababah and his colleagues [9] explain that the pandemic highlighted the importance of universities as intellectual leaders in terms of social orientation. The empirical study conducted by these researchers revealed the positive influence of “the university management creativity, effective communication with the public and stakeholders, the quality of the educational process and the development of scientific activities”; in their perspective, these should be employed in order to lay the foundation of the strategic planning against a background heavily marked by the pandemic, having in view especially “the social needs of modern society”.

In their cross-sectional study, Roslan and Halim [10] found that although all students had at least one learning device and an appropriate online (OL) self-regulation level, more than one fifth lacked a learning space at their homes; moreover, more than one fifth could not access the Wi-Fi, and more than one tenth lacked mobile broadband coverage. The same researchers found that the students with better academic performances had higher self-regulation levels and benefitted at home from a space designated for their learning activities. Furthermore, the researchers noticed that “high-immediacy and low-bandwidth applications such as WhatsApp and Telegram, and YouTube” were seen “as the most accessible and easiest platforms to navigate OL.” This research enabled Roslan and Halim to design “a conceptual model of OL enablers at learners, educators, and institution levels,” which could be employed as a guide “in faculty development planning and policymaking, especially in promoting a more socially inclusive OL”.

Petchame and his colleagues [11] conducted research on student perceptions regarding three distinct teaching modalities (i.e., face-to-face, Emergency Remote Teaching, and Smart Classroom), the last two being implemented during the pandemic. Both Emergency Remote Teaching and Smart Classroom proved their efficacy in coping with the issues triggered by the pandemic, especially those regarding social mobility. In addition, they found that Smart Classroom modality entailed some other benefits, such as time savings (as travel to campus was no longer necessary), although it also involved considerable drawbacks, i.e., a decrease in the efficiency of the interaction between the instructor and his/her students, and distractions that hindered teamwork activities. Nevertheless, according to the authors, these drawbacks can be counteracted “by specific online teaching training” aimed at the design of active learning forms that boost student involvement and participation.

This study brings a new research perspective to the study of Emergency Remote Teaching by comparing perceptions of online learning between medical students and students in other programs. Specifically, the study explores the following research questions:

- (a) Are students in the medical and dentistry fields more likely to experience technical problems in online courses than other students?
- (b) Is there a significant difference in perceived course quality between medical/dentistry students and other students?

- (c) Are students in the medical and dentistry fields more likely to experience personal problems during online education than other students?
- (d) Is there a significant difference in instructors' use of effective online instructional practices between the medical and non-medical fields?
- (e) How do predictors of satisfaction with online education differ between medical and non-medical students?

The COVID-19 crisis has revealed a series of challenges in implementing online education. Some institutions were not able to adapt to swift educational change because they were not technologically competent to pivot to this new mode of delivery [12]. Therefore, to successfully implement educational change, which in this case refers to the transition from traditional teaching and learning methods to online methods, the implications of this change must be analyzed.

Although studies to date have described the benefits of online education for faculty [13], the evidence of benefits from the student perspective is scattered and sometimes even contradictory. In the context of the COVID-19 pandemic, the transition of an entire education system to the virtual environment has shaken the traditional system of teaching, as both faculty and students were forced to adapt quickly to the new online environment.

One of the foundational elements on which student–faculty relationships are built in both face-to-face and online instruction is communication. Communication can significantly influence students' learning performance. Unfortunately, prior to the pandemic, the ways in which most Romanian faculty transmitted information to students and the means and methods by which they communicated with students were largely based on the traditional lecturing system, where the student is more of a passive actor or a recipient of information, from whom response or feedback is very rarely expected or requested. The transmission of information to students solely through the traditional lecture, in which the dynamics of communication become limited, no longer meets the needs and profile of the 21st century student—a student waiting to be surprised and captivated by the creativity and innovation of their instructor's teaching methods, preferably accompanied by the use of most recent educational technologies and relevant examples from the field [14]. With the outbreak of the COVID-19 pandemic, instructors' adaptation of teaching methods that meet their students' communication needs has now become even more necessary. The vision of the student-centered learning approach (SCL) in teaching assumes that students should be seen as active partners who have much to gain or lose from the way the teaching process is organized and implemented [15]. The student becomes a co-participant in the teaching process and one of the key actors in making that process successful. Thus, students should be given the opportunity to be involved in the design of their courses and assessments [16]. For example, students may be invited to propose study topics and teaching and learning methods, or to choose assessment methods. Metaphorically, such an approach can be likened to a restaurant where the chef leaves the kitchen and invites the patrons to share their preferred tastes so that he can give a personal flavor to the dishes he prepares, thus managing to make the patrons feel that they are important and that their preferences and needs are important to the success of food preparation [17].

A defining characteristic of the student-centered learning approach is the recognition that higher education institutions and academic programs are different, instructors are different and, last but not least, students are different. In other words, students have different learning styles and different needs [18]. Based on this principle, learning in the student-centered approach occurs when the styles and particularities of each of the three actors (university, instructor and student) are taken into account. Thus, the differentiated or individualized approach to teaching allows students to benefit from specific instruction that is most suitable to them [18]. In other words, SCL acknowledges the needs of students and follows the principles of personalized teaching. Some of these principles include: respecting students' learning pace and engaging them in learning activities that help to increase autonomy; the use of different teaching methods as drivers of motivation, rather than as sources of mechanical information delivery; and the continuous use of feedback.

All of these aspects are essential for the learning process, as well as for setting learning objectives together with students and increasing student engagement in the class [19]. The institutional and educational climate that promotes SCL is one that accepts and adapts to the fact that some students learn better through trial and failure, while others learn by applying, others by reading specialized literature, and so on. Moreover, this climate must be one that is permanently open between teacher and student, in order to understand the different learning needs of the student [20].

As each academic program in the university has its specificity that must be taken into account when designing instruction, the current transition to the online environment raised more issues than during the period preceding the COVID-19 pandemic. Undoubtedly, the three actors involved in the educational process (university, instructor and student) have different roles and duties; however, they all have much in common to achieve during the instructional process, which rests heavily on formal and informal student–faculty relationships. The university as an institution is the environment that creates the necessary framework for establishing these relationships.

## 2. Methods

### 2.1. Instrumentation

For the purpose of this study, the researchers adapted the questionnaire used in the study conducted by Digital Promise and Langer Research Associates in the United States on the transition to online education [21]. Specifically, the questionnaire was translated and adapted to the context of the Romanian higher education system. Based on the Likert-type questions formulated in the questionnaire, the researchers developed four composite scales to measure the following constructs:

- (1) Technical Problems corresponds to five technology issues: problems with Internet connectivity, hardware or software related problems, problems with the platforms offered by the university for courses in the virtual environment (i.e., Zoom, Webex, Moodle, Microsoft Team), problems encountered by instructors with the Internet connection, and other technical problems encountered by instructors.
- (2) Course Quality combines three items: the quality of the pedagogical methods used by the instructors, the quality of the content, and the extent to which the instructor prepared for the class.
- (3) Personal Problems combines six items: the time at which the courses (synchronous) are offered interferes with student responsibilities at home; fitting courses in the students' work schedule; feeling too ill, physically or emotionally, to attend classes; whether students knew where to seek help for their courses; whether or not students found a quiet place to attend online courses; and whether they could remain motivated to obtain good grades in the program.
- (4) Instructional Practices includes ten strategies that are viewed as best practices by researchers of online teaching: live (synchronous) sessions in which students can ask questions and participate in discussions; live (synchronous) lectures with the class following the course in real time; recorded lectures (asynchronous); projects that require students to meet in "breakout groups" during a live course; group projects that require students to meet outside the course; the breakdown of teaching activities in the classroom into shorter units than in the courses previously offered in person; use of practical examples to illustrate course content; frequent tests or other assessments; personal messages in which the instructor asks students how they are doing in class or if they can access the materials online; and use of pre-recorded videos from external sources (i.e., YouTube).

To measure the internal consistency of the items used for these scales, the researchers examined the Cronbach Alpha coefficient. Cronbach alpha assesses the commonality of the items in a test, their "uniqueness," and the correlations among the items. However, these characteristics do not imply that the items would describe a single factor [22,23]. In fact, Cronbach himself states that alpha mainly estimates the "concentration of the first

factor" [24]. For this reason, as the number of items loaded with the first factor increases, the value of the Cronbach's alpha coefficient also increases. In other words, alpha is a measure of the saturation of the first factor [22].

There is no absolute threshold that a Cronbach's alpha coefficient should meet in order to indicate adequate reliability. In general, in the social sciences, values around 0.90 are considered "excellent," around 0.80 "very good," and around 0.70 "adequate" [25]. However, there are scholars who view a value of 0.60 as acceptable, though only in exploratory studies [26]. The reliability results for the four constructs are presented in Table 1.

**Table 1.** Descriptive statistics for scales.

	Number of Items	N	Min	Max	Mean	SD	Cronbach Alpha
Technical Problems	5	1693	5	25	13.89	4.06	0.76
Course Quality	3	1712	3	21	15.16	4.82	0.92
Personal Problems	6	1611	6	18	9.14	2.91	0.77
Instructional Practices *	10	1751	0	10	2.64	1.60	N/A

\* Items for construct are yes/no answers.

The Technical Problems scale had a minimum score of 5 and a maximum of 25, with a Cronbach's Alpha of 0.76. The maximum score reflects the fact that students, universities, and instructors faced a large number of technical problems during the transition to online education. The second scale, Course Quality, ranged from 3 to 21, with the maximum level indicating a high degree of student satisfaction with the quality of online education. The Cronbach's Alpha for this scale was 0.92. The third scale, Personal Problems, had a wide range (6–18), with a high score indicating that students faced many problems of a personal nature during the COVID-19 pandemic. The Cronbach's Alpha for this scale was 0.77. The last construct concerned the use of effective online instructional practices and ranged from 0 to 10, capturing the total number of online practices used by instructors. Since there was a yes/no answer for each instructional practice, Cronbach's Alpha could not be calculated for this scale. Overall, the high Cronbach's Alpha values indicated very good internal consistency for the Technical Problems and Personal Problems scales, and excellent consistency for the Course Quality scale.

## 2.2. The Research Setting

The research setting for this study was Ovidius University, which is the successor of the first higher education institution in Constanța, the Pedagogical Institute of Constanța, founded in 1966. In 1990, it became a multidisciplinary university that offers bachelor's, master's and doctoral programs, and it is recognized by national and international accreditation bodies. It is currently the largest European university on the Black Sea coast. The university is named after the Roman poet Publius Ovidius Naso, who lived the last part of his life in Tomis, a well-known Greek and then Roman colony which was a forerunner to the city of Constanța. The spiritual patron of the university left a cultural heritage to humanity, transmitting through his entire work a message about passion and dedication, the power of love, creation, evolution and transformation (<https://www.univ-ovidius.ro/uoc/prezentare-uoc> accessed on 15 May 2021). The university has modern educational spaces equipped with the necessary equipment for the teaching process. The usable instructional space (classrooms, seminar rooms, laboratories and reading rooms) measures more than 24,000 square meters. After implementing the Bologna Process starting in the 2005–2006 academic year, Ovidius University became part of the European Higher Education Area, offering diplomas that are recognized both inside and outside the European Union. Moreover, the University's academic transcripts are bilingual, being released in both Romanian and English.

In Fall 2020, about 15,000 students were studying at Ovidius University, guided by 650 instructors and researchers and supported by over 300 staff members and administrators. The university is multidisciplinary, educating students in degree programs that span



all study cycles, from bachelor's to master's and doctorate, as well as various pedagogical training courses, professional development courses for certified teachers, and medical residency programs. The fields of study offered cover a wide range, including medicine, engineering, humanities, natural sciences, social sciences, law, arts and theology. The university currently has 86 undergraduate programs in 44 fields, 76 master's programs, and four doctoral schools in eight fields of study. The university is organized in 16 schools (faculties): Faculty of Arts, Faculty of Civil Engineering, Faculty of Law and Administrative Sciences, Faculty of Physical Education and Sports, Faculty of Pharmacy, Faculty of Mechanical Engineering and Maritime Engineering, Faculty of History and Political Science, Faculty of Letters, Faculty of Medicine, Faculty of Dentistry, Faculty of Mathematics and Informatics, Faculty of Psychology, Faculty of Applied Sciences and Engineering, Faculty of Economics, Faculty of Natural Sciences and Agricultural Sciences, and Faculty of Theology. Within the university there are 487 students enrolled in the doctoral programs, and 870 medical residents.

### 2.3. Description of the Sample

A convenience sample was used for this study. The questionnaire was sent to all students at Ovidius University via Qualtrics between 8 December 2020–18 December 2020, obtaining 1747 valid answers, which represents a 12% response rate. Responses were examined separately for two groups: Medical Students, which includes students from the Faculty of Medicine and the Faculty of Dentistry ( $N = 446$ ) and Non-Medical Students, which includes students from all other academic programs ( $N = 1301$ ). Pearson's Chi Square statistics were used to explore significant differences between the two groups for a range of demographic characteristics (Table 2). The type of academic program (medicine vs. non-medicine) did not prove to be significantly associated with whether or not the student took online courses prior to the COVID-19 outbreak. However, there were significant associations for student status (with fee/without fee), gender, start date of program, place of residence, employment status, and level of education. Regarding student status (with fee/without fee), there were significant differences between the two groups analyzed: 41% of the medical students were paying tuition fees, compared to 53% of students from other programs ( $\chi^2 (1) = 18.39, p < 0.001$ ). A large number of non-medical students were employed full-time or part-time, while medical students tended not to work or their study program did not allow them to work during the academic semester ( $\chi^2 (2) = 182.06, p < 0.001$ ). There was a higher percentage of female students in medicine than in other programs,  $\chi^2 (1) = 34.94, p < 0.001$ . With regard to the year in which students started their program there were significant differences, as student interest in medicine was much lower compared to interest in other programs in 2020, when the COVID-19 pandemic started, ( $\chi^2 (1) = 48.12, p < 0.001$ ). Thus, only 17% of medical students started their studies in 2020, compared to 34.5% of students from other programs. A student's locality also proved to be significantly different between the two groups ( $\chi^2 (1) = 32.75, p < 0.001$ ), with medical students being more likely to come from urban areas than students in other programs. Regarding students' involvement in caring for younger siblings, there were no considerable differences between the two groups, with approximately two thirds reporting that they have no younger siblings.

**Table 2.** Characteristics of study participants.

		Medical Students	Non-Medical Students	N	Chi Square	<i>p</i>	Cramer's V
Student Status				1749	18.39	0.000	0.13
	Without fees	59.2%	47.4%				
	With fees	40.8%	52.6%				
Sex				1750	34.94	0.000	0.14
	Male	20.0%	35.0%				
	Female	80.0%	52.6%				
First Year of Enrollment				1751	48.12	0.000	0.17
	Started before 2020	83.0%	65.5%				
	Started in 2020	17%	34.5%				
Locality				1748	32.75	0.000	0.14
	Urban	84.9%	71.3%				
	Rural	15.1%	28.7%				
Employment Status				1733	182.06	0.000	0.32
	Not-Employed	84.5%	48.0%				
	Part-Time	8.7%	23.4%				
	Full Time	6.7%	28.6%				
Younger Siblings				1731	10.61	0.005	0.08
	No	69.1%	67.8%				
	Yes, but not involved in caring for them	18.2%	13.8%				
	Yes, and involved in caring for them	12.8%	18.4%				
Taken online courses				1600	1.18	0.270	0.03
	Has taken online courses before COVID-19	85.1%	87.2%				
	Has not taken online courses before COVID-19	14.9%	12.8%				

#### 2.4. Data Analysis

First, survey data were analyzed using descriptive statistics (i.e., percentages) to describe the two groups of students in terms of technical problems experienced during online education, perceived course quality, personal problems, and use of effective online instructional strategies by faculty. Next, the researchers conducted a bivariate analysis including independent sample t-tests and Chi-Square statistics to determine whether the differences between the two groups as shown by the descriptive statistics were statistically significant. Third, binary logistic regression models were developed for each group to determine whether factors impacting the probability that a student would be satisfied with online education differed between medical and non-medical students.

### 3. Results

#### 3.1. Descriptive Statistics

The following analysis compares the responses for the items included in the four scales between medical and non-medical students. The comparative analysis regarding the technical problems experienced by the two groups is summarized in Table 3.

**Table 3.** Technical problems experienced in online courses.

	Medical Students		Other Students			
	N	% Often and Very Often	% Agree or Strongly Agree	N	% Often and Very Often	% Agree or Strongly Agree
Instructors encountered problems with their Internet connection	446		12.1	1296		19.4
Instructors could not teach due to technical issues	446		7.2	1290		11.5
Issues with Internet connectivity experienced by students	445	42.1		1289	30.1	
Software or hardware issues experienced by students	444	76.1		1268	53.2	
Issues with the university platforms experienced by students	443	58.1		1271	33.3	

As Table 3 indicates, a smaller percentage of medical students considered that their instructors encountered problems with the Internet connection (12.1%) or could not teach due to technical problems (7.2%) compared to students in other programs, who stated that these problems occurred more frequently in their courses (19.4% and 11.5%, respectively).

Regarding perceived course quality, only a very small number of students (6.6%) stated that their instructors had become more engaged and that classes in the online environment had improved compared to those offered in face-to-face instruction before the pandemic. There are significant differences between the two groups, with medical students being less satisfied with course quality than their peers (Table 4). Specifically, medical students seem less satisfied than non-medical students in terms of the quality of pedagogy used by their instructors (53.5% vs. 70%), the quality of course content (59.7% vs. 69.2%), and their instructors' preparation for the course (60.3% vs. 74.8%).

**Table 4.** Perceived course quality.

	% Somewhat Satisfied or Satisfied	
	Medical Students	Other Students
Quality of pedagogy used by instructors	53.5	70.0
Course content quality	59.7	69.2
Instructor preparation for the course	60.3	74.8

The analysis of the personal problems encountered by students revealed some notable differences between the two groups. A majority of the medical students surveyed (54.4%) stated that they could not remain motivated to obtain good grades in the online environment, compared to only 18.7% of the students in other programs (Table 5). Regarding motivation, one medical student confessed, "The ability to stay constantly attentive in the classes that were transferred into the virtual environment is undoubtedly low and this is a difficulty encountered by most students. Also, the motivation I had in the face-to-face courses and labs does not compare to that experienced in the online environment, which is gradually decreasing due to a lack of interpersonal interaction and other activities that are necessary to maintain the motivational tonus".



**Table 5.** Personal problems reported by students.

	% Reporting Minor or Major Problem	
	Medical Students	Other Students
The time when classes are offered interferes with my family responsibilities	42.8	46.1
The time when classes are offered interferes with my work schedule	20.0	38.0
I did not feel well enough (physically or emotionally) to participate in the online classes	36.3	36.9
I did not know where to ask for help for one or more of my online courses	42.6	37.6
I could not find a quiet place at home or outside home where I could participate in the online courses	32.3	35.0
I could not remain motivated to obtain good grades in my program of study	54.4	18.7

Fitting the class hours into a work schedule was a problem for only 20% of the medical students compared to 38% for non-medical students, which has to do with the lower percentage of medical students who work while in college. In the case of students from other programs, fitting the course into their work schedule created problems of a personal nature, a significant number of them being employed full-time or part-time.

An important issue concerning the courses that were transferred to the virtual environment relates to the extent to which instructors used online instructional strategies that have been proved as effective by research. Students were asked to indicate what types of teaching strategies their professors used in online classes, and they could specify up to ten options. The results comparing the use of effective online instructional strategies in medicine vs. other fields are shown in Table 6.

**Table 6.** Use of effective online instructional strategies by faculty.

	Medicine (% Used)	Other Programs (% Used)
(a) Synchronous sessions where students can ask questions and participate in discussions	78.5	77.1
(b) Live lectures, with students following the class in real time	54.5	43.1
(c) Recorded lectures	8.5	10.0
(d) Group projects that ask students to meet in “breakout rooms” during live courses	0.4	5.7
(e) Group projects that ask students to meet outside the class	5.2	24.4
(f) Breaking down course material in units that are shorter compared to units taught face-to-face	5.4	8.4
(g) Practical examples used to illustrate course content	37.0	32.9
(h) Frequent tests or other assessments	30.7	18.5
(i) Personal message in which the professor asks how you are doing in the course or if you can access the online course materials	9.2	17.9
(j) Pre-recorded video clips from external sources (i.e., YouTube)	43.0	23.5

Most students (over 77%) in both groups said that their professors use live teaching sessions (synchronous) during which they can ask questions and participate in discussions, and there is minimal difference between the two groups. Another teaching method frequently used is that of live, real-time lectures, which is reported by about half of the students in both groups. Notably, recorded lectures (asynchronous), projects that require students to meet in breakout rooms during a live course, and the breakdown of classroom teaching activities into shorter units than in previously offered in-person courses are rarely used by instructors, regardless of the program.

Assigning group projects that require students to meet outside the course seems to be more frequently used by professors who teach outside the medical school (24.4%) than in the medical school (5.2%). The use of pre-recorded videos from external sources (e.g., YouTube) is reported by 43% of medical students, compared to 23.5% of the non-medical students.

In addition, 37% of medical students said that their professors use practical examples to illustrate the content of the course, which is higher than the percentage reported by students in other programs (32.9%). However, compared to other students, medical students are less likely to report that their instructors sent them personal messages to ask how they were doing in the course or whether they were able to access the online course materials (9.2% vs. 17.9%).

### 3.2. Bivariate Analysis

The results reported in the descriptive statistics indicate the possibility of significant differences between the two groups of students in the way they experienced online education. To test the significance of these differences, the researchers used independent samples *t*-tests and Pearson Chi Square statistics. The *t*-test was employed to determine if there were significant differences between medical students and students from other programs in terms of technical problems, perceived quality of courses offered in the virtual environment, personal problems, and use of effective online teaching methods by instructors. Size effect was measured using Cohen's *d*. The conventional effect sizes proposed by Cohen are 0.20 (small effect), 0.50 (moderate effect) and 0.80 (large effect) [27]. The *t*-tests obtained indicate significant differences for Technical Problems and Course Quality, although effect sizes were relatively low (Table 7). Regarding personal problems, the *t*-test shows no significant differences between the two groups of students. There are also no notable differences in the number of effective online instructional practices used by faculty. Cohen's *d* was used to calculate the effect size of each difference between the groups.

**Table 7.** Results of independent samples *t* tests.

	Medicine			Other Programs			<i>t</i>	<i>p</i>	Cohen's <i>d</i>
	N	Mean	SD	N	Mean	SD			
Technical Problems	441	14.70	3.61	1252	13.60	4.17	5.27	0.000	0.27
Course Quality	441	13.98	4.23	1271	15.56	4.94	6.48	0.000	0.33
Personal Problems	420	9.00	2.68	1191	9.19	2.98	1.20	0.232	0.06
Instructional Practices	446	2.72	1.43	1305	2.61	1.65	1.34	0.181	0.07

Pearson chi square statistics were also employed to examine differences in the use of effective online teaching methods between the student groups (medical vs. non-medical). Table 8 indicates a significant effect for the following instructional practices: live (synchronous) lectures in which the class follows the course in real time ( $\chi^2(1) = 17.21$ ,  $p < 0.001$ ), tasks to be solved in "breakout rooms" carried out during a live course ( $\chi^2(1) = 22.20$ ,  $p < 0.001$ ), assigning group projects that require students to meet outside the course ( $\chi^2(1) = 4.37$ ,  $p < 0.001$ ), breaking down course material into shorter units than in the courses previously offered in person ( $\chi^2(1) = 78.23$ ,  $p < 0.001$ ), using frequent tests or other assessments ( $\chi^2(1) = 29.47$ ,  $p < 0.001$ ), personal messages from the instructor to check how students are doing in class or whether they can access the materials online ( $\chi^2(1) = 18.89$ ,  $p < 0.001$ ), and using pre-recorded videos from external sources such as YouTube ( $\chi^2(1) = 62.18$ ,  $p < 0.001$ ). Although the differences between the two groups of students are significant, the magnitude of these differences is relatively small, as evidenced by the Phi Coefficient. Overall, the results suggest that instructors in medicine are less likely to assign group projects or use breakout rooms, and are more likely to use live lectures and frequent tests and assessments compared to their peers teaching in other fields.

**Table 8.** Chi-square results for use of effective online instructional strategies: medicine vs. other programs.

	Student Group		N	Chi-Square	<i>p</i>	Effect Size (Phi Coeff)
	Medicine	Other				
(a) Synchronous sessions where students can ask questions and participate in discussions	78.8%	77.1%	1751	0.37	0.545	0.01
(b) Live lectures with students following the class in real time	54.5%	43.1%	1751	17.21	0.000	0.10
(c) Recorded lectures	8.5%	10.0%	1751	0.80	0.372	0.02
(d) Group projects that ask students to meet in “breakout rooms” during live courses	0.4%	5.7%	1751	22.20	0.000	0.11
(e) Group projects that ask students to meet outside the class	5.2%	24.4%	1751	78.23	0.000	0.21
(f) Breaking down course material in units that are shorter compared to units taught face-to-face	5.4%	8.4%	1751	4.37	0.037	0.05
(g) Practical examples used to illustrate course content	37%	32.9%	1751	2.52	0.112	0.04
(h) Frequent tests or other assessments	30.7%	18.5%	1751	29.47	0.000	0.13
(i) Personal message in which the professor asks how you are doing in the course or if you can access the online course materials	9.2%	17.9%	1751	18.89	0.000	0.10
(j) Pre-recorded video clips from external sources (i.e., YouTube)	43.0%	23.5%	1751	62.18	0.000	0.19

### 3.3. Logistic Regression Results

Based on the results of the bivariate analysis, the researchers developed a binary logistic regression to estimate the probability that a student will be satisfied with online education. Students indicating that they were satisfied or somewhat satisfied with online education were coded as “Satisfied” while the other students were coded as “Dissatisfied.” Specifically, a binomial logistic regression model was used to assess whether satisfaction with online education could be predicted by the following factors: perceived course quality, technical problems, personal problems, and use of effective online teaching practices. Additionally, the model included controls for demographic and background variables such as locality, employment status, student status (fee/no fee), starting date of program, and sex. A separate regression model was developed for each student group.

To evaluate how much of the variance in the dependent variable can be explained by the models, the researchers used Cox and Snell R Square and Nagelkerke R Square. For medical students, the independent variables introduced in the model explain from 17.4% (Cox and Snell R Square) to 23.6% (Nagelkerke R Square) of the variance in satisfaction with online education. For non-medical students, the independent variables explain from 25.3% (Cox and Snell R Square) to 34.9% (Nagelkerke R Square) of the variance. The percentage of cases correctly classified was 69.5% for the medical students model and 76.8% for the non-medical students model. For medical students, the perceived quality of online courses is significantly associated with their satisfaction with online learning. For every one-unit increase in the Course Quality scale, the 1.12 ratio indicates that medical students are 12% more likely to be satisfied with their online education (Table 9). For students in other programs, the improvement in Course Quality determines a similar increase in the likelihood of being satisfied with online education (12%). As shown in Table 9, several other factors contribute significantly to students’ satisfaction with online education.

**Table 9.** Logistic regression results for satisfaction with online courses.

	B		S.E.		Wald		p		Expl (B)	
	Medical Students	Non-Medical	Medical Students	Non-Medical	Medical Students	Non-Medical	Medical Students	Non-Medical	Medical Students	Non-Medical
Course Quality	0.20	0.12	0.04	0.03	21.47	17.30	0.001	0.001	1.12	1.12
Technical Problems	−0.08	−0.11	0.05	0.03	2.85	9.98	0.091	0.002	0.92	0.90
Personal Problems	−0.07	−0.28	0.05	0.04	1.78	44.32	0.182	0.001	0.93	0.76
Instructional Practices	0.05	0.13	0.10	0.08	0.30	2.73	0.586	0.098	1.05	1.13
Locality	−0.46	0.19	0.38	0.24	1.44	0.66	0.230	0.415	1.58	1.21
Employment Status (Not employed)	0.45	−0.93	0.68	0.31	0.44	8.87	0.506	0.003	1.57	0.39
Employment Status (Employed PT)	0.63	−0.48	0.80	0.34	0.63	2.01	0.429	0.155	1.88	0.62
Student Status (Tuition Waived)	−0.26	0.16	0.28	0.22	0.90	0.52	0.344	0.470	1.30	1.17
Started in fall 2020	0.27	0.69	0.36	0.24	0.47	7.74	0.495	0.005	1.28	1.22
Sex	0.50	−0.31	0.32	0.24	2.38	1.89	0.126	0.170	1.65	0.87

NOTE: Reference levels for categorical variables: Employed FT for Employment Status; Paying Tuition for Student Status.

Personal Problems were not significant in the medical students model. However, this factor was significant for non-medical students; with each additional unit increase on this scale, non-medical students were 24% less likely to report satisfaction with online education.

Likewise, Technical Problems does not seem to affect medical students' satisfaction with online education. However, the coefficient of 0.90 in the non-medical student model indicates that for each one-unit increase on the scale of technical problems encountered, students are 10% less likely to be satisfied with online education. Regarding the specific types of technical problems encountered, the most frequent difficulty for some students was poor Internet connection, while others mentioned impediments related to their personal computers.

Regarding employment status, there was a significant association with satisfaction for students who do not have a job in the non-medical group. Full-time employed students are 61% more likely to be satisfied with online courses than non-employed students. Additionally, the year in which students started their program significantly influences the satisfaction with online education among non-medical students. Namely, the students who did not experience face-to-face classes and started their program online in Fall 2020 are 22% more likely to be satisfied with online education than their peers who started earlier and had experience with in-person instruction.

### 3.4. Qualitative Research Results

The responses given by students to the open-ended questions in the survey were analyzed to derive common themes. Of the 320 students who commented in the open-ended question related to greatest challenges encountered in online education, 24.7% considered that the biggest difficulty they encountered was the lack of clinical rotations and contact with patients, 15% reported a decline in motivation to learn, 14.4% had problems maintaining concentration and attention, and 8.4% could not understand the information presented in the course. The non-medical students mentioned a series of problems related to the

fact that they feel discomfort when they have to sit with the camera and microphone on and cannot concentrate, being subjected to high levels of stress, lack of interaction with colleagues, lack of face-to-face interaction with their professors, and lack of free time to engage in other activities (e.g., recreational activities).

Another important issue reported by students was that of high levels of stress. Here is the testimony of a medical student: "The level of anxiety and stress felt is much higher than it was in face-to-face education. We are afraid both for our health and that of our families, but we also have to deal with stress and uncertainty related to our ability to go into exams. Also, staying home for a long time does not offer us the same efficiency and motivation. We are preparing for a job that entails huge responsibilities, as the times we now live in have proved. Although some professors feel the need to "select" only some of us, given that the medical school lasts six years, I believe this selection can be made in the coming years, when things will return to normal".

Being forced into online courses for two semesters has caused a number of health problems for many students. One student noted, "First of all, I got back and eye pain because I spend so many hours at the computer." Another problem invoked often by students was the loss of motivation. One student confessed, "Because a lot of cheating takes place in online courses, many students earn high grades, and there is no difference anymore between a capable student and a mediocre one. In addition, student motivation has declined a lot due to the fact that the online environment bores you and you no longer understand the purpose of your degree program, the laboratories are non-existent, and the quality of the lectures is very poor; there are students who cheat and that's demoralizing because you study a lot to get an 8 for example and others do not study at all and get a 10, just by cheating".

Others mentioned several distractions from learning, "Easier distraction from learning and a lot of redirecting of attention to the phone, Netflix, etc." Many students in the sample confessed that they could not concentrate at home during their online classes. One of the students remarked, "I can't take seriously a college course that I watch as a series. In addition, my home environment is not conducive to learning. I live in a relatively small house with three noisy people. The only hours I can learn are after 11:00 p.m. at night, sometimes starting at 3:00 a.m. in the morning; after that I'm too tired to go to class at 8:00 a.m. in the morning; so, I accumulate absences and if I have too many absences I cannot sit on the exams. It's a vicious circle for which I cannot be blamed".

Overall, students believe that tuition fees need to be lowered for online education to reflect the university's lower educational expenditures. One student noted, "Both the teaching and testing methods that are offered to us have changed with the switch to online education. It made teaching and learning more convenient and less stressful for absolutely everyone, as instructors do not have to commute to campus and students only have to log into their online courses. Since everyone's effort has diminished, I believe that tuition should also be reduced. Moreover, I believe that everyone was financially affected during the pandemic, and this makes it very difficult for students to continue their studies". When asked how the university could improve courses in the virtual environment, medical students proposed the following measures: making additional investments in equipment for instructors and study materials for students (specialized applications, pdf textbooks, useful links/websites), organizing course content and putting it on a platform so that it can be accessed later by students, addressing the technical problems encountered during courses, eliminating student cheating during examinations, increasing interactions with students, increasing instructor use of explanatory videos, improving the organization of courses, and ensuring instructor compliance with the course schedule. One medical student reported, "It is difficult to work with 3D models in front of the video camera, and the instructors do not have the necessary materials or equipment to be able to work with us online properly. Some students and faculty do not have proper laptops so that the lecture can be heard clearly and the instructors can make an interesting presentation. It would be useful to introduce applications using 3D visualizations, such as Biomap".

Regarding improvement of online education, one student remarked, “The online environment is a natural step toward facilitating everyone’s access to information. The problem with online education now stems from a lack of vision that many of our professors have demonstrated mainly because they have not had enough time to improve their technology skills. If students are to learn the subject, faculty need to find ways to capture their attention. They need to keep up with the current times and give up the arid and voluminous materials that make students get lost in their educational journey. Education must focus on creativity and not just memorization. Generations are changing. Only this way, the online environment will succeed in becoming a step in the betterment of all”.

#### 4. Discussion

This study provides insights regarding the online education of medical students and students from other programs enrolled at a public university in Romania, highlighting similarities and differences in student perceptions. Of the medical students surveyed, 73.5% said they were generally dissatisfied with online courses, compared to only 40.5% of the students in other degree programs. A majority of the medical students surveyed (54.4%) stated that they could not remain motivated to obtain good grades in the online environment, compared to 18.7% of the students in other programs. It is evident from the survey comments that the lack of participation in clinical rotations and contact with patients makes medical students more apprehensive toward online education. The difference in satisfaction might also have to do with differences in the perceived quality of courses. The researchers examined why students in each group were dissatisfied with online education by focusing on factors such as technical and personal problems experienced, perceived quality of courses, instructional strategies used by faculty, and demographic characteristics. The results show that while factors affecting satisfaction with online education differ among the two groups of students, there is one common factor that is significant in both models: perceived quality of courses. This factor includes three components: (a) quality of pedagogy used by instructors, (b) course content quality, and (c) instructor preparation for the course.

For the non-medical group, there are additional factors related to satisfaction with online education, with students who work full-time and students who started college in 2020 (with no experience of in-person instruction) demonstrating higher levels of satisfaction. Additionally, the extent of both technical and personal problems encountered negatively affects satisfaction for this group. Neither technical nor personal problems were significant for the medical students.

Related to the use of effective online instructional practices, although the scale was not significant in either model, the bivariate analysis showed that of the ten highly effective online teaching practices listed in the survey, both medical and non-medical students stated that their instructors used synchronous sessions most frequently, in which they could ask questions and participate in discussions. However, irrespective of the degree program, recording courses for later viewing is rarely done by instructors at the examined institution, indicating that faculty are not familiar with asynchronous online courses in which training materials are fully prepared in advance. Such courses, in which students can watch and play instructional videos at any time, could lead to improved learning and confidence in online courses, as each student would be able to work at their own pace [28]. Additionally, a large number of medical students are unfamiliar with working on group projects either in “breakout rooms” during a live course or outside the course, which can impede the ability of future graduates to work effectively as members of a team. Medical students are also less likely to receive messages from their instructors that ask them how they are doing in the course.

There are several limitations related to the research design employed in this study. First, the response rate was relatively small, affecting the representativeness of the sample, and the study was conducted at one university, which limits the generalizability of the results to other Romanian universities. Second, the study lacks medical students’ in-depth perspective regarding the impact of the pandemic on medical education, which could have



been obtained through semi-structured interviews or focus groups conducted with the students. Family income and other important background characteristics which may have affected the responsiveness and results of this survey are lacking. Additionally, the study lacks outcome data regarding final course evaluations, which could be a key outcome for measuring teaching effectiveness. However, the authors assumed that the ratings of satisfaction with instruction are a good proxy for measuring teaching performance.

## 5. Conclusions

Given the significant effect of course quality on satisfaction with online education, and the finding that only 24.5% of medical students at the examined institution were satisfied with online instruction and half reported difficulties staying motivated, faculty teaching in medical fields in an online environment will need to improve in three areas: quality of pedagogy used, quality of course content, and preparation for the course. They will need to make more frequent use of group projects and breakout rooms to increase student motivation, and check individually with students through personal messages on how they are doing in the course.

Future research should consider exploring the impact of the pandemic on medical education using qualitative approaches such as interviews and focus groups conducted with medical students. Additionally, research that focuses on the longer-term impact of the pandemic on medical education should be expanded to include more than one university, preferably using a random sample of students enrolled at various medical universities. Future studies could also benefit research on medical education by comparing the skills of medical students trained before and after the pandemic.

**Author Contributions:** Conceptualization, K.-A.A. and D.T.; methodology, D.T.; software, K.-A.A. and D.T.; validation, K.-A.A. and D.T.; formal analysis, K.-A.A.; investigation, K.-A.A.; resources, K.-A.A. and D.T.; data curation, D.T.; writing—original draft preparation, K.-A.A.; writing—review and editing, D.T.; visualization, K.-A.A.; supervision, K.-A.A. and D.T.; project administration, K.-A.A.; funding acquisition, K.-A.A. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research was supported with a grant from Old & New Construct SRL.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Not applicable.

**Conflicts of Interest:** The authors declare no conflict of interest.

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