The Positive Effects of the Coronavirus Pandemic on Marine Higher Education

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Abstract

The study aims to analyze the positive effects, deriving from the pandemic situation, on the marine higher education in "Mircea cel Bătrân" Naval Academy, by examining the degree of satisfaction of students and teachers on the educational process carried out during the two pandemic academic years. The analysis was carried out in three main directions: the use of ICT technologies and didactic resources in the education process, the qualitative evaluation of teaching and evaluation methods in e-learning, and the communication and relationship methods between students, teachers, and institutional management. The results allow the identification of new development directions and trends in marine higher education, which respond to current and future challenges, to improve the quality of marine education.

Keywords: marine higher education, education process, e-learning, online.

1. Introduction

No education system is perfect. Each type of education has its advantages and disadvantages. The evaluation of each education system is necessary to identify which of the features of these systems best fit the didactic objectives specific to each university and the social environment in which they operate.

The coronavirus pandemic has radically changed the social environment causing all forms of education to quickly adapt to a virtual social environment (Dietrich, 2024). With the advancement of information and communication technologies and the adoption of various forms of synchronous and asynchronous e-learning, such as online, blended, and hybrid learning (Lup & Mitrea, 2020), all participants in the educational process—including teachers, students, and institutional management—needed to adjust to these changes (Lup & Mitrea, 2020).

Thus, the actors participating in the education process (teachers, students/students, and institutional management) had to adapt to the new form of education, by adapting the curriculum content and didactic resources, implementing new teaching/learning and evaluation methods, as well as new methods of communication and relationship (Ionescu & Vrăsmaș, 2024). The evaluation of educational systems is crucial to identify the most suitable characteristics for each university. The coronavirus pandemic forced rapid adaptation to a virtual environment, including at the "Mircea cel Bătrân" Naval Academy (MBNA) a representative marine higher education institution, where education was conducted online in 2019-2020 and hybrid in 2020-2021.

The study analyzes the degree of satisfaction of MBNA students and teachers, as part of marine higher education, on the educational process carried out during the two years of the pandemic, with an emphasis on the positive effects. Evaluative research specifically targets information technologies, the educational resources utilized, the e-learning process, the qualitative assessment of teaching and evaluation methods, and the communication and relationship dynamics between students and teachers, as well as between students and institutional management.

2. Methodology

The target group under analysis consists of military and civilian students from all forms of education and full professors within MBNA, a marine higher education institution. Thus, the participants in this study in the academic year 2019-2020 were 320 students out of a total of 1793 enrolled students, and 27 teachers out of a total of 58 tenured teachers, and in the academic year 2020-2021 were 390 students out of a total of 1899 enrolled students and 24 teachers out of a total of 58 tenured teachers (Avram & Coșofreț, 2020).

To validate the collected data, from the point of view of statistical research, the minimum sample required/reported to the population under study was identified by calculation for a tolerated error of +/-5% and a confidence interval of 95% (Coșofreț & Kaiter, 2022) (Gârboan, 2007). Thus, for the 2019-2020 academic year, the minimum validation sample is 317 respondents, and for the 2020-2021 academic year, the minimum study validation sample is 320 respondents. Therefore, the study samples fall within the convenience of statistical research (Renovater, 2024).

Data analyzed in the study were collected during the two academic years, between May 25 - June 16, 2020 and between April 27 and June 7, 2021, through the opinion survey method, the survey technique being the electronic survey. The survey tool used for data collection was the anonymous questionnaire built with the help of the Google Forms program. The collected data was stratified into two respondent categories: teachers and students. The analysis of this data employed the following statistical methods:

- the percentage reporting method, for presenting the frequency of use of applications or didactic activities;
- simple ANOVA variance (dispersion) analysis method, to identify the intensity with which the respondents perceived the effects of the current situation on the teaching process, or on themselves.

To analyze the effects of an independent variable, Likert scales were used, with several steps of comparison. The comparative data analyzed were: the number of respondents, the mean and the standard deviation, the value of the F ratio (F-Fisher test) for testing the differences between

two groups and the Bonferroni t-test, for testing the differences between the means of the compared groups.

3. Results and Discussions

The use of forms of education that take place in the virtual environment requires didactic support based on information and communication technology.

For the educational process to run smoothly in the virtual environment, the cumulative fulfillment of the following requirements is necessary:

- a stable and high-speed Internet connection;
- high-performance hardware devices;
- stable platforms and communication methods;
- digital didactic resources for each subject in the curriculum;
- technical and pedagogical support;
- competences and digital skills of the actors of the education process.

3.1.Internet connection benchmarking

The existence of an Internet connection is a main condition for e-learning. A permanent and high-speed Internet connection is necessary for the teaching and evaluation processes to run smoothly in the virtual environment. The percentage comparative analysis for the two academic years regarding the type of Internet connection used by both categories of respondents is presented in **Figure 1**.

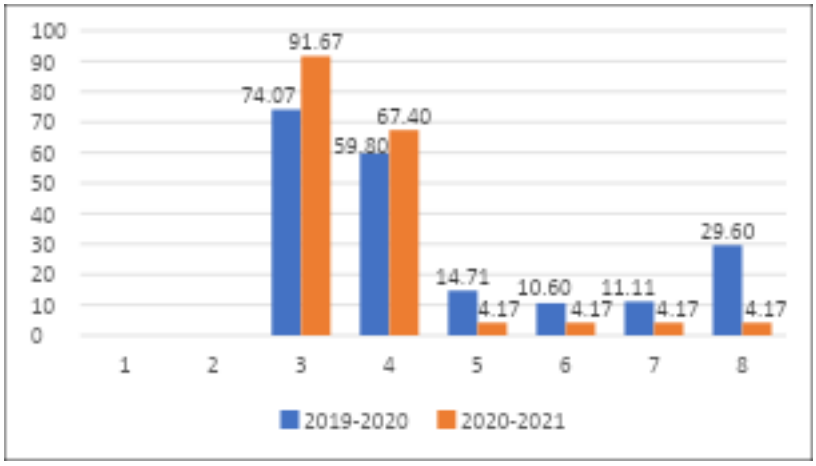

Figure 1. Comparative percentage analysis, by university year, of respondents' answers regarding the type of internet connection used.
used.

An improvement in the internet connection in the academic year 2020-2021 compared to the previous year can be observed in both categories of respondents, with an increase in the permanent high-speed internet connection (for students by 7.64% and for teachers by 17.65%). This can be attributed to the recognition of the internet's crucial role in the effective functioning of the virtual educational process. The marine higher education institution expanded the campus Wi-Fi network in the second academic year, while students upgraded their internet subscriptions.

3.2. Benchmarking the use of hardware tools

The primary hardware tools utilized by teachers and students for conducting the educational process in a virtual environment include desktop computers, laptops, notebooks, tablets, and mobile phones/smartphones. The comparative analysis regarding the degree of use of hardware tools is presented in **Figure 2**.

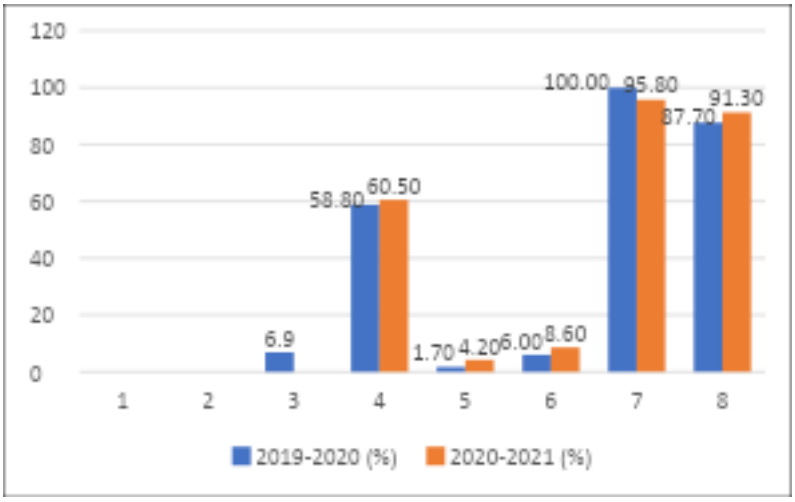

Figure 2. Comparative analysis by university year regarding the use of hardware tools by respondents

From the figure, it can be seen that, among the communication hardware devices analyzed, the computer is the most used due to its hardware performance, storage capacity, installation of

communication and teaching software tools, teaching materials in digital format, augmented reality applications, and virtual reality applications, as well as due to its seamless operation. In the 2020-2021 academic year, there was a 3.6% increase in computer usage among student respondents, replacing the use of phones. This shift is attributed to the institution's initiative to provide laptops to military students and the recognition by civilian students that computers are the most suitable tool for virtual learning. Additionally, there was a 2.5% increase in tablet usage among teachers, replacing the use of computers and phones (from 6.9% to 0%). This change is due to the university supplying high-performance tablets to the teachers.

3.3. Comparative analysis regarding the use of digital communication platforms

To support specific educational activities in the virtual environment, various software platforms for synchronous and asynchronous online communication are essential. These platforms facilitate synchronous online meetings between teachers and students, as well as asynchronous activities through the implementation of a Learning Management System (LMS). The LMS encompasses recording the training process, test results, and access to all educational materials. For conducting virtual classes, specific videoconferencing platforms like Webex or Big Blue Button (used with Moodle) are utilized. Additionally, numerous free synchronous and asynchronous communication platforms, such as email, Skype, WhatsApp, and Facebook Messenger, enable information exchange between teachers and students. At the onset of the pandemic, MBNA, a significant marine higher education institution, had an e-learning platform for video conferences with an integrated LMS and an institutional email platform. **Table 1** presents a comparative analysis of the usage levels of digital communication tools. This analysis was conducted using the Bonferroni t-test and by comparing the Likert scale means of responses from the two categories of respondents. The Likert scale ranged from 1 to 4, where 1 indicates "never," 2 indicates "once a week or less," 3 indicates "once every few days," and 4 indicates "daily."

Software tools	University years	Students					Teachers	F	Significant differences *
		Average	Year I N=86 N=128	Year II N=61 N=108	Year III N=40 N=68	Year VI N=112 N=85	N=27 N=24		
ADL platform	2019-2020	3.737	3.820	3.767	3.732	3.630	3.625	1.032	No

	2020-2021	3,735	3,870	3,676	3,790	3,720	3,735	1,043	No
E-mail	2019-2020	3.506	3.477	3.508	3.575	3.438	3.778	1.544	No
	2020-2021	3,180	3,240	2,971	3,130	3,370	3,180	2,335	No
Videoconference (Google Meets, Microsoft Teams,.....)	2019-2020	3.067	3.151	2.885	3.450	3.098	2,923	4.568	III>II;III > T; I < T
	2020-2021	2,923	3,110	2,490	3,160	3,100	2,478	8,338	T<III,IV; II<III
Audio and chat communication	2019-2020	2.991	3.023	2.984	2.975	2.920	3.222	0.439	No
	2020-2021	2,676	2,940	2,529	2,440	2,670	2,348	1,080	No
Open educational resources and digital content	2019-2020	3.052	2.814	3.295	3.325	3.125	2.556	5.083	III > T; I > T; > I; IV > T
	2020-2021	2,348	1,191	2,714	1,778	3,820	2,957	1,716	I<T; VI>T

* Significant differences identified using the Bonferroni t test.

Table 1. Software tools used for conducting educational activities were analyzed in relation to respondents from the two academic years, with responses measured on a scale from 1 to 4

From the analysis of the results, it can be seen that the e-learning platform of the university remains, in the academic year 2020-2021, the most used software tool with a daily usage regime for both categories of respondents. Also, a slight regression is observed regarding the degree of use of other types of platforms for video conferences, as well as email and other platforms for audio and chat communication. This improvement can be attributed to the enhancement of the advanced distance learning platform during the 2020-2021 academic year, particularly through the development of the learning management system.

3.4. Analysis of the use of digital teaching resources by the respondents

Synchronous online teaching differs from traditional face-to-face instruction, necessitating the adaptation of teaching resources and methods for the online environment. Although online teaching resources must cover the same content as face-to-face teaching, they should be tailored to the discipline's specifics using visual and multimedia support. These can include collaborative presentations (Google), dynamic presentations (Prezi), interactive presentations (Mentimeter), PowerPoint presentations with quizzes, videos, and interactive materials, virtual laboratories, and process simulations.

The term "Digital didactic resources" used in the study is a generic one, which represents the software tools used by respondents to carry out teaching/learning and evaluation activities in the virtual environment. The way to integrate digital didactic resources into didactic activities depends to a great extent on the digital and pedagogical skills of teachers and their creativity in the educational design of learning resources and activities (Grosseck & Craciun, 2020).

The choice or combination of various applications is determined by the teacher's teaching philosophy – their perspective on teaching, learning, and assessment; the presentation and structural requirements of the discipline taught; the skills and abilities needed to be developed in students; and the ability and competence of the teacher to identify and integrate different digital educational resources into the teaching process in the virtual environment.

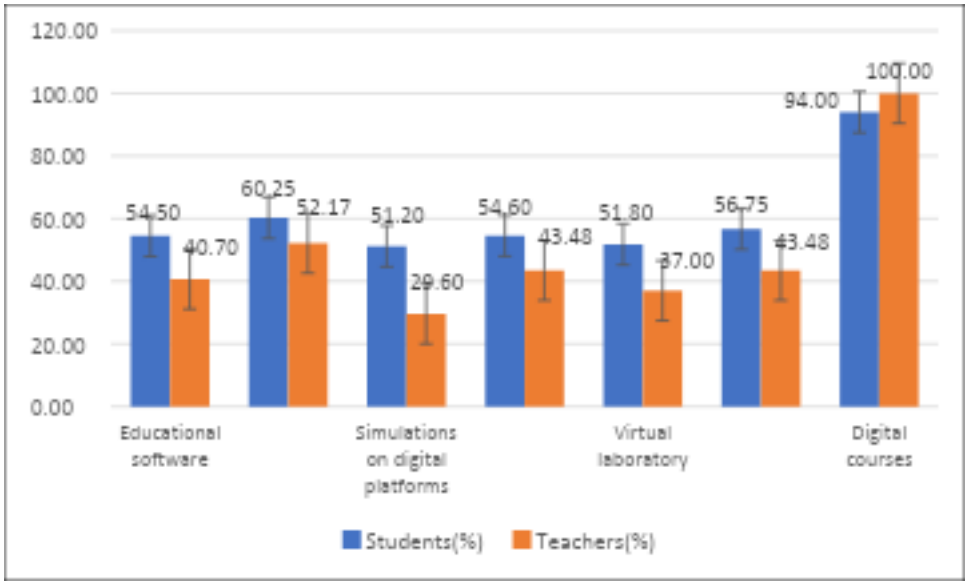

Figure 3. Comparative analysis by university year regarding the degree of use of digital didactic resources by respondents

From **Figure 3**, a significant increase in the use of specialized digital teaching resources can be observed by both categories of respondents in the academic year 2020-2021. Thus, in addition to using courses in digital format, teachers used approximately 11% more educational software, approximately 13% more simulations on professional platforms, and approximately 6% more virtual laboratories. This can be attributed to the teachers' increased experience and digital skills in teaching and assessing subjects in the virtual environment compared to the previous academic

year, as well as the additional time they had to prepare courses for the 2020-2021 academic year.

3.5. Analysis of evaluation activities in the virtual environment

The shift from face-to-face education to a virtual environment necessitated the adaptation of assessment methods for educational activities, while maintaining the specific assessment requirements for each discipline. According to specialized literature, the advantages of virtual environment evaluations include (Vișan, 2021):

- reduction of costs, efforts, and time needed by teachers in relation to classical assessment. Specialized assessment applications on the platforms have the ability to share tests quickly and securely online. This reduces the costs and time of printing exam questions, simplifies the task of teachers in manually collecting and correcting students' answers, and sharing their results.
- streamlining the administration of evaluations. Through specialized applications, the results of the evaluations can be centralized, the results obtained by each student can be tracked over time, and they can facilitate the easy retrieval of response scripts at the request of students or teachers;
- automatic evaluation of answers, thus reducing human error. By defining an answer evaluation algorithm in the software, the results are provided instantly after the test is completed, thus eliminating the human errors of the teachers;
- options for adding comments and feedback for the pupil/student reference.

As the main disadvantages of online assessment, it can mention:

- allocating a long time and a greater workload in developing the tests;
- lack of knowledge on the part of teachers to use assessment applications;
- complexity in developing the test. The teacher must create specifications associating taxonomic cognitive levels (knowledge and understanding, application, and reasoning) that are adapted to the respective discipline; • low and average complexity of the assessed learning outcomes;
- probability of guessing the answer;

- ambiguities that may arise from careless test design.

The study periods also overlapped with the assessment activities (colloquiums, exams), so that the study participants were able to express their point of view, knowingly, regarding the assessment methods that can be implemented in education in the virtual environment.

The methods of evaluation of the didactic activities subject to the survey of both categories of respondents were: grid test, oral evaluation, online oral presentation of reports. The reporting of these evaluation methods was carried out by the respondents according to the type of teaching activities, namely for: courses, seminars, and laboratories.

The comparative analysis of responses from the two academic years regarding assessment methods suitable for the virtual environment shows that there are no significant differences in students' use of online grid tests between the two years, as illustrated in **Figure 4**. However, among teaching staff, there was a decrease of approximately 12% in the use of this method for course evaluations in the 2020-2021 academic year compared to the previous year. Conversely, the same academic year saw an increase of about 8% in the use of online tests for evaluating laboratory activities.

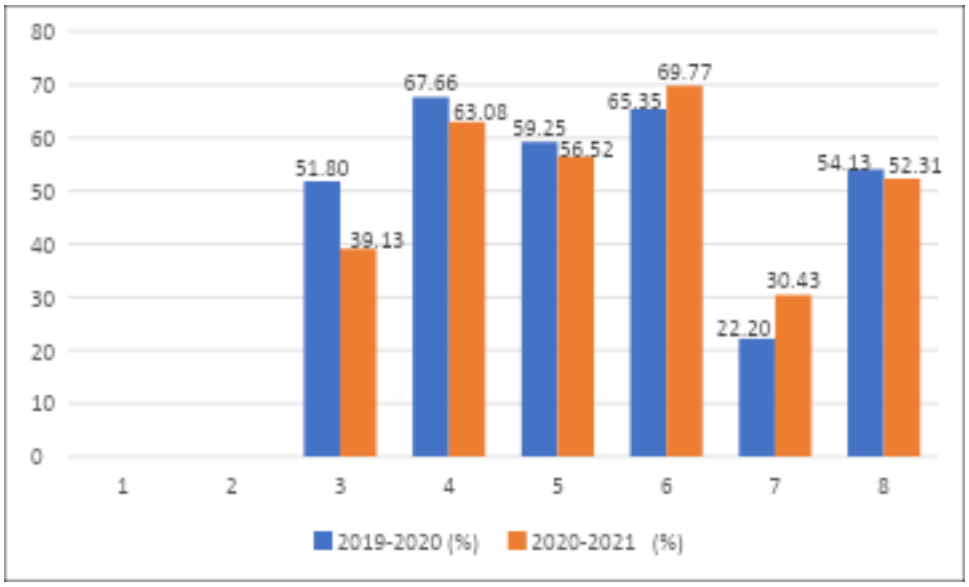

Figure 4. Comparative analysis by university year regarding the degree of use of the online grid test in the evaluation of didactic activities

3.6. Comparative analysis, by university years, of the advantages of didactic activities in the virtual environment from the teachers' perspective

From the analysis of teachers' answers over the two academic years regarding the advantages of education in the virtual environment, significant differences were observed for "Online education is useful for facilitating students' learning" (a reduction of approximately 0.4 in the average of answers in the academic year 2020-2021, compared to the average of the answers from the year 2019-2020).

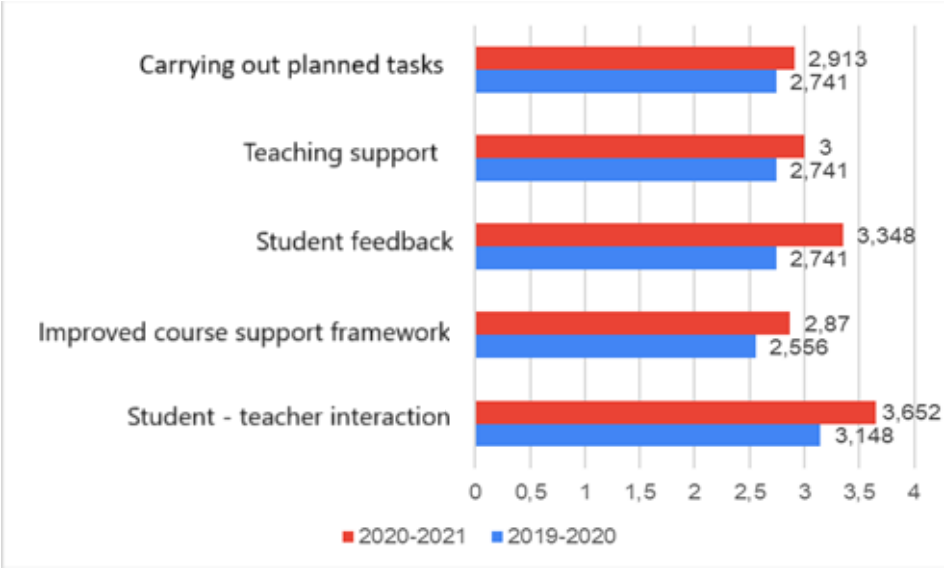

Figure 5. Averages of teachers' answers on the advantages of learning in the virtual environment - comparative analysis, by university years

Concerning the answers to "the digital skills acquired during this period are useful acquisitions for the subsequent didactic activity" (an increase of approximately 0.9% in the average of the answers in the academic year 2020-2021, in relation to the average of the answers from the previous year).

Regarding the limitations of virtual education from the teachers' perspective, the average responses over the two academic years are compared in **Figure 5**. Significant differences were noted in the statement "limitation of feedback received from students," with an increase of approximately 0.6 in the 2020-2021 academic year, indicating a reduction in these limitations due to improved communication methods between teachers and students. Similarly, there was an increase of about 0.5 in the average responses for the 2020-2021 academic year concerning the limitation of interaction between teaching staff and students.

4. Conclusions

Disruption of "traditional" courses caused by the emergence of the coronavirus pandemic has led to the closure of schools and universities globally, including marine higher institutions.

This generated, in the first phase, significant difficulties and challenges in the teaching-learning process. However, in retrospect, these changes also produced beneficial effects on the educational process. Here are some of these positive effects:

The need to move quickly to online education has accelerated the adoption of digital technology in the educational process. Educational institutions have implemented and continue to develop digital platforms and tools, and teachers and students have developed their digital skills through their use. Today, these digital technologies have become an integral part of the process of delivering and receiving educational knowledge. Thus, in MBNA, a marine higher education institution, the Wi-Fi network was developed, laptops and tablets were purchased for teachers and military students, the university's e-learning platform was developed, interactive whiteboards were purchased in each lecture hall and seminar, the electronic catalog was implemented, digital platforms and software for teaching and research laboratories were purchased, and the learning management system (LMS) was improved, etc.

The experience of online education has paved the way for the adoption of a hybrid teaching/assessment model that combines elements of online and classroom teaching. This model offers more flexibility for students and can better meet their individual needs. Currently, cadetship students on transport ships can access teaching resources, access courses, and communicate with teachers to complete certain teaching tasks, etc.

During the pandemic, online educational resources such as open online courses (MOOCs), virtual conferences, and digital libraries have developed and diversified. This expanded access to educational resources can help equalize learning opportunities and facilitate continued education in diverse contexts.

Online learning and virtual collaboration have enabled a greater exchange of ideas and knowledge internationally. Students and teachers had the opportunity to participate in online events and collaborate with colleagues from around the world, contributing to the globalization

of education. For example, nowadays, many international conferences are organized in the online and/or hybrid environment.

Students who had to navigate the online environment developed organizational, time management, and self-regulation skills. These skills are essential in lifelong learning and in today's rapidly changing context. MBNA, like marine higher education institution, has begun to provide more resources and support for managing stress and pressures, recognizing the importance of balance between academic and personal life.

It is important to note that these beneficial effects do not negate the overall impact of the pandemic on education and that many students and teachers have faced significant challenges during this time. Adapting to the changes brought about by the pandemic has been a complex and ongoing process.

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