

Traditional Class And Online Class Teaching. Comparing The Students Performance Using ANCOVA

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Abstract— The educational system of Albania, the Albanian universities, and in this case the Academic staff and the students of the Polytechnic University of Tirana, had to face a great challenge for the last two years due to the COVID 19 pandemic. The educational system was forced to change from the traditional way of teaching and learning in the classroom to the online process. The system was not fully prepared for this great change and all the academic staff was under great pressure to maintain their high quality of teaching performance. In this article, we will evaluate and compare the students' performance online and conventional classes. The samples under study are students of the IMI bachelor course of Statistics, at the Polytechnic University of Tirana. The groups are divided into two; one group used online learning while the other group used conventional classroom learning. Both groups completed two tests, the first at the beginning and the second at the end of the semester. Analysis of Covariance (ANCOVA) was performed to determine if there were significant differences in the mean scores of the second tests, having the first test scores as covariate.

Keywords: *teaching, online, traditional, classroom, ANCOVA*

I. INTRODUCTION

As a result and following the extraordinary developments of Internet services, especially in the last decade, there has been a wide application of Internet services as an information and a communication tool. And, when it was the time the virtual classroom was needed to continue with the educational teaching process, because of the covid 19 pandemic, the Internet's services have contributed by facilitating and complementing the traditional teaching. At the same time, the internet has become an important learning tool for distance learning and for realizing various learning projects [1]. However, various studies, works, and researches have provided mixed evaluations regarding the effectiveness of the Internet as a teaching tool. The enthusiastic researchers and academics have concluded that

Internet has improved and helped the learning and teaching process, its quality as well as its effectiveness [2]. On the other hand, the critics have concluded in their studies that the Internet has minimized the quality and the standard of traditional teaching [3].

In a study of two groups of students who completed the same course, in the classroom and online, Redding and Rotzien concluded that online learning was more effective than classroom learning, a conclusion drawn from the results of the exams they conducted with students. The study resulted that the online class course test was better than the traditional class. In another study, comparing the effectiveness of teaching as well as the time spent on the course it was concluded that the time spent by students learning online was significantly greater than the time spent attending the traditional class. In another study, dealing with the evaluation and attitude of students about virtual and traditional class teaching and learning, it was concluded that the students were more satisfied with the traditional classroom, and to them, the classroom teaching was more effective [4].

There are, of course, differences between online and traditional classes; Traditional teaching and learning methods are teacher-centered and are mainly used by teachers in the classroom to distribute the topic to students [5]. The level of understanding of students is related to attention and personal involvement, but many students are often passive learners. Teachers share and deliver the course content with students and this is considered an important part of the teaching-learning process [6]. However, the traditional method of teaching gives a special role to the teacher, while students have to gain maximum knowledge in a limited time. The main problem is that the goal of making students develop conceptual understanding and critical thinking is not fully achieved.

In several studies, comparing online and classroom learning in University was found that during online courses lecturers try harder and are more engaged to make students understand the content of the course more effectively, which results in better and highest scores in the final tests [7]. This is attributed to the importance of Internet-based learning

to a better collaborative learning environment for lecturers and students, increasing learning resources, promoting effective Internet search for course materials, which had been neglected before, as well as being more convenient and having more time for study. On the other hand, there are the unique features of the internet and online learning in the educational context that are a factor in favor of the online assessment.

The tremendous opportunities created by the Internet are the facilitating communication and scientific research that encouraged and helped the academics and researchers to use it in the creation of new learning environments such as conferences, online materials, presentations [8]. The new, fast, effective Internet communication tools enabled teachers, professors, and students to communicate easily and in real-time, with its unique material storage capabilities, easy publication, and fast exchange of information making it an important scientific and teaching tool [9]. The creation of a plethora of scientific and teaching materials, tutorials, lectures, videos, documents, presentations, graphics, as well as the ease of finding and using them has greatly increased the use of the Internet.

The Internet offers opportunities for teaching outside of traditional classrooms and facilitates communication between teachers and students, making it ideal in terms of distance education. Teaching and other educational information provided on the Internet is accessible to all and at all times and has a wide reach [10]. Many other studies have concluded that virtual communication help students to work and learn independently, and to develop better and more rational research methods [11].

However, the use of the Internet is not excluded from problems that are always present such as security problems, limited access for many people, or too much information for the same topics that comes with the difficulty to choose and select, and the need for technical skills that make it rather difficult for the elderly [12].

A common mistake made by Internet enthusiasts is the concept that technology will replace everything, even that video lectures can completely replace lecturers. Many online learning enthusiasts and practitioners have forgotten and ignored the pedagogical considerations of learning, assuming that traditional classroom learning practices will be replaced by teaching online, thereby harming the educational process and the students themselves [13].

The process of teaching and learning is not just a process of transmitting, giving, and getting knowledge, but it is also a significant pedagogical and educational, process, that cannot be achieved with just technology. It needs the human face, human

communication, and human emotions. It means that the teacher, the lecturer is and will be irreplaceable in the educational teaching and learning process. According to other studies, online teaching and learning class compared to traditional classes vary greatly in terms of goals, contents, pedagogical practices, and audience [14]. For online learning classes to be effective should be available on-demand, support self-paced learning, be combined with high-quality tutor support in distance learning settings, facilitate collaboration, communication, and interaction, and be learner-centered and not teacher-directed [15].

The pedagogy changes from a knowledge transmission strategy that is the case in a traditional classroom to a pedagogy that promotes problem-solving methods and techniques, personal and group scientific searching, and interactive and collaborative styles and methods. The roles and the interaction of the teacher and students change in a technology-supported and mediated- learning environment. The teacher differs from the one who transmits the course content to the students and directs them to a mentor, guide, collaborator, colleague, and leader. The teacher does more than teach the students, he helps the students develop problems solving skills and solve the problems by themselves [16].

During the teaching and learning process in the traditional classroom, it happens often that students because of the limited time of the face-to-face meeting could not optimally receive materials. The high teacher is only obliged to have class a maximum of 24 hours per week, university lecturers less. For filling the gap, one of the alternatives is by using mixed learning, traditional course, and online materials. Using mixed learning could develop a student's skills and knowledge, and could be an opportunity to integrate innovative development and technology through online education [17].

To have successful online instruction in the face of these multiple challenges, the instructor should provide frequent, immediate, and adequate feedback, and should participate in discussions [18]. Teachers and learners should move at the same pace, and diverse evaluation and strategies should be applied for a more effective classroom. Online learning can be flexible in that the instructional styles can perform a classroom learning style where content is delivered to students at the same pace [19]. On the other hand, during online courses, students should be allowed access to course materials and content, and teachers and lecturers should communicate and interact with their students at all times. Students who need to communicate outside of school hours, afternoons, or weekends should receive the same teaching support as their weekday friends. Online students have the independence and convenience that traditional classroom students do not have [20].

II. MATERIALS AND METHODS

The purpose of the study is to compare the results of the tests of online and traditional class teaching. For that, two groups of students of the same course were chosen, analyzed, and compared. The first group participated in the classroom and the second group online. For the first group, the Internet was used also to send materials, as for the second group, the Internet was used as the only tool for teaching and learning and other additional projects and class discussions. The online group did not receive face-to-face classroom teaching.

The two groups of students were enrolled in the same Statistics course, which is part of their bachelor curricula. The course, besides the theoretical content, uses computer programs like Microsoft Excel and for calculations of probability values, descriptive statistics, testing hypotheses, and programs and applications such as SPSS, MINITAB, etc. During the course, the students were required to conduct research for several topics of the course, solve exercises and problems to keep them interested and help them to work all the time. Students were asked to complete assignments almost every week, using course internet materials, creating Power Point presentations, etc.

At the beginning of the semester, the lecturer introduced the course, presented the syllabus, and discussed the course requirements and expectations with students of both groups. The two groups started by completing the first test. During the semester, the classes met several times to discuss progress and experiences. The second test was completed after 15 weeks of class and online course, for both groups, and the results were compared. The online lessons were administered using Teams class internet service.

The classroom and online groups progressed at the same course pace, the same presentations were scheduled for both groups each week, while the delivery and the formats were different, while traditional class students were lectured in the classroom, the online group was lectured using Microsoft PowerPoint, Microsoft Word, and other useful formats. The traditional teaching group was also helped with materials online to read and prepare.

III. THE CASE STUDY

The primary purpose of the study was to compare the performances of students in the two classes, the traditional (with online supplements) and virtual classroom. The groups under study had together 47 students, the first group consisting of 24 students were enrolled in the classroom section of the course, while the other group of 23 students completed the online course. The second group did receive only online lessons, as for the first group, they did receive also additional online materials. There were 18 female

and six male students in the classroom group, while the online group had 18 female and five male students.

The first test was administered to the two groups at the beginning of the semester; the results have produced the histograms and the descriptive statistics, figure 1, 2 & table 1. The second test was also administered at the end of the semester, the same test for both groups; the data have produced the histograms and the descriptive statistics, figure 3, 4 & table 2. The t-test for the comparison of the first test scores means was conducted, producing the result, table 3.

Analysis of covariance (ANCOVA) was conducted to determine if there was a statistically significant difference between the mean of the second test scores for the two groups using the first test scores as their covariates. The level of significance was set at the $p=0.05$ for all analyses.

The results show that the normality assumptions were valid. Leven's test for homogeneity of variance indicated that the assumption of the equality of variance was not violated. ANCOVA resulted in no significant difference ($F = .392, p = .535$) in the mean score difference between the two groups. The mean score of the first and second tests and ANCOVA results are presented in Table 4.

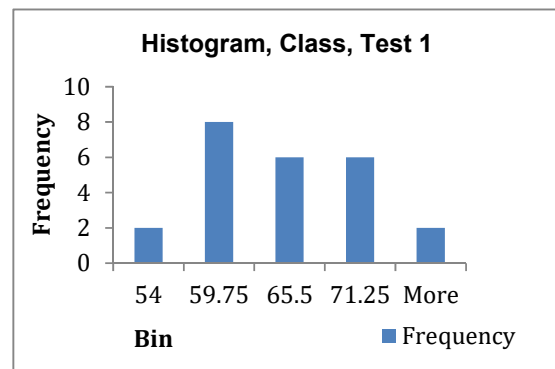


Fig 1. Histogram, Class, Test 1

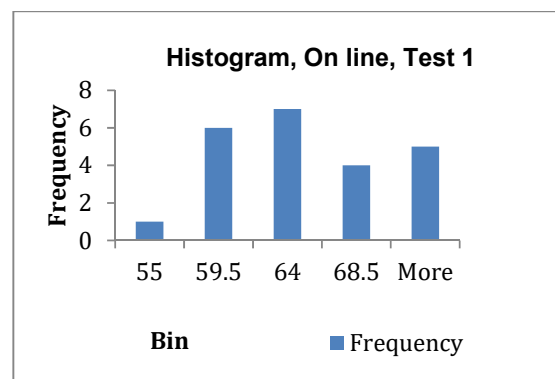
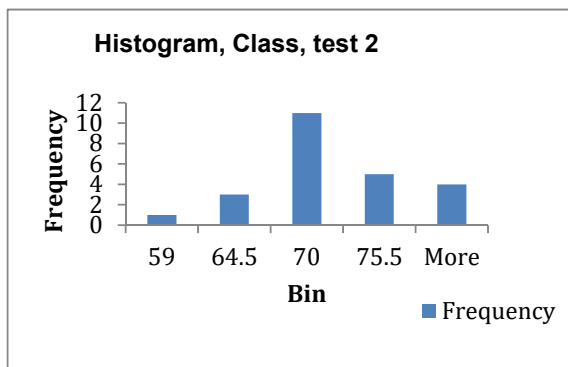
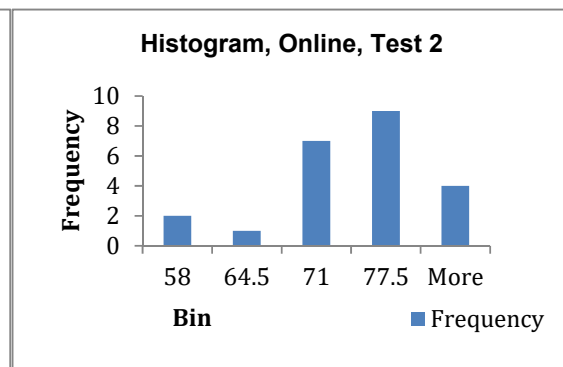


Fig 2. Histogram, Online, Test 1

TABLE 1. Class and Online test1 scores, descriptive analyses.

CLASS	T1	ONLINE	T1
Mean	62.625	Mean	63.39130435
Standard Error	1.315752526	Standard Error	1.160514964
Median	61.5	Median	63
Mode	58	Mode	57
Standard Deviation	6.445844634	Standard Deviation	5.565634248
Sample Variance	41.54891304	Sample Variance	30.97628458
Kurtosis	-0.149084828	Kurtosis	-1.033423921
Skewness	0.615132951	Skewness	0.29616298
Range	23	Range	18
Minimum	54	Minimum	55
Maximum	77	Maximum	73
Sum	1503	Sum	1458
Count	24	Count	23
Confidence Level(95.0%)	2.721841477	Confidence Level(95.0%)	2.406760729

**Figure 3. Histogram, Class, Test 2.****Figure 4. Histogram, Online, Test 2.****Table 2. Class and Online test2 scores, descriptive analyses.**

CLASS	T2	ONLINE	T2
Mean	69.375	Mean	71.13043478
Standard Error	1.239174135	Standard Error	1.421606768
Median	68	Median	72
Mode	67	Mode	72
Standard Deviation	6.070688665	Standard Deviation	6.81778655
Sample Variance	36.85326087	Sample Variance	46.48221344
Kurtosis	-0.618413057	Kurtosis	0.181302617
Skewness	0.360442239	Skewness	-0.365900383
Range	22	Range	26
Minimum	59	Minimum	58
Maximum	81	Maximum	84
Sum	1665	Sum	1636
Count	24	Count	23
Confidence Level(95.0%)	2.563427004	Confidence Level(95.0%)	2.948231988

Table 3. t- test for the T1 test scores

t-Test: Two-Sample Assuming Unequal Variances		
	class	online

Mean	62.63	63.391
Variance	41.55	30.976
Observations	24	23
Hypothesized Mean Difference	0	
df	45	
t Stat	-0.44	
P(T<=t) one-tail	0.332	
t Critical one-tail	1.679	
P(T<=t) two-tail	0.664	
t Critical two-tail	2.014	

Table 4. ANCOVA. Means, standard deviation, first and second test.

Groups	n	first test	second test
Traditional class	24	62.6 ± 6.5	69.4 ± 6.1
Online	23	63.4 ± 5.7	71.1 ± 6.8

Note. ANCOVA, $F(1, 44) = .392, p = .535$.

The traditional (classroom) group scores are slightly higher than the online group on both the first and the second test, but the mean change was almost the same for both groups, (the p-value is slightly higher than the level of significance, $p = .535 > .5$).

IV. RESULTS AND DISCUSSION

This study has provided the data from two tests administered for two classes, which have enrolled in two different ways of learning, in the classroom and online. The two groups have followed the same course, bachelor in Statistics.

The t-test was conducted for the first test results to verify if the class and online scores means are equal. The t-test showed that the groups have equal means.

The second test was administered at the end of the first semester. The ANCOVA with SPSS was applied to verify the impact of online teaching and learning on the students' performance, comparing the second test scores for the class and online groups, having as covariates the first test result scores.

The results show that the learning environments and the instructional medium have little impact on student learning. The lack of significant difference between the two ways of the teaching process and the impact on student performance between the two groups indicates the effectiveness of the Internet as a tool of the teaching process.

As the traditional method has been used for a long time and is well studied and analyzed and its effectiveness is evident, the focus in this article was the evaluation of the significance of the Internet as an instructional tool of teaching and learning.

Students of the online group were confident that they would be able to handle the technology but the technical challenges they experienced, though they always received technical support, were a cause of concern.

For the classroom group, their expectations that technology will help them in learning were not fully realized. Realizing that technology is just a tool, they changed their perception about technology as a significant aid that can help to learn.

In summary, the different learning environments did not produce a significant difference in students' performance, and the results of group two show that technology plays a role in students' learning. Although students recognized the potential and significant role of technology in teaching and learning, the recognition is limited to the use of technology as an instructional medium, it is not a key determinant of learning.

The Internet is an important instructional delivery medium that can compete and complete the traditional classroom but not replace it.

Nevertheless, the use of the Internet as a long-distance supplement to the conventional classroom is a useful way to improve teaching and learning, sharing knowledge and information, ideas and increase access to education.

The combination of both methods would produce a more effective process for a more successful school. On the one hand, teaching in the classroom would use the benefits of the traditional school, the direct delivery of the course content, on the other hand, students would use additional materials from the Internet, performing various projects, conversations, conferences, presentations of ideas and accomplished tasks, thus being placed in a freer, more independent and more productive position.

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