Challenges Affecting Students' Outcomes & Strategies to Promote Learning during the COVID-19 Pandemic

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***Abstract*—During the Covid-19 pandemic, the Algerian university had to face a critical situation. Online learning was the only alternative to ensure the continuity of education throughout the first semester of the 2020–2021 academic year. This research employs the results of 100 student responses to a paper survey and statistical analysis using obtained results in an examination of 200 students before and after the pandemic. This study was carried out by a team of Algerian researchers from the Computer Science and Mathematics Laboratory of Ibn Khaldoun University among 1st year students of a bachelor's degree in computer science. The results show that students have been able to provide their courses online despite the fact that the vast majority of them had many barriers such as the quality of the internet connection, distance to the university, have a computer, and quiet work environment. Finally, two sides were pointed out, namely the importance of distance learning for some online courses and the lack of pedagogical instructions to perform hybrid learning on the other hand.**

Keywords—Online learning, Classroom learning, Covid-19, Algerian university, ICTs.

I. INTRODUCTION

Since the beginning of 2020, The global higher education sector as the other sectors has been affected by the Covid-19 pandemic which has been declared to be a global pandemic on March 11, 2020 [1]. In Algeria, the closure of universities and academic educational institutions has significantly changed the living conditions of students and has required the implementation of new forms of teaching and assessment using information and communication technologies (ICTs). Since the integration of technology in higher education, initiatives have been made to form Algerian teachers and students who were not familiar with this new technology for distance education [2]. They had to adapt quickly to the new educational conditions generated by the pandemic. Some researchers suggest that online learning can be at least as effective as a classroom learning [3]. Some believe that the results will be less satisfactory without preparation, training and support in classroom. Moreover, others suggest that students in rural areas may not have a good internet connection, resulting in a loss of educational opportunities [4]. The following questions are at the centre of the research:

- *RQ1: Are there significant differences in academic performance of students between online and classroom learning?*
- *RQ2: What were the challenges facing students during their distance learning?*

This study aims to investigate the challenges faced by students during social confinement and analyses the effects of Covid-19 on students achievement comparing results of distance learning versus traditional, using a case study from TIARET University.

This paper is structured as follows. Section 2 presents the theoretical background of the research. Section 3 describes the research method. Section 4 analyzes the research findings and discusses the future directions. Section 5 concludes the research.

II. BACKGROUND TO THE RESEARCH

A. Covid-19 transition

There is extensive literature that examines the impact of Covid-19 pandemic on students' progress in higher education. The spread of Covid-19 had a significant impact on how the studies will be continued [5]. Students were expected to adopt distance education regardless of whether teachers, and administration staff were pedagogically prepared for this transition [6].

B. Academic performance and Health

Academic performance is determined by students' average grades as an indicator of the knowledge retained [7]. However, knowledge retention rates are influenced by students' learning environments, external factors such as teaching formats, abilities and cognitive efforts [8]. Good health is generally associated with strong academic performances as students learn social and self-restraint skills through physical activity [9].

C. Using ICTs: Challenges

Universal access to information and communication technologies (ICTs) means the possibility of making them available to everyone, wherever they are, and without any discrimination, broadband Internet, and communication services. Access to technology is a fundamental need for people, yet many people living in rural and remote areas do

not have wireless coverage. We can notice that until 2019, 33% of the world's population remained unsubscribed to mobile networks, and 53% unconnected to the broadband Internet [10]. Rural and isolated areas are characterized by an absence of basic infrastructure (electrical, transport, etc.) [11]. Therefore, the non-existence of underlying infrastructure is considered in several studies as one factor blocking universal access and the provision of telecommunications services [12]. Many studies confirm that education policy has significant effects on teachers' behavioural intention to use information and communication (ICTs) tools in the classroom. They have also indicated the following factors as significant in using ICTs tools by teachers: limited accessibility and network connection, limited technical support, lack of effective training, limited time and lack of teachers' competency [13].

D. Distance education

Moore et al [14] describe distance education as physically separation between teacher and learner. Physical separation between teachers and learners has existed in various forms, but in the earlier era of distance education, most interactions between teachers and students were asynchronous. With the introduction of the Internet, opportunities for synchronous work diversified across arrange from chats to videoconferencing systems [15]. During Covid-19 pandemic, online learning was forced by an external factor rather than a pedagogical desire to make courses or computer applications [16].

Faced with these major challenges, it is essential to identify the fundamental reasons that block the distance learning of isolated regions and the strategies to be put in place to make learning during the health crisis a reality.

III. RESEARCH APPROACH

The research involves two distinct phases of analysis. Phase One draws upon data of students gathered from the faculty of Computer Science and Mathematics of IBN KHALDOUN University in TIARET. In Phase Two, we explore the same issue with a paper survey on the effectiveness of online learning during covid-19 pandemic.

A. Phase One: Statistical Analysis

This study attempted to conduct an exploratory analysis on research questions through an analytical study comparing online learning and classroom learning. The quantitative study presented in this article was conducted with an analysis of 200 first-year students' outcomes in Computer Science and Mathematics at the University of Tiaret, Algeria. Exploratory analyses were performed using descriptive statistics. Collected data contained the students' scores of two fundamental courses before and after the pandemic: Course 1, Information and Communications Technology; Course 2, Machine Structure. We have used the Python programming language for exploratory data analysis. We have used Jupyter Notebook for a detail analysis. We have implemented different library packages of python, like, Pandas, NumPy, Matplotlib, and Plotly for data visualization.

Exploratory Data Analysis helps to analyze the data sets to summarize their statistical characteristics such as the measures of central tendency (the mean, the mode and the median), measures of spread (standard deviation and variance), the shape of the distribution and the existence of outliers. Data Exploration is the first stage of data analysis. Here we can know about the content and characteristics of the data set. It tells about the size of the data. We can find the missing value and the possible relationship among data.

Pandas is the most powerful package for data analysis. We can clean, transform, analyse and visualize the data that can be stored in CSV format in computer. It is built on the top of the NumPy package. Plotting functions from Matplotlib and machine learning algorithm in Scikit-learn.

Jupiter Notebook gives ability to execute the code in a particular cell. It gives the console based approach for computing. It provides web based application process. It includes input and output of the computation. It gives rich media representation of the object.

B. Phase Two: Spatial Analysis

In the second phase, a paper survey was used to investigate if students' geographical classification is a factor of failure in distance learning. The analysis method is based on 100 student responses on the validated and reliable survey to ascertain and contrast the challenges facing students during their online learning.

ArcGis is a software package designed to develop a geographic information systems .in order to assist in making decisions, in our case information are extracted directly by representation of geographic features as points, lines, and shapes organized in layers associated with spatial and attribute data stored in a Geodatabase [17].

IV. FINDINGS AND DISCUSSION

A. Study of the distribution of sample elements

This study aims to know characteristics of the sample elements and ensure their suitability for the study and the possibility of comparing them by reference to the composition of the population studied. Before analysis, it was important to report the percentage of students categorized in each geographical location.

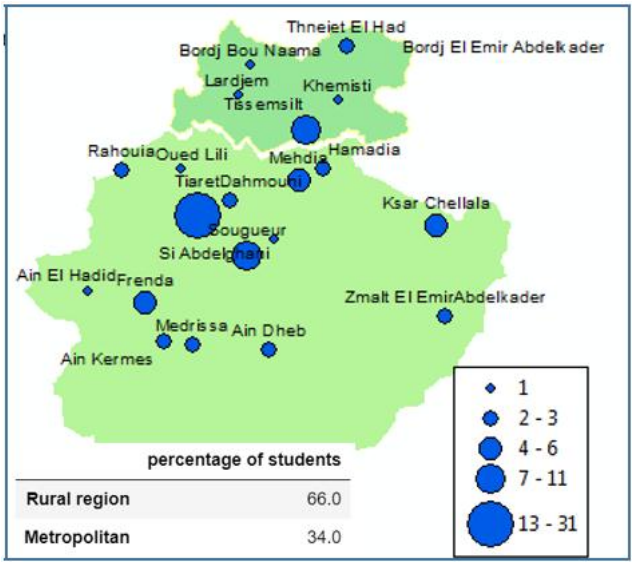

Figure 1. Distribution of students by geographical location

As shown in Figure 1, nearly 66 per cent of the sample are categorized as students living in a rural region, while only 34 per cent living in a metropolitan area. The students are geographically distributed according to the place of residence.

B. Comparison between classroom and online learning

During the period of confinement, the traditional teaching methods have been modified. Students interacted with teachers using Moodle and Email. Some of them had the opportunity to take courses by videoconference with Google meet and Zoom.

Figs 3 and 4 compare the scores of students who received online education to scores of students who received the same course face to face. This experiment was applied on two 1st year courses (Course 1: Information and Communications Technology, Course 2: Machine Structure). An analysis using the Line Chart plot was chosen here. This method involves performing a graphical fit in the form of a line applied to a simple of n points (here, the students' scores) defined by their abscissa and ordinate. Finally, it is easy to read and compare the mean and standard derivation of the two samples.

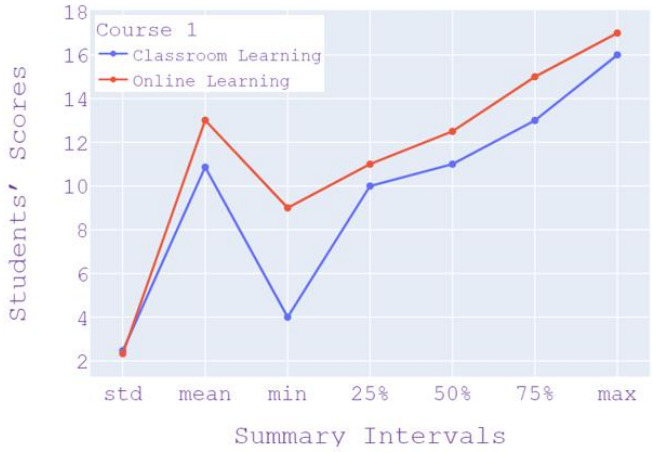

Figure 2. Comparison between classroom and online learning for course 1

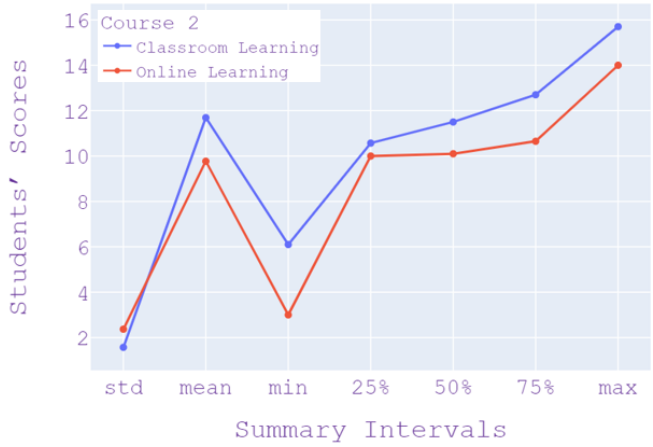

Figure 3. Comparison between classroom and online learning for course 2

The analysis conducted on the performance of students during the confinement period shows that the health crisis had a significant effect on their results. For Course1 (Figure 2), the results show that online learning enhances the performance of students. On contrary, for Course 2 (Figure 3), the online learning degrades the performance of students.

C. Statistically significant difference

In this experiment, we used the Independent Samples t Test that compares the means of two independent groups in order to determine whether there is statistical evidence that the associated population means are significantly different.

1) Hypotheses: The null hypothesis (H0) and alternative hypothesis (H1) of the Independent Samples t Test were expressed as follows:

- H0: $\mu 1 = \mu 2$
- H1: $\mu 1 \neq \mu 2$

Where $\mu 1$ and $\mu 2$ are the students mean score for classroom learning and online learning, respectively.

Two sections appear in the output: Group Statistics and Independent Samples Test. Group Statistics, provides basic information about the group comparisons, including the sample size, mean, standard deviation, and standard error by group. The second section, displays the results most relevant to the Independent Samples t Test.

2) t Test for Course 1 :

Table 1. Statistics about students for course 1

Variable	N	Mean	SD	SE
Rating_Of_Classroom_Learning_Course1	100.0	10.8650	2.476001	0.247600
Rating_Of_Online_Learning_Course1	100.0	13.0100	2.339796	0.233980
combined	200.0	11.9375	2.632393	0.186138

Table 1 shows the total number of the sample, there are 1oo students in each group. The mean for classroom learning is 10.86 and the mean for online learning is 13.01. The standard error (SE) is the standard error of the mean difference estimate.

Table 2. t Test result for course 1

	Independent t-test	results
0	Difference (Rating_Of_Classroom_Learning_Cours...	-2.1450
1	Degrees of freedom =	198.0000
2	t =	-6.2965
3	Two side test p value =	0.0000
4	Difference < 0 p value =	0.0000
5	Difference > 0 p value =	1.0000
6	Cohen's d =	-0.8905
7	Hedge's g =	-0.8871
8	Glass's delta1 =	-0.8663
9	Point-Biserial r =	-0.4084

Ttest_indResult (statistic = -6.296518323631222,
Pvalue = 1.9248050175985746 e-09)

Table 2 summarizes the results obtained. Since p value = 1.9248050175985746 e-09 is less than our chosen significance level $\alpha = 0.05$ we can reject the null hypothesis H0, and conclude that the means between classroom learning and online learning for Course 1 are significantly different. α is the probability of making the wrong decision when the null hypothesis is true, t is the computed test statistic, Mean Difference is the difference between the sample means. The average for online learning was 2.14 greater than the average for classroom learning.

3) t Test for Course 2:

Table 3. Statistics about students for course 2

Variable	N	Mean	SD	SE
Rating_Of_Classroom_Learning_Course2	100.0	11.69000	1.576148	0.157615
Rating_Of_Online_Learning_Course2	100.0	9.77250	2.372936	0.237294
combined	200.0	10.73125	2.227323	0.157495

Table 3 shows the total number of the sample, there are 1oo students in each group. The mean for classroom learning

is 11.69 and the mean for online learning is 9.77. The standard deviation and the standard error are mentioned.

Table 4. t Test result for course 2

	Independent t-test	results
0	Difference (Rating_Of_Classroom_Learning_Cours...	1.9175
1	Degrees of freedom =	198.0000
2	t =	6.7311
3	Two side test p value =	0.0000
4	Difference < 0 p value =	1.0000
5	Difference > 0 p value =	0.0000
6	Cohen's d =	0.9519
7	Hedge's g =	0.9483
8	Glass's delta1 =	1.2166
9	Point-Biserial r =	0.4315

Ttest_indResult (statistic = 6.7311497461508205,
Pvalue = 1.7755330736471246 e-10)

Based on the results given in the above table (Table 4), we can state that the independent sample t-test showed significant difference in student performance between classroom learning and online learning (p value = 1.7755330736471246 e-10 < α = 0.05). The average for online learning was 1.91 lower than the average for classroom learning.

D. Connectivity challenge on online learning

This analysis was conducted based on the student's responses to questions in the paper survey. Students from rural areas face a number of barriers preventing them from accessing distance learning. Among the difficulties declared in online learning during confinement, the problem of internet connection, difficulties in accessing documentation or even difficulties in using the digital tools made available to them. The results of the descriptive analysis (Figure 4) show that half (49%) of the students in this study had slow internet connection at home, and 20% of them did not.

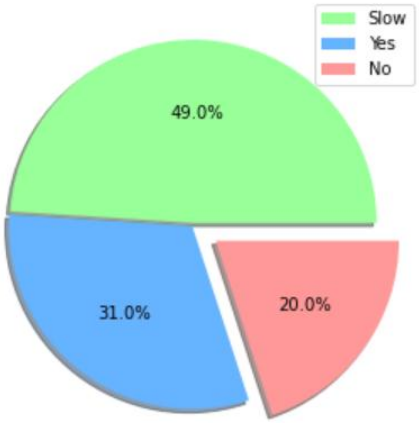

Figure 4. Percentage of connected students

Figure 5 shows the distribution of the Internet connection of students according to their areas of residence. We find that students in rural areas have not high-speed internet access at home compared to those in metropolitan areas. Of those who have internet access at home, 49 percent had a slow connection.

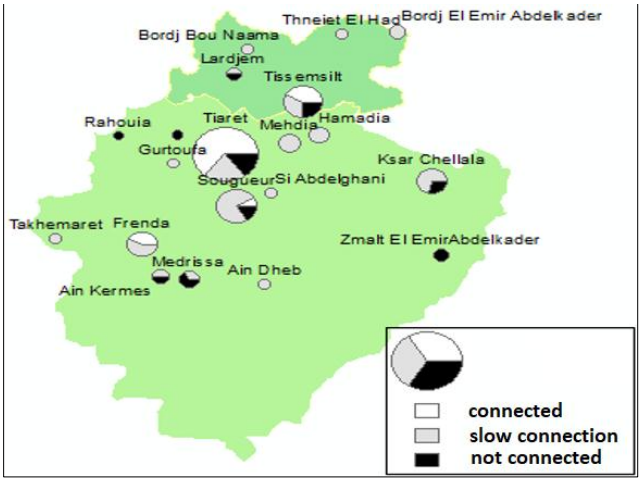

Figure 5. Distribution of the Internet connection of students according to their areas of residence

As shown in the below figure, the Time spent online before and after the pandemic varies from one student to another. This difference is mediated by a range of factors, including family background, geography and internet access.

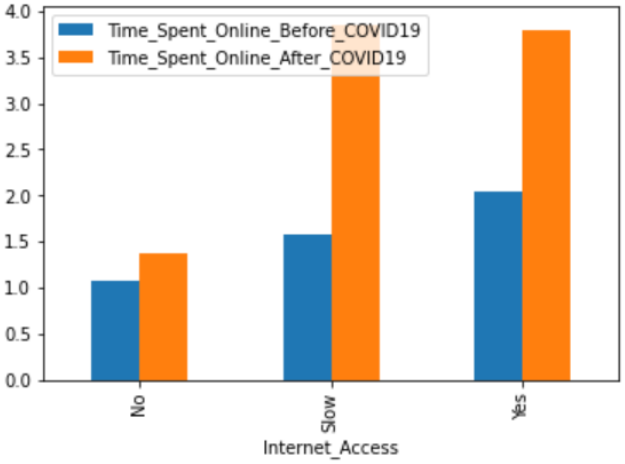

Figure 6. Time spent online before and after the pandemic

These proportions vary greatly according to the conditions of confinement: 37% of students without a personal computer, 43% of students without a quiet space to work and 49% of students without a good internet connection. These conditions have become particularly essential for success in higher education. It can be concluded that almost majority of rural students have not had an adequate environment of online learning during the Covid-19.

Table 5. Students' conditions during the confinement

	Have_a_Computer		Have_a_Workspace
Yes	63.0	Yes	57.0
Shared	25.0	No	43.0
No	12.0		

V. STRATEGIES TO IMPROVE LEARNING ACTIVITIES

Due to the Covid-19 pandemic, there is a need to identify tools to provide a list of strategies and policies for both Higher education sector and Health sector to move learning performance forward.

a) Hybrid learning is a key element in ensuring continued learning to enhance the student experience and teaching outcomes in the wake of Covid-19.

b) The universities should pay attention to students, to help them adapt to online learning faster and more effectively. Information and Communication Technologies (ICTs) should be accessible. Teachers could also be assisted to learn how they could employ the ICTs to enhance their effectiveness in the distance education. Ensure that students, teachers, and lab assistants have access to computer rooms 24 hours a day, seven days a week.

c) Creation of a Health platform to record and monitor the health status of students. This platform is shared between two main sectors: Higher education and the Health sector, in order to reduce the spread of Covid-19 and increase the success rate in the university. Students will have a communication link to the stakeholders, which will result in more needed advice to help them carry out their learning activities during Covid-19.

VI. CONCLUSION AND PERSPECTIVE

The Covid-19 pandemic had a positive and negative impact on student's success. On the one hand, students' scores increased in online course environment for some courses. On the other hand, several students have demonstrated good performance in classroom learning. A hybrid learning therefore is the solution to improve students' performance and to ensure the continuity of learning activities in the situation of the Covid-19 outbreak.

The use of information and communication technologies (ICTs) in education has become increasingly important, in order to facilitate teaching and learning activities during various emergency circumstances. Therefore, the study suggests that interested parties should mobilize funds to enhance the availability and usage of ICTs in higher education. Faculty and Public Health Sector need to work together to identify ways to conduct learning activity during the COVID-19 pandemic.

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