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Exploring the Persistent Impact of Online Education on Graduation Grade Point Average: A Case Study in Industrial Engineering

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ABSTRACT

Due to the global impact of the Covid-19 pandemic, educational institutions worldwide resorted to remote/online learning for uncertain periods. Researchers have extensively monitored the effects of Covid-19 on education at various levels. While several studies in the literature have indicated a positive numerical impact of online education on course success, others have revealed that students, despite achieving high grades, may experience dissatisfaction with online education for various reasons such as lack of motivation, communication challenges, and limited opportunities to engage with course content. This study delves into the long-term outcomes of online education by examining students' Grade Point Averages (GPAs). Specifically, the research assesses the academic performance of first, second, and fourth-grade students enrolled in industrial engineering, considering selected courses, matriculation scores, and graduation averages across both online and face-to-face learning periods. Descriptive statistics, analysis of variance to explore group relationships, and Pearson correlation to analyze parameter relationships were employed in the study. Upon scrutinizing the study results, it was observed that the GPAs exhibited a correlation with the matriculation score but did not show a significant relationship with courses learned through online education.

Keywords: Online education, face 2 face education, long term affect of online education.

Introduction

The Covid-19 pandemic brought about significant changes across various aspects of human life, from manufacturing to education. In the manufacturing sector, there were disruptions, leading production enterprises to adapt by operating in more shifts with reduced personnel in each shift. The health sector prioritized addressing the Covid-19 epidemic, resulting in the postponement of non-urgent surgeries and outpatient clinic services. The tourism industry experienced a notable slowdown. Globally, online education methods gained widespread preference. In Turkey, online education was implemented for an extended period, spanning one and a half years or three semesters. Additionally, online education was also adopted in Turkey for one semester in response to a major earthquake in Maraş. These changes reflect the adaptive measures taken in response to external challenges, emphasizing the versatility of online education in various circumstances.

The transition to distance education, prompted by the unprecedented challenges posed by the Covid-19 pandemic and earthquakes, has significantly reshaped the landscape of higher education. However, the comprehensive understanding of the effectiveness and impact of this transition on student success, particularly in engineering education, remains a crucial area of investigation. While existing literature provides insights into various aspects of online education, there is a notable gap in understanding its specific implications for disciplines like industrial engineering.

This study aims to address this gap by examining the long-term effects of online education on the academic performance of industrial engineering students. By delving into the nuances of this transition and its implications, the research seeks to elucidate the extent to which online learning models have influenced student success metrics, particularly Grade Point Averages (GPAs). Through a comprehensive analysis, this study endeavors to provide actionable insights for educational stakeholders to optimize online learning experiences in engineering education. There are three research questions given below for a clearly understanding;

RQ1: What is the impact of the transition to online education on the GPAs of industrial engineering students?
RQ2: How do the academic performance trends differ among different semester students during online and face-to-face learning periods?
RQ3: Are there any significantly relations between matriculation score and course success with GPAs?

By addressing these research questions, this study seeks to contribute to the growing body of knowledge on online education and its implications for engineering disciplines, offering valuable insights for educational practitioners and policymakers alike. For a total of two years and 4 semesters, courses, exams, midterms, projects and laboratory studies were conducted entirely through online education tools. Online and face-to-face education durations are as shown in Figure 1.

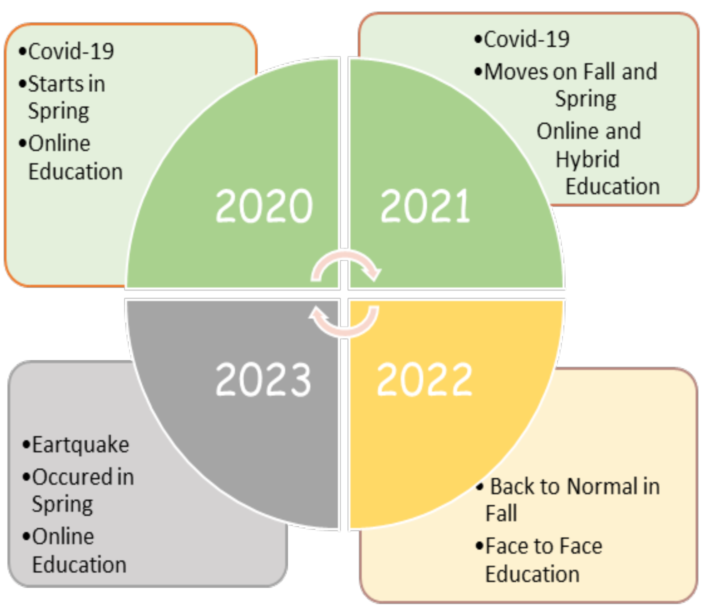

Figure 1.
Online and Face To Face Education For 4 Year

Literature Review
The studies presented in this section consist of studies investigating the effects of distance/online education on students' academic performance.

Studies by Zhou et al. (2021) and Sengupta and Gupta (2021) explored the impact of online education on student academic performance, providing insights into the effectiveness of virtual instruction methods. Another group of studies focused on the impact of the COVID-19 pandemic on online education practices. Alkhalil et al. (2021), García-Alberti et al. (2021), and Martínez-García et al. (2022) investigated the challenges and experiences of remote learning during the pandemic, while Nazempour et al. (2022) assessed the impacts of emergency transitions to remote teaching on students' academic performance. These studies shed light on the adaptations made in response to the crisis and their implications for engineering education.

Díez-Pascual et al. (2023) compared face-to-face and online learning in science and engineering courses during the COVID-19 pandemic. Their study explored the effectiveness of different instructional modalities in promoting student engagement and academic success. Zhang et al. (2023) investigated the effectiveness of synchronous and asynchronous online learning during the COVID-19 pandemic. Their research compared the outcomes of different online learning formats and their impact on student engagement and academic achievement.

A study by Wang et al. (2022) examined the challenges and opportunities for engineering students adapting to online learning during the COVID-19 pandemic. Their research identified strategies for enhancing student engagement and academic success in virtual instructional settings. Another study focused on student preparedness in online engineering education, providing insights into factors influencing student readiness for virtual learning environments and their implications for instructional design (Wang & Jiang, 2022).

Ulum (2022) presented a meta-analysis study examining the effects of online education on academic success. By aggregating and analyzing data from various studies, the research concluded that online education generally has a positive impact on academic performance. However, the extent of this impact varies depending on the type of course, student demographics, and instructional methods used. Interactive and personalized learning tools in online education were identified as critical factors in enhancing academic success.

Nieuwoudt (2020) explored the role of synchronous (real-time) and asynchronous (self-paced) class attendance in predicting academic success in online education. The findings indicated that synchronous class attendance is strongly correlated with higher academic performance, as it fosters immediate interaction and feedback. However, asynchronous attendance also showed significant benefits, especially for students requiring flexible learning schedules.

A study by Torun (2020) examined the readiness of students for e-learning as a predictor of academic achievement in online distance learning within higher education. The study highlighted that students' technical skills, self-discipline, and motivation are crucial factors influencing their success in an online learning environment. Higher e-learning readiness was associated with better academic performance, emphasizing the need for preparatory training and resources.

Neroni et al. (2019) investigated the impact of different learning strategies on academic performance in distance education. The study identified effective strategies such as time management, self-regulation, and active engagement with course materials. It concluded that students employing a combination of these strategies tend to perform better academically in a distance learning setting.

Another article by Jiao et al. (2022) introduced an AI-enabled prediction model designed to forecast student academic performance in online engineering education. Utilizing machine learning algorithms, the model analyzed various factors such as engagement metrics, assignment scores, and participation rates. The study demonstrated that the AI model could accurately predict academic outcomes, providing valuable insights for educators to support at-risk students.

Bir (2019) compared the academic performance of students enrolled in online engineering courses versus those in traditional classroom settings. The findings revealed that, on average, students in online courses performed comparably to their peers in traditional settings. However, the study noted that the effectiveness of online courses is highly dependent on the quality of the course design and the level of student support provided.

Mamedova et al. (2023) evaluated the impact of various educational platforms on the academic performance of engineering students in an online education context. Their study assessed platforms based on usability, interactivity, and support features, finding that platforms offering robust interactive tools and comprehensive support services significantly enhance students' learning experiences and academic outcomes.

Kanetaki et al. (2021) analyzed engineering students' academic performance in online higher education during the COVID-19 pandemic. The study identified trends and challenges faced by students, including issues related to remote learning environments, access to resources, and mental health. The findings suggested that while many students adapted well to online learning, targeted interventions are necessary to support those who struggled during this period.

Ouyang et al. (2023) explored how integrating artificial intelligence (AI) with learning analytics (LA) can enhance the academic performance of engineering students in online courses. The research highlighted that AI models could predict student performance by analyzing various learning behaviors and providing real-time feedback. This integration helps identify at-risk students and optimize instructional strategies, thereby improving overall learning outcomes.

Meng and Hu (2023) evaluated the relationship between student motivation and academic performance, with a particular focus on the mediating role of online learning behavior. The findings indicated that both intrinsic and extrinsic motivations significantly impact academic performance through active engagement in online learning activities. Enhancing online learning behaviors, such as participation in virtual classrooms and timely submission of assignments, is crucial for maximizing the benefits of blended learning environments.

Two systematic reviews by Chung et al. (2022) and Zekaj (2023) examined various factors influencing academic performance in online higher education settings. Chung et al. (2022) highlighted that student characteristics, including cognitive and psychological factors, significantly impact performance, suggesting that understanding these correlates can help design better support systems. Zekaj (2023) focused on the impact of various online learning strategies, revealing that active engagement, effective time management, and regular participation in online discussions are crucial for academic success.

Finally, studies in the literature have generally assessed academic success through various metrics such as exam grades (Díez-Pascual et al., 2023), project scores (Jiao et al., 2022), presentations, teamwork (Meng & Hu, 2023), and laboratory works. However, the current study diverges from this approach by focusing specifically on the impact of compulsory online education—implemented for approximately two years in departments lacking prior infrastructure for distance learning—on students' GPAs. This study investigates the influence of students' entrance scores and academic performance during the online education period on their overall GPAs.

Methods

In beginning, the number of students enrolled in the department and courses, the number of graduating students, their grades in courses, the averages, standard deviations of each course, minimum and maximum values and the number of registered students are explained with descriptive statistics methods. ANOVA test was used to measure whether there were significant differences between the success of the courses in the distance and face-to-face periods, and the Tukey test was used to measure the success of each course in different periods.

In Tukey's test, letter grouping is used to indicate significant differences between group means after conducting an ANOVA or a similar test. After performing a statistical test such as ANOVA to compare multiple group means, Tukey's test is often employed as a post hoc test to determine which specific group means are significantly different from each other.

The letter grouping system in Tukey's test assigns different letters (e.g., A, B, C) to the group means based on their statistical similarity. Groups that share the same letter are not significantly different from each other at the chosen level of significance (e.g., α = .05), while groups with different letters are significantly different. Finally, whether there is a relationship between the final grades, matriculation scores and GPAs of the students used in this study was investigated using Pearson correlation.

An Overview of the Study

This study encompasses a selection of courses within the Industrial Engineering undergraduate program's curriculum, comprising one elective course, "Inventory Planning" and three core courses: "Introduction to Probability," "Cost Accounting" and "Design". All these courses are instructed by a full-time faculty member in the Department of Industrial Engineering.

Table 1.
Guideline About Courses

Lecture Name	Term	Type	Ects	Period	Midterm Exam	2. Midterm Exam	Quiz	Project	Final Exam
Int. to Probability	2	selective	5	14 week	✓		✓		✓
Cost Accounting	3	core	5	14 week	✓				✓
Inventory Planning	8	core	3	14 week	✓	✓	✓		✓
Design	8	core	6	14 week				✓	✓

The entries in the table above correspond to the following categories: "Term" denotes the period during which the course is integrated into the curriculum, "Type" indicates whether the course is elective or core, "ECTS" refers to the European Credit Transfer System, and "Period" represents the duration of the course in weeks per semester. The examination components include the midterm exam, second midterm exam, quiz, project, and final exam, each denoted by checkmarks in Table 1 to signify the types of evaluations conducted for each course.

In the assessment of courses, the final grade at the end of the semester is determined by a combination of factors. Specifically, 50% of the final grade is derived from the final exam, while the remaining 50% is based on midterm exams and other activities. The faculty member responsible for each course determines the relative weight of midterm exams, quizzes, and projects in influencing the overall success grade.

Data Collection

The study's data were sourced from the Atatürk University Student Information System. Among the courses named, “Introduction to Probability” and “Cost Accounting” fall within the core course category and are instructed by a single faculty member during the respective semesters. “Inventory Planning” is an elective course, and students have an alternative option, "Enterprise Resource Planning”. “Design” is classified as a core course, and when offered, it involves the collaboration of 4-6 faculty members simultaneously. These courses (except design) have been taught by a single industrial engineering departmant member for the last 5 years and that is why they were chosen by researcher. Table 2 provides information on the academic year, semester of instruction, and the count of students who registered for and were assessed in each course during the specified periods

Table 2.

Course Periods and Number of Students Evaluated

	2019-2020		2020-2021		2021-2022		2022-2023		
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Total
Int. to Probability		102		99		87		107	395
Cost Acc.	63		119		91		93		366
Inventory P.		31		40		32		47	150
Design		24		25		27		35	111

Descriptive Statistics

In the initial phase of the study, the academic performance of students was scrutinized across four courses during both online and face-to-face education periods. Among the courses considered, "Inventory Planning", "Introduction to Probability" and "Design" are conducted during the spring semester as stipulated by the curriculum. Notably, "Design" is an advanced course aimed at assisting students in analyzing, planning, and designing a project. It is taught by four-six faculty members simultaneously during the same semester. Conversely, the "Cost Accounting" course is scheduled for the fall semester and is instructed by a single faculty member. Figure 2 illustrates the mean final success grades for each course during the periods of the Covid-19 pandemic, face-to-face instruction, and the earthquake occurrence. All statistical analyses in this study were carried out utilizing the Minitab 21 application.

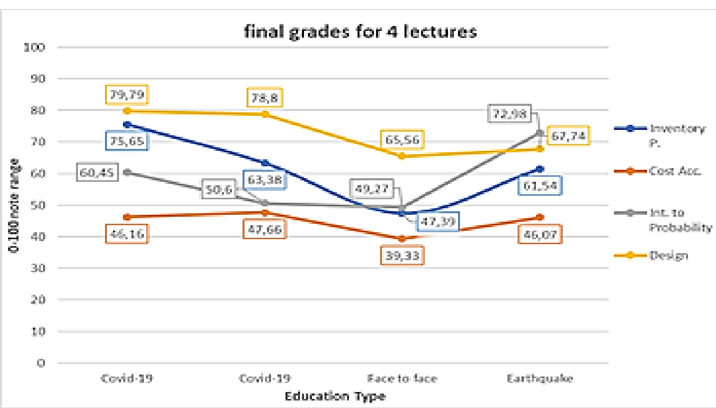

Figure 2.

Final Success Grade Means of Each Course

The x-axis in Figure 2 represents the grade range (0-100) that students can achieve in each course. On the y-axis, the education periods are depicted. The Covid-19 and Earthquake column, spanning four years, signifies the periods of online education, while the face-to-face column represents education conducted in a traditional classroom setting. Upon analyzing the average success rates of each course, it becomes evident that the success grade averages during face-to-face periods are lower compared to the averages of the other three semesters conducted via online education. This observation suggests that the online education system may enhance the success of engineering faculty students.

However, it is important to note that upon reviewing exam papers, it is apparent that the similarity in answers given by students to the same question does not support this assumption. The continuous communication among students during exams and the lack of instantaneous monitoring through a camera contribute to this perception. As a concluding remark regarding Figure 2, the course with the closest average across all four years is the cost accounting course. The inventory planning course, characterized by a high algebraic calculation load, exhibits the highest variability. Additionally, despite being a fall semester course, the cost accounting course's initial average value of 46.16 is lower than the averages of the remotely conducted semesters. Descriptive statistical parameters for each course are detailed in Table 3.

Table 3.

Descriptive Statistical Parameters of The Courses

Parameter	N	Mean	St. Dev	Min	Q1	Median	Q3	Max
Inventory P.	150	61.93	17.98	.00	55.00	63.75	73.13	92.50
Cost Acc.	366	45.30	23.06	.00	33.00	49.50	62.00	98.50
Int. to Probability	395	60.89	27.05	.00	48.50	67.50	81.00	100.00
Design	111	72.40	17.86	11.00	55.00	75.00	85.00	95.00

Table 3 provides the following statistical measures for the success grades achieved over four years: sample size (N), mean, standard deviation, minimum (Min), maximum (Max), and quartiles (Q1, Q3). Notably, Q1 represents the 25th percentile, and Q3 signifies the 75th percentile.

According to the table, the course with the largest number of students is "Introduction to Probability," with 395 students, while the course with the fewest students is "Design," with 111 students. Additionally, the course with the highest average success grade is "Design," boasting a mean of 72.40, whereas the course with the lowest average success grade is "Cost Accounting," with a mean of 45.30. The range of success grades spans from a minimum of 0 to a maximum of 100.

One-Way Anova and Tukey Test

The combination of One-way Analysis of Variance (ANOVA) and the Tukey test serves as a statistical approach for comparing means across multiple groups. One-way ANOVA is utilized when there are three or more groups, aiming to discern whether statistically significant differences exist among the means of these groups. In this study, the academic success of students was analyzed on a semester basis, employing both one-way ANOVA and the Tukey test at a 95% confidence level. The outcomes of these analyses are detailed in Table 4.

Table 4.

The Results of ANOVA and Tukey Test

Analysis of Variance-*Inventory Planning*					Tukey Method at 95% Confidence Level					
Terms	N	Mean	StDev	*p*	Terms	N	Mean	Grouping		
Covid 19-20	31	75.65	11.01	.000	Covid 19-20	31	75.65	A		
Covid 19-21	40	63.375	5.563		Covid 19-21	40	63.375		B	
Face to face	32	47.39	23.71		Earthquake	47	61.54		B	
Earthquake	47	61.54	16.95		Face to face	32	47.39			C
Analysis of Variance-*Cost Accounting*					Tukey Method at 95% Confidence Level					
Terms	N	Mean	StDev	*p*	Terms	N	Mean	Grouping		
Covid 19-20	63	46.16	21.28	.039	Covid 19-20	119	47.66	A		
Covid 19-21	119	47.66	18.6		Earthquake	93	47.55	A	B	
Face to face	91	39.33	28.26		Covid 19-21	63	46.16	A	B	
Earthquake	93	47.55	23.07		Face to face	91	39.33		B	
Analysis of Variance-*Introduction to Probability*					Tukey Method at 95% Confidence Level					
Terms	N	Mean	StDev	*p*	Terms	N	Mean	Grouping		
Covid 19-20	102	60.45	26.74	.000	Earthquake	107	78.44	A		
Covid 19-21	99	50.6	26.11		Covid 19-20	102	60.45		B	
Face to face	87	49.38	25.79		Covid 19-21	99	50.6			C
Earthquake	107	78.44	21.23		Face to face	87	49.38			C
Analysis of Variance-*Design*					Tukey Method at 95% Confidence Level					
Terms	N	Mean	StDev	*p*	Terms	N	Mean	Grouping		
Covid 19-20	24	80.42	9.55	.002	Covid 19-20	24	80.42	A		
Covid 19-21	25	78.6	15.38		Covid 19-21	25	78.6	A	B	
Face to face	27	65.56	12.89		Earthquake	35	67.74		B	C
Earthquake	35	67.74	23.3		Face to face	27	65.56			C

Upon examination of the results in Table 5, it was observed that significant differences existed among the inter-semester groups for the Inventory Planning, Introduction to Probability, and Design and Cost Accounting courses ($p < .05$). RQ2 can be answered obvioußlu with a focus on ANOVA results. It is seen as a result of the variance analysis that the grade success averages of the courses increased during the periods when the education was provided online.

Further insights from the Tukey test results, presented on the right side of the table, revealed significant differences among the Inventory Planning course groups. Specifically, the success rate of the Inventory Planning course during the face-to-face period was significantly different from its success rates during other semesters. Significant differences were also identified among the groups for the Introduction to Probability course. Notably, the mean during the earthquake period and the first Covid-19 period were found to be significantly different compared to other groups. A similar scenario applied to the success means of the Design course, where the Covid-19 periods were significantly different from other periods. RQ2 has found its own answer. No significant relationship was found between the transition to online education and students' graduation averages.

Figure 3 displays histogram diagrams illustrating the distributions of grade point averages and the frequencies of grade ranges. These visualizations provide additional insights into the overall distribution patterns of student performance.

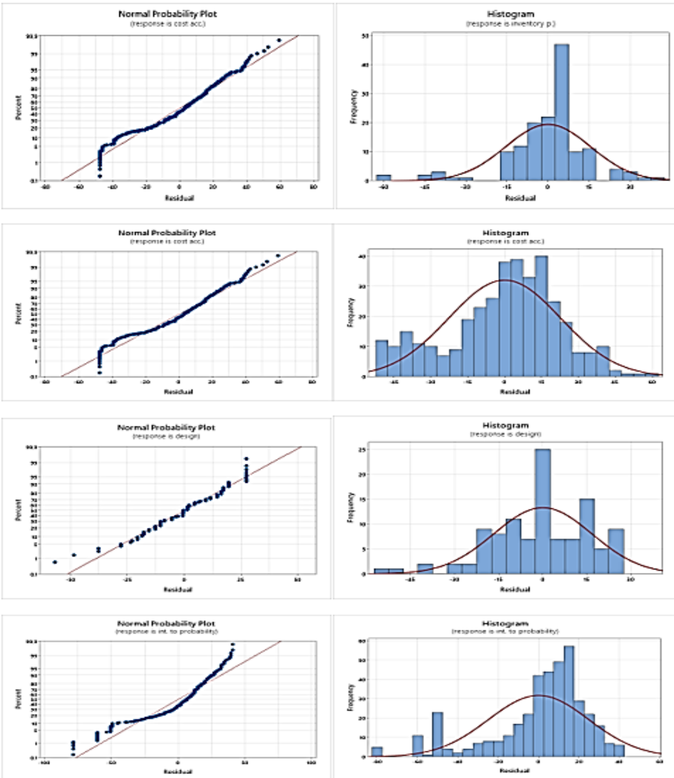

Figure 3.

Distributions and Histogram Charts

It appears that the next step in the study involves examining the Grade Point Averages (GPAs) of students who graduated between 2019 and 2023. Figure 4 illustrates the graph of GPAs across these years. This analysis could provide valuable insights into the academic performance trends of graduating students over this period.

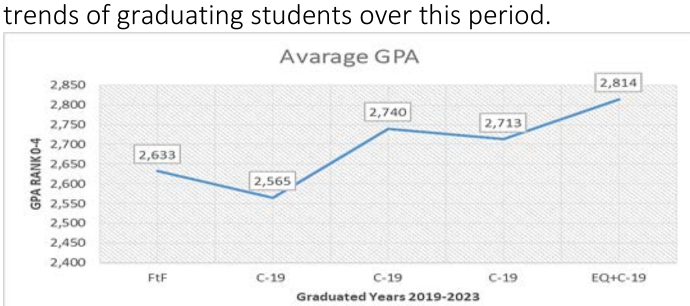

Figure 4.

Average Gpa's by Years

Figure 4 illustrates GPA ranges on the vertical axis, with the horizontal axis representing the education periods of students who graduated between 2019 and 2023. The graduation patterns are as follows: the student who graduated in 2019 completed face-to-face education, those who graduated in 2020, 2021, and 2022 pursued online education courses due to Covid-19, and finally, those who graduated in 2023 completed online education courses due to both Covid-19 and the earthquake. For a more detailed visualization of students' graduation averages, Figure 5 is presented. This graph likely offers a comprehensive view of how GPAs varied across different graduating classes and educational contexts.

Figure 5.

Gps Ranges by Years

To earn graduation from the Faculty of Engineering, a student needs to complete 240 ECTS courses and maintain a minimum GPA of 2.00, with an upper limit of 4.00. Figure 5 illustrates the distribution of students' GPAs by year. The GPA distribution is presented at the bottom of the columns, and the numbers above each column signify the count of students graduating within that GPA range for the respective year. Upon examining Figure 5, it becomes apparent that as the number of semesters in online education increases, the number of students graduating with a higher GPA also increases.

Figure 6 provides an overview of the total number of online and face-to-face courses taken by graduating students per year. Over the course of four years and eight semesters, the total number of courses completed by students amounted to 48.

In 2019, students did not engage in online education courses. However, the landscape changed in 2020 with the advent of Covid-19, prompting students to initiate online courses. The notable increase in the number of courses in 2023 can be attributed to the earthquake that occurred on February 6. Table 5 delves into the distinctions in GPAs across different years, employing Anova and Tukey tests to assess these differences. These statistical analyses likely provide insights into how GPAs vary across different academic years and educational context.

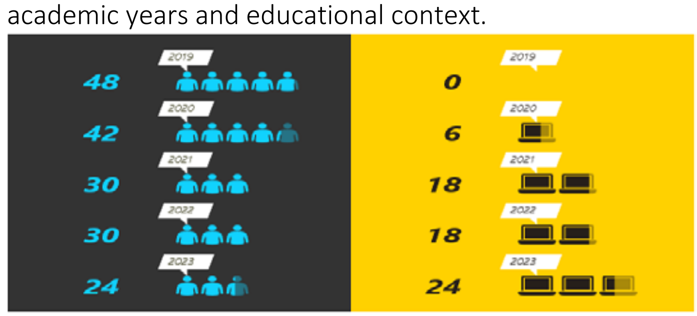

Figure 6.

Courses Taught Online and Face to Face by Years

Table 5.
Anova and Tukey Test for GPA

Total number of courses taught by distance education	Number of terms affected by C-19 and EQ				Analysis of Variance-*Graduation Grade*					Tukey Method at 95% Confidence Level					
					Graduation Year	N	Mean	StDev	*p*	Graduation Year	N	Mean	Grouping		
0					2019	62	2.6327	.34	.000	2023	60	2.8143	A		
6				C-19	2020	60	2.5647	.2539		2021	50	2.74	A	B	
18		C-19	C-19	C-19	2021	50	2.74	.2733		2022	63	2.7129	A	B	
18		C-19	C-19	C-19	2022	63	2.7129	.2926		2019	62	2.6327		B	C
24	EQ	C-19	C-19	C-19	2023	60	2.8143	.3247		2020	60	2.5647			C

In Table 5, the columns provide information on the total number of courses conducted via online education, the periods during which online education was offered along with the reasons (Covid-19, earthquake), the graduation years of students, the count of graduating students in each respective year, and the mean and standard deviation of GPAs. Given that $p < .05$, it is evident that there is a significant difference between the mean GPAs.

On the right side of the table, the outcomes of the Tukey test conducted at the 95% confidence level are presented. According to these results, the GPA means of individuals graduating in 2021, 2022, and 2023 (who completed 18-24 courses through online education) are significantly different from those who graduated in 2019 and 2020 (who completed 0-6 courses through online education). This information suggests a substantial impact of the number of online courses on the GPAs of graduating students.

Pearson Correlation Test

In this section, the associations between the courses under investigation, GPAs, and matriculation scores were explored in pairs. In the Turkish education system, students undergo a central exam, and based on their scores, preferences, and a central assignment algorithm, they are allocated to departments. Student groups were randomly selected during the examination of the correlation between students' matriculation scores in the department and other parameters. Table 6 presents the results of pairwise correlations, shedding light on the relationships between these variables.

Table 6.
Correlations Between Courses, Gpa, and Matriculation Scores

Variables (295 total graduates)	Matriculation Score 200-400	Gpa 2.00-4.00	Inventory P.	Cost Acc.	Int. to Probability	Design
Matriculation Score	1.000					
Gpa	.725	1.000				
Inventory P.	.067	- .163	1.000			
Cost Acc.	.096	- .102	.155	1.000		
Int. to Probability	.385	.161	- .003	.079	1.000	
Design	.061	.026	.096	.019	- .173	1.000

As per Table 6, the total number of graduates between 2019 and 2023 is reported as 259. Upon scrutinizing the bilateral correlations, it becomes evident that the most notable relationship exists between GPA and matriculation score. The substantial correlation coefficient of .725 signifies a positive and robust association between these two variables. For all other pairs, the Pearson correlation values range between $-.173 < p < .385$. This indicates that the relationships in these cases are weak. Thus, the RQ1 has found answer. No significant relationship was found between the transition to online education and GPAs. The correlation coefficients provide insights into the strength and direction of these relationships, and it appears that GPA and matriculation score have the most pronounced and positive correlation among the variables examined.

As a result of the analysis, it was determined that the courses success dosent pair off with GPAs, in other saying there is no significant relationship between courses success and GPAs. But students with higher matriculation scores graduated with higher GPAs and have a significant relationship each other.

Results

This study examines the academic performance of Engineering Faculty students in both online and face-to-face education periods and assesses the long-term impact of online education on students' GPAs. The ANOVA test, conducted at a 95% confidence level, revealed significant differences in student performance between the two modes of education. This variation is largely attributed to the nature of online exams. Historical data indicates that students who previously failed courses during face-to-face instruction were able to pass these courses with higher scores during the online education period. Further analysis on a course-by-course basis showed an increase in average course success rates and a decrease in the number of students failed.

Another notable finding is that students' GPAs were higher during the online education period compared to previous years, as illustrated in Figures 4 and 5. Figure 5 clearly illustrates the intervals of GPAs during online and face to face periods. Mostly students have increased better GPAs scores in online period. Finally, another finding of the study is that there is a strong positive relationship between matriculation score and GPAs.

Discussion

The transition from formal education to online education in Turkey and the world occurred with the Covid-19 pandemic. As lecturers, we started to provide remote education directly via the internet and camera, without having any online education infrastructure before. The ability to record lecture videos was a positive situation for the quality of online education. However, taking the exams as projects, homeworks or traditionally was one of the biggest handicaps of online education. This study examines the results that occur when the education and exam environment changes (online) while all other variables (lecturer, student and course content) are constant. As such, the quality of online education could not be the main subject of this study.

All four courses discussed in this study were taught by the same lecturer in both face-to-face and online education periods. This situation does not scientifically change the fact that the faculty member can act subjectively. However, since only one lecturer can teach a core course at a time, it is thought that objectivity control couldn't be sufficient over these courses and gradings.

The aims of this study are not to investigate the quality and benefits of online education. This study aims to investigate and examine the results of a current situation which is the online education period due to Covid-19.

Conclusion and Recommendations

In conclusion, while our study contributes to the growing body of knowledge on online education and its implications for engineering disciplines, there remains a need for continued research to further elucidate the complexities of this transition. By adopting a multidimensional approach and leveraging diverse research methodologies, scholars can advance our understanding of online learning and inform evidence-based practices for promoting student success in the digital age.

Ethics Committee Approval: There is not any data or study conducted for Ethics committee approval.
Peer-review: Externally peer-reviewed.
Author Contributions: Concept-SÖ; Design-SÖ; Supervision-SÖ; Resources-SÖ; Data Collection and/or Processing-SÖ; Analysis and/or Interpretation-SÖ; Literature Search-SÖ; Writing Manuscript-SÖ; Critical Review-SÖ; Other-SÖ
Conflict of Interest: The authors have no conflicts of interest to declare.
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