Akademisyenlerin COVID-19 Pandemisi Sırasında ve Öncesindeki Çalışma Periyotlarına Göre Öğretim İş Yüklerinin Karşılaştırılması Üzerine Bir Pilot Çalışma

A Pilot Study on Comparison of Teaching Workloads of Academicians Based on Working Periods During and Before the COVID-19 Pandemic

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Özet

COVID-19 pandemisi tüm dünyayı derinden etkilemiş, insanların sosyal ve çalışma hayatlarını değiştirmiştir. Başta yükseköğretim olmak üzere tüm eğitim kurumları yüz yüze eğitime ara vererek uzaktan eğitime geçmek zorunda kalmıştır. Çalışma hayatındaki bu değişim kaçınılmaz olarak akademisyenlerin çalışma biçimlerini ve iş yüklerini de etkilemiştir. Bu çalışmada, COVID-19 pandemisinin akademisyenlerin çalışma süreleri ve öğretim iş yükleri üzerindeki etkilerinin ortaya konulması amaçlanmaktadır. Bu kapsamda COVID-19 pandemisinden önceki bir yıllık yüz yüze eğitim süreci ile pandemi dönemindeki uzaktan eğitim işlem verileri karşılaştırılmıştır. Karşılaştırma için kullanılan veriler, pandemi öncesi ve pandemi döneminde etkin olarak kullanılan bir öğrenim yönetim sistemi platformunun günlük kayıtlarından alınmıştır. Günlük kayıtlar alınırken, yalnızca akademisyenler tarafından yapılan işlemlerin kayıtları esas alınmıştır. Pandemi öncesi ve pandemi dönemi olarak ikiye ayrılan veriler, işlem yoğunluğu, işlemlerin yapıldığı gün ve saat dilimi gibi değişkenler açısından incelenmiştir. Araştırma sonucunda, pandemi öncesi dönemde akademisyenlerin hafta içi işlem yoğunluğunun hafta sonları işlem yoğunluğuna göre daha fazla olduğu belirlenmiştir. Ancak pandemi sürecinde uzaktan eğitime geçişle birlikte hafta içi ve hafta sonu işlem yoğunluğu arasındaki farkın yüksek düzeyde ortadan kalktığı görülmüştür. Çalışma saatlerinin, pandemi ile birlikte yaklaşık bir saat olmak üzere günün ilerleyen saatlerine kaydığı tespit edilmiştir.

Anahtar Sözcükler: Çalışma Yaşamı, COVID-19 Pandemisi, Öğretim İş Yükü

Abstract

The COVID-19 pandemic has had a profound impact on society, greatly changing the structure of social and working lives. Educational institutions, especially in higher education, were forced to suspend face-to-face education and switch to distance education. This change inevitably affected the working styles and workloads of academics. This study aims to explore the effects of the COVID-19 pandemic on academic teaching workloads by examining transaction data for a one-year period before and during the pandemic. The data were obtained from the system logs of a learning management system platform, which was used extensively during the pre-pandemic and pandemic periods, and were analyzed in terms of transaction density, day, and time of transactions. The findings from the pre-pandemic period showed that the academic workload was higher on weekdays than on weekends. However, with the transition to distance education during the pandemic, the difference between weekday and weekend workloads diminished significantly. Additionally, the working hours shifted during the pandemic by approximately one hour to later hours in the day.

Keywords: COVID-19 Pandemic, Teaching Workload, Working Life

The COVID-19 pandemic, caused by the SARS-CoV-2 virus, first emerged in Wuhan, the capital of China's Hubei Province, in December 2019. After spreading from China, it reached Europe, North America, and the Asia-Pacific region. On March 11, 2020, the World Health Organization (WHO) declared it a global pandemic. In response, Hubei Province placed 16 cities, housing 57 million people, under full or partial quarantine. Train, planes, and long-term bus services were suspended, official and religious celebrations were canceled, and tourist places and schools were closed. The pandemic has since impacted countries worldwide, affecting every aspect of people's lives and prompting significant changes in many areas.

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To combat its spread, countries have taken measures such as social isolation, wearing masks, paying attention to cleanliness, and vaccination. In particular, avoiding crowded places and minimizing the time spent in such environments are considered crucial preventive measures. People have been encouraged to stay at home and work from home whenever possible, leading to a global shift in work practices. An analysis of internet usage patterns of over three million people revealed a significant average increase in the workday duration by 8.2% (or 48.5 minutes) for employees working from home (DeFilippis et al., 2020). Additionally, a survey of 988 people found that the time spent in front of a computer for work increased by approximately 1.5 hours compared to pre-pandemic levels (Xiao et al., 2021). A survey-based study of 345 white-collar employees in Türkiye reported that 51% felt that the boundaries between work and personal life had blurred, while 36% experienced longer working hours (Politeknik, 2021).

This inevitable shift in working patterns due to the COVID-19 pandemic has also manifested in higher education, with the transition to distance education. Information and communication technologies have been increasingly used to facilitate educational activities. Platforms like Learning Management Systems (LMS), Zoom, Skype, and Microsoft Teams have enabled both theoretical and practical courses to be conducted remotely. This has further blurred the boundaries between educators' work and personal lives, leading to an unsustainable "always-on" mentality, with educators constantly sacrificing their private hours (Murphy et al., 2021). While this problem predates the pandemic, the emergence of distance education has exacerbated it, leading to changes in working styles, working periods, and academic workloads.

Understanding these changes in working life is important for understanding the broader impact of the pandemic. It is necessary to determine these effects in order to develop coping strategies for such crises. However, a review of the literature reveals a limited number of studies investigating the impact of the pandemic on working life. These studies can be summarized as follows:

One study argued that the COVID-19 pandemic resulted in more positive than negative emotions among faculty members during the initial quarantine period (Meishar-Tal & Levenberg, 2021). Nonetheless, the majority of studies have reported negative effects. A systematic review concluded that academics faced an increased or even double the usual workload. Unlike traditional face-to-face education with fixed timeframes and locations, distance learning has blurred the boundaries between academic and personal life (Abu Talib et al., 2021).

Aiming to reveal the psychological effects of the pandemic, a groundbreaking study involving 4,700 people in Türkiye found that 64.1% of the participants experienced both physical and mental fatigue (Morgul et al., 2021). Otluoglu et al. (2021) explored the effect of the pandemic on work–life balance, academic productivity, and careers of academic mothers. Through interviews with 20 academic mothers, the study revealed a negative impact on their productivity and academic publications during the pandemic (Otluoğlu et al., 2021).

Yılmaz (2020) analyzed social inequalities experienced in the home environment during the pandemic, focusing on class, status, and occupation. Interviews with 28 academic mothers highlighted that women shoulder multiple responsibilities due to a lack of support in childcare, cleaning, and cooking (Yılmaz, 2020).

Güven (2021) interviewed academics from various universities in Türkiye and investigated the effect of healthy living factors on the quality of work life of academic staff and the organizational and individual success of academics during the pandemic (Güven, 2021).

Akbaş and Dursun (2020) emphasized that working mothers had to fit their work lives into their private lives during the pandemic, noting that the demands of motherhood increased significantly due to distance education and working from home (Akbaş & Dursun, 2020).

Ghasemi et al. (2021) examined the problems encountered by academics during the pandemic and their impact on perceived fatigue and mental health. With 172 academics participating, the study identified key concerns, such as adapting to new technologies for online/offline education, delays in research projects, conflicts with students, and dealing with children at home. These challenges were categorized into two main groups: university-related issues and family-related issues. These problems have been found to significantly contribute to mental and physical fatigue among academics (Ghasemi et al., 2021).

Noh et al. (2021) conducted a study involving 39 academics across three campuses in Malaysia to examine the academic stress experienced during the pandemic. The study found that academic stress levels increased due to the added responsibilities of caring for babies, children, and elderly parents while managing distance education. Academics struggled with problems such as distractions, ineffective time management, social isolation, and difficulty maintaining focus. Additionally, the demands of learning technologies and virtual communication systems required for online distance learning contributed to stress (Noh et al., 2021).

A review of literature focusing directly or indirectly on academics' teaching workload during the pandemic revealed publications based on anecdotal evidence from the early stages of the pandemic. These studies indicated that academics faced extended working hours due to additional work and teaching responsibilities (McMurtrie, 2020).

Ehrlich (2020) quoted an academic who said, "I don't think I've ever worked more hours," highlighting the teaching workload during the pandemic. Similarly, Dawkins (2022) shared the first-hand experiences of academics, emphasizing the rise in teaching workload in online settings during the pandemic (Dawkins, 2022). Khan et al.'s (2022) qualitative study, based on interviews with students and academics, revealed that academics were more affected by the high workload compared to students. "Preparing for lessons," "responding to e-mails," and "being accessible" made academics feel that they had to work 24 hours a day (Khan et al., 2022).

Survey-based studies have also been conducted to assess the teaching workload of academics during the pandemic. In a study by Filho et al. (2021) involving 238 academics from 147 universities, 42% of the participants reported a medium increase and 31% indicated a large increase in their teaching workload during the pandemic (Leal Filho et al., 2021).

A study conducted on 4,099 academics at a state university in Russia revealed that the teaching workload decreased by 15% in terms of total course hours due to a 1.7-fold decrease in face-to-face course hours during the pandemic. Despite the decrease in class hours, academics were observed spending more time and effort on tasks such as "preparing for lessons," "planning," "developing digital resources," "monitoring the learning process," and "mastering new online services and learning platforms." Consequently, the overall workload for distance education increased by 50% compared to traditional face-to-face education (Larionova et al., 2021).

In a survey-based study by Taylor and Frechette (2022) involving 88 academics in business administration, 60% of respondents reported a significant increase in their teaching workload during the pandemic. The study concluded that there is a positive correlation between academics' teaching workload and burnout (Taylor & Frechette, 2022). Açıkel and Esen (2023) surveyed 212 academics and reported that 59% perceived an increase in workload during the pandemic compared to before the pandemic (Açıkel & Esen, 2023).

Notably, the literature review did not identify any comparative studies evaluating the teaching workloads and working hours of academics before and during the pandemic. Therefore, this study serves as an original contribution to the literature, shedding light on the variations in teaching workload and working hours among academics due to the pandemic.

Workload can be defined as the tasks a person has to perform in a specified period to achieve any gain. Workload is affected by job requirements, working conditions, abilities, habits, and perceptions of a person (Gawron, 2008; Weiner, 1982). The perception of excessive workload varies among individuals and can negatively impact motivation, performance, and commitment to work, leading to increased stress and fatigue, and decreased attention and job satisfaction (Roelen et al., 2008).

The COVID-19 pandemic has altered the working styles of academics, necessitating adaptations to their workload. The intertwining of home and work life, together with the integration of online platforms into their tasks, has rendered it important to analyze the changes in the workload of academics, especially considering the added stress of the pandemic. Understanding these changes can inform strategies for managing similar situations in the future.

Accordingly, this study examines the impact of the COVID-19 pandemic on the working periods and workloads of academics engaged in distance education. Academics often perform many side duties, including publications, projects, administrative duties, jury memberships, and participation in congresses and seminars, in addition to teaching. Since the way these duties are carried out has changed with the pandemic, their teaching workload has also increased. This study aims to provide quantitative evidence of this increased workload by comparing one-year transaction data from the pre-pandemic face-to-face education period and the pandemic-induced distance education period. Data for comparison were obtained from the system logs of the Moodle platform, a popular LMS for distance education. The collected data were analyzed using statistical and data-mining methods. The study examined two working periods: the pre-pandemic period, referring to face-to-face education between March 11, 2019, and March 11, 2020; and the pandemic period, referring to distance education between March 11, 2020, and March 11, 2021. By analyzing the unbiased daily transaction records of academicians from the Moodle server, this study reveals the workload changes experienced by academics during the pandemic.

The remainder of this paper is organized as follows. Section 2 discusses the data and analytical approaches used in this study. Section 3 presents the findings and Section 4 offers a discussion and conclusions based on the analysis.

Method

Academic analytics is one of three primary research areas within educational analytics (Susnjak et al., 2022). This study focuses on academic analytics using data extracted from Moodle LMS logs. In this study, academics who engaged with the Moodle LMS were categorized under the "teacher" role. The study population consisted of academics using the Moodle LMS at a university in Ankara, Türkiye. All user transactions on the Moodle LMS were added to the database as a daily record. These records captured various user interactions, such as viewing, deleting, and updating content, and were added as one-line entries, resulting in logs for over 50 interactions (Akçapınar & Bayazıt, 2019). In a log record, summary data were kept about the user, their

IP address, the module they accessed, when it was accessed, the action they took, and who the affected user was.

The Moodle LMS allows log reports to be exported in file formats such as ".csv" or ".xls". These reports can be customized by specifying categories, specific dates, users, and activity restrictions, if desired. For this study, log records of users assigned the "Teacher" role by the system administrator were downloaded and saved in Excel format. However, due to the large volume of data, attempting to retrieve all records simultaneously resulted in a "time-out error." To overcome this problem, data were exported as separate daily files for both the pre-pandemic and pandemic periods. These files were then combined using the Pandas and NumPy libraries in the Python programming language, resulting in a file of 4,462,947 lines. Pandas and NumPy libraries are commonly used in data mining applications. SPSS software was used for the statistical analysis of the combined data.

Findings

During the pre-pandemic period, Moodle LMS primarily supported face-to-face education, resulting in fewer user interactions compared to the pandemic period when Moodle LMS became a fundamental tool for distance education and handled all interactions. As illustrated in ▉ Figure 1, the annual total number of actions during the pandemic period (4,462,947 actions/year) increased nearly sevenfold compared to the pre-pandemic period (641,946 actions/year).

▉ Figure 1.
Annual total number of actions
of users for the pre-pandemic and pandemic periods.
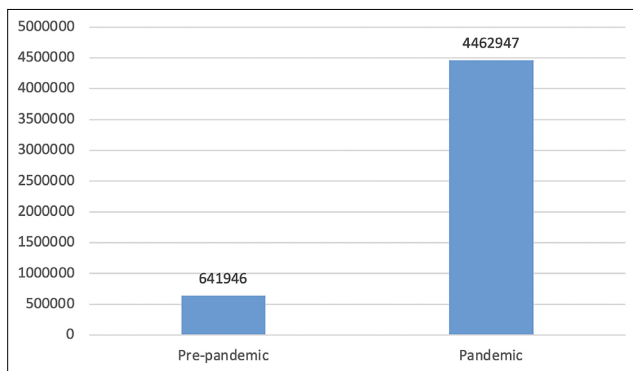
The total annual number of action records was analyzed based on time information to determine the distribution of actions per day of the week for both the pre-pandemic and pandemic periods. ▉ Figure 2 shows the distribution of the annual number of actions during the pre-pandemic period across different days of the week. Similarly, ▉ Figure 3 presents the distribution of actions during the pandemic period.

▉ Figure 2.
Distribution of annual action numbers
for the pre-pandemic period by days of the week.
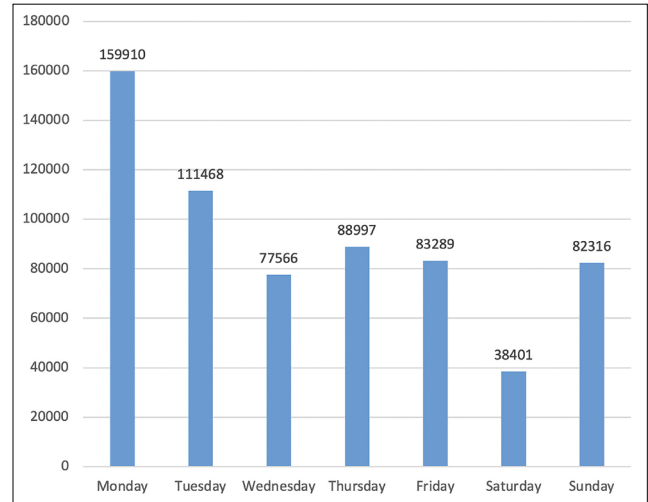
As shown in ▉ Figure 2, Mondays were the day with the highest number of actions taken by academics during the pre-pandemic period, while Saturdays saw the least activity.

▉ Figure 3.
Distribution of annual action numbers
for the pandemic period by days of the week.
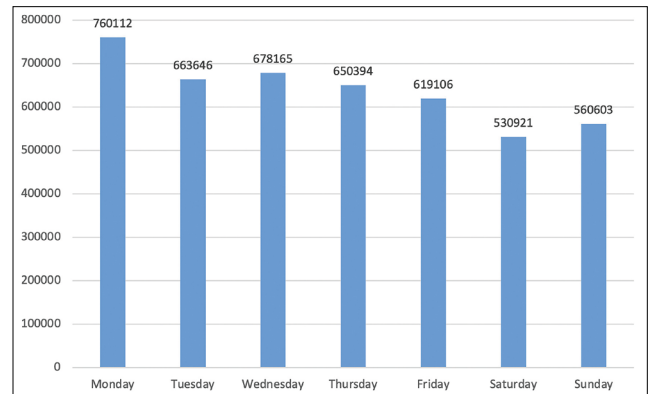
As depicted in ▉ Figure 3, Mondays emerged as the day with the highest number of actions taken by academics during the pandemic, while Saturdays showed the least activity.
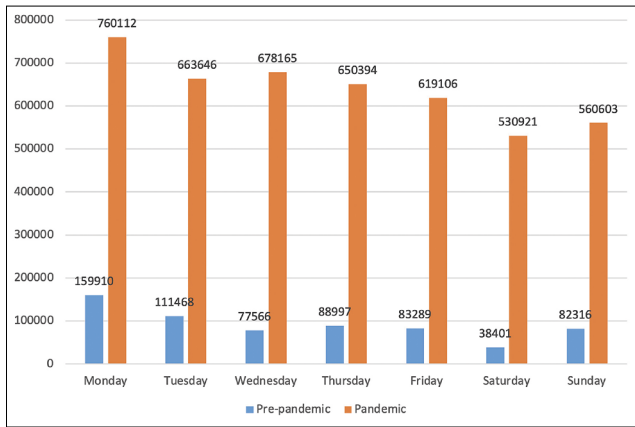
▉ Figure 4 compares the distribution of daily actions conducted by instructors across days for both the pre-pandemic and pandemic periods.

As shown in ▉ Figure 4, there was a daily increase in the actions taken during the pandemic. Descriptive statistics for the number of actions taken during both the pre-pandemic and pandemic periods are presented in ▉ Table 1.

■ Figure 4.
Comparison of the annual number
of actions in each day before and after the pandemic

■ Table 1.
Descriptive statistics of the number of actions the pre-pandemic and pandemic periods.

Periods		n	Mean	Standard Deviation	Minimum Value	Q_1	Median	Q_3	Maximum Value
Pre-pandemic	Monday	53	3017	5377	0	518	1506	3383	34239
	Tuesday	53	2103	3043	0	499	1578	2478	16165
	Wednesday	52	1492	1332	2	429	1283	2030	5324
	Thursday	52	1711	1555	0	328	1562	2259	6646
	Friday	52	1602	1570	5	194	1266	2537	6984
	Saturday	52	738	1564	6	29	324	718	10409
	Sunday	53	1553	4672	0	112	519	1229	32760
Pandemic	Monday	53	14904	14186	769	4783	10677	18594	67035
	Tuesday	52	12762	12830	194	3263	9002	14926	49519
	Wednesday	52	13042	13181	104	2604	9345	18652	59657
	Thursday	52	12508	11946	306	3297	10296	17403	61025
	Friday	52	11906	11605	153	3806	9522	16906	61722
	Saturday	52	10210	13004	6	2044	5517	13815	64063
	Sunday	50	11212	13759	133	2341	6467	14613	66468

Examining the quartiles (and) for each day during the pandemic revealed high variability in the data, leading to large standard deviation values.

Given that the number of actions did not follow a normal distribution for both pre-pandemic and pandemic periods, non-parametric tests were employed for pairwise comparisons of the days. Using the Mann–Whitney test, the hypotheses in Equation 1 were tested: whether two independent samples of sizes and are random samples from populations with similar medians:

$$H_0 : n_1 = n_2$$
$$H_1 : n_1 \neq n_2 \tag{1}$$

■ Table 1 reveals that the average number of daily actions before the pandemic ranged from 738 to 3,017. In contrast, the average number of daily actions during the pandemic varied between 10,210 and 14,904. Although Monday consistently had the highest average number of actions in both periods, there was an approximately five-fold increase in the average number of actions on Mondays during the pandemic. While the minimum number of actions before the pandemic was mostly zero, the maximum number of actions reached 34,239 on Mondays. In comparison, the maximum number of actions during the pandemic was approximately double that of the pre-pandemic period.

In Equation 1, and present the median values of the action numbers for the relevant days in the pre-pandemic and pandemic periods, respectively. The results are summarized in ■ Table 2.

In ■ Table 2, the median values for each day during the pre-pandemic and pandemic periods are compared. Since both 95% confidence interval limits are negative, this indicates that the median values for the pandemic period are higher than those before the pandemic. In addition, all -values corresponding to the Mann–Whitney statistics in ■ Table 2 are 0.000, indicating that the null hypothesis (was rejected at any significance level.

■ Table 2.
Mann-Whitney Test Results for the Number of Daily Actions Before and During the Pandemic.

Days		n	Median	95% confidence interval	Test statistics	P-value
Monday	B	53	1506,0	(-13108,-5722)	1778.5	0.000
	D	51	10677.0			
Tuesday	B	53	1578.0	(-10787,9-4772,0)	1808.5	0.000
	D	52	9001.5			
Wednesday	B	52	1283,0	(10737,0,-5380,1)	1639.0	0.000
	D	52	9344.5			
Thursday	B	52	1562,0	(-12118,-5413)	1668.0	0.000
	D	52	10296.0			
Friday	B	52	1265.5	(-10640,9,-4747,1)	1680.0	0.000
	D	52	9521,5			
Saturday	B	52	324.0	(-7465,9,-3396,9)	1635.5	0.000
	D	52	5516.5			
Sunday	B	53	519.0	(-9013,9,-3600,9)	1677.5	0.000
	D	50	6466.5			
B: Before pandemic D: During pandemic						

Therefore, the action numbers from the pre-pandemic and pandemic periods do not have distributions with similar medians. The hypotheses in Equation 2 were tested using the Kruskal–Wallis test to examine whether different days had an effect on the number of actions before the pandemic.

$H_0 : n_{1B} = n_{2B} = ... = n_{7B}$
H_1 : At least one median value is different.   (2)

In Equation 2, the null hypothesis (H_1) suggests that the number of actions before the pandemic has populations with the same medians across different days of the week. The alternative hypothesis (H_0) tests whether at least one median value differs from the others. According to the test results, a significant difference was found in the number of actions performed on different days before the pandemic (K–W = 43.021, p-value = 0.0). The multiple comparisons conducted to identify the specific day(s) contributing to this difference are presented in ■ Table 3.

According to ■ Table 3, there is no difference between the number of actions on Saturday and Sunday at a significance level of 0.05 (p-value > 0.05). However, there is a significant difference between the number of actions on weekdays and weekends (p-value < 0.05).

For the pandemic period, the hypothesis in Equation 3 was tested using the Kruskal–Wallis test.

$H_0 : n_{1D}= n_{2D} = ... = n_{7D}$
H_1 : At least one median value is different.   (3)

■ Table 3.
Multiple comparison test results
of action numbers for the pre-pandemic period

Comparisons	Test statistics	P-value
Saturday-Sunday	-26.207	0.202
Saturday-Friday	78.990	0.000*
Saturday-Wednesday	-80.442	0.000*
Saturday-Thursday	-88.635	0.000*
Saturday-Tuesday	-93.702	0.000*
Saturday-Monday	-105.329	0.000*
Sunday-Friday	52.784	0.010*
Sunday-Wednesday	-54.235	0.008*
Sunday-Thursday	-62.428	0.002*
Sunday-Tuesday	-67.495	0.001*
Sunday-Monday	-79.123	0.000*
Friday- Wednesday	-1.452	0.944
Friday-Thursday	-9.644	0.640
Friday-Tuesday	-14.711	0.480
Friday-Monday	-26.339	0.200
Wednesday-Thursday	8.192	0.691
Wednesday-Tuesday	13.259	0.525
Wednesday-Monday	24.887	0.226
Thursday-Tuesday	-5.067	0.808
Thursday-Monday	16.695	0.416
Tuesday-Monday	11.628	0.575
*significant at 0.05 level		
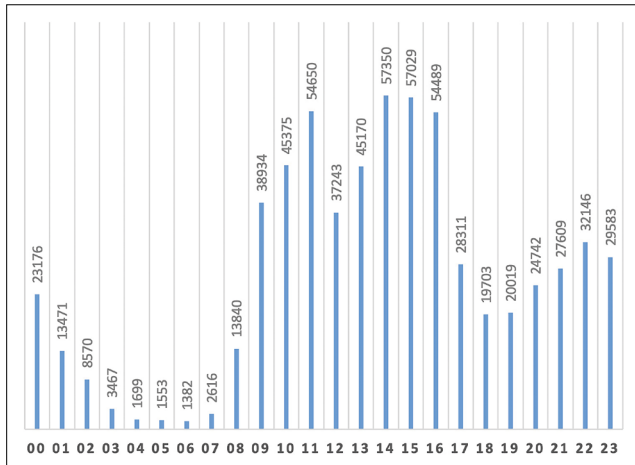
In Equation 3, the null hypothesis (H_0) suggests that the number of actions during the pandemic has populations with the same medians across different days of the week. The alternative hypothesis (H_1) tests whether at least one median value differs from the others. The test results revealed no significant difference between the days of the week (K-W=8.739,p-value =0.189).

Figure 6.
Distribution of annual
action numbers for the pandemic period by hours
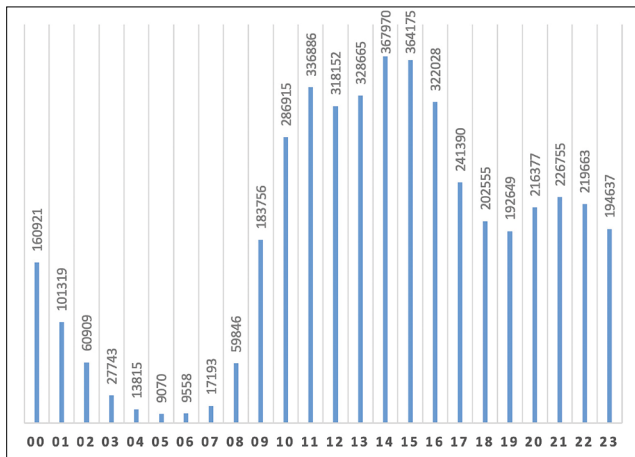
The distribution of the annual number of actions during both the pre-pandemic and pandemic periods, categorized by hours, is shown in Figures 5 and 6, respectively.

As shown in Figure 5, the highest number of annual actions during the pre-pandemic period occurred at 14:00 on the day, while the lowest number of actions was recorded at 06:00 h.

As depicted in Figure 6, the highest number of annual actions during the pandemic period occurred at 14:00 on the day, while the lowest number of actions was performed at 05:00 h.

Cluster analysis in data mining refers to the natural grouping or clustering of data based on measured or perceived intrinsic properties or similarities. It can be difficult for humans to interpret and aggregate data embedded in multidimensional spaces. The K-means clustering algorithm, which uses the square of the error criterion, is a simple and widely used method for this purpose (Kantardzic, 2011). Due to these features, it was chosen for this study. The algorithm starts with random initial partitioning and continues to reassign samples to clusters based on their similarity until a convergence criterion is met. Typically, convergence occurs when no further sample reassignment between clusters results in a reduced total squared error.

Figure 7.
The center points of the pre-pandemic and pandemic clusters.
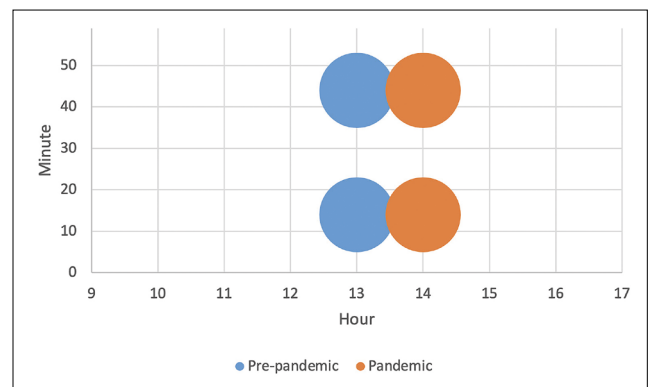
The K-means algorithm was implemented in Python using the Pandas and NumPy libraries. The daily pre-pandemic and pandemic period records were divided into two clusters based on the hours. As shown in Figure 7, the center points for the pre-pandemic period were 13:14 and 13:44, while the centers for the pandemic period were 14:44 and 14:14.

Conclusions and Recommendations

The findings indicate that the Moodle LMS emerged as a pivotal tool for educational communication during the pandemic, facilitating a significant increase in educational activities through this platform. The pandemic led to a nearly seven-fold increase in transactions compared to the pre-pandemic period, underscoring the system's importance when face-to-face education was not feasible.

Regarding the distribution of the number of transactions over days, academics predominantly conducted activities at the beginning of the week during both periods, with fewer transactions toward the end of the week. This pattern persisted during the pandemic, with Mondays seeing the highest activity and Saturdays seeing the lowest. This result shows that, both before and during the pandemic, academics tried to differentiate between weekdays and weekends to maintain clear boundaries between work and home life. However, the data revealed that the number of transactions increased noticeably during the pandemic, even on Saturdays, traditionally the least active day. Consequently, there was no statistically significant difference between weekdays and weekends during the pandemic. Thus, it can be concluded that instructors could not take weekend breaks during the pandemic period. Overall, the academic teaching workload increased significantly throughout the week during the pandemic.

The data revealed that, similar to the pre-pandemic period, transactions increased toward the afternoon during the pandemic. However, there was a shift in the start time for transactions during the pandemic, starting at a later hour compared to the pre-pandemic period. Cluster analysis revealed that the working hours shifted by approximately one hour to the late hours of the day.

Overall, the pandemic led to noticeable changes in both the living and working styles of academics and increased teaching workloads. This study examined only changes in the teaching workload within the scope of working life. Considering an addition to workloads in their home lives, it is clear that the workload increase will be even higher. The study clearly shows that the balance between work and the social life of academics has deteriorated to the detriment of lecturers. Accordingly, institutional administrators, managers, and higher education policymakers should consider implementing measures like additional annual leave and compensation for working from home during extraordinary situations, such as pandemics, to help academics face these challenges more comfortably.

This study has several limitations. In Moodle LMS, individuals designated as "Teachers" are considered academicians. This study did not distinguish between academic titles (e.g., research assistant, lecturer, assistant professor, professor). Additionally, the analysis focused solely on training activities carried out using the Moodle LMS, excluding activities performed using other distance education tools (such as Zoom and Microsoft Teams).

Future research could explore other clustering algorithms for data analysis and compare the results. Additionally, the pre-pandemic and pandemic period data can be compared based on the type of operations performed. In the case of a retransition to face-to-face education after the pandemic, researchers can gather relevant data and update the study results. Thus, the pre-pandemic, during-pandemic, and post-pandemic data can be compared. Future studies could also examine the relationship between teaching workload and LMS activity alongside other dynamic and control variables. Additionally, research can be conducted on how teaching workloads vary at the associate, undergraduate, and graduate levels.

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