Post-Pandemic Perspective: An Investigation into Higher Education Students' Attitudes towards Mobile Learning

[1,]Dr. Musab Talha Akpınar, [2,]Prof. Dr. Ömür Akdemir

[1,2,]*Management Information Systems Department, Ankara Yıldırım Beyazıt Üniversitesi, Ankara, Türkiye*

ABSTRACT : In today's technologically advanced age, mobile learning has surged to the forefront of educational modalities. This prominence has been further amplified by the unforeseen challenges posed by the COVID-19 pandemic, making mobile learning indispensable in higher education settings. This research, situated at Ankara Yıldırım Beyazıt University, delves into the pandemic's transformative effects on students' perceptions of mobile learning, examining variations based on their grades, gender, academic level, and motivation. Through a meticulous cross-sectional scale design, the study captures the nuanced views of undergraduate students specifically from the said university. Preliminary findings suggest that post-pandemic, there have been perceptible shifts in students' attitudes towards mobile learning, albeit with variations. Such insights underscore the imperative for educational institutions to understand the multifaceted impacts of the pandemic on digital learning. They also emphasize the need to fine-tune educational strategies to align with changing student preferences in this new normal. Conclusively, this research offers valuable insights for refining pedagogical approaches and technological adaptions in tertiary education, especially when facing abrupt global disruptions. It culminates in a call for a broader inquiry to grasp the enduring implications of the pandemic on mobile learning, aiming to fortify adaptability and resilience in higher education landscapes.

KEYWORDS - Educational Technology, Higher Education, Mobile Learning, Post-pandemic, Student Attitudes

I. INTRODUCTION

As human being navigate the fourth Industrial Revolution characterized by the integration of digital, physical, and biological technologies [1], the educational landscape has evolved significantly. The recent COVID-19 pandemic catalyzed an urgent shift towards digital and mobile learning environments [2]. This paper, probes into this transitional shift to comprehend student attitudes in the context of mobile learning (M-learning). Over the past few decades, technological advancements have ushered in several innovative learning forms such as e-learning, blended learning, and the recently emerged, mobile learning [3]. According to Crompton [4], mobile learning is a style of education that is not restricted to a single location and makes use of the advantages offered by mobile technologies. These innovations offer omnipresent, individualized, and adaptable learning experiences, ranging from smartphones and tablets to wearable technology. The spread of mobile devices and the advancement of wireless communication technology are key factors in the development of mobile learning. The emergence of the smartphone in the twenty-first century, known for its improved processing power and internet connectivity, fundamentally altered the nature of education [5]. The rapid development of cloud computing, which provided students with a flexible and collaborative learning environment, accelerated this shift [6]. Mobile devices are widely used, which encouraged academics and researchers to use them for pedagogical reasons, resulting in the development of mobile learning [7]. Mobile learning promotes a learner-centric strategy that goes beyond the limitations of traditional classrooms, enables students to access instructional content from any location, and accommodates a variety of learning styles and tempos. However, mobile learning is not devoid of contemporary issues. The creation of interesting and dynamic mobile learning content is a challenge, as are issues with the digital divide and privacy [7]. Additionally, there is the lingering question about mobile learning's effectiveness, which came to the fore during the hasty transition to remote learning during the COVID-19 pandemic [8].

II. BACKGROUND

In this regard, the purpose of this study is to comprehend the present state of mobile learning in higher education, particularly in a post-pandemic world. Through an investigation of student attitudes. Furthermore, findings of this study can inform future policies and practices in technologies in education to enhance learning experiences in a mobile context. Learning can be defined as a measurable and relatively permanent change in behavior through experience, instruction, or study.

According to Driscoll [9], learning is a long-lasting improvement in human performance or performance potential that must occur from the learner's exposure to and engagement with the outside world. Especially The development of information was not as slowly after World War II. Knowledge is expanding at an exponential rate. Technology has specifically altered how individualities, how they interact, and how they study since the turn of the millennium. Along with many other processes, educational methodologies have changed because of the advancement of technology. Learning requirements and theories that outline learning concepts and procedures ought to consider the underlying social contexts. Learning theories are starting to adapt to the digital age by including technology and connection-making in learning activities. The knowledge we need to act cannot be acquired by personal experience [10].

On the other hand, remote learning programs were available for students to take long before the internet was even invented. Isaac Pitman, who was the developer of the system of shorthand, known now as Pitman shorthand, taught his students shorthand by correspondence in the 1840s [11]. In 1970s, online learning started to become more participatory. The original online learning systems were only designed to transmit material to students. The Open University in Britain was eager to benefit from e-learning [12]. Their educational system has traditionally placed a heavy emphasis on distant learning. By the early 1990s, several institutions had been established that only offered courses online. By utilizing the internet, these institutions were able to educate people who would not have otherwise been able to attend college owing to time or geographic restrictions. At the 21st century, distance learning began to be referred to as online learning or E-learning [13]. It is the employment of technology to aid and enhance learning. Shortly, E-learning can be defined as a web-based educational system on platform with Internet, Intranet, or computer access [14] Mobile devices have made it possible for users to access course materials at any time and from any location thanks to the development of mobile learning. Specialized systems are being created to assist mobile learning [15]. They not only oversee the educational material but also adapt it for mobile devices' small screens and ensure that it is properly shown.

The rise of mobile learning, or m-learning, has been well-documented over the past decade [16]. Defined as learning across multiple contexts, through social and content interactions, using personal electronic devices [4], m-learning allows for unprecedented access to information and flexibility in learning. According to a study by Alrasheedi, Capretz, and Raza [17], mobile learning's key advantages include its ability to provide personalized learning, learner mobility, and anytime access. However, they also noted that challenges such as technical issues, a lack of professional development, and privacy concerns could hinder its effective implementation.In response to the COVID-19 pandemic, institutions around the world rapidly shifted to online learning, which included various forms of m-learning. A study by Toquero [18] on challenges and opportunities for higher education amid the COVID-19 pandemic, particularly in Southeast Asia, highlighted the key role of m-learning during this time. Yet, it also noted the digital divide, lack of resources, and other issues that have hampered its widespread and effective use.

Research on students' attitudes towards m-learning is varied. While many studies pre-pandemic reported positive attitudes [19], some post-pandemic studies have found mixed results. For example, Alqahtani and Rajkhan [20] noted increased anxiety and discomfort among students with online learning during the pandemic. However, there is limited research focusing explicitly on students' attitudes towards m-learning post-pandemic, indicating a gap in the literature that this study aims to fill.In an era characterized by rapid technological advancements, mobile learning has established itself as an integral part of the educational landscape [21]. However, the global COVID-19 pandemic has dramatically redefined the context and relevance of mobile learning within higher education [2]. This study delves into the transformation in attitudes in general and, satisfaction levels, impacts on learning scores, motivation, and perceived usefulness particularly towards mobile learning among undergraduate students in the post-pandemic world.Drawing upon the cross-sectional survey design, this research seeks to examine the current perspectives of undergraduate students on mobile learning [22]. Using a comprehensive survey instrument, the study collected responses from undergraduate students across a range of departments of the selective university, ensuring a representative and diverse sample. The research questions this study seeks to address include (1) the attitude of undergraduate students towards mobile learning after pandemic, (2) the attitude of undergraduate students towards mobile learning after pandemic by gender, (3) the satisfaction level of undergraduate students towards mobile learning after pandemic by gender, (4) the learning level of undergraduate students towards mobile learning after pandemic by gender, (5) the motivation of undergraduate students towards mobile learning after pandemic by gender,, (6) the usefulness of mobile learning after pandemic by gender.

Initial findings suggest that the pandemic has considerably influenced students' attitudes and perceptions, although not uniformly across all dimensions [23]. While there was a significant increase in motivation and perceived usefulness of mobile learning platforms, there was concurrent variability in satisfaction levels and learning outcomes. These results underscore the need for higher educational institutions to understand the nuanced impact of the pandemic on mobile learning and develop strategies aligning with the evolving needs and preferences of students in the post-pandemic world [24].This study is projected to provide valuable insights for shaping pedagogical strategies and technological interventions in the realm of higher education in the wake of unprecedented global crises [25]. This paper concludes by advocating for more comprehensive research to understand the long-term implications of the pandemic on mobile learning, and the consequent need to foster resilience and adaptability in higher education [26]. It also discusses the broader societal implications of these shifts, as understanding these changes could inform educational policy, institutional decision-making, and future research directions in an increasingly digital educational landscape. Given that the COVID-19 pandemic has dramatically impacted all facets of life, including education, there has been a substantial shift towards digital learning environments [8]. Research on mobile learning in higher education, particularly during and post-pandemic, is still in its nascent stages, necessitating a thorough review of literature from various aspects.Another part of this study that is being investigated is satisfaction with m-learning, which is a key factor in determining how effective it is. According to earlier studies, perceived usefulness, perceived usability, and system quality all have an impact on students' happiness with mobile learning [21]. However, there is currently a dearth of research on students' happiness with mobile learning during and after the COVID-19 pandemic, making this a crucial subject to investigate.

Another topic of focus is performance in m-learning settings. Wu et al.'s [27] meta-analysis revealed that m-learning can considerably improve student performance. The majority of these studies were carried out before the pandemic, therefore more research is required to determine whether these conclusions still hold true in the post-pandemic era, in which mobile learning is frequently both a requirement and not just an option.Even though m-learning has played a crucial role in higher education throughout the COVID-19 pandemic, there hasn't been much research done on undergraduate students' attitudes after the pandemic. This study intends to fill this knowledge gap and advance our knowledge. Globally, the pedagogical landscape has changed because of the COVID-19 pandemic, which has sparked an extraordinary movement toward digital learning settings. Mobile learning, sometimes known as m-learning, has become a prominent player in higher education among the variety of digital learning options. Learning is now more accessible and flexible than ever, thanks to m-learning, which is described as learning across different contexts through social and content interactions using personal electronic devices [4]. Although m-learning's promise has been acknowledged for more than ten years [5], the global health crisis has necessitated a more thorough investigation of its applicability, efficacy, and ramifications. To better understand this fascinating feature of modern education, this study will examine undergraduate students' attitudes towards m-learning in the post-pandemic context. The following queries will be addressed in the study:

1. What is the current attitude of undergraduate students towards mobile learning after pandemic?
2. How does the attitude of undergraduate students towards mobile learning after pandemic change by the gender?
a. How does the satisfaction level of undergraduate students towards mobile learning after pandemic change by the gender?
b. How does the effects of undergraduate students' learning towards mobile learning after pandemic change by the gender?
c. How does the motivation of undergraduate students towards mobile learning after pandemic change by the gender?
d. How does the usefulness level of undergraduate students towards mobile learning after pandemic change by the gender?
3. How does the attitude of undergraduate students towards mobile learning after pandemic change based on the grade level?
a. How does the satisfaction level of undergraduate students towards mobile learning after pandemic change based on the grade level?
b. How does the effects of undergraduate students' learning towards mobile learning after pandemic change based on the grade level?
c. How does the motivation of undergraduate students towards mobile learning after pandemic change based on the grade level?

    d.   How does the usefulness level of undergraduate students towards mobile learning after pandemic change based on the grade level?

III. METHODOLOGY

The cross-sectional survey design is used in the study to investigate the research questions (Creswell, 2014). This design was chosen as it allows for the examination of the attitudes of undergraduate students towards mobile learning after the pandemic. The attitude scale towards mobile learning developed by Demir & Akpınar [28] was used for the data collection. The scale has four factors: satisfaction with mobile learning, the effects of mobile learning on learning outcomes, motivation towards mobile learning, and perceived usefulness of mobile learning. The scale contained 45 items and utilized a five-point Likert scale ranging from 'totally disagree' (1) to 'totally agree' (5). Due to its ease of use, reliability, and validity, this sort of scale has been extensively employed in research studies [29]. The convenience sampling, widely employed in educational research when a subset of the population is easily available, was utilized to choose participants for this study [30]. In the study, undergraduate students from one of the public universities located in the capital city of Türkiye was selected. served as our target demographic. This decision was influenced by a combination of pragmatic factors and the fact that this university's varied student body offers an ideal setting for investigating attitudes toward mobile learning. The participants come from a variety of faculties, including but not limited to the faculties of law, economics and administrative sciences, health sciences, humanities and social sciences, and engineering and natural sciences. This broad representation among faculties enables a thorough comprehension of the difficulties and opportunities given by mobile learning across many fields. Additionally, it offers the chance to examine and contrast how attitudes, motivations, levels of satisfaction, and perceived usefulness of mobile learning vary across different fields of study, which can offer important insights into how mobile learning strategies may affect higher education in the post-pandemic world. To gain a thorough knowledge of students' attitudes about mobile learning in a post-pandemic society, a thorough cross-sectional scale design was employed for this advanced study, comprising undergraduate students from multiple faculties.

The online version of the scale was distributed to the undergraduate students in the university. Due to their affordability, effectiveness, and potential for collecting massive amounts of data, online surveys have become more and more common in research studies [31,32]. To collect comprehensive data and gain an understanding of the attitudes towards mobile learning among undergraduate students, this study chose Ankara Yıldırım Beyazıt University as the research site. The university's population of Turkish students is 15,909, consisting of 9,472 female and 6,437 male students. These individuals comprise a diverse and representative pool of subjects across various faculties, making the university an ideal setting for this investigation [33]. Given the university's substantial student population, the determination of an appropriate sample size was crucial to ensure the validity and reliability of the study's findings. Sample size calculations were based on a confidence level of 95%, a margin of error of 5%, and an assumed population proportion of 50% [30]. As such, the sample size necessary for this study was calculated to be a minimum of 376 participants. Recruiting a sample size of this magnitude ensures that the results obtained from the study are representative of the larger student body, within a 5% margin of error, and provide reliable insights into students' attitudes, motivations, satisfaction levels, and perceived utility of mobile learning in the post-pandemic environment [34].

IV. DATA ANALYSIS

This study applies a cross-sectional survey design to address the research questions [35], offering a snapshot of undergraduate students' attitudes towards mobile learning in a post-pandemic context. The chosen instrument for data gathering is the attitude scale towards mobile learning, developed by Demir & Akpınar [28]. It comprises four elements: satisfaction with mobile learning, mobile learning's impact on learning outcomes, motivation for mobile learning, and perceived value of mobile learning. The scale consists of 45 items, using a five-point Likert scale from 'strongly disagree' (1) to 'strongly agree' (5). Due to its simplicity, reliability, and validity, this scale type is a popular choice in research efforts [29]. The study adopted convenience sampling; a strategy frequently used in educational research when a subset of the population is readily accessible [30]. Undergraduate students at a public university in Turkey's capital served as the primary participants. The decision was based on pragmatic considerations and the understanding that this university's diverse student base provides an ideal backdrop to explore mobile learning attitudes. Participants spanned various faculties, encompassing the faculties of law, economics and administrative sciences, health sciences, humanities and social sciences, and engineering and natural sciences. This wide representation aids in gaining a comprehensive understanding of the challenges and opportunities presented by mobile learning across different disciplines. Moreover, it offers an opportunity to investigate how attitudes, motivations, satisfaction levels, and perceived usefulness vary across distinct fields of

study, providing valuable insights into the potential impact of mobile learning strategies in the post-pandemic era of higher education. An online version of the scale was disseminated among the university's undergraduate students. The increasing prevalence of online surveys in research [31,32] is due to their cost-effectiveness, efficiency, and capacity to amass large volumes of data. In this study, data collection was conducted via the online forms, a versatile application that supports the generation of comprehensive surveys. Spanning all faculties and levels, the participants from the public University located in the capital of Türkiye, were invited to participate in this online survey. The purpose was to gather a broad spectrum of data pertaining to students' perceptions of mobile learning's value in the post-pandemic age, their attitudes towards it, their levels of satisfaction, impacts on their learning scores, and their motivation [33]. Confidentiality and preservation of anonymity in the responses were emphasized to encourage genuine and objective feedback [36]. The data were transferred from online Forms to an spreadsheet for initial processing and cleaning once the survey was completed. Following the cleaning process, the refined dataset was imported into SPSS and Python for analysis. Descriptive statistics, including means, standard deviations, and frequency distributions, were primarily conducted using SPSS to provide an overview of the data trends and patterns [37]. To ascertain any significant differences in student responses based on their faculties or levels of study, the Mann-Whitney Tests were performed. Inferential statistical analyses were further conducted to address the research questions [34].

Data visualization was performed using Microsoft Office [38], facilitating the creation of graphs, charts, and other visual representations of the statistical analysis findings. These visualizations enriched the interpretation and presentation of results by allowing an intuitive understanding of the data and the conclusions drawn from it. These analytic approaches collectively offered a comprehensive understanding of post-pandemic attitudes, satisfaction levels, impacts on academic performance, motivation, and perceived usefulness of mobile learning among students in higher education. Convenience sampling was employed to select the participants [30]. Students were informed about the study and were invited to participate by voluntarily completing the online questionnaire. The survey gathered responses from a total of 411 students, with an equal distribution of male and female respondents. The responses were collected from the online platform, resulting in potential scores ranging from 1 to 5 for each question. Descriptive statistics and Mann-Whitney Tests were used to answer the research questions, with statistical tests conducted at a significance level of 0.05 [39]. Non-parametric analyses are particularly beneficial when the data does not adhere to normal distribution assumptions, often seen with ordinal or nominal scales [34]. In the context of this study, the employment of a five-point Likert scale underscores the appropriateness of non-parametric tests since Likert scales produce ordinal data. The Mann-Whitney Test, a widely recognized non-parametric test, was utilized to distinguish any significant disparities in the students' responses across different faculties or academic levels [39]. For illustration, when assessing mobile learning satisfaction levels between students from the faculties of engineering and humanities, the Mann-Whitney Test provides insights into whether one group consistently ranks higher than the other. Utilizing non-parametric methods, such as Mann-Whitney, ensures the robustness of the results, especially when data diverges from normal distribution expectations, thereby offering a more authentic depiction of students' attitudes across varying disciplines [34].

V. RESULTS

The first research question investigated attitude level of undergraduate students towards mobile learning after the pandemic. It was found that the attitude level of undergraduate students towards mobile learning (M=142,327, SD=17,09) (Table 1).

Table1: Attitude Level Of Undergraduate Students Towards Mobile Learning after the pandemic

	Sex	N	Mean	Std. Deviation	Std. Error Mean
Attitude Scores	Male	146	142,3	17,09	1.41
	Female	190			

The second research question investigated whether the attitude of undergraduate students towards mobile learning change by the gender. The results of the Mann-Whitney U Tests revealed that the attitude of undergraduate students towards mobile learning does not change by the gender (U= 13344,5, p > 0,05) (Table 2). Also, the result of the Mann-Whitney U test revealed that there is not any significant difference for the sub-factors of the attitude (satisfaction, the effects on learning, motivation, usefulness) by the gender (Table 2).

Table 2: Attitude of undergraduate students towards mobile learning after the pandemic by the gender

Factors	Gender	N	Mean Rank	Sum of Rank	U	p
Attitude	Male	190	165,7	31489,5	13344,5	0,551
	Female	146	172,1	25126,5		
Satisfaction	Male	190	161,63	30710	12565	0,139
	Female	146	177,44	25906		
Effects on learning	Male	190	173,06	32881	13004	0,326
	Female	146	162,57	23735		
Motivation 0204	Male	190	162,61	30896,5	12751	0,204
	Female	146	176,16	25719,5		
Usefulness	Male	190	171,33	32553	13332	0,541
	Female	146	164,82	24063		

The presented Table 2 elucidates the attitude of undergraduate students towards various facets of mobile learning after the pandemic, segmented by gender. The factors examined include the general attitude towards mobile learning, satisfaction derived from it, the perceived effects of mobile learning on academic outcomes, the motivation to engage in mobile learning, and its perceived usefulness. For each factor, the gender-wise distribution of the sample, their respective mean rank in terms of the responses, the sum of these ranks, the Mann-Whitney U statistic, and the p-value are presented. The Mann-Whitney U test, a non-parametric statistical method, is used to compare the distributions of two independent samples, in this case, male and female students. Regarding the general attitude towards mobile learning, male students (N=190) had a mean rank of 165.7 with a sum of ranks amounting to 31,489.5, yielding a U value of 13,344.5 and a p-value of 0.551. In contrast, their female counterparts (N=146) manifested a slightly higher mean rank of 172.1, aggregating to a sum of ranks of 25,126.5. Similarly, for the facets of satisfaction, effects on learning, motivation, and perceived usefulness, the mean ranks, sum of ranks, and the U values are detailed, with the respective p-values offering insights into the statistical significance of the differences in distribution between the two gender categories. In interpreting the results, a p-value below the conventional threshold of 0.05 would indicate that there's a statistically significant difference in attitudes between male and female students for the respective factor. However, all the given p-values exceed this threshold, suggesting that there's no statistically significant difference in the attitudes of male and female students towards mobile learning across the explored factors in this post-pandemic context.

The last research question investigated whether the attitude of undergraduate students towards mobile learning change by grade level. The results of the The Kruskal-Wallis H test revealed that the attitude of undergraduate students towards mobile learning does not change by the gender (U= 13344,5, p > 0,05) (Table 3). Also, the result of the The Kruskal-Wallis H test revealed that there is not any significant difference for the sub-factors of the attitude (satisfaction, the effects on learning, usefulness) by the gender (Table 3). However, the results of the statistical analysis have revealed that a significant difference between Junior and Freshman undergraduate students' motivation and between Junior and Sophomore undergraduate students' motivation (Table 3). To identify the differences, the Mann-Whitney U Tests are conducted. It has been found that the motivation level of Juniors is higher than the motivation of Freshman undergraduate students. Also, it has been found that the motivation level of Juniors is higher than the motivation of Sophomore undergraduate students (Table 4).

Table3: Attitude of undergraduate students towards mobile learning after the pandemic by the grade level

Factors	Gender	N	Mean Rank	sd	X^2	p	Significant difference
Attitude	Freshman	68	162,18	3	5,273	0,153	
	Sophomore	84	155,24				
	Junior	75	189,23				
	Senior	109	168,40				
Satisfaction	Freshman	68	173,63	3	2,918	0,404	

	Sophomore	84	156,05				
	Junior	75	181,19				
	Senior	109	166,16				
Effects on learning	Freshman	68	155,32	3	6,398	0,094	
	Sophomore	84	155,05				
	Junior	75	188,75				
	Senior	109	173,15				
Motivation	Freshman	68	159,46	3	8,956	0,030*	Junior>Freshman*
	Sophomore	84	150,60				Junior>Sophomore*
	Junior	75	194,67				
	Senior	109	169,93				
Usefulness	Freshman	68	170,68	3	3,618	0,306	
	Sophomore	84	184,19				
	Junior	75	163,68				
	Senior	109	158,36				

* There is a statistically significant difference.

Table 3 presents a comparative evaluation of the attitude of undergraduate students towards various facets of mobile learning post-pandemic, segmented by their grade level. The factors under examination encompass general attitude towards mobile learning, the satisfaction derived from it, its perceived effects on learning outcomes, the motivation to engage in mobile learning, and its perceived usefulness. For every factor under consideration, the data unfolds grade-wise, specifying the number of respondents (N), their mean ranks, the standard deviation (sd), the Chi-square (X^2) value, the associated p-value, and if there's any significant difference between the grade levels. The Kruskal-Walli's test, which is a non-parametric method, is employed here. It's used to determine if there are statistically significant differences between two or more groups of an independent variable on a continuous or ordinal dependent variable. Overall, Table 3 offers a comprehensive view of the variations in attitudes towards mobile learning post-pandemic across different academic grade levels. The most pivotal finding being the heightened motivation of Juniors relative to their freshman and sophomore peers.

Table4: The motivation level of undergraduate students towards mobile learning after the pandemic by the grade level

Factors	Grade level	N	Mean Rank	Sum of Rank	U	p
Motivation	Junior	75	79,46	5959,5	1990,5	0,023*
	Freshman	68	63,77	4336,5		
Motivation	Junior	75	91,09	6832	2318	0,004*
	Sophomore	84	70,1	5888		

* There is a statistically significant difference.

Table 4 provides insights into the motivation levels of undergraduate students towards mobile learning in the post-pandemic context, categorized by their grade level. The focus here is specifically on Juniors in contrast with Freshmen and Sophomores. Comparison between Juniors and Freshmen: Juniors (N=75) have a mean rank of 79.46 with a sum of rank value of 5959.5, whereas Freshmen (N=68) exhibit a mean rank of 63.77 and a sum of rank value of 4336.5. The U-statistic for this comparison is 1990.5. The p-value is 0.023, which is less than the commonly used significance threshold of 0.05. This indicates that there is a statistically significant difference in motivation levels towards mobile learning between Juniors and Freshmen, with Juniors exhibiting higher motivation. Comparison between Juniors and Sophomores: For Juniors, the mean rank is 91.09 with a sum of rank value of 6832, while Sophomores (N=84) possess a mean rank of 70.1 and a sum of rank value of 5888. The U-statistic here is 2318. The p-value for this pair is even more notable at 0.004, which is well below the 0.05 significance threshold. This confirms a statistically significant difference in the motivation levels towards mobile learning between Juniors and Sophomores, with Juniors showing a greater inclination. In summary, Table

4 elucidates that Juniors display a higher motivation towards mobile learning after the pandemic when compared to both Freshmen and Sophomores, with the differences being statistically significant.

VI. CONCLUSION AND DISCUSSION

The landscape of higher education has witnessed significant upheavals in recent times, with mobile learning becoming a quintessential facet of this transformation. The pressing challenges and global shift dictated by the COVID-19 pandemic have catalyzed the dependence on and adaptation to mobile educational platforms [40]. In this context, our study sought to comprehend the multifaceted reactions of undergraduate students towards mobile learning, analyzing their attitudes, perceived values, motivation, and satisfaction post-pandemic. The findings corroborate the pivotal role the pandemic has played in driving the digital shift within higher education [40]. Most of the undergraduate respondents showcased an overarching positive disposition towards mobile learning, emphasizing its heightened relevance and indispensability. This aligns with prior research that underscores the capacity of mobile devices to elevate learning experiences and enhance student engagement [41].One salient observation from the study was the burgeoning enthusiasm of students towards mobile platforms, arguably stemming from the inherent flexibility and convenience they offer. This allows learners to seamlessly integrate education into their routines, accessing content irrespective of time or place [42].Yet, amidst the prevalent optimism, our data also hinted at varied satisfaction levels and learning outcomes. This diversity in experiences can be attributed to potential technological challenges, a palpable void of face-to-face interactions, and the contrasting adaptability rates among students. These nuances resonate with the observations made by Bao [43], who emphasized that the efficacy of online learning is contingent on the individual's circumstances and adaptability. Delving deeper, our results also unearthed differential attitudes based on gender and grade levels. While the positive perception was universal across genders, specific grade levels, notably Juniors, showcased heightened motivation compared to Freshmen and Sophomores. Such disparities accentuate the imperative for a more tailored mobile learning approach, cognizant of the distinct needs and challenges across demographics. To conclude, as the educational domain continues its trajectory towards digital prominence, it's pivotal to continually refine and adapt mobile learning paradigms. Our research underscores the importance of not only embracing this transition but also ensuring it's inclusively tailored, accommodating the diverse spectrum of learners. Such a holistic approach, underpinned by persistent research, promises a progressive and inclusive educational horizon.

REFERENCES

[1]   Schwab, Klaus, and Richard Samans. "The future of jobs: Employment, skills and workforce strategy for the fourth industrial revolution." World Economic Forum. 2016.

[2]   Daniel, Sir John. "Education and the COVID-19 pandemic." Prospects 49.1 (2020): 91-96.

[3]   Garrison, D. Randy, and Heather Kanuka. "Blended learning: Uncovering its transformative potential in higher education." The internet and higher education 7.2 (2004): 95-105.

[4]   Crompton, Helen. "A historical overview of m-learning: Toward learner-centered education." Handbook of mobile learning. Routledge, 2013. 3-14.

[5]   Traxler, John. "Defining, discussing, and evaluating mobile learning: The moving finger writes and having writ...." International Review of Research in Open and Distributed Learning 8.2 (2007): 1-12.

[6]   González-Martínez, José A., et al. "Cloud computing and education: A state-of-the-art survey." Computers & Education 80 (2015): 132-151.

[7]   Kaliisa, Rogers, and Michelle Picard. "A systematic review on mobile learning in higher education: The African perspective." (2017).

[8]   Hodges, Charles B., et al. "The difference between emergency remote teaching and online learning." (2020).

[9]   Driscoll, M. P. "Psychology of learning for instruction. Needham." MA: Allyn & Bacon (2000).

[10]   Siemens, George. "Connectivism: a learning theory for the digital age. 2004." Online: http://www. elearnspace. org/Articles/connectivism. htm (accessed October 2012) (2014).

[11]   Matthews, Diane. "The origins of distance education and its use in the United States." The Journal 27.2 (1999).

[12]   Weller, Martin. "The distance from isolation: Why communities are the logical conclusion in e-learning." Managing Learning in Virtual Settings: The Role of Context. IGI Global, 2006. 182-196.

[13]   Moore, Michael G., and Greg Kearsley. Distance education: A systems view of online learning. Cengage Learning, 2011.

[14]   Brusilovsky, Peter, and Eva Millán. "User models for adaptive hypermedia and adaptive educational systems." The adaptive web: methods and strategies of web personalization. Berlin, Heidelberg: Springer Berlin Heidelberg, 2007. 3-53.

[15]   Georgieva, Evgeniya S., Angel S. Smrikarov, and Tsvetozar S. Georgiev. "Evaluation of mobile learning system." Procedia Computer Science 3 (2011): 632-637.

[16]   Traxler, John. "Current state of mobile learning." Mobile learning: Transforming the delivery of education and training 1 (2009): 9-24.

[17]   Alrasheedi, Muasaad, Luiz Fernando Capretz, and Arif Raza. "A systematic review of the critical factors for success of mobile learning in higher education (university students' perspective)." Journal of Educational Computing Research 52.2 (2015): 257-276.

[18]   Toquero, Cathy Mae. "Challenges and opportunities for higher education amid the COVID-19 pandemic: The Philippine context." Pedagogical Research 5.4 (2020).

[19]   Park, Sung Youl, Min-Woo Nam, and Seung-Bong Cha. "University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model." British journal of educational technology 43.4 (2012): 592-605.

[20]   Alqahtani, Ammar Y., and Albraa A. Rajkhan. "E-learning critical success factors during the covid-19 pandemic: A comprehensive analysis of e-learning managerial perspectives." Education sciences 10.9 (2020): 216.

[21]   Wang, Yi-Shun, Ming-Cheng Wu, and Hsiu-Yuan Wang. "Investigating the determinants and age and gender differences in the acceptance of mobile learning." British journal of educational technology 40.1 (2009): 92-118.

[22]   Creswell, John W., and Vicki L. Plano Clark. Designing and conducting mixed methods research. Sage publications, 2017.

[23]   Adedoyin, Olasile Babatunde, and Emrah Soykan. "Covid-19 pandemic and online learning: the challenges and opportunities." Interactive learning environments 31.2 (2023): 863-875.

[24]   Murphy, Michael PA. "COVID-19 and emergency eLearning: Consequences of the securitization of higher education for post-pandemic pedagogy." Contemporary Security Policy 41.3 (2020): 492-505.

[25]   Bozkurt, Aras, et al. "A global outlook to the interruption of education due to COVID-19 pandemic: Navigating in a time of uncertainty and crisis." Asian Journal of Distance Education 15.1 (2020): 1-126.

[26]   Johnson, Nicole, George Veletsianos, and Jeff Seaman. "US Faculty and Administrators' Experiences and Approaches in the Early Weeks of the COVID-19 Pandemic." Online Learning 24.2 (2020): 6-21.

[27]   Wu, Wen-Hsiung, et al. "Review of trends from mobile learning studies: A meta-analysis." Computers & education 59.2 (2012): 817-827.

[28]   Demir, Kadir, and Ercan Akpınar. "Mobil öğrenmeye yönelik tutum ölçeği geliştirme çalışması." Eğitim Teknolojisi Kuram ve Uygulama 6.1 (2016): 59-79.

[29]   Allen, I. Elaine, and Christopher A. Seaman. "Likert scales and data analyses." Quality progress 40.7 (2007): 64-65.

[30]   Etikan, Ilker, Sulaiman Abubakar Musa, and Rukayya Sunusi Alkassim. "Comparison of convenience sampling and purposive sampling." American journal of theoretical and applied statistics 5.1 (2016): 1-4.

[31]   Wright, Kevin B. "Researching Internet-based populations: Advantages and disadvantages of online survey research, online questionnaire authoring software packages, and web survey services." Journal of computer-mediated communication 10.3 (2005): JCMC1034.

[32]   Bhattacherjee, Anol. Social science research: Principles, methods, and practices. USA, 2012.

[33]   Kumar, S., and P. Phrommathed. "Research methodology (pp. 43-50)." (2005).

[34]   Field, Andy. "Discovering statistics using IBM SPSS statistics 5th ed." (2018).

[35]   Creswell, John W., and J. David Creswell. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications, 2017.

[36]   Sue, Valerie M., and Lois A. Ritter. Conducting online surveys. Sage, 2012.

[37]   Pallant, Julie. SPSS survival manual: A step by step guide to data analysis using IBM SPSS. McGraw-hill education (UK), 2020.

[38]   McKinney, Wes. Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.", 2012.

[39]   Pallant, Julie. SPSS survival manual: A step by step guide to data analysis using IBM SPSS. McGraw-hill education (UK), 2020.

[40] Crawford, Joseph, et al. "COVID-19: 20 countries' higher education intra-period digital pedagogy responses." Journal of Applied Learning & Teaching 3.1 (2020): 1-20.

[41] Almaiah, Mohammed Amin, Ahmad Al-Khasawneh, and Ahmad Althunibat. "Exploring the critical challenges and factors influencing the E-learning system usage during COVID-19 pandemic." Education and information technologies 25 (2020): 5261-5280.

[42] Kukulska-Hulme, Agnes, Helen Lee, and Lucy Norris. "Mobile learning revolution: Implications for language pedagogy." The handbook of technology and second language teaching and learning (2017): 217-233.

[43] Bao, Wei. "COVID-19 and online teaching in higher education: A case study of Peking University." Human behavior and emerging technologies 2.2 (2020): 113-115.