Facets of Digital Learning: An Exploratory Survey among University Students

Payal Kanwar Chandel, Nidhi Kalonia, and Pramjeet Singh
Central University of Haryana, Mahendragarh

This research paper aims to explore the dynamics of digital learning among university students based on their self-reported patterns and experiences. A self-constructed survey questionnaire consisting of 13 statements was administered to a sample of 201 students, comprising 71 males and 130 females, from different departments of the Central University of Haryana, India. The findings show a strong preference for blended learning among students, despite challenges like stress, anxiety, mental fatigue, sleep disturbances, and reduced social interactions. Males exhibit higher digital proficiency, while females show better digital etiquette and focus. Rural students experience more anxiety with digital devices, whereas urban students demonstrate higher proficiency but greater mental fatigue. These results highlight the need for carefully planned and customized digital learning strategies to address diverse demographic and environmental needs.

Keywords: digital learning, higher education, learning experience, digital device usage

Education systems around the world are experiencing significant changes and transformations, with developed nations like the USA, European countries, Japan, China, and more, embracing various forms of digital education. The extensive use of digital teaching materials, tools, and delivery methods has become commonplace, transforming the traditional classroom into a dynamic, technology-infused learning environment (Selwyn, 2010). The NEP 2020 also emphasizes the integration of technology in education, aiming to leverage digital tools to enhance the quality and accessibility of learning (Umachagi & Selvi, 2022). While these approaches have been evolving for decades, their widespread adoption is now a global phenomenon. The use of digital technology by students is now widely accepted among higher education professionals as an ordinary aspect of modern universities and a necessary component of daily life on campus and academic work (Henderson et al., 2015; Prensky, 2012).

Digital learning includes any form of learning that utilizes technology or instructional methods that effectively utilize technology (Walker, 2023). The integration of technology into education brings forth numerous advantages, including cost-effectiveness, instant access, immediate feedback, a comfortable learning environment, ease, and flexibility (Saileela et al., 2020; Henderson et al., 2015). Digital learning empowers students to take control of their educational journey, fostering deep thinking and collaborative engagement (Digital Promise, 2022). Despite the benefits, challenges associated with digital learning are evident. Issues such as information overload, digital plagiarism, and concerns about the reliability of online sources are raised (Roberts, 2018; Selwyn, 2016).

The high levels of screen time are being associated with heightened rates of anxiety,

depression, and feelings of social isolation (Yadav & Reddy, 2023; Twenge & Campbell, 2018; Primack et al., 2017). Moreover, research indicates that the constant connectivity, excessive technology use, and information overload engendered by digital devices can result in cognitive fatigue, reduced attention spans, diminished cognitive performance, impairments in emotional and social intelligence, and impaired brain development (Kumar et al., 2023; Wilmer et al., 2017; Rosen et al., 2013). Furthermore, digital device usage, particularly before bedtime, has been linked to sleep disturbances and sleep disorders. The exposure to the blue light emitted by screens, coupled with engaging in stimulating activities, can disrupt circadian rhythms and compromise the quality of sleep (Kumar et al., 2023; Hjetland et al., 2021; Cain & Gradisar, 2010; Gradisar et al., 2013).

Beyond mental health and sleep considerations, digital devices play a pivotal role in shaping social interactions. While they facilitate connectivity and communication, concerns have been raised regarding their potential negative impact on face-to-face communication and interpersonal relationships (Yadav & Reddy, 2023; Turkle, 2015). The constant connectivity afforded by digital devices may inadvertently hinder authentic and meaningful interactions, influencing the dynamics of how individuals engage with one another in both personal and professional spheres.

Rationale

The landscape of education is undergoing a transformative shift with the integration of digital learning tools and devices. While this pervasive presence of technology offers exciting possibilities for enhanced learning, a deeper understanding of how students interact with these tools is crucial for optimizing their effectiveness. Understanding students' familiarity with digital learning devices is vital as it affects their ability to use these tools effectively for educational purposes. Additionally, analyzing the patterns of digital learning device usage provides insights into how often and in what ways students interact with these technologies, shedding light on their role in daily academic activities. Moreover, investigating the psychological impacts associated with digital learning is essential to comprehend both the benefits and potential challenges, such as stress, anxiety, or increased cognitive load, that students may experience. Identifying students' preferred modes of learning can also inform educators and policymakers about the most effective strategies for integrating digital tools into the curriculum. By addressing these aspects, this study offers valuable insights for improving educational practices and enhancing student outcomes in the digital age.

Objectives

The present study aims to explore the dynamics of digital learning among university students. The study was conducted with the following objectives:

1. To assess the familiarity and usage patterns of digital learning devices.

2. To explore the psychological impacts associated with digital learning and the use of digital learning devices.

3. To know the more preferred mode of learning.

4. To assess the differences in the facets of digital learning on the basis of demographic variables (Gender and Locality).

Method

Participants

A total of 208 participants completed the survey, out of which 7 responses were removed which were found to be outliers. Therefor the final study sample comprised

of 201 participants, including 71 males and 130 females, with a mean age of 21.37 years (SD = ± 2.65, Range = 16-30 years). Among them, 36% were undergraduates, 54% were postgraduates, and the remaining 10% were PhD scholars. Geographically, 54% of participants hailed from rural areas, 46% from urban areas.

Measure

Given the absence of a standardized tool that adequately addressed the specific research objectives, the researchers opted to create their own survey questionnaire, consisting of two sections. The first section includes questions about demographic information such as age, gender, program of study, geographical area, and an individual's consent to participate in the study, along with the use of digital learning devices. The second section encompasses the questions pertaining to the patterns, experiences, and psychological impacts associated with digital learning, as well as the utilization of digital learning devices on a 5-point Likert scale response format. In addition to the multiple-choice questions, participants were asked to respond to a short-answer question at the end, which elicited information about their reasons for selecting a preferred mode of learning. The content validity of survey questions was reviewed by a panel of experts.

Table 1. Showing the survey questions included in the study with their codes

Sr.No	Survey Question	Coding
1.	Which device do you use most frequently for educational purposes?	Frequently used device
2.	On average, how many hours per day do you spend for educational purposes on digital learning devices?	Frequency of device usage
3.	How proficient are you in using digital learning devices?	Proficiency
4.	Are you aware of digital etiquettes and responsible device usage regarding E-learning?	E-etiquettes
5.	To what extent do you believe digital learning has enhanced your ability to self-pace your learning?	Ability to self-pace
6.	Do digital learning devices enhance your ability to focus and concentrate during learning or studying?	Ability to concentrate
7.	Do you experience a state of stress while using digital learning devices?	Device-induced stress
8.	Does the usage of digital learning devices make you feel anxious?	Device-induced anxiety
9.	Does the regular usage of digital learning devices lead to mental fatigue?	Device-induced mental fatigue
10.	Do you find that frequent usage of digital learning devices affects your sleep patterns?	Impact on sleep patterns
11.	Do you experience a decrease in your social interactions and relationships due to digital learning?	Impact on interpersonal relations
12.	How helpful do you find digital learning in making your overall learning experience better?	Digital learning effectiveness
13.	Which is your more preferable mode of learning?	Preferable learning mode

Table 1 presents the survey questions, which have been coded for easier representation.

Procedure

A Google Forms-based online survey questionnaire was distributed to the students of various departments (such as Psychology, Commerce, Geography, Physics, Mathematics, Computer, Tourism and Hotel Management, Statistics, Engineering branches, etc.) at the Central University of Haryana, India. After discussing the purpose of the study, the informed consent was obtained from all participants. The obtained was subsequently analyzed using MS Excel and SPSS.

Results

To know the familiarity with digital learning devices, patterns of digital learning device usage, psychological impacts associated with the use of digital learning devices and preferable mode of learning, frequency and percentage of the responses were measured. To determine the differences in the facets of digital learning on the basis of demographic variables i.e., Gender and Locality, t-test analysis was conducted. The obtained findings are presented in Table 2, 3, and 4 respectively.

Table 2. Showing the frequency and percentage of responses towards various facets of digital learning included in the study

Sr.No. Coding	Response (%)				
1. Frequently used device	Mobile (71%)	Tablet (3%)	Laptop (26%)	Desktop (0%)	Any Other (0%)
2. Frequency of device usage	<1 Hour (12%)	1-2 Hours (32%)	2-3 Hours (30%)	3-4 Hours (14%)	>4 Hours (12%)
3. Proficiency	Very Much (41%)	Somewhat (47%)	Can't Say (9%)	Not really (2%)	Not at all (1%)
4. E-etiquettes	Strongly Agree (17%)	Agree (55%)	Neutral (24%)	Disagree (3%)	Strongly Disagree (1%)
5. Ability to self-pace	Extremely (19%)	Considerably (46%)	Moderately (27%)	Slightly (6%)	Not at all (2%)
6. Ability to concentrate	Strongly Agree (9 %)	Agree (44 %)	Neutral (31%)	Disagree (14%)	Strongly Disagree (2%)
7. Device-induced stress	Very Often (5%)	Often (19%)	Sometimes (49%)	Rarely (19%)	Never (8%)
8. Device-induced anxiety	Very Often (3%)	Often (16%)	Sometimes (38%)	Rarely (29%)	Never (14%)
9. Device-induced mental fatigue	Very Often (8%)	Often (28%)	Sometimes (43%)	Rarely (16%)	Never (5%)
10. Impact on sleep patterns	Very Often (17%)	Often (27%)	Sometimes (32%)	Rarely (18%)	Never (6%)
11. Impact on interpersonal relations	Strongly Agree (10%)	Agree (31%)	Neutral (27%)	Disagree (27%)	Strongly Disagree (5%)

12.	Digital learning effectiveness	Very Much (37%)	Somewhat (51%)	Can't Say (9%)	Not really (2%)	Not at all (1%)
13.	Preferable learning mode	Digital Learning (23%)		Traditional in-person learning (29%)		Blended mode (48%)

The analysis of Table 2 reveals that significant majority (71%) of respondents favor mobile devices for educational purposes, emphasizing their preference for portable and versatile learning tools. Moreover, over half (56%) dedicate more than two hours daily to digital learning, indicating a strong commitment to leveraging digital resources for educational enrichment. Notably, a substantial proportion (47%) perceive themselves as moderately proficient in utilizing digital learning devices, while 41% express a high level of proficiency, reflecting students' confidence and comfort with digital tools. Additionally, a majority (72%) exhibit responsible usage of digital devices, showcasing a mature and conscientious approach to digital conduct.

The findings further indicate both benefits and drawbacks associated with digital learning. A significant percentage (65%) believe that digital learning enhances their ability to self-regulate their learning pace, while more than half (53%) feel it improves their focus and concentration. However, a considerable portion (49%) experiences occasional stress related to digital learning, with 38% reporting intermittent anxiety. Moreover, a notable percentage (43%) encounters mental fatigue, and a considerable number (44%) experiences disrupted sleep patterns due to prolonged digital device usage, highlighting potential concerns regarding students' well-being. Furthermore, 41% acknowledge a decline in social interactions due to digital learning.

However, the overall effectiveness of digital learning remains positive, as the majority (51%) perceive that digital learning moderately enhances the overall learning experience, with 37% affirming its effectiveness to a greater extent. Lastly, nearly half (48%) prefer a blended mode of learning, emphasizing the appeal of a flexible and personalized educational approach that combines traditional and digital methods to meet diverse learning needs.

Table 3. Showing Independent sample t-test of the various facets of Digital Learning among Female and Male participants

	Female (n=130)		Male (n=71)		t-ratio	p-value
	M	SD	M	SD		
Frequency of Device usage	2.79	1.14	2.91	1.25	0.71	0.48
Proficiency	4.21	0.69	4.42	0.69	2.11*	0.04
E-etiquettes	2.17	0.61	1.91	0.63	2.79**	0.01
Ability to self-pace	3.73	0.79	3.89	0.92	1.26	0.21
Ability to concentrate	2.28	0.57	2.06	0.67	2.45**	0.01
Device induced stress	2.95	0.93	2.98	0.93	0.23	0.82
Device induced anxiety	2.58	0.97	2.69	1.01	0.78	0.44
Device induced mental fatigue	3.25	0.93	3.08	0.91	1.19	0.24

Impact on Sleep pattern	3.20	1.10	3.48	1.11	1.71	0.09
Impact on interpersonal relations	2.16	0.61	2.11	0.64	0.53	0.59
Digital Learning effectiveness	4.25	0.65	4.32	0.63	-0.82	0.41

** p<0.01 * p<0.05

The examination of Table 3 reveals notable mean differences in proficiency (t (199) = 2.11, p < .05), E-etiquettes (t (199) = 2.79, p < .01), and the capacity to concentrate (t (199) = 2.45, p < .01). Male participants exhibited higher proficiency scores (M = 4.42, SD = 0.69) in comparison to their female counterparts (M = 4.21, SD = 0.69), suggesting a greater skill with digital learning tools. Conversely, female participants demonstrated better digital etiquettes and responsible device usage (M = 2.17, SD = 0.61) than males (M = 1.91, SD = 0.63). Furthermore, female students perceived digital learning as more positively impacting their ability to focus and concentrate during learning (M = 2.28, SD = 0.57) than males (M = 2.06, SD = 0.67). No significant difference is observed in other facets of digital learning assessed in the study.

Table 4. Showing Independent sample t-test of the various facets of Digital Learning among Urban and Rural participants

	Rural (109)		Urban (92)		t-ratio	p-value
	M	SD	M	SD		
Frequency of Device usage	2.82	1.16	2.86	1.21	0.25	0.80
Proficiency	4.19	0.77	4.39	0.57	2.03*	0.04
E-etiquettes	2.10	0.61	2.05	0.65	0.52	0.60
Ability to self-pace	3.71	0.85	3.87	0.83	1.29	0.20
Ability to concentrate	2.16	0.61	2.25	0.62	1.08	0.28
Device induced stress	3.04	0.92	2.88	0.94	1.19	0.24
Device induced anxiety	2.74	1.02	2.47	0.92	1.99*	0.05
Device induced mental fatigue	3.07	0.94	3.33	0.89	1.95*	0.05
Impact on Sleep pattern	3.29	1.09	3.30	1.14	0.06	0.95
Impact on interpersonal relations	2.19	0.66	2.09	0.57	1.21	0.23
Digital Learning effectiveness	4.24	0.65	4.31	0.63	0.85	0.40

* p<0.05

Table 4 reveals significant mean differences in proficiency (t(199) = 2.03, p < .05), device-induced anxiety (t(199) = 1.99, p < .05), and device-induced mental fatigue (t(199) = 1.95, p < .05) based on the locality of the participants. The findings demonstrate that rural participants exhibited higher scores in device-induced anxiety (M = 2.74, SD = 1.02) compared to their urban counterparts (M = 2.47, SD = 0.92), indicating that rural participants feel more anxious about the regular use of digital learning devices. However, the pattern reversed for proficiency

and device-induced mental fatigue, with urban participants reporting higher proficiency scores (M = 4.39, SD = 0.57) compared to rural participants (M = 4.19, SD = 0.77). Similarly, urban participants exhibited higher scores in device-induced mental fatigue (M = 3.33, SD = 0.89) compared to rural participants (M = 3.07, SD = 0.94). These findings suggest that rural participants feel more anxious using digital learning devices, possibly due to less exposure, while urban participants, who use these devices more frequently, demonstrate higher proficiency but also experience greater mental fatigue. No significant differences were found in the other aspects of digital learning evaluated in the study.

Discussion

The first objective of the study was to assess the familiarity and usage patterns of digital learning devices. The survey's findings reveal a prevailing inclination towards mobile devices for educational purposes, emphasizing their accessibility, portability, and multi-functionality. Further the data reveal that the participants dedicate a significant amount of time to digital learning, with a majority of students engaging for more than two hours per day, reflecting a significant integration into their daily academic routines. Moreover, student's proficiency in using digital learning devices is also noteworthy, which highlights a sense of confidence and ease among students. The survey also assessed participants' responsible usage of digital learning devices and their belief in the enhancement of self-paced learning. The data indicate that a substantial majority of students acknowledged responsible usage and attributed the improvement of their ability to independently manage the pace of their learning process to digital learning. The effectiveness of digital learning elicits a diversified response, with students offering a moderate to strong endorsement. These findings highlight the positive impact of digital learning on students' overall learning experience, thereby aligning with the existing body of literature (Wang et al., 2020; Langer-Crame, M. et al., 2019; Smith & Brown, 2019; Johnson et al., 2018; Bates, 2015).

The second objective was to explore the psychological impacts associated with digital learning and the use of digital learning devices. The obtained findings reflect a nuanced array of challenges, with students experiencing intermittent stress, occasionally feeling anxious, and acknowledging mental fatigue, which emphasizes the necessity for a balanced and mindful approach to digital engagement. Moreover, students frequently report disruptions in their sleep patterns, shedding light on the potential influence of digital learning device usage on students' sleep hygiene. Social interactions are also negatively impacted, with a substantial portion of students perceiving a decline in their social connectedness. This observation emphasizes the need for careful consideration, as social interactions and relationships constitute integral components of a student's overall well-being and academic experience. The current findings align with the results of prior research conducted in this domain (Kumar et al., 2023; Yadav & Reddy, 2023; Hjetland et al., 2021; Brown & Davis, 2019; Smith et al., 2018; Twenge & Campbell, 2018; Jones et al., 2017; Primack et al., 2017).

The third objective was to know the more preferred mode of learning. A majority of the participants expressed their preference for the blended learning mode, valuing its flexibility and engagement. This inclination aligns with the diverse educational needs of today's students and emphasizes the importance of a well-rounded educational experience. The preference for blended learning mode is also reported by Alzahrani and O'Toole (2017) in their study.

The last objective of the study was to assess the differences in the facets of digital learning on the basis of demographic variables: Gender and Locality. The findings show that male participants demonstrate superior proficiency in utilizing digital learning tools, indicative of a heightened technological adeptness. Conversely, female counterparts exhibit a stronger adherence to digital etiquettes and perceive a more favorable impact on their concentration during learning activities. Historically, males have been encouraged to explore and excel in STEM-related fields, which could contribute to their higher proficiency levels in utilizing digital learning tools. On the contrary, societal expectations may have led females to prioritize digital etiquettes and responsible device usage, aligning with broader gender norms emphasizing conscientious behavior. Additionally, differences in cognitive processing styles between genders could account for variations in perceived impacts on concentration during learning activities.

Furthermore, examination of participants' localities reveals notable variations in proficiency, device-induced anxiety, and device-induced mental fatigue. Rural participants exhibit heightened levels of anxiety induced by digital devices, potentially stemming from limited access or familiarity with technology. Concurrently, they report lower proficiency levels compared to urban counterparts, suggesting a disparity in resource access. Conversely, urban participants demonstrate elevated proficiency but experience heightened mental fatigue induced by digital devices, possibly due to increased exposure. However, given the limited research available in this area, only a small number of studies corroborate the current findings regarding demographic variables. The findings align with those of Liu et al. (2021), Lucas et al. (2022), and Vardhan et al. (2024).

Conclusion

This survey provides a comprehensive understanding of the evolving milieu of digital education by focusing on the self-reported patterns and experiences of university-going students. The study not only sheds light on students' preferences, proficiency levels, and patterns of engagement but also draws attention to the psychological aspects and challenges associated with digital education. The results indicated a strong preference for mobile devices in education due to their accessibility, versatility, and the ability to self-pace learning. Despite proficiency in digital learning, challenges like stress and reduced social interactions highlight the need for mindful engagement. Interestingly, most students favored a blended learning approach, emphasizing the demand for a comprehensive educational experience integrating digital and traditional elements. Lastly, gender-based disparities surface with differing proficiency levels and adherence to digital etiquettes, whereas disparities based on locality highlight increased anxiety among rural participants and increased mental fatigue among urban counterparts, explaining role of socio-demographic factors in digital learning experiences.

These findings highlight the complex interplay between environmental contexts, proficiency levels, and psychological responses, necessitating careful planning and customized strategies for digital learning program design and implementation tailored to diverse demographic and environmental settings.

Limitations and Future Implications

Although the present study explores the dynamics of digital learning among university students by utilizing a self-constructed survey questionnaire, it also has certain limitations. The study is constrained by a small sample size, focusing exclusively on a single university, limiting its generalizability to

diverse global digital learning contexts. Another limitation is regarding the use of self-constructed measures; the use of other complementary methods such as interviews, observation, etc. can add to the richness of information. Additionally, future research should consider comparative analyses of traditional, digital, and blended learning models, offering valuable insights for educators and policymakers in shaping effective educational approaches. These multifaceted insights would not only encourage further research in this field but also serve as a valuable guide for educators, policymakers, and educational institutions in making informed decisions to better tailor educational approaches, implement targeted interventions, and foster an environment that aligns with the diverse needs of contemporary learners.

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Payal Kanwar Chandel, PhD, Professor, Department of Psychology, Central University of Haryana, Mahendragarh. Email: paayalchandel@cuh.ac.in

Nidhi Kalonia, Research Scholar, Central University of Haryana. Email: nidhi212105@cuh.ac.in

Pramjeet Singh, Research Scholar, Central University of Haryana, Mahendragarh. Email: pramjeet212107@cuh.ac.in