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### Digital learning engagement and its linkages with academic performance, perceived stress and mental wellness among higher education students

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#### Abstract

Digital learning has emerged as a critical component of higher education, particularly following the accelerated shift to online education during the COVID-19 pandemic. This study investigates digital learning engagement and its linkages with academic performance, perceived stress, and mental wellness among higher education students. A descriptive survey design was employed and a structured questionnaire was administered via Google Forms to a sample of 60 students — comprising postgraduate (PG) scholars and research scholars — drawn from the Faculty of Agriculture, Annamalai University, Tamil Nadu, India, using simple random sampling. The findings revealed that the majority of students exhibited a moderate level of digital learning engagement (51.67%), attributable to factors such as limited peer interaction, screen fatigue, average internet quality, and technical constraints. Academic performance was reported at a high level by 83.33 per cent of respondents, facilitated by the flexibility, accessibility, and self-paced nature of digital platforms. Perceived stress was moderate among 76.67 per cent of respondents, arising from online assignment deadlines, connectivity issues, and prolonged screen time. Mental wellness was similarly moderate for 78.33 per cent of students, reflecting a balance between the advantages of digital learning and its associated psychological burden. The study concludes that while digital learning engagement positively influences academic performance, it also contributes to perceived stress, which in turn affects mental wellness. Institutional strategies emphasizing balanced digital learning, technical support, and mental health services are essential to optimize student outcomes in digital higher education environments.

**Keywords:** Digital learning engagement, academic performance, perceived stress, mental wellness, higher education, Annamalai University

#### 1. Introduction

Digital learning has emerged as a transformative force in higher education, driven by rapid advancements in Information and Communication Technology (ICT). By integrating digital tools such as online platforms, virtual classrooms, and digital libraries, higher education institutions have fundamentally reshaped traditional teaching and learning processes. Students can now access educational content beyond geographical boundaries, at their own pace, and through diverse multimedia formats — a paradigm shift that has redefined the learning experience (Chang, 2016; Songkram *et al.*, 2015) <sup>[3, 15]</sup>.

The COVID-19 pandemic significantly accelerated the adoption of digital learning, compelling universities worldwide to transition from conventional classroom instruction to virtual modes of education. During nationwide lockdowns, students increasingly relied on ICT tools — smartphones, laptops, and internet-based platforms — to attend online classes, access digital libraries, and acquire knowledge. Platforms such as SWAYAM, e-Pathshala, and Krishikosh became essential channels for academic continuity. The effective utilization of ICT is now recognized as a critical determinant of academic success and knowledge management in a knowledge-based society

(Aithal & Aithal, 2016) <sup>[1]</sup>.

Digital learning engagement — encompassing the behavioural, emotional, cognitive, and social involvement of students in online learning environments — has emerged as a key determinant of academic outcomes and psychological well-being (Fredricks *et al.*, 2004) <sup>[7]</sup>. While digital learning enhances academic performance and accessibility, it may also contribute to perceived stress through online examination anxiety, prolonged screen time, connectivity issues, and heavy workloads. Sustained stress, in turn, adversely affects mental wellness — students' psychological and emotional capacity to manage demands and maintain well-being (Seligman, 2011) <sup>[13]</sup>.

Despite growing scholarly interest in digital education, studies that simultaneously examine digital learning engagement alongside academic performance, perceived stress, and mental wellness — particularly within the context of Indian agricultural higher education — remain limited. This study addresses that gap by investigating these linkages among students of the Faculty of Agriculture, Annamalai University, Tamil Nadu.

#### The objectives of the study are

1. To assess the level of digital learning engagement

among higher education students.

2. To measure the level of academic performance of students engaged in digital learning.
3. To determine the level of perceived stress experienced by students during digital learning.
4. To evaluate the mental wellness of students participating in digital learning.

## 2. Methodology

### 2.1. Research Design

The study employed a descriptive survey research design, which facilitated the systematic collection and analysis of quantitative data on digital learning engagement, academic performance, perceived stress, and mental wellness. A descriptive design is appropriate when the objective is to portray an accurate profile of variables without manipulation of the study environment (Robson, 2002). This design enabled the documentation of student experiences in their naturally occurring digital learning environment and the identification of associations among the study variables.

### 2.2. Study Area and Sampling

The study was conducted at the Faculty of Agriculture, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu — one of the largest residential universities in Asia, offering postgraduate (M.Sc.) and doctoral (Ph.D.) programmes across a range of agricultural disciplines. The Faculty of Agriculture was purposively selected because agricultural higher education in India has witnessed a significant transition toward digital learning following the COVID-19 pandemic, with platforms such as Krishikosh, SWAYAM, and e-Shodh Sindhu becoming integral to academic activities.

A total of 60 students were selected as the sample. Simple random sampling was employed using the lottery method, ensuring that every member of the target population had an equal and independent probability of selection. This method minimizes selection bias and enhances the representativeness of the sample.

### 2.3. Data Collection

Primary data were collected using a structured questionnaire administered via Google Forms. The instrument comprised five sections: (i) Demographic profile; (ii) Digital Learning Engagement Scale; (iii) Academic Performance Scale; (iv)

Perceived Stress Scale; and (v) Mental Wellness Scale. All scale items were rated on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree).

### 2.4. Data Analysis

Quantitative data were analyzed using descriptive statistical tools including frequency, percentage, and mean score analysis. Respondents were classified into low, medium, and high levels for each variable based on predetermined score ranges. Mean scores facilitated inter-variable comparisons, and the distribution of respondents across levels provided a clear profile of the study variables.

## 3. Findings and Discussion

### 3.1. General Profile of Respondents

Table 1 presents the demographic profile of the 60 respondents. Gender-wise, 37 respondents (62.00%) were female and 23 (38.00%) were male, reflecting the current enrolment pattern at the Faculty of Agriculture where female students constitute the majority at both postgraduate and doctoral levels. The higher representation of female respondents suggests that the findings are primarily reflective of female students' experiences of digital learning in agricultural higher education.

In terms of academic programme, 45 respondents (75.00%) were pursuing postgraduate (M.Sc.) programmes while 15 (25.00%) were doctoral (Ph.D.) research scholars. This composition mirrors the actual enrolment ratio within the faculty and ensures that the study findings reflect the perspectives of both programme levels. Regarding the device used for digital learning, 43 respondents (71.67%) primarily used mobile phones, while 17 (28.33%) used laptops. None used tablet devices. The dominant reliance on mobile phones can be attributed to their affordability, portability, and compatibility with mobile data networks — consistent with the broader mobile-first digital learning trend in India (Dhawan, 2020) <sup>[4]</sup>.

Internet quality was rated as average by 45.00 per cent of respondents, good by 35.00 per cent, and poor by 20.00 per cent. The finding that 65 per cent of respondents experienced average to poor connectivity is a significant contextual factor, as internet quality directly influences engagement with online learning platforms and is a recognized source of perceived stress (Son *et al.*, 2020) <sup>[16]</sup>.

**Table 1:** General Profile of the Respondents (n = 60)

| S. No. | Category           | Particulars          | No. of Respondents | Percentage (%) |
|--------|--------------------|----------------------|--------------------|----------------|
| 1      | Gender             | Male                 | 23                 | 38.00          |
|        |                    | Female               | 37                 | 62.00          |
| 2      | Academic Programme | Postgraduate (M.Sc.) | 45                 | 75.00          |
|        |                    | Doctoral (Ph.D.)     | 15                 | 25.00          |
| 3      | Device Used        | Mobile Phone         | 43                 | 71.67          |
|        |                    | Laptop / Computer    | 17                 | 28.33          |
|        |                    | Tablet               | 00                 | 0.00           |
|        |                    |                      |                    |                |
| 4      | Internet Quality   | Poor                 | 12                 | 20.00          |
|        |                    | Average              | 27                 | 45.00          |
|        |                    | Good                 | 21                 | 35.00          |

### 3.2. Digital Learning Engagement, Academic Performance, Perceived Stress, and Mental Wellness among Students

Table 2 presents the distribution of respondents according to

their levels of digital learning engagement, academic performance, perceived stress, mental wellness, and the constraints faced in digital learning.

**Table 2:** Distribution of Respondents according to Digital Learning Engagement, Academic Performance, Perceived Stress, and Mental Wellness (n = 60)

| S. No. | Variable                    | Level   | Score Range | No. of Respondents | Percentage (%) |
|--------|-----------------------------|---------|-------------|--------------------|----------------|
| 1      | Digital Learning Engagement | Low     | 1–21        | 0                  | 0.00           |
|        |                             | Medium  | 21–33       | 31                 | 51.67          |
|        |                             | High    | 33–45       | 29                 | 48.33          |
| 2      | Academic Performance        | Poor    | 1–14        | 0                  | 0.00           |
|        |                             | Average | 14–22       | 10                 | 16.67          |
|        |                             | Good    | 22–30       | 50                 | 83.33          |
| 3      | Perceived Stress            | Low     | 1–14        | 8                  | 13.33          |
|        |                             | Medium  | 14–22       | 46                 | 76.67          |
|        |                             | High    | 22–30       | 6                  | 10.00          |
| 4      | Mental Wellness             | Poor    | 1–14        | 1                  | 1.67           |
|        |                             | Average | 14–22       | 47                 | 78.33          |
|        |                             | Good    | 22–30       | 12                 | 20.00          |

**Table 3:** Distribution of Respondents according to Constraints Faced in Digital Learning (n = 60)

| S. No. | Constraint Faced                                                                               | No. of Respondents | Percentage (%) |
|--------|------------------------------------------------------------------------------------------------|--------------------|----------------|
| 1      | Poor internet connectivity affects participation in digital learning                           | 17                 | 28.33          |
| 2      | Long screen time and online classes cause difficulty in concentrating                          | 39                 | 65.00          |
| 3      | Technical problems (software errors, login issues, platform errors) interrupt digital learning | 4                  | 6.67           |

### 3.2.1. Digital Learning Engagement

The level of digital learning engagement among the respondents is presented in Table 2. None of the respondents fell under the low level of digital learning engagement. A slight majority of 31 respondents (51.67%) exhibited a medium level of engagement, while 29 respondents (48.33%) demonstrated a high level. These findings indicate that students are broadly active in digital learning environments; however, a considerable proportion remains constrained from achieving full engagement. The moderate engagement level may be attributed to factors such as average internet quality reported by 45.00 per cent of respondents, limited face-to-face interaction, screen fatigue from prolonged device use, home environment distractions, and technical barriers. These findings are consistent with Jiang *et al.* (2024) <sup>[9]</sup>, who reported that online engagement is significantly influenced by both technological infrastructure and the quality of the learning environment.

The dominance of mobile phones as the primary access device (71.67%) — while convenient — may also limit the depth of cognitive and social engagement, as smaller screens and mobile interfaces are less conducive to sustained academic tasks compared to laptop or desktop environments. Institutions should focus on improving internet infrastructure, adopting interactive pedagogical methods such as online discussions, polls, and collaborative activities, and providing breaks between online sessions to reduce screen fatigue and sustain student engagement (Martin & Bolliger, 2018) <sup>[11]</sup>.

### 3.2.2. Academic Performance

Regarding academic performance, none of the respondents fell in the poor category. Ten respondents (16.67%) demonstrated an average level, while the majority — 50 respondents (83.33%) — reported a high level of academic performance. This finding affirms the positive relationship between digital learning and academic success documented in prior research (Sánchez *et al.*, 2024) <sup>[12]</sup>. The high academic performance may be attributed to the flexible

access to recorded lectures, self-paced study, easy retrieval of digital study materials, online quiz-based feedback, and access to repositories such as Krishikosh and e-Shodh Sindhu that provide vast agricultural research resources.

The ability to revisit recorded sessions, access materials anytime, and manage individual learning schedules aligns with the principles of self-regulated learning, which has been consistently linked to higher academic achievement in online environments (Broadbent & Poon, 2015) <sup>[2]</sup>. However, it is important to note that while 83.33 per cent reported high academic performance, the moderate level of engagement reported simultaneously suggests that academic performance is sustained even without full engagement — likely because digital platforms lower the threshold for access to learning materials, requiring less active participation than traditional classrooms.

### 3.2.3. Perceived Stress

The perceived stress levels of the respondents, measured using an adapted version of the Perceived Stress Scale (Cohen *et al.*, 1983), revealed that 8 respondents (13.33%) experienced a low level of stress, 46 respondents (76.67%) reported a medium level, and 6 respondents (10.00%) reported a high level of stress. The predominance of medium-level stress indicates that digital learning imposes a moderate but tangible psychological burden on students. The primary stressors identified align with those documented in recent literature: online assignment deadlines, internet connectivity issues, prolonged screen time, limited social interaction, and the anxiety associated with online examinations (He *et al.*, 2025; Daud, 2025) <sup>[8, 1]</sup>. The finding that only 10 per cent of respondents experienced high stress, while the majority reported moderate stress, suggests that while digital learning does not overwhelm most students, its cumulative demands create a sustained background level of psychological pressure. This is particularly relevant in the context of agricultural education, where students must simultaneously manage field-based practical requirements alongside digital coursework. Institutions should mitigate this stress by

reducing online workloads, offering flexible submission deadlines, improving internet facilities, and providing counselling and stress management support (Son *et al.*, 2020) <sup>[16]</sup>.

### 3.2.4. Mental Wellness

Mental wellness was evaluated using a scale based on Seligman's PERMA model (2011) <sup>[13]</sup>, which encompasses positive emotions, engagement, relationships, meaning, and achievement. Only one respondent (1.67%) reported poor mental wellness. The majority — 47 respondents (78.33%) — exhibited a medium level of mental wellness, while 12 respondents (20.00%) reported a good level. The moderate mental wellness among the majority of respondents reflects the dual nature of digital learning: while it offers flexibility and reduced travel stress, it simultaneously introduces social isolation, screen-induced physical discomfort, sleep disruption, and reduced physical activity — all of which negatively influence psychological well-being (Sharma & Nigam, 2025; Zhang *et al.*, 2024) <sup>[14, 18]</sup>.

The finding is consistent with the theoretical framework of this study, which posits that perceived stress mediates the relationship between digital learning engagement and mental wellness. Students who experience moderate stress from digital learning are likely to sustain only moderate levels of mental wellness, even if their academic performance remains high. Mental wellness can be improved by reducing continuous screen exposure, fostering peer interaction through collaborative online activities, promoting physical exercise, and institutionalizing mental health support services within the university framework (Seligman, 2011) <sup>[13]</sup>.

### 3.2.5. Constraints Faced in Digital Learning

Table 3 presents the constraints experienced by respondents in digital learning. The most prevalent constraint was prolonged screen time and difficulty concentrating during online classes, reported by 39 respondents (65.00%). This was followed by poor internet connectivity, which affected 17 respondents (28.33%), and technical problems — including software errors, login issues, and platform errors — reported by 4 respondents (6.67%). The dominance of screen fatigue as the primary constraint is noteworthy and underscores the need for institutions to redesign online sessions with deliberate breaks, blended learning approaches, and asynchronous content delivery to alleviate cognitive overload (Broadbent & Poon, 2015) <sup>[2]</sup>.

Poor internet connectivity — affecting 28.33 per cent of respondents — reflects the digital infrastructure disparities that persist among students even within a university setting. Although technical problems affected a smaller proportion (6.67%), they constitute a significant barrier for the students concerned. These findings collectively affirm that addressing digital learning constraints requires a multi-pronged institutional response encompassing infrastructure improvement, technical support, and student well-being initiatives.

## 4. Conclusion

The present study examined digital learning engagement and its linkages with academic performance, perceived stress, and mental wellness among postgraduate and

doctoral students at the Faculty of Agriculture, Annamalai University. The findings demonstrate that while digital learning has significantly enhanced academic performance — with 83.33 per cent of students achieving a high level — it simultaneously exerts a moderate psychological burden, manifesting as medium-level perceived stress in 76.67 per cent and medium-level mental wellness in 78.33 per cent of respondents. Digital learning engagement was predominantly moderate (51.67%), constrained by screen fatigue, connectivity limitations, and reduced social interaction.

The study concludes that digital learning engagement has both direct and indirect effects on student well-being: it directly enhances academic performance through flexible access to resources, while indirectly affecting mental wellness through its contribution to perceived stress. These findings have important implications for higher education institutions adopting digital learning models. A balanced approach — combining online and offline learning, reducing screen exposure, improving digital infrastructure, and providing mental health support — is essential to maximize the benefits of digital learning while protecting student well-being.

Future research should expand the sample size across multiple institutions and disciplines, employ longitudinal designs to track changes over time, and investigate the specific mediating and moderating roles of perceived stress and demographic variables in the relationship between digital learning engagement and mental wellness.

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