

# Digital Sedentary Behaviour and Its Relationship With Physical Fitness and Psychological Well-Being Among University Students: An Illustrative Cross-Sectional Analytical Framework for Western Uttar Pradesh, India

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**ABSTRACT-** Digital technologies increasingly shape university students' academic and recreational routines, motivating research on sedentary behaviour, physical fitness, and psychological well-being. This paper presents a cross-sectional analytical framework for examining these relationships in the context of Western Uttar Pradesh, India, and demonstrates its application using 350 artificially generated student records distributed across eight hypothetical institutional groups. Academic and recreational screen time are examined separately; physical fitness is represented by step-test recovery heart rate, push-up performance, and sit-and-reach flexibility, while psychological well-being is represented by WHO-5 scores. The constructed records yield a mean total digital sedentary duration of 6.79 hours per day. Total screen time correlates with recovery heart rate ( $r = .257$ ), push-up performance ( $r = -.167$ ), flexibility ( $r = -.119$ ), and WHO-5 well-being ( $r = -.252$ ). In adjusted models, recreational screen time is associated with recovery heart rate ( $B = 1.300$ ,  $p < .001$ ), push-up performance ( $B = -0.497$ ,  $p = .026$ ), and WHO-5 scores ( $B = -3.079$ ,  $p < .001$ ), but not significantly with flexibility ( $B = -0.382$ ,  $p = .119$ ). These figures are properties of simulated records and are not empirical estimates for students in the region. The contribution is a transparent, multidimensional research framework suitable for subsequent validation using ethically collected participant-level data.

**Keywords:** Digital sedentary behaviour; physical fitness; psychological well-being; screen time; university students; Western Uttar Pradesh; simulation.

## I. INTRODUCTION

The expansion of online learning, smartphones, digital communication, and entertainment has changed the structure of daily life in higher education. These technologies provide educational and social benefits, yet extended screen engagement can also increase time spent sitting. Sedentary behaviour is defined as waking behaviour with energy expenditure of 1.5 metabolic equivalents or less while sitting, reclining, or lying (Tremblay et al., 2017). Importantly, sedentary behaviour is not synonymous with insufficient moderate-to-vigorous physical activity: students may

be physically active and nevertheless spend many hours sedentary.

University students face distinctive conditions, including intensive coursework, independent study, irregular schedules, and widespread recreational device use. Reviews of student sedentary behaviour identify substantial sedentary exposure and considerable variation by measurement approach and setting (Castro et al., 2018, 2020). The World Health Organization recommends both regular physical activity and limiting sedentary time, underscoring the value of considering these behaviours together (Bull et al., 2020).

Physical fitness includes multiple components, such as cardiorespiratory capacity, muscular endurance, and flexibility, which need not show identical associations

with screen-based sitting. Evidence relating sedentary behaviour to health and fitness is heterogeneous across populations and methods (Saunders et al., 2020; Memon et al., 2021). Psychological well-being may likewise be related to screen engagement, although much screen-time evidence derives from children and adolescents and cannot automatically be extrapolated to university-aged adults (Stiglic & Viner, 2019).

An important conceptual issue is the purpose of digital engagement. Academic screen time may be difficult to avoid, whereas recreational screen use includes social networking, streaming, and gaming. Aggregating these categories may obscure differences in context, duration, and accompanying behaviours. The present paper therefore sets out a framework that separates these domains and combines them with individual fitness measures, WHO-5 well-being, physical activity, sleep, and demographic characteristics. Because no original field observations are available, the accompanying numerical results serve solely to illustrate the analysis that future research could undertake in Western Uttar Pradesh.

## II. REVIEW OF LITERATURE

### 1. Digital Sedentary Behaviour And Changing Student Lifestyles

Digital technology has become embedded in university learning and leisure. The Sedentary Behaviour Research Network terminology consensus distinguishes sedentary posture and low energy expenditure from physical inactivity, providing an important basis for defining digital sedentary time (Tremblay et al., 2017).

Screen duration should therefore be interpreted with attention to posture and activity context rather than assumed to be equivalent to all sedentary behaviour. Castro et al. (2018) reviewed correlates of sedentary behaviour in university students and highlighted the range of individual and contextual influences. Their later systematic review and meta-analysis documented substantial sedentary time in this population, while demonstrating the importance of how sedentary behaviour is measured (Castro et al., 2020). Babaeer et al. (2022) examined sedentary behaviour and physical activity in relation to educational outcomes, further

illustrating the relevance of these behaviours to university environments.

### 2. Digital Sedentary Behaviour And Physical Fitness

Physical fitness is multidimensional, and sedentary exposure may relate differently to cardiorespiratory recovery, muscular endurance, and flexibility. An overview of systematic reviews identified associations between sedentary behaviour and several adult health outcomes but also noted limitations in the underlying evidence (Saunders et al., 2020). It is therefore inappropriate to assume that every fitness component responds identically to screen-based sedentary time.

Kljajević et al. (2022) reviewed physical activity and physical fitness among university students, demonstrating variability across populations and measurement practices. Memon et al. (2021) mapped systematic reviews and meta-analyses on adult sedentary behaviour, highlighting the breadth and methodological diversity of this evidence base. Taken together, these findings justify assessing several distinct fitness indicators and accounting for physical activity rather than relying on a single composite outcome.

### 3. Screen Exposure And Psychological Well-Being

Screen engagement may be associated with psychological functioning through multiple pathways, including sleep displacement, social interaction, and patterns of recreation. Stiglic and Viner (2019) reviewed associations between screen time and health and well-being among children and adolescents; the evidence varied by outcome and quality. Because that population differs from university students, the review provides contextual rather than direct evidence for the present target population.

The WHO-5 Well-Being Index is a concise measure of positive subjective well-being. Its measurement properties and broad research use have been examined systematically (Topp et al., 2015). Use of a well-being scale rather than a diagnostic instrument is appropriate when the objective is to assess variation in positive psychological functioning, while avoiding claims about clinical mental disorders.

#### **4. Physical Activity, Sedentary Behaviour, And Psychological Health**

Physical activity and sedentary time are complementary but distinct health behaviours. The WHO guidelines recommend regular movement and limiting sedentary exposure (Bull et al., 2020). Analyses of screen use and well-being should therefore consider weekly physical activity and sleep duration as potential covariates rather than treating digital engagement as the only relevant lifestyle characteristic. Ferreira Silva et al. (2022) identified lack of time, motivation, and accessible places as common barriers to physical activity among high school and university students. Their findings reinforce the importance of institutional and behavioural contexts, which may influence both movement and screen-based activities. The relationships between these variables require careful assessment because observational designs cannot determine whether screen engagement causes changes in well-being or vice versa.

#### **5. Academic And Recreational Screen Engagement**

Academic screen engagement includes online lectures, assignments, research, and educational communication, while recreational engagement includes social media, gaming, streaming, and entertainment. These domains differ in purpose and may also differ in their timing and associated routines. However, differences in purpose do not establish that one category has intrinsically stronger adverse health effects.

Domain-specific measurement is consistent with the need for precise sedentary-behaviour terminology (Tremblay et al., 2017) and with evidence that sedentary estimates vary by assessment method (Castro et al., 2020). A valid comparison of academic and recreational associations requires both coefficients to be estimated and a formal statistical contrast, not simply comparison of their individual p-values.

### **III. RESEARCH GAP**

The literature supports examining sedentary behaviour, physical activity, fitness, and psychological well-being jointly, but important questions remain concerning differences across fitness components and screen-use purposes. International evidence cannot be assumed to

describe students in Western Uttar Pradesh without local observation. A regional empirical study would need to document sampling, institutional contexts, instrument validity, and relevant confounding variables. This paper therefore specifies an integrated field-research framework and demonstrates selected statistical procedures using synthetic records. The demonstration is intended to support future research design and analysis planning; it does not fill the regional empirical evidence gap.

#### **1. Research Objectives And Hypotheses**

##### **2. Research Objectives**

- Describe the extent and distribution of academic, recreational, and total digital sedentary time among university students.
- Examine associations between digital sedentary time and cardiorespiratory recovery, muscular endurance, and flexibility.
- Assess the association between digital sedentary time and psychological well-being.
- Compare associations of academic and recreational screen engagement with the selected health-related outcomes.
- Evaluate these relationships while accounting for age, gender, physical activity, and sleep duration.

##### **3. Research Hypotheses**

- H1: Greater digital sedentary time is associated with less favourable physical fitness indicators.
- H2: Greater digital sedentary time is associated with lower psychological well-being.
- H3: More favourable physical fitness indicators are associated with higher psychological well-being.
- H4: Academic and recreational digital sedentary time have different associations with physical fitness and psychological well-being.

### **IV. RESEARCH METHODOLOGY**

#### **1. Research Design**

A quantitative, cross-sectional, correlational design is proposed for a future field study among university students in Western Uttar Pradesh. This paper additionally presents a simulation-based analytical

demonstration. The STROBE reporting framework (von Elm et al., 2007) informs the intended reporting of any subsequent observational study; the present synthetic exercise must not be represented as an observational study of recruited participants.

## 2. Target Population And Sampling

The proposed field population comprises undergraduate and postgraduate students aged 18–25 years enrolled in higher education institutions across Western Uttar Pradesh. An initial planning target of approximately 400 students across eight institutions is envisaged, subject to power analysis, institutional access, and feasibility. A multistage stratified approach could be used to consider academic level, discipline, gender, and institution. Eligibility would require regular enrolment and informed consent; relevant medical contraindications would preclude participation in exertional fitness tests. No participants were recruited for the current numerical demonstration. The separate synthetic dataset consists of 350 constructed records allocated across eight hypothetical institutional groups.

## 3. Variables And Instruments

Digital sedentary behaviour is operationalised as screen engagement undertaken in sedentary postures. A proposed questionnaire would distinguish academic and recreational screen time and record average weekday and weekend use; its items require content validation and pilot testing. Cardiorespiratory recovery would be represented by heart rate after a standardised three-minute step test (beats/minute), muscular endurance by push-up repetitions, and flexibility by sit-and-reach distance (centimetres). Psychological well-being would be measured with the WHO-5, transformed to a 0–100 score (Topp et al., 2015). Age, gender, academic level, weekly physical activity (minutes), and nightly sleep (hours) are proposed covariates.

## 4. Proposed Field Procedure

A future empirical investigation would require institutional permission, applicable ethics approval, participant information sheets, voluntary informed consent, and confidential data handling. Questionnaires would precede supervised fitness testing under standardised conditions and appropriate safety

screening. These are proposed procedures only; no consent, physical testing, or participant recruitment occurred in generating the illustrative results.

## 5. Analytical Strategy

Categorical characteristics are summarised using frequencies and percentages; continuous variables are described using means and standard deviations. Pearson correlations describe bivariate relationships between total digital sedentary time and the four reported outcomes. Separate multiple linear regression models estimate the association of recreational screen time with recovery heart rate, push-ups, flexibility, and WHO-5, with academic screen time, age, gender, weekly physical activity, and sleep included as covariates. Coefficients (B), standard errors, model  $R^2$ , 95% confidence intervals, and p-values are reported;  $p < .05$  is used descriptively as the conventional threshold. A future empirical study should check model assumptions, missingness, collinearity, and multiplicity. To test H3, direct fitness–well-being associations must be analysed; to test H4, a formal coefficient contrast is required. Neither test is available in the supplied results.

## 6. Measurement Quality And Ethics

The WHO-5 has established published measurement evidence (Topp et al., 2015), but the proposed screen-time questionnaire would require local validation and pilot testing. Assessor training and consistent protocols would be necessary for physical tests. Any human-participant field study would require prior ethical review and appropriate data protections. Synthetic records contain no actual participant observations, and no ethics approval is claimed for an empirical study.

## 7. Limits Of The Demonstration

The 350 records were artificially generated. Their distributions, coefficients, confidence intervals, and p-values depend on the generation process and cannot estimate prevalence, effects, or statistical significance in the real student population. The construction algorithm and row-level records were not included with the source manuscript, so the reported analyses could not be independently reproduced in this editorial revision. Even with real observations, cross-sectional associations would not establish causality.

## V. RESULTS AND DATA ANALYSIS

Illustrative analysis of artificially generated records (N = 350). All reported numerical results are simulation outputs, not field observations

### 1. Constructed Demographic Profile

The demonstration dataset contains 350 records: 190 female and 160 male profiles, 283 undergraduate and 67 postgraduate profiles, and ages 18–25 years. Eight hypothetical institution groups contain 43–44 records each.

| Characteristic     | Category          | n   | %    |
|--------------------|-------------------|-----|------|
| Gender             | Female            | 190 | 54.3 |
| Gender             | Male              | 160 | 45.7 |
| Academic level     | Undergraduate     | 283 | 80.9 |
| Academic level     | Postgraduate      | 67  | 19.1 |
| Age                | 18–20             | 186 | 53.1 |
| Age                | 21–23             | 139 | 39.7 |
| Age                | 24–25             | 25  | 7.1  |
| Institution groups | Groups 1–6 (each) | 44  | 12.6 |
| Institution groups | Groups 7–8 (each) | 43  | 12.3 |

### 2. Digital Sedentary Behaviour And Lifestyle Indicators

| Variable                             | Mean   | SD    |
|--------------------------------------|--------|-------|
| Academic screen time (h/day)         | 3.13   | 0.96  |
| Recreational screen time (h/day)     | 3.65   | 1.31  |
| Total digital sedentary time (h/day) | 6.79   | 1.70  |
| Physical activity (min/week)         | 187.78 | 97.99 |
| Sleep (h/night)                      | 6.95   | 0.89  |

The constructed records show a mean of 6.79 hours/day of total screen-based sedentary engagement. Recreational screen time exceeds academic screen time in the simulated averages; this difference should not be interpreted as a regional population estimate.

### 3. Physical Fitness And Psychological Well-Being

| Variable                    | Mean   | SD    | Minimum | Maximum |
|-----------------------------|--------|-------|---------|---------|
| Step-test recovery HR (bpm) | 113.82 | 11.12 | 83.0    | 142.0   |
| Push-ups (repetitions)      | 15.64  | 7.95  | 0       | 39      |
| Sit-and-reach (cm)          | 24.23  | 6.41  | 6.5     | 42.3    |
| WHO-5 score (0–100)         | 60.97  | 14.35 | 20      | 100     |

These values describe variability introduced into the generated profiles; they do not measure the fitness or well-being of any recruited student.

### 4. Correlations With Total Digital Sedentary Time

| Outcome             | Pearson r | p      |
|---------------------|-----------|--------|
| Recovery heart rate | .257      | < .001 |
| Push-ups            | –.167     | .002   |
| Sit-and-reach       | –.119     | .026   |
| WHO-5 score         | –.252     | < .001 |

Within the synthetic dataset, greater total digital sedentary time is associated with higher recovery heart rate and lower values on the remaining indicators. The correlations are small in magnitude, and their statistical significance cannot be generalised to a real student population.

### 5. Adjusted Associations Of Recreational Screen Time

| Outcome       | Model R <sup>2</sup> | B      | SE   | p      | 95% CI         |
|---------------|----------------------|--------|------|--------|----------------|
| Recovery HR   | .379                 | 1.300  | .373 | < .001 | [0.57, 2.03]   |
| Push-ups      | .565                 | –.497  | .223 | .026   | [–0.94, –0.06] |
| Sit-and-reach | .198                 | –.382  | .244 | .119   | [–0.86, 0.10]  |
| WHO-5         | .199                 | –3.079 | .546 | < .001 | [–4.15, –2.00] |

The reported coefficients describe recreational screen time adjusted for academic screen time, age, gender, weekly physical activity, and sleep duration. Model  $R^2$  describes the full predictor set, not recreational screen time alone. The flexibility coefficient is not statistically significant at  $p < .05$ . The supplied tables do not report the academic screen-time coefficients or formal contrasts between the two screen domains; they also do not report a direct test of physical fitness against WHO-5.

## 6. Hypothesis Coverage

The reported simulated correlations illustrate the patterns posited in H1 and H2, but cannot confirm those hypotheses in a real population. H3 and H4 are not tested by the available tables. The results should be treated as a demonstration of analytical reporting, not as hypothesis-confirming empirical evidence.

# VI. DISCUSSION

The illustrative analysis demonstrates how screen-use domains, individual fitness components, and psychological well-being can be integrated in a single statistical framework. Its principal contribution is methodological: it shows the structure of descriptive, correlational, and adjusted regression reporting that could be applied to an appropriately sampled regional dataset. The observed numerical patterns are generated-data properties rather than discoveries about students in Western Uttar Pradesh.

The synthetic mean of 6.79 hours/day illustrates the scale of screen exposure that an instrument might capture, but it must not be compared directly with empirical prevalence estimates as though it were observed. Previous systematic reviews have documented substantial sedentary behaviour in university settings and important differences across measurement methods (Castro et al., 2018, 2020). A future study should distinguish screen time from objectively assessed total sedentary time and validate participants' reported durations.

The simulated correlations are weak and differ across outcomes: higher total screen time aligns with higher recovery heart rate and lower push-up, flexibility, and WHO-5 values. Reviews suggest that fitness and health

associations vary by outcome and evidence quality (Saunders et al., 2020; Memon et al., 2021). The demonstration therefore reinforces the rationale for analysing fitness components separately rather than claiming a single overall fitness effect.

In the adjusted synthetic models, recreational screen time has negative coefficients for push-ups and WHO-5, a positive coefficient for recovery heart rate, and a non-significant coefficient for flexibility. These are not causal effects, and the presence of statistically significant coefficients in generated data cannot substantiate real-world risk. Moreover, the reported models do not establish that recreational screen time has a stronger association than academic screen time: that claim requires an explicit statistical comparison of coefficients.

The psychological outcome uses the WHO-5, which assesses positive subjective well-being rather than diagnosing mental illness (Topp et al., 2015). Contextual research on screen time and well-being suggests that activity type and evidence quality matter (Stiglic & Viner, 2019), while WHO guidance emphasises physical activity alongside limiting sedentary time (Bull et al., 2020). Such literature supports the proposed research questions but cannot validate simulated coefficients.

For a future field investigation, institutional factors, student workload, socioeconomic context, and patterns of physical activity and sleep should be considered. Ferreira Silva et al. (2022) identified time constraints, motivation, and access to suitable places as important barriers to student physical activity. An empirical analysis should include prespecified confounders, assess model assumptions, and interpret small effects cautiously.

## 1. Limitations

The central limitation is the complete absence of original participant-level data. The 350 records and all resulting statistics are synthetic; their apparent precision and p-values arise from the simulation design. The source material does not provide a reproducible data-generation protocol or raw records for independent reanalysis. The planned cross-sectional design would additionally preclude causal inference, and self-reported screen time would be vulnerable to recall and classification error. The proposed fitness indicators measure selected dimensions rather than

comprehensive physical fitness. Hypotheses H3 and H4 remain untested in the supplied tables.

## 2. Directions For Empirical Research

Future research should secure ethics approval, calculate sample size from a prespecified primary outcome, recruit real students across institutions, validate the screen-use questionnaire, and standardise fitness testing. Academic and recreational screen time should be measured separately, with a planned coefficient contrast to assess H4 and direct fitness–well-being analyses to assess H3. Transparent reporting of missing data, model diagnostics, and confidence intervals would strengthen interpretability. Longitudinal or intervention designs could subsequently investigate temporal relationships.

## VII. CONCLUSION AND IMPLICATIONS

This paper proposes a multidimensional framework for investigating academic and recreational digital sedentary behaviour in relation to physical fitness and psychological well-being among university students in Western Uttar Pradesh. An illustrative analysis of 350 artificially generated records demonstrates descriptive summaries, correlations, and adjusted regression models across distinct fitness and well-being indicators. Because no students were recruited or measured, the numerical findings cannot establish the prevalence, direction, magnitude, or significance of associations in the target population. The available tables also do not test the direct fitness–well-being hypothesis or statistically compare academic and recreational coefficients. The appropriate next step is ethically approved, adequately powered field research using validated measures. Only such evidence can inform context-specific institutional recommendations about digital engagement, physical activity, and student well-being.

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