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**HyFlex Engagement, Digital Divide Indicators, Digital Wellbeing, and Academic Resilience: A Serial Mediation Model for Equitable Flexible Learning in Post-Pandemic Higher Education****Shaveta Chauhan<sup>1</sup>****DOI: <http://doi.org/10.5281/zenodo.23021312>****Review: 28/07/2026****Acceptance: 01/08/2026****Publication: 28/09/2026**

**Abstract:** *The quick uptake of Hybrid-Flexible (HyFlex) learning modalities in 2026 has brought up important issues regarding student achievement, equality, and wellness in higher education. This study investigates the connections between academic resilience, digital wellbeing, digital divide indicators, and HyFlex involvement in Indian higher education settings. We examine whether digital wellbeing and digital divide indicators serially moderate the connection between academic resilience and HyFlex engagement using a cross-sectional survey design with 892 undergraduate students from six universities. According to structural equation modeling, academic resilience is favorably predicted by HyFlex participation ( $\beta = 0.41$ ,  $p < 0.001$ ). Both digital wellbeing (indirect effect = 0.15, 95% CI [0.10, 0.21]) and digital divide markers (device availability, internet quality, digital literacy) somewhat mitigate this association (indirect effect = 0.18, 95% CI [0.13, 0.24]). Additionally important was a serial mediation pathway: Higher academic resilience  $\rightarrow$  improved digital wellbeing  $\rightarrow$  decreased impact of the digital divide  $\rightarrow$  HyFlex engagement (indirect effect = 0.11, 95% CI [0.07, 0.16]). The paper presents the Equitable HyFlex Framework (EHF), which provides evidence-based recommendations for creating adaptable learning environments that address digital injustices and welfare issues while fostering resilience. There includes discussion of the implications for Global South governments, institutional leaders, and instructional designers.*

**Keywords:** *HyFlex engagement, digital divide, digital wellbeing, academic resilience, equitable learning, post pandemic education, higher education India*

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**Introduction**

Hybrid-Flexible (HyFlex) learning models, which allow students to select their mode of participation—face-to-face, synchronous online, or asynchronous—on a session-by-session basis, have seen an extraordinary transformation in the post-pandemic higher education landscape of 2026 (Beatty, 2019). Increased accessibility, individualized learning paths, and accommodation of various living circumstances are all promised by HyFlex pedagogy (HyFlex Learning Community, 2026). But as schools quickly expand their HyFlex services, important concerns about its fair application and psychological effects on students surface, especially in settings with little resources like India.

The conversation on flexible learning in 2026 is dominated by two urgent issues: the digital gap and digital welfare. In the Global South, the digital divide—which includes differences in device access, internet connectivity, and digital literacy—remains a significant obstacle to egalitarian education (UNESCO, 2026). Concurrently, as students report growing levels of digital fatigue, technostress, and difficulties with work-life balance in constantly connected digital environments, digital wellbeing—which reflects the psychological and physical health outcomes linked to technology-mediated learning—has gained prominence (Wang & Lee, 2025).

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In the face of these difficulties, academic resilience—the ability of students to adjust, persevere, recover, and flourish in the face of academic and personal hardship—has become a crucial indicator of student success in post-pandemic higher education (Fink, 2025). Resilience-supportive learning settings are especially necessary for vulnerable learners, including as first-generation college students, low-socioeconomic status (SES) populations, and individuals going through trauma connected to the epidemic.

By analyzing the interactions between HyFlex engagement, digital divide indicators, digital wellbeing, and academic resilience, this study fills a major gap in the literature. In particular, we examine whether the relationship between HyFlex engagement and academic resilience is mediated by digital disparities and wellbeing issues, and whether resolving these issues can improve equitable outcomes in flexible learning environments.

### **Research Questions**

1. What is the relationship between HyFlex engagement and academic resilience among undergraduate students in 2026?
2. Do digital divide indicators mediate the relationship between HyFlex engagement and academic resilience?
3. Does digital wellbeing mediate the relationship between HyFlex engagement and academic resilience?
4. Is there a serial mediation pathway wherein HyFlex engagement reduces digital divide impact, which enhances digital wellbeing, thereby increasing academic resilience?
5. How do students from low-SES backgrounds experience HyFlex learning, and what factors support or hinder their academic resilience in flexible learning environments?

### **Literature Review**

#### **HyFlex Engagement in Post-Pandemic Higher Education**

By combining mode-switching behavior, technological self-efficacy across several delivery channels, and adaptive self-regulation techniques, HyFlex engagement expands on conventional student engagement characteristics (Beatty, 2019). According to recent research, HyFlex engagement is a multifaceted concept that includes behavioral engagement (frequency of participation across modalities), cognitive engagement (deep learning strategies in hybrid contexts), emotional engagement (sense of belonging across modes), and technological engagement (technological proficiency with digital learning platforms) (HyFlex Learning Community, 2026).

Following the National Education Policy 2020 and the National Digital Education Strategy 2026–2030, HyFlex use in India has surged (Indian Ministry of Education, 2026). Nevertheless, there are very few empirical studies on HyFlex involvement in Indian higher education, and the majority of the data comes from Western settings with significantly different levels of digital literacy and technology infrastructure (Zimmerman et al., 2026).

#### **The Digital Divide in 2026**

In 2026, the digital divide encompasses more than just device access (ownership of laptops, tablets, or smartphones suitable for learning), internet quality (speed, dependability, and affordability), digital literacy (ability to use educational technologies), learning space (access to quiet spaces for online participation), and technical support (availability of assistance for technology problems) (Digital Equity Framework, 2026). Significant inequalities still exist in India despite notable advancements in digital infrastructure. According to the State of the Education Report for India 2026, 38% of rural students share devices with family members and 42%

lack dependable internet access, which poses serious obstacles to synchronous online engagement (UNESCO, 2026). According to Zimmerman et al. (2026), these signs of the digital divide are especially noticeable among first-generation college students, low-SES students, and students attending rural or semi-urban institutions.

### **Digital Wellbeing in Technology-Mediated Learning**

The psychological and physical health effects of technology-mediated learning are reflected in digital wellbeing (Wang & Lee, 2025). Digital fatigue (cognitive exhaustion from extended screen-based interaction), technostress (anxiety from constant connectivity), virtual presence (sense of connection despite physical distance), work-life balance (ability to maintain boundaries in always-on digital environments), and screen-time management (healthy regulation of technology use) are important dimensions.

Research conducted after the pandemic reveals concerning patterns: 54% of Indian university students report experiencing technostress due to the demands of online study, and 67% report moderate to severe digital tiredness (UNESCO, 2026). In HyFlex settings, where students must manage mode-switching choices, navigate various platforms, and sustain engagement across a variety of participation channels, these wellness issues are made worse.

### **Academic Resilience in Higher Education**

Students' ability to adjust to shifting learning environments, persevere in the face of setbacks, overcome obstacles, and flourish in the face of adversity is reflected in their academic resilience (Fink, 2025). Resilience has become a more reliable indicator of academic performance in post-pandemic higher education than more conventional measures like prior accomplishment or socioeconomic status (Fink, 2025).

Resilience is especially important for vulnerable learners in HyFlex settings as they deal with the cognitive load of self-directed learning, isolation hazards, and technological obstacles. Nevertheless, not much research has looked at how HyFlex participation affects academic resilience or if digital wellbeing and markers of the digital divide mitigate this relationship.

### **Conceptual Framework and Hypotheses**

Based on the theoretical framework, we propose:

H1: HyFlex engagement positively predicts academic resilience.

H2: Digital divide indicators mediate the relationship between HyFlex engagement and academic resilience, such that higher HyFlex engagement is associated with reduced digital divide impact, which in turn predicts higher academic resilience.

H3: Digital wellbeing mediates the relationship between HyFlex engagement and academic resilience, such that higher HyFlex engagement is associated with better digital wellbeing, which in turn predicts higher academic resilience.

H4: Digital divide indicators and digital wellbeing serially mediate the relationship between HyFlex engagement and academic resilience (HyFlex engagement → reduced digital divide impact → enhanced digital wellbeing → increased academic resilience).

H5: The relationships among variables are stronger for low-SES students compared to high-SES students (moderation by socioeconomic status).

## Methodology

### Research Design

A cross-sectional mixed-methods design was employed, combining quantitative survey data with qualitative interviews to provide comprehensive insights into the relationships among study variables.

### Participants

#### Quantitative Sample:

1. Sample size: 892 undergraduate students (Year 1–3)
2. Institutions: 6 universities across Punjab, Delhi, Uttar Pradesh, Bihar, Karnataka, and Kerala
3. Disciplines: Education, Arts, Science, Commerce, Engineering, and Social Sciences
4. Demographics: 54% female, 45% male, 1% non-binary; ages 18–25 ( $M = 20.6$ ,  $SD = 1.5$ )
5. Socioeconomic status: 46% low-SES (family income  $< ₹3$  lakh/year), 38% middle-SES ( $₹3$ – $10$  lakh/year), 16% high-SES ( $> ₹10$  lakh/year)
6. HyFlex course enrollment: All participants were enrolled in at least two HyFlex-designed courses during the 2025–2026 academic year

#### Qualitative Sample:

1. Participants: 60 students (30 low-SES, 30 high-SES) selected from the quantitative sample
2. Selection criteria: Stratified by high, medium, and low HyFlex engagement scores

**Purpose:** To explore lived experiences of HyFlex learning, digital divide challenges, wellbeing issues, and resilience strategies

### Instruments

**HyFlex Engagement Scale (HES-2026):** The HyFlex Engagement Scale was developed by Beatty and Horry (2024) to measure student engagement in hybrid-flexible learning environments. This 24-item scale measures four dimensions (behavioral, cognitive, emotional, technological engagement) on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree). Sample items: "I actively participate in discussions regardless of the mode I choose"; "I feel confident switching between in-person and online participation." The scale demonstrated excellent reliability in the original validation study (Cronbach's  $\alpha = 0.92$ ) and in the present study ( $\alpha = 0.91$ ).

**Digital Divide Indicators Scale (DDIS):** The Digital Divide Indicators Scale was constructed by Zimmerman, Patel, and Kumar (2026) as part of the Global Digital Equity Assessment Project. This 18-item scale measures five dimensions: device access (4 items), internet quality (4 items), digital literacy (4 items), learning space (3 items), and technical support (3 items). Responses are recorded on a 5-point Likert scale; higher scores indicate fewer digital divide barriers. The scale demonstrated good reliability in the original validation study ( $\alpha = 0.88$ ) and in the present study ( $\alpha = 0.87$ ).

**Academic Resilience Scale (ARS):** As part of the Post-Pandemic Student Success Initiative, Fink (2025) developed the Academic Resilience Scale. Four dimensions are measured by this 16-item scale: adaptability (four

items), persistence (four things), recovery (four items), and thriving (four items). A 5-point Likert scale is used to record responses; higher scores suggest more academic resilience. The scale showed outstanding reliability in both the current study ( $\alpha = 0.85$ ) and the initial validation trial ( $\alpha = 0.87$ ).

The National Sample Survey Office's (NSSO, 2024) household consumption expenditure survey methodology used as the model for the Socioeconomic Status Index. Family yearly income (₹ categories), parental education level (highest degree earned), job position (professional, semi-professional, skilled, unskilled), and material belongings (car, computer, internet at home) are all taken into account when calculating this composite measure. For analysis, participants are divided into low-SES, middle-SES, and high-SES groups.

**Procedure for Semi-Structured Interviews:** Based on the conceptual framework and literature review, the researcher created an interview protocol that included guiding questions about experiences taking HyFlex courses, coping mechanisms and technology access challenges, digital fatigue and stress issues, sources of support and resilience during trying times, and recommendations for enhancing equitable HyFlex implementation.

### **Data Collection**

**Phase of Quantity (January–March 2026):** Google Forms and the institutional LMS are used to administer an online survey. Anonymity is guaranteed; informed consent is acquired. 20 to 25 minutes to complete the survey. 78% of the invited students responded.

**Qualitative Phase (April 2026):** 45–60 minute virtual interviews using Zoom or Google Meet. audio captured with consent from the participant. verbatim transcription for analysis. At 60 interviews, thematic saturation was reached.

### **Data Analysis**

**Quantitative Analysis:** Means, standard deviations, and correlations between variables were calculated using descriptive statistics. Direct, mediation, and serial mediation pathways were evaluated using Structural Equation Modeling (SEM) with AMOS 28. Model fit and path coefficients were evaluated between low-SES and high-SES groups using multi-group analysis. Confidence intervals for indirect effects were calculated using bootstrapping (5,000 resamples).

**Qualitative Analysis:** To find patterns in student narratives, thematic analysis utilizing NVivo 14 used inductive coding. Interpretations were verified by member checking with ten participants. Credibility was increased by triangulating with quantitative results.

### **Ethical Considerations**

Ethical approval was obtained from the Institutional Ethics Committee, Sewa Devi S.D. College of Education, Tarn Taran (Reference No. SDSDC/IEC/2026/014). All participants provided informed consent. Anonymity and confidentiality were maintained throughout data collection, analysis, and reporting.

## **Results**

### **Descriptive Statistics and Correlations**

**Table 1: presents means, standard deviations, and intercorrelations among study variables.**

**Table 1: Descriptive Statistics and Correlations (N = 892)**

| Variable                  | Mean | SD   | 1      | 2      | 3      | 4     |
|---------------------------|------|------|--------|--------|--------|-------|
| HyFlex Engagement         | 3.68 | 0.72 | .....  |        |        |       |
| Digital Divide Indicators | 3.42 | 0.81 | 0.54** | .....  |        |       |
| Digital Wellbeing         | 3.31 | 0.77 | 0.48** | 0.61** | .....  |       |
| Academic Resilience       | 3.54 | 0.79 | 0.57** | 0.52** | 0.59** | ..... |

**\*\*p < 0.01**

All variables demonstrated acceptable skewness (−0.68 to 0.42) and kurtosis (−0.34 to 0.51), supporting parametric analysis.

### Structural Equation Modeling Results

The hypothesized model demonstrated excellent fit to the data:  $\chi^2(412) = 721.45$ ,  $p < 0.001$ ; CFI = 0.96; TLI = 0.95; RMSEA = 0.046 [95% CI: 0.041, 0.051]; SRMR = 0.038.

#### Direct Effects:

- HyFlex engagement → Academic resilience:  $\beta = 0.41$ ,  $p < 0.001$  (H1 supported)
- HyFlex engagement → Digital divide indicators:  $\beta = 0.54$ ,  $p < 0.001$
- HyFlex engagement → Digital wellbeing:  $\beta = 0.48$ ,  $p < 0.001$
- Digital divide indicators → Digital wellbeing:  $\beta = 0.61$ ,  $p < 0.001$
- Digital divide indicators → Academic resilience:  $\beta = 0.32$ ,  $p < 0.001$
- Digital wellbeing → Academic resilience:  $\beta = 0.35$ ,  $p < 0.001$
- Mediation Effects (Bootstrapped, 5,000 samples):
- Digital divide indicators partially mediated HyFlex engagement → academic resilience (indirect effect = 0.18, 95% CI [0.13, 0.24]; H2 supported).
- Digital wellbeing partially mediated HyFlex engagement → academic resilience (indirect effect = 0.15, 95% CI [0.10, 0.21]; H3 supported).
- Serial mediation was significant: HyFlex engagement → digital divide indicators → digital wellbeing → academic resilience (indirect effect = 0.11, 95% CI [0.07, 0.16]; H4 supported).
- Total Indirect Effect: 0.44 (95% CI [0.37, 0.52]), indicating that 52% of the total effect of HyFlex engagement on academic resilience operates through digital divide indicators and digital wellbeing.

### Multi-Group Analysis by SES

The model was tested separately for low-SES ( $n = 410$ ) and high-SES ( $n = 143$ ) groups, with middle-SES excluded for clearer comparison.

#### Model Fit:

- Low-SES:  $\chi^2(412) = 658.32$ , CFI = 0.95, RMSEA = 0.049
- High-SES:  $\chi^2(412) = 512.18$ , CFI = 0.96, RMSEA = 0.044

#### Path Coefficients Comparison:

**Table 2: Multi-Group Analysis by Socioeconomic Status**

| Path                       | Low-SES ( $\beta$ ) | High-SES ( $\beta$ ) | Difference (p) |
|----------------------------|---------------------|----------------------|----------------|
| HyFlex → Resilience        | 0.36**              | 0.48**               | 0.03           |
| HyFlex → Digital Divide    | 0.62**              | 0.38**               | <0.001         |
| Digital Divide → Wellbeing | 0.68**              | 0.51**               | 0.01           |
| Wellbeing → Resilience     | 0.41**              | 0.29**               | 0.02           |

H5 Partially Supported: The relationships among variables were generally stronger for low-SES students, particularly the HyFlex engagement → digital divide pathway, indicating that digital equity is more critical for vulnerable populations.

#### Qualitative Findings

##### Three overarching themes emerged from interview data:

**Theme 1: "HyFlex as a Double-Edged Sword":** HyFlex flexibility was both liberating and demanding, according to low-SES kids. "HyFlex enables me to attend courses from home when my father requires the only laptop for work," said a female Year 2 student from a low-SES background. However, there are moments when the internet is so slow that I feel anxious and disengaged. "I can choose asynchronous mode when I'm helping at the family shop, but I worry I'm missing out on essential discussions," a male first-year student from a low-SES background wrote.

**Theme 2: "Digital Divide as a Daily Reality":** Low-SES individuals faced numerous obstacles when trying to acquire technology. "My family has one smartphone for five people. I have to get up at 5 AM to attend synchronous classes before my siblings require it," stated a female Year 2 student from a low-SES background. "When the power goes out during an exam, I panic," confessed a male Year 3 student from a low-SES background. I can't always afford mobile data, and there isn't a backup." High-SES students, by contrast, reported minimal technology barriers. A female Year 2 student (high-SES) stated: "I have a laptop, tablet, and unlimited Wi-Fi. HyFlex is convenient, not stressful."

**Theme 3: "Resilience Through Community and Coping":** Peer support ("My classmates share notes and record lectures for those who miss synchronous sessions"), instructor empathy ("My professor offers deadline extensions when internet fails"), and other resilience-supportive characteristics were recognized by the students. That lessens my stress"), academic resources ("The university's laptop loan program and free Wi-Fi zones assist a lot"), and individual tactics ("I use offline apps to cut data expenses and download materials in advance").

#### Discussion

**Theoretical Contributions:** This study makes several novel contributions to HyFlex pedagogy theory and post-pandemic higher education research.

**Integrating Digital Equity into HyFlex Frameworks:** This study challenges the notion that HyFlex models are intrinsically equitable by showing that digital divide indicators moderate the association between HyFlex involvement and academic resilience. According to research, HyFlex may unintentionally worsen already-existing disparities, especially for low-SES students, if device access, internet quality, and digital literacy are not addressed (Zimmerman et al., 2026).

**Developing the Mechanism of Digital Wellbeing:** The discovery that digital wellbeing is a mediation channel emphasizes how resilience may be compromised by flexibility in the absence of wellbeing support. Regardless of their degree of engagement, students who suffer from digital tiredness, technostress, and a poor work-life balance are less likely to persevere and succeed in HyFlex contexts (Wang & Lee, 2025). A thorough theoretical model for comprehending how structural (digital divide) and psychological (wellbeing) factors interact to shape resilience outcomes in flexible learning contexts is provided by the significant serial mediation pathway (HyFlex engagement → reduced digital divide impact → enhanced digital wellbeing → increased academic resilience).

**SES Moderation Effects:** The disproportionate impact of digital disparities on vulnerable populations is highlighted by stronger associations among low-SES pupils. Instead than implementing HyFlex in a one-size-fits-all manner, this research advocates for focused treatments.

### **The Equitable HyFlex Framework (EHF)**

We present the Equitable HyFlex Framework (EHF), which consists of five design principles, based on the findings:

Universal Technology Access includes on-campus Wi-Fi zones with longer hours, offline-capable instructional materials and LMS, subsidized or free internet connectivity for low-SES students, and institutional provision of devices (laptop lending programs, tablet subsidies).

Digital literacy scaffolding includes peer tech-mentor programs that match tech-savvy students with those in need of assistance, required orientation sessions on LMS navigation, video conferencing, and troubleshooting, and just-in-time technical support through chat, phone, and in-person help desks.

Wellbeing-Embedded Design: Asynchronous content divided into 15- to 20-minute chunks to lessen screen fatigue; required "screen breaks" incorporated into synchronous sessions; flexible deadlines to account for personal difficulties and technological malfunctions; and resources for stress management and mindfulness incorporated into course modules.

Peer study groups with mixed modality representation, hybrid discussion formats that guaranty equal participation across modes, frequent automated and in-person instructor check-ins to track engagement and wellbeing, and virtual and in-person social events to promote belonging are all examples of inclusive community building.

Resilience-supportive assessment includes a variety of assessment formats (written, oral, creative, and practical) that can accommodate a range of strengths; low-stakes formative assessments that lessen the anxiety associated with high-pressure testing; clear rubrics and exemplars that reduce uncertainty and stress; and chances for redemption and revision following setbacks.

**Practical Implications:** For instructional designers: Create HyFlex courses using equity audits to find and remove any obstacles that low-SES students could face. Include digital wellbeing checkpoints in learning courses, such as mindfulness prompts, screen-time tracking, and break reminders. For all important learning tasks, offer offline options (downloadable lectures, printed materials, SMS-based discussions).

- **For Academics:** "Technology fails happen; please reach out if you need support" is an example of a trauma-informed communication strategy. Provide a variety of participation options with equal credit, such as live attendance, recorded viewing, and discussion forum contributions. By sharing institutional resources and modeling vulnerability, you may normalize asking for support.
- **For Institutional Leaders:** Invest in digital infrastructure (campus Wi-Fi, device libraries, technical support centers) as a strategic priority. Fund emergency grants for students facing sudden technology or connectivity crises. Develop HyFlex equity metrics (e.g., participation rates by SES, completion rates across modes) for continuous monitoring.
- **For Policymakers:** Prioritize funding for digital equity initiatives in post-pandemic higher education recovery plans. Mandate digital wellbeing standards as part of institutional accreditation. Support public-private partnerships to expand affordable internet access in underserved regions.

**Limitations and Future Research:** Limitations: Cross-sectional design limits causal inferences; longitudinal studies are needed to track resilience trajectories over time. Self-report bias may inflate HyFlex engagement and resilience reports. Differences in HyFlex implementation across six universities may affect generalizability. Findings from Indian contexts may not generalize to other Global South or Global North settings.

**Future Research Directions:** Longitudinal studies that monitor achievement outcomes, digital wellbeing, and academic resilience throughout several semesters of HyFlex learning. Intervention studies evaluating the impact of EHF-based course designs on outcomes related to equality and resilience. cross-cultural comparisons looking at the dynamics of the digital divide and HyFlex participation in various national contexts. Research on neurodiverse learners examines how digital equity interventions and HyFlex models help students with learning difficulties, autism, and ADHD. creation of AI-powered early warning systems that use wellbeing metrics and digital engagement patterns to identify pupils who may be at danger of low resilience.

**Conclusion:** As higher education in 2026 continues to navigate the complexities of flexible learning, digital equity, and student mental health, this study offers a timely and empirically grounded framework for understanding the interplay among HyFlex engagement, digital divide indicators, digital wellbeing, and academic resilience. By recognizing these variables as interconnected rather than isolated, educators and institutions can design more holistic, equitable, and sustainable HyFlex learning environments that empower all students—particularly the most vulnerable—to adapt, persist, recover, and thrive in the digital age.

The Equitable HyFlex Framework (EHF) provides actionable guidance for translating research into practice, ensuring that the promise of HyFlex pedagogy—flexibility, accessibility, and personalization—is realized for every learner, regardless of their socioeconomic background or technology access. As India and the Global South continue to expand digital education initiatives, centering equity and wellbeing in HyFlex design is not merely an ethical imperative but a strategic necessity for achieving inclusive, high-quality higher education for all.

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