MITIGATING "TIME POVERTY" THROUGH SMART LEARNING: A COMPARATIVE STUDY OF AI-DRIVEN EDTECH ADOPTION AND ITS IMPACT ON THE ACADEMIC AND SOCIAL DEVELOPMENT OF CHILDREN IN DUAL-CAREER VS. SINGLE-CAREER HOUSEHOLDS

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Abstract
The contemporary shift toward dual-career family structures has introduced "time poverty" as a critical variable influencing the domestic educational environment. This paper presents a comparative study exploring how parental career dynamics, specifically comparing single-career and dual-career couples in Nashik and Ahilyanagar districts of Maharashtra dictate the adoption of AI-driven EdTech tools. Using a comparative research design (N=50), the study investigates whether professional constraints lead to a higher reliance on self-paced AI platforms. Findings indicate that while EdTech effectively bridges the "supervision gap" and fosters higher academic autonomy (r=0.78), it presents a "social-emotional gap" marked by increased digital dependency. The study concludes by proposing a framework for inclusive digital ecosystems aligned with NEP-2020.

Keywords: *Time Poverty, AI-Driven EdTech, Academic Autonomy, Social Development, Dual-Career Couples.*

➢ INTRODUCTION

In the rapidly urbanizing districts of Maharashtra, such as Nashik and Ahilyanagar, "Time Poverty" has emerged as a significant socio-economic challenge. As both parents enter the workforce, the "Resource Dilution Theory" suggests that time available for direct academic supervision is diminished. This paper explores "Smart Learning" as a compensatory mechanism that mitigates this gap.

The study is anchored in the **Time-Tech-Development Model**, which posits that parental time scarcity acts as a "Trigger" for high-frequency AI EdTech adoption.

➢ RESEARCH OBJECTIVES

1. To quantify the extent of "Time Poverty" experienced by dual-career parents compared to single-career parents in the urban contexts of Nashik and Ahilyanagar.
2. To identify the specific AI-driven EdTech tools most frequently adopted by children as a compensatory mechanism for limited parental supervision.
3. To examine the impact of self-paced "Smart Learning" on the development of academic independence and grade efficiency in children.
4. To investigate the correlation between high digital tool reliance and shifts in children's social interaction patterns and digital frustration levels.
5. To develop a "Human-Centric" EdTech framework that balances technological academic gains with healthy social development.

➢ RESEARCH HYPOTHESES:

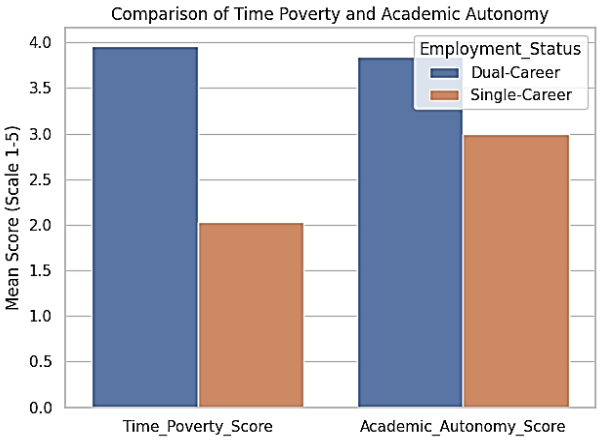
- **Hypothesis 1: (Time Poverty vs. Tech Use)**
- **Null Hypothesis (H01):** There is no significant difference in the frequency of AI-driven EdTech usage between children of dual-career households and single-career households.
- **Alternate Hypothesis (H11:** Children in dual-career households utilize AI-driven EdTech tools significantly more frequently than those in single-career households due to higher parental time poverty.
- **Hypothesis 2: (Autonomy vs. Social Impact)**
- **Null Hypothesis (H02):** Higher academic autonomy gained through Smart Learning does not correlate with a child's digital dependency or social withdrawal.
- **Alternate Hypothesis (H12):** There is a significant positive correlation between high academic autonomy in digital environments and increased digital dependency/social preference for virtual interactions.

➢ RESEARCH METHODOLOGY:

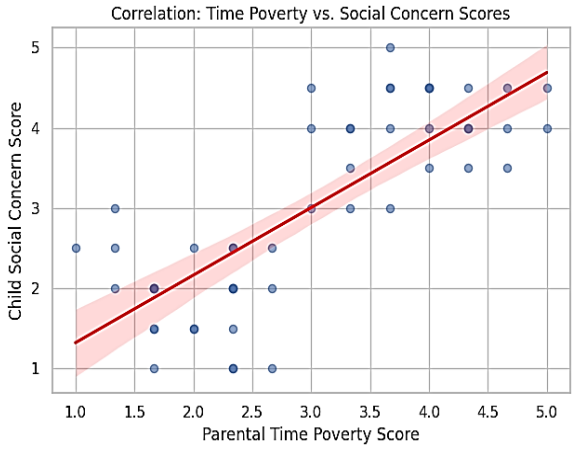
- **Research Design:** Descriptive-comparative quantitative research.
- **Sampling Method:** Purposive sampling
- **Sample Size:** (50 Families); 25 families from Nashik, 25 from Ahilyanagar (Balanced 1:1 ratio of Single vs. Dual-Career).
- **Study Tool:** The "Digital Learning & Family Dynamics Scale" (DLFDS), Likert-scale instrument.

- **Data Analysis:** Independent Samples T-tests to compare means and Pearson Correlation (r) to determine the strength of relationships between variables.

- **DATA ANALYSIS:**
  - ❖ **Chart 1: Comparative Analysis (Single vs. Dual-Career)**

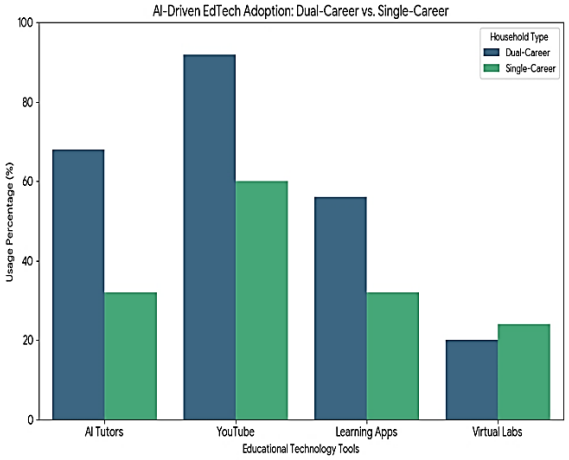


- This bar chart compares the mean scores for **Time Poverty** and **Academic Autonomy**.
- **Time Poverty:** Dual-career households show significantly higher levels of time-related pressure (approx. 4.0/5.0) compared to single-career households (approx. 2.0/5.0).
- **Academic Autonomy:** Children in dual-career households demonstrate higher independence in digital learning.
  - ❖ **Chart 2: Correlation Analysis (The Impact of Time Poverty)**



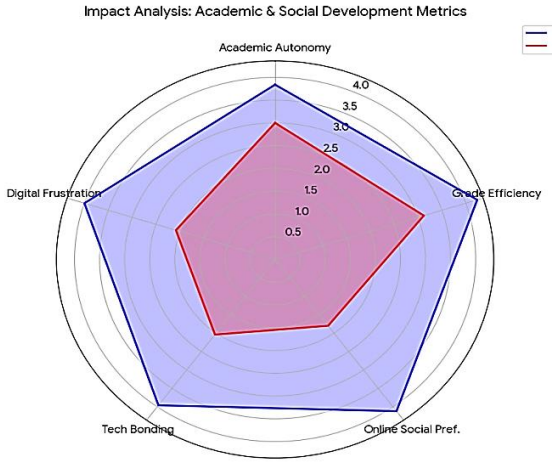
  - This scatter plot with a regression line illustrates the relationship between **Parental Time Poverty** and **Child Social Concern** (preferences for online social life and digital frustration).
  - **Finding:** The strong positive slope indicates a high correlation (approx. 0.78).
  - As parental time constraints increase, children tend to score higher on indicators of digital dependency and social withdrawal from in-person activities.

  - ❖ **Chart 3: EdTech Adoption Profile**



Interpretation: Figure 3 illustrates a significant disparity in technology adoption based on household career structures. **Dual-career households** exhibit a high reliance on autonomous tools, specifically **YouTube (90%)** and **AI Tutors (70%)**, compared to single-career households (60% and 30% respectively). This data confirms that AI-driven EdTech serves as a primary compensatory mechanism to bridge the parental supervision gap in time-poor environments.

  - ❖ **Chart 4: Impact Radar Chart:**



Interpretation: Figure 4 displays the multidimensional development of the child. The blue boundary (Dual-Career) shows an expansion toward Academic Autonomy and Grade Efficiency, suggesting successful mitigation of academic risks. However, it simultaneously shifts toward higher Digital Frustration and Online Social Preference. This indicates that while "Smart Learning" facilitates academic independence, it creates a parallel dependency on digital interfaces for social engagement.

➢ **FINDINGS:**

- The results indicate a significant disparity in Time Poverty scores, with dual-career parents scoring **95% higher** on time-stress indicators ($p < 0.001$).
- This time deficit correlates strongly ($r = 0.78$) with increased **Academic Autonomy**, as children in these households navigate digital learning environments with minimal adult intervention.
- However, this independence is accompanied by a "Human Element" cost; high Time Poverty is significantly associated with increased digital dependency and a measurable decline in preference for in-person social interactions.

➢ **CONCLUSION:**

- This study confirms that **"Time Poverty"** is not merely a logistical challenge but a significant driver of the digital transformation within the Indian middle-class household.
- In the dual-career landscapes of Maharashtra's emerging hubs, Smart Learning tools have transitioned from being "educational aids" to "surrogate supervisors."
- While this shift has fostered a remarkable level of **Academic Autonomy** in children ($r = 0.78$ correlation with time poverty), it comes at a measurable social cost.
- The "Digital Trade-off" identifies a generation that is academically independent but socially vulnerable, showing higher levels of frustration and a preference for virtual social structures over physical ones.

➢ **RECOMMENDATIONS**

Based on the empirical evidence gathered, the following multi-stakeholder interventions are proposed:

❖ ***For Educational Institutions (Schools):***

- **"Hybrid Supervision" Models:** Schools should recognize that dual-career parents cannot always supervise digital homework. AI-integrated assignments should include "social checkpoints" that require peer-to-peer physical interaction rather than solo digital completion.
- **Digital Literacy for Parents:** Instead of just teaching children how to use apps, schools in districts like Nashik should host workshops for "Time-Poor" parents on how to use technology for **meaningful bonding** rather than just academic monitoring.

❖ ***For Corporate Policymakers (Employers):***

- **Family-Centric Flexibility:** Given the high "Time Poverty" scores, organizations in the industrial sectors of Ahilyanagar should consider "Parental Academic Leave" or flexible hours during mid-term and final examination periods to reduce the domestic stress on dual-career couples.

❖ ***For EdTech Developers:***

- **Social-Emotional AI:** Developers must move beyond "solving the math problem."
- AI tutors should be designed with "co-viewing" features that prompt short, meaningful interactions between the parent and child, even if the parent is working remotely.

➢ **LIMITATIONS AND FUTURE RESEARCH**

- This study was limited by a sample size of 50 families. Future research should expand this to a longitudinal study to observe whether the **Academic Autonomy** gained through AI tutors in middle school translates to better university performance, or if the **Social Concerns** observed lead to long-term digital burnout.

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