Screen time and developmental evidence: An empirical assessment from rural West Bengal

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UNDERGRADUATE LEVEL DISSERTATION PROJECT

SCREEN TIME AND DEVELOPMENTAL EVIDENCE: AN EMPIRICAL ASSESSMENT FROM RURAL WEST BENGAL

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ABSTRACT

The rise of social media use among adolescents has sparked growing concerns regarding its potential impact on both physical health and academic performance. This paper is trying to explore the intricate relationship between social media scrolling time and two major student developmental outcomes: Quetelet index and Test scores in the Madhyamik (10-th board) examination. Primary data has been collected through a structured questionnaire (Pro-goti) survey administered to 300 students across four administrative blocks in West Bengal. We apply multivariate regression model estimation to account for interdependent educational and health outcomes. Preliminary findings suggest that higher social media use is negatively associated with both well-being and academic performance. The association with Quetelet index, while weaker, is contextually relevant due to the behavioural and lifestyle implications of prolonged screen exposure. Regression results indicates that higher levels of parental education contributing significantly to improved test scores, underscoring the intergenerational transmission of educational advantages. Children from joint families and larger households tend to perform worse, possibly due to divided attention, limited resources, or less conducive study environments. Religious disparities are also evident, with students from the muslim community recording significantly lower test scores compared to their hindu counterparts. The results provide valuable early evidence to inform policy discussions around screen time regulation, digital education literacy, and school-based behavioural interventions.

Keywords: *Screen time, Quetelet index, Test scores, OLS*

JEL Codes: *C51; C81; I15; I25; O12*

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1. INTRODUCTION

Child development is a complex and multidimensional process that takes place through physical, cognitive, linguistic, emotional, and social changes (Brand et al., 2024). From birth, a child gradually acquires new skills, which depend on their surrounding environment, experiences, and education. Research indicates that the first five years are the most crucial for brain development, as this period lays the foundation for learning abilities, intellectual growth, and emotional regulation (Housman, 2017; Styne et al., 2017). Proper nutrition, adequate care, a supportive family environment, and positive social interactions ensure a child's healthy developmental side. Children learn through play and acquire social and linguistic skills. At the same time, the use of technology also plays a significant role in a child's development, particularly as social media has introduced a new dimension to this process. In the modern digital era, social media has become an integral part of daily life, even for children (Chassiakos et al., 2019; Holilulloh et al., 2020; Brand et al., 2024). Due to the easy availability of smartphones and the internet, many children spend hours endlessly scrolling through social media (Lora et al., 2024; Kumar et al., 2025). While the proper use of technology enhances learning opportunities, excessive scrolling or uncontrolled use can negatively impact attention span, mental health, anxiety levels, and social interactions (Del Boca et al., 2013; Schwarzer et al, 2022).

In the modern digital age, social media and digital technology have become an integral part of daily life. Children and teenagers, in particular, are highly drawn to social media (Hardell, 2017). Platforms like Facebook, Instagram, Snapchat, and YouTube provide opportunities for entertainment, education, and social connection. However, excessive use of these platforms has a negative impact on children's mental and physical development (Smahel et al., 2015; Domoff et al., 2019).

Excessive social media scrolling reduces children's attention span (Bonetti et al., 2010). The rapidly changing content on social media makes them dependent on instant gratification, making it difficult for them to focus on activities like studying, reading books, or engaging in meaningful conversations. Excessive social media use at night disrupts their sleep cycle (Bonetti et al., 2010; Styne et al., 2017). As a result, a lack of adequate sleep leads to fatigue, irritability, and reduced learning ability (Hamm et al., 2014; Thorell et al., 2024). Although social media enhances virtual connections, excessive use leads to social isolation in real life. Many children struggle with face-to-face communication, making it difficult for them to build relationships with family members and friends (Wolak et al., 2003; Subrahmanyam and Greenfield, 2008; Zhang et al., 2018). A lack of physical exercise weakens children's immune systems and overall health. Most social media platforms are designed to keep users engaged and addicted. Many children develop a habit of repeatedly checking their phones, which negatively impacts their daily routines, studies, and personal relationships. Recent research has shown that excessive social media use increases the risk of depression, anxiety, and cyberbullying (Conte et al., 2024). Negative online experiences can lower children's self-confidence and lead to long-term mental health issues (Spitzer et al., 2023; Long et al., 2023; Liu et al., 2025; Flint et al., 2025).

Obtaining specific statistics on the impact of excessive social media use among children and adolescents in India can be challenging. However, global research has shown that excessive social media use can have negative effects on children's mental health. For example, a directive issued by the New York City Department of Health states that social media usage can increase the risk of negative social comparison, sleep disruption, mental stress, and online harassment. Similar effects may be observed in India, however due to the lack of ground level research and statistics, it is pretty much difficult to gather precise information. Therefore, further research is needed to understand the impact of social media use on children in India. Nonetheless, our focus in this study is very simple. Our study is confined to examine the influence of long screen time on child developmental outcomes in terms of health and education.

Through this empirical study, we will conduct a detailed investigation of both the positive and negative aspects of screen time on child overall development. In particular, we will closely examine how excessive scrolling hinders children's mental and physical development. We are trying to examine the intricate relationship between social media scrolling time and two major student developmental outcomes namely Quetelet index and Test scores of board examination by controlling for several socio-economic and socio-demographic determinants. Findings of this study may help ensure a safer digital experience for children and play a crucial role in their mental and physical growth

The rest of this paper organized as follows: Section 2 provides the key objectives of our study. Section 3 highlights the potential pathways. The next section presents data and adopted methodology. Section 5 contains empirical findings and related discussions. The last section provides some key takeaways and ends up with some references.

2. OBJECTIVES OF OUR STUDY

The aim of the paper is twofold: (1) To investigate the impact of prolonged screen time on children's developmental status with a specific focus on Quetelet Index and Academic score (10-th grade board examination, secondary board exam namely Madhyamik in West Bengal) in rural West Bengal; (2) To examine caste-specific disparities in the relationship between screen time and child Quetelet Index, controlling for several socioeconomic and sociodemographic factors across four administrative blocks.

3. POTENTIAL CHANNEL

In this section, we are trying to emphasize on potential pathways of the study. This graph represents how child development is affected by extended screen time. Prolonged screen time can have both positive and negative impacts on child development, affecting physical, mental, and social well-being of the children (Hadjipanayis et al., 2019). Child health and education are influenced by external factors like, family size, family type, internet daily usage etc (Cho and Cheon, 2005; Heaton et al., 2005; Boca et al., 2013; Paulus, 2024). Moreover, parental characteristics can affect child developmental status in terms of good health and quality education (Glewwe, 2005). However, some potential negative impacts of long scrolling hours on social media on child development in education and health such as excessive screen time on digital device can impact negatively on academic grades. On the other hand, social media

can aid child development by improving social skills, encouraging self-expression and identity formation, building support networks, and enhancing critical thinking. Figure 1 illustrates the interconnections between the variables examined in this study. We now conduct an empirical analysis based on our collected data using a structured survey questionnaire named Pro-goti.

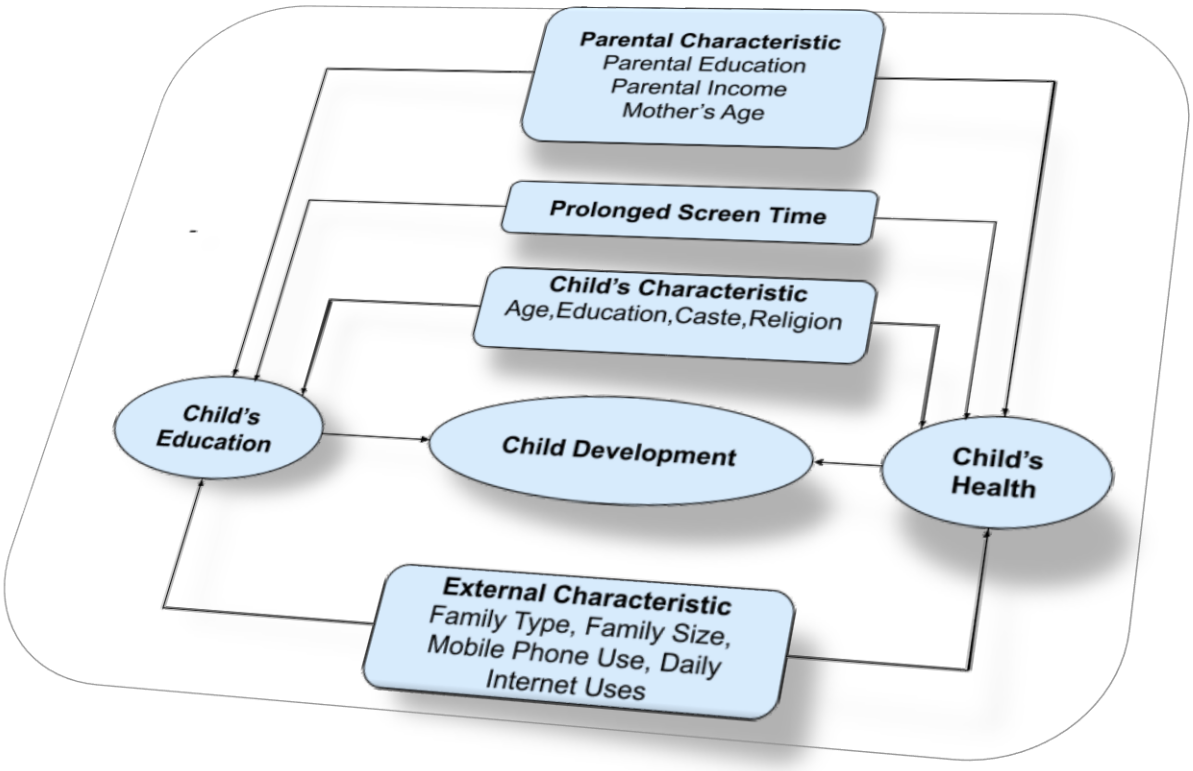

Figure 1. Potential pathways for child cognitive development

4. DATA AND METHODOLOGY

4.1.Study Area and Sampling

The study is grounded in primary data gathered from four blocks of East Midnapur district viz., Panskura-I, Kolaghat, Tamluk & Saheed Matangini. The selected region represents a diverse socio-economic characteristic of the region and include a mix of semi-urban and rural settings. Selection of the blocks aimed to capture spatial variation and representation of different community profiles. However, data for this study is obtained through random sampling using an well-structured questionnaire. Youth between the ages of 18 and 25 who had successfully completed their 12-th standard Higher Secondary examination were selected as the targeted population for our sample. A total of 300 youths participated in this survey. This age cohort has been selected due to its transitional phase between schooling to higher education and employment, providing valuable insights into long-term developmental impacts such as education outcomes, employability, digital exposure, and perceived quality of life.

4.2. Variables and Measurements

The study specifically focuses on two aspects of child development from the point of view of health and education. The study utilizes these two indicators as the outcome. We measure child health status on the basis of Quetelet Index (QI), and education status on the basis of Mathematics score of the class 10-th Board Madhyamik Examination, Secondary board exam in West Bengal.

$$QI = \frac{weight(kg)}{height^2(m)}$$

Mathematics score is used in their original form, measured as the percentage score out of 100, obtained in the 10-th grade board examination, conducted by the West Bengal Board of Secondary Education (WBBSE).

For analysis purposes, the study adopts Ordinary Least Square (OLS) approach. We use two outcomes separately to analyse the association by controlling several socioeconomic and sociodemographic determinants. The description of variables are presented in Table 1.

Table 1. Variable Description

Variable Name	Variable Description	Source
gender	Gender of the Respondent (1=Female; 0=Male)	Primary Data
age	Age of the Respondent	
caste	Caste of the Respondent (0=General; 1=SC; 2=ST; 3=OBC; 4=EWS)	
religion	Religion of the Respondent (0=Hindu; 1=Muslim)	
height	Height of the Respondent (in Cm)	
weight	Weight of the Respondent (in Kg)	
f_edu	Father's Education of the Respondent (1=Zero Education; 2=Primary; 3=Secondary; 4=Higher Secondary; 5= College & above)	
m_edu	Mother's Education of the Respondent (1=Zero Education; 2=Primary; 3=Secondary; 4=Higher Secondary; 5= College & above)	
income	Income of the Family (1=0-10000; 2= 11000-20000; 3=21000-30000; 4= 30000 and above)	
f_occu	Father's Occupation of the Respondent (0= Formal; 1= Informal)	
m_occu	Mother's Occupation of the Respondent (1= House wife; 2= Formal; 3= Informal)	

math_score	Score in Mathematics in Madhyamik	
study_time	How much the Child prepared for their study?	
screen_time	Mobile Screen time (hours/ week)	
tv	Whether the Respondent is Watching TV? (0= No; 1= Yes)	
mobile	Whether the Respondent use Mobile Phone? (0= No; 1= Yes)	Primary Data
sanitation	Whether the Respondent has Sanitation? (0= No; 1 = Yes)	
water	What is the Source of Drinking Water?	
cooking	What is the Cooking Process of the Respondent? (Chulla=0; Gas=1)	
internet	Internet Daily Uses of the Respondent? (1GB=0; 1.5GB=1; 2GB=2; 25GB=3)	
telecom	Which Telecom Company child Use? (VI=1; JIO=2; Airtel=3; BSNL=4)	

Source: Based on our survey dataset (Pro-goti)

5. MODEL SPECIFICATION

This study aims to examine the determinants of child development by estimating a linear regression model. The model explores how social media scrolling, along with child, parental, and external characteristics, influence two main dimensions of child development that is health and education. OLS helps us understand the strength and direction of association between these independent variables and the dependent outcomes by minimizing the sum of squared residuals. Subsequently, the econometric model is formulated as follows:

$$QI_i = \beta_0 + \beta_1 X_{1i}^{key} + \beta_2 X_{1j}^{child} + \beta_3 X_{1k}^{parent} + \beta_4 X_{1l}^{ext} + \epsilon_{1i} \quad (1)$$

$$Score_i = \gamma_0 + \gamma_1 X_{2i}^{key} + \gamma_2 X_{2j}^{child} + \gamma_3 X_{2k}^{parent} + \gamma_4 X_{2l}^{ext} + \epsilon_{2i} \quad (2)$$

Where:

QI_i is the Quetelet Index measuring child nutritional status; $Score_i$ measures the education status of the child. Here Mathematics score of the class 10-th Board Madhyamik Examination is observed to measure score.

X_i^{key} indicates the key variable screen time (hours) per week.

X_j^{child} indicates the child related factors such as child age, gender, caste, religion.

X_k^{parent} indicates the parental variables such as parental education, parental income, mothers age, migrated father, live with biological parents.

X_l^{ext} indicates the external variables such as family size, family type, mobile use, sanitation facilities, watching TV, drinking water, internet daily use, screen time per week.

$\beta_0, ..., \beta_4$ and $\gamma_0, ..., \gamma_4$ are the estimable parameters, and $\epsilon_{1i}, \epsilon_{2i}$ are the disturbances.

6. EMPIRICAL FINDINGS

This section elucidates the empirical results of our proposed model performing least squares estimation. The summary statistics of variables for the are reported in Table 2.

Table 2. Summary Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max
bmi	300	22.11950	3.663543	14.95152	35.55556
math_score1	300	34.17209	17.60717	1	65
screentime1	300	22.13023	13.02197	1	50
internet	300	2.204651	1.043438	1	4
study_time	300	1.404651	0.49197	1	2
HS_stream1	300	2.572093	0.793173	1	4
fam_size1	300	11.15814	2.97232	1	17
height_m	300	1.603767	0.108547	1.2	1.9
weight	300	56.75349	9.984552	35	85
type	300	1.265116	0.442425	1	2
gender	300	0.665116	0.473051	0	1
age	300	20.46047	2.629287	16	30
caste	300	0.865116	1.334461	0	4
religion	300	0.362791	0.481927	0	1
F_edu	300	3.613953	1.166026	1	5
M_edu	300	3.334884	1.009044	1	5
income1	300	2.962791	1.04502	1	5
sanitation1	300	2.637209	0.632833	1	3
water1	300	4.209302	0.921147	1	5
cooking1	300	2.813953	0.435344	1	3
telecom1	300	2.804651	0.813999	1	5

Notes: Sample size=300

Source: Authors' calculation based on survey dataset (Pro-goti)

Firstly, we estimate the effect of the key regressors with other external socio economic and socio demographic factors on two sets of outcome variables viz., QI and mathematics test score. Results are reported in Table 3 and 4 respectively. Our estimation suggests that, for 1 unit change in screen time QI will decrease by 0.035 unit and the variable is statistically significant.

Table 3. Effect of Screen Time on Health Indicator (without factors)

BMI	Coefficient	Std. Error	p-value
Screentime	-0.035	0.019	0.069

Notes: Sample size=300; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' calculation based on survey dataset (Pro-goti)

Conversely, in case of test score we see that, for 1 unit change in screen time BMI will increase by 0.101 unit. In a nutshell, findings suggest that increasing screen time adversely affects health status, whereas it positively impacts the test score.

Table 4. Effect of Screen Time on Test Score (without factors)

Score	Coefficient	Std. Error	p-value
Screentime	0.101	0.092	0.275

Notes: Sample size=300; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' calculation based on survey dataset (Pro-goti)

We now execute the full model analysis. Here we see the similar kind of results for the key regressors. Table 5 reports the full estimation results, where the outcome is QI. The variable screen time is negatively related with the QI, and the variable is statistically significant at 1% level. Regression results also suggest that long study hours are negatively associated with the health factor. Furthermore, female students have lower levels of QI because of lack of proper nutritional value. Also, if we focus on the religion-based factor, our results suggest that, Muslim community has the lowest levels of QI value, and the variable is significant at 5% level. Moreover, findings also suggest that higher levels of parental education are largely associated with greater QI for the child. Increased family size reduces the QI level. Furthermore, income is positively related to health status, and the variable is significant at 1% level. Results also indicate that children from joint families have a lower QI status, and the variable is significant at 5% level.

Table 5. Estimation Results (Full Model), Outcome = QI

QI	Coefficient	Std. Error
Screentime	-0.03167***	0.020639
Study Time	-0.42615***	0.57197
Internet Usage		
1.5 GB	0.759325***	0.660638
2 GB	0.842449	0.875676
2.5 GB	0.950343***	0.85107
Gender (1=Female)	-0.48463***	0.66879
Age	0.079329	0.106027
Caste		
SC	0.327566	1.058155
ST	-0.33133	3.954456
OBC	0.924588	0.755756
EWS	4.028137**	2.025407
Religion (1=Muslim)	-1.43856**	0.740152
Father's Education		
Primary Education	-0.29449***	2.365238
Secondary Education	1.136904*	2.38106
Higher Secondary	0.518457	2.393207
College and above	0.596836***	2.378804
Mother's Education		
Primary Education	-1.50863	2.521043
Secondary Education	-1.76585	2.569093
Higher Education	-1.32155	2.625534
College and above	-1.80469	2.677189

Family Type (1=Joint)	-0.40951**	0.601868
Income	0.715104*	0.278925
Family Size	-0.08715**	0.091542
Television (1=Yes)	-0.06541***	0.545405
Sanitation (1=Yes)	0.426209	0.437936
Mobile (1=Yes)	-0.05922*	1.306558
Water	0.136551	0.31143
Cooking	0.462122	0.706719
Telecom		
VI	3.403895	3.802858
Jio	2.627561	3.813544
Airtel	2.79765	3.860173
BSNL	2.190814	4.014046

Notes: Sample size=300; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' calculation based on survey dataset (Pro-goti)

Next, we proceed towards the estimation of another dependent variable which is the mathematics test score of matriculation. Results are reported in table 6. Here findings suggest that screen time is positively associated with the test score. For 1 unit increase in screen time, the test score will increase by 0.099 units. Here, we also observe that higher levels of parental education are associated positively with the score. Children from joint families have a negative impact on the test score, and the variable is significant. Furthermore, larger family size is also negatively associated with the education status in terms of score. Findings also highlight the religion-based difference. Muslim community has a lower education level in terms of test score as compared to Hindu community. The variable is negative and significant at the 5% level.

Table 6. Estimation Results (Full Model), Outcome = Score

Score	Coef.	Std. Error
Screentime	0.099713	0.092742
Study Time	1.859304**	2.570159
Internet Usage		
1.5 GB	1.022915**	2.968592
2 GB	2.726567*	3.934872
2.5 GB	0.618087	3.824304
Gender (1=Female)	-2.38606	3.005224
Age	0.357493	0.476435
Caste		
SC	7.452076	4.754846
ST	22.86357	17.76944
OBC	-0.0173	3.396005
EWS	-0.06878	9.101211
Religion (1=Muslim)	-6.5021**	3.325889
Father’s Education		
Primary Education	-9.92985	10.62825
Secondary Education	-0.15952	10.69935
Higher Secondary	-1.1893	10.75393
College and above	1.936823	10.68921
Mother’s Education		
Primary Education	17.70161*	11.32836
Secondary Education	19.62308**	11.54428

Higher Education	19.83279**	11.7979
College and above	29.58328***	12.03001
Family Type (1=Joint)	-0.46849**	2.704508
Income	-0.24928	1.253357
Family Size	-0.18612	0.411348
Television (1=Yes)	-2.30984	2.450789
Sanitation (1=Yes)	-0.45656	1.967877
Mobile (1=Yes)	2.060254	5.871048
Water	-1.26528	1.39942
Cooking	6.652345**	3.175659
Telecom		
VI	-29.0345*	17.08823
Jio	-25.3321	17.13625
Airtel	-20.9352	17.34577
BSNL	-12.4623	18.03721

Notes: Sample size=300; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Source: Authors' calculation based on survey dataset (Pro-goti)

7. CONCLUSIONS

This study highlights several critical socio-demographic and economic determinants of child health and educational outcomes. The results reveal that female students tend to have lower QI levels, potentially due to inadequate nutritional intake. Religion-based disparities are also evident, with children from the Muslim community exhibiting significantly lower QI levels. Parental education emerges as a strong positive determinant of child QI, underscoring the

importance of informed parenting in promoting better health outcomes. Conversely, larger family size and joint family structures are also associated with reduced QI levels, possibly due to resource dilution or distribution challenges within households. Furthermore, income shows a robust positive relationship with health status, reinforcing the role of economic well-being in securing adequate nutrition and healthcare facilities. Findings affirm that increased screen time is positively associated with educational outcomes, as reflected in improved test scores, suggesting the potential educational benefits of digital engagement. Parental education continues to play a pivotal role, with higher levels of parental education contributing significantly to improved test scores, underscoring the intergenerational transmission of educational advantages.

However, the study identifies several socio-demographic constraints. Children from joint families and larger households tend to perform worse, possibly due to divided attention, limited resources, or less conducive study environments. Religious disparities are also evident, with students from the Muslim community recording significantly lower test scores compared to their Hindu counterparts.

In a nutshell, these findings underscore the multifaceted influences on child well-being and call for integrated policy approaches that address nutritional equity, educational access, and family-level interventions to enhance health and learning outcomes across diverse social groups.

- **NOTES**: Since this is an undergraduate-level dissertation project, we restrict our analysis to OLS methods. In the subsequent stage, we plan to extend the study using a simultaneous equations including policy framework.

DISCLOSURE STATEMENT

No potential conflict of interest are reported by the authors.

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APPENDIX

To Be Updated Soon

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