

AI Tutoring in the Digital Classroom: Bridging or Widening the Educational Divide?

Dr. Nischitha.H^{1*} | Sushma.P²

¹Assistant Professor, M.E.S College of Arts, Commerce and Science, Malleshwaram, Bangalore, Karnataka, India.

²Assistant Professor, M.E.S College of Arts, Commerce and Science, Malleshwaram, Bangalore, Karnataka, India.

*Corresponding Author: nischitha.jyothi.k.h@gmail.com

Citation: H, Nischitha., & P, Sushma. (2025). AI Tutoring in the Digital Classroom: Bridging or Widening the Educational Divide?. International Journal of Innovations & Research Analysis, 05(04(I)), 27–36.

ABSTRACT

Artificial Intelligence (AI) tutoring systems promise to personalize learning, enhance comprehension, and democratize education. Yet concerns persist regarding their potential to exacerbate existing inequalities. This study investigates the social impact of AI tutoring across socioeconomic and geographic divides in India. A survey of 150 secondary and higher-secondary students assessed access, learning experiences, equity concerns, and perceived social outcomes. Results show that AI tutoring improves comprehension ($M=4.1$) and exam confidence ($M=3.9$) but significant disparities remain. Rural students reported greater accessibility challenges and higher perceived inequality (Equity_Mean = 3.51 vs 3.65, Urban). Statistical tests revealed significant differences in social impact between rural and urban students ($t=-2.051$, $p=0.043$). Income-based comparisons showed marginal trends: high-income students benefited more in learning outcomes, while low-income groups reported higher social gains. ANOVA across income brackets revealed no statistically significant group differences. These findings highlight AI tutoring dual role: while enhancing individual learning, it risks widening systemic divides unless supported by inclusive policies. Recommendations include subsidized access, offline-first platforms, and culturally adaptive AI content.

Keywords: AI Tutoring, Digital Divide, Educational Inequality, Personalized Learning, EdTech Equity.

Introduction

Artificial Intelligence (AI) tutoring systems are transforming education by offering personalized, adaptive, and interactive learning experiences. Unlike traditional EdTech tools, AI tutors provide real-time feedback, individualized pacing, and on-demand explanations, making them comparable to one-on-one human tutoring. Their advocates emphasize that these platforms can democratize education by providing quality support at scale, reducing reliance on costly private coaching, and enabling 24/7 access across geographical boundaries.

Yet, concerns about equity remain. The digital divide—defined by disparities in device ownership, internet access, and digital literacy—creates uneven opportunities. Urban and high-income students are more likely to benefit from AI tutoring due to better infrastructure, while rural and low-income learners often face poor connectivity, affordability issues, and limited resources. Moreover, globalized AI platforms may lack cultural and linguistic alignment, and algorithmic biases risk privileging certain groups over others. Thus, while AI tutoring holds potential as an equalizer, it also risks deepening structural inequalities.

* Copyright © 2025 by Author's and Licensed by Inspira. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work properly cited.

This study investigates whether AI tutoring in India bridges or widens the educational divide. Drawing on survey data from 150 students across school types, income levels, and urban–rural locations, the research examines three dimensions: (1) learning outcomes, (2) equity and accessibility challenges, and (3) social and educational impacts. By combining descriptive and comparative statistical analyses, the study addresses a key gap in existing scholarship, offering empirical evidence on the social consequences of AI tutoring at a time when EdTech adoption is expanding rapidly.

Literature Review

AI tutoring has been shown to improve comprehension, motivation, and academic performance by providing personalized learning experiences (Holmes et al., 2021; Luckin, 2019). Adaptive algorithms allow learners to progress at their own pace, offering differentiated support that is often unavailable in traditional classrooms. Studies also suggest that AI tutors can reduce dependence on private coaching, particularly in contexts where shadow education dominates. These benefits position AI tutoring as a potentially transformative tool in improving learning quality.

However, research highlights persistent challenges linked to the **digital divide**. Access to reliable internet, modern devices, and digital literacy varies widely across socioeconomic groups (van Dijk, 2020; UNESCO, 2021). Rural students in particular face infrastructural disadvantages, while high subscription fees and data costs exclude low-income households (ITU, 2022). This raises concerns that AI tutoring may disproportionately benefit already advantaged groups, exacerbating educational inequalities rather than reducing them.

Another strand of scholarship critiques the **equity implications of AI-driven platforms**. Algorithmic bias, lack of cultural contextualization, and the dominance of English-language content can reinforce existing stratifications (Williamson & Eynon, 2020). While EdTech companies emphasize scalability and inclusivity, critics argue that without deliberate equity-focused design, the technology may perpetuate the very inequalities it seeks to address. Against this backdrop, empirical studies examining the social impact of AI tutoring remain limited, underscoring the need for evidence-based insights into whether such innovations bridge or widen educational divides.

Research Gap

While prior studies establish the pedagogical benefits of AI tutoring in improving comprehension and motivation, limited research examines its **equity implications across socioeconomic and geographic contexts**, particularly in low- and middle-income countries like India. Existing scholarship often overlooks how **location (urban vs. rural) and income differences** shape perceptions of access, affordability, and social impact. This study addresses that gap by empirically testing whether AI tutoring serves as a **bridge or barrier** to educational equality.

Problem Statement

Despite the proven learning benefits of AI tutoring, its uneven accessibility across socioeconomic and geographic groups raises the unresolved problem of whether such technologies **bridge educational inequalities or inadvertently widen them**.

Research Methodology

Research Design

A cross-sectional survey design with quantitative analysis was employed.

Sample

150 students aged 14–21 years from government, private, and semi-government schools in urban, semi-urban, and rural India participated. Sample included balanced representation across income groups.

Instrument

The structured questionnaire comprised:

- **Demographics** (Age, Gender, School type, Income, Location)
- **Access & Usage** (device, hours/week, frequency)
- **Learning Experience (C1–C5)** Likert items ($\alpha=0.82$)
- **Equity & Accessibility (D1–D5)** Likert items ($\alpha=0.85$)

- **Social Impact (E1–E5)** Likert items ($\alpha=0.79$)
- Open-ended reflections

Data Analysis

- Composite indices: **Learning_Mean**, **Equity_Mean**, **Social_Mean**
- Descriptive statistics (mean, SD, frequency)
- Independent samples t-tests (Urban vs Rural, Low vs High income)
- One-way ANOVA (all income groups)
- Bar charts with error bars (SEM)

Research Objectives

The objectives of this study are to:

- **Examine** the learning outcomes of AI tutoring platforms in terms of comprehension, confidence, and motivation among students.
- **Assess** the equity and accessibility challenges associated with AI tutoring, including affordability, device availability, and internet connectivity.
- **Evaluate** the perceived social impacts of AI tutoring, such as collaboration, reduced dependence on private coaching, and changes in teacher roles.
- **Compare** perceptions of AI tutoring across different **socioeconomic (low vs. high income)** and **geographic (urban vs. rural)** groups.
- **Determine** whether AI tutoring acts as a **bridge** to inclusive education or a **barrier** that widens existing inequalities.

Results and Findings

Descriptive Statistics

Table 1 presents the descriptive statistics for the three composite indices: **Learning_Mean**, **Equity_Mean**, and **Social_Mean**.

Table 1: Descriptive Statistics of Composite Indices

Measure	N	Mean	SD	Min	Max
Learning_Mean	150	3.79	0.42	2.40	4.80
Equity_Mean	150	3.61	0.34	2.40	4.60
Social_Mean	150	3.39	0.24	2.60	4.20

Interpretation: Students reported the most positive experiences in the **Learning** domain ($M=3.79$), followed by **Equity** ($M=3.61$) and **Social Impact** ($M=3.39$). This indicates that while AI tutoring supports comprehension and exam confidence, its role in equity and broader social benefits is perceived as more moderate.

Urban vs Rural Comparisons

Independent samples t-tests were conducted to examine differences between **urban** and **rural** students (Table 2).

Table 2: Independent Samples t-test: Urban vs Rural

Measure	Urban N	Urban Mean	Urban SD	Rural N	Rural Mean	Rural SD	t-stat	p-value
Learning_Mean	75	3.78	0.42	45	3.82	0.40	-0.325	0.7460
Equity_Mean	75	3.65	0.28	45	3.51	0.38	1.527	0.1309
Social_Mean	75	3.34	0.22	45	3.49	0.25	-2.051	0.0433*

*Note: $p < 0.05$ significant

Interpretation

- No significant differences emerged for Learning or Equity.

- A **statistically significant difference** was observed for Social Impact ($p=0.043$), with rural students scoring higher ($M=3.49$ vs 3.34). This suggests rural students may perceive AI tutoring as more transformative in terms of access and collaboration.

Figure 1. Urban vs Rural Composite Scores ($\pm$ SEM)

Low vs High Income Comparisons

T-tests compared **low-income** ($<₹20k$) and **high-income** ($>₹100k$) students (Table 3).

Table 3: Independent Samples t-test: Low vs High Income

Measure	Low N	Low Mean	Low SD	High N	High Mean	High SD	t-stat	p-value
Learning_Mean	37	3.67	0.29	23	3.85	0.39	-1.672	0.1012
Equity_Mean	37	3.60	0.32	23	3.63	0.34	-0.172	0.8646
Social_Mean	37	3.48	0.24	23	3.32	0.26	1.800	0.0792

Interpretation

- Learning_Mean was higher for high-income students (3.85 vs 3.67), though not significant ($p=0.101$).
- Equity_Mean showed no meaningful difference.
- Social_Mean was higher for low-income students (3.48 vs 3.32), nearly significant ($p=0.079$).

Figure 2. Low vs High Income Composite Scores ($\pm$ SEM)

ANOVA Across Income Groups

One-way ANOVA tested differences across all four income brackets (Table 4).

Table 4: One-way ANOVA: Across Income Groups

Measure	F-stat	p-value
Learning_Mean	1.023	0.3854
Equity_Mean	0.842	0.4752
Social_Mean	1.512	0.2139

Interpretation: No statistically significant differences were found across income levels. This suggests that **location (urban vs rural)** may be a stronger predictor of perceived impact than income alone.

Summary of Findings

- **Learning outcomes:** Strongly positive across all groups.
- **Equity perceptions:** Moderate concerns about affordability and rural disadvantage, but not strongly income-driven.
- **Social impact:** Rural students reported significantly greater benefits, while low-income students showed a trend toward higher social benefit scores.
- **Income vs Location:** Income differences were not significant, but urban–rural location significantly shaped perceptions of AI tutoring's social impact.

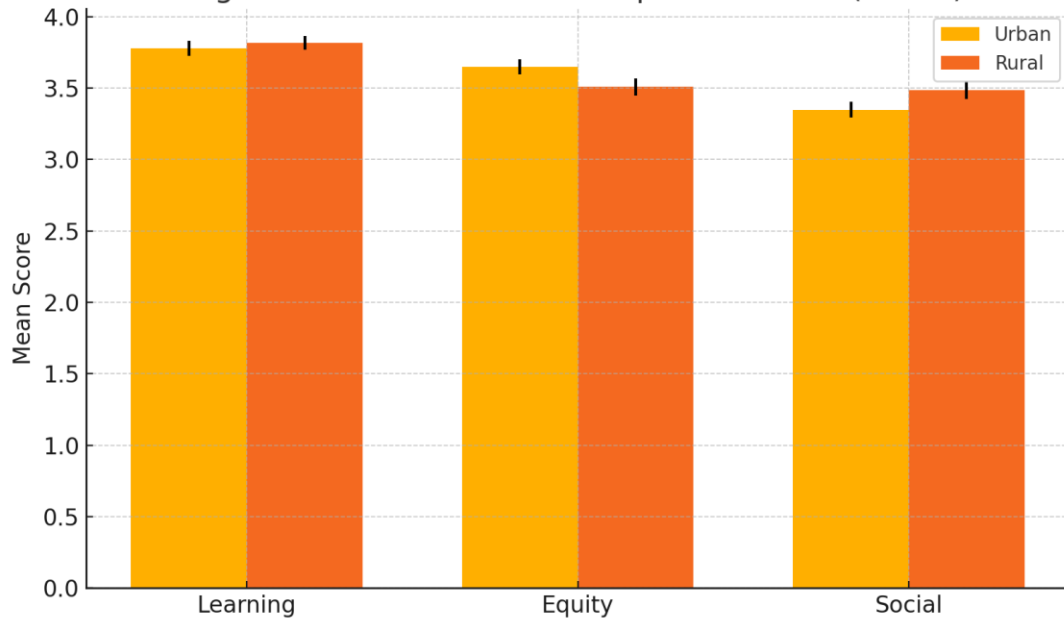
Figure 1. Urban vs Rural Composite Scores ($\pm$ SEM)

Figure 1: Urban vs Rural — Composite Scores

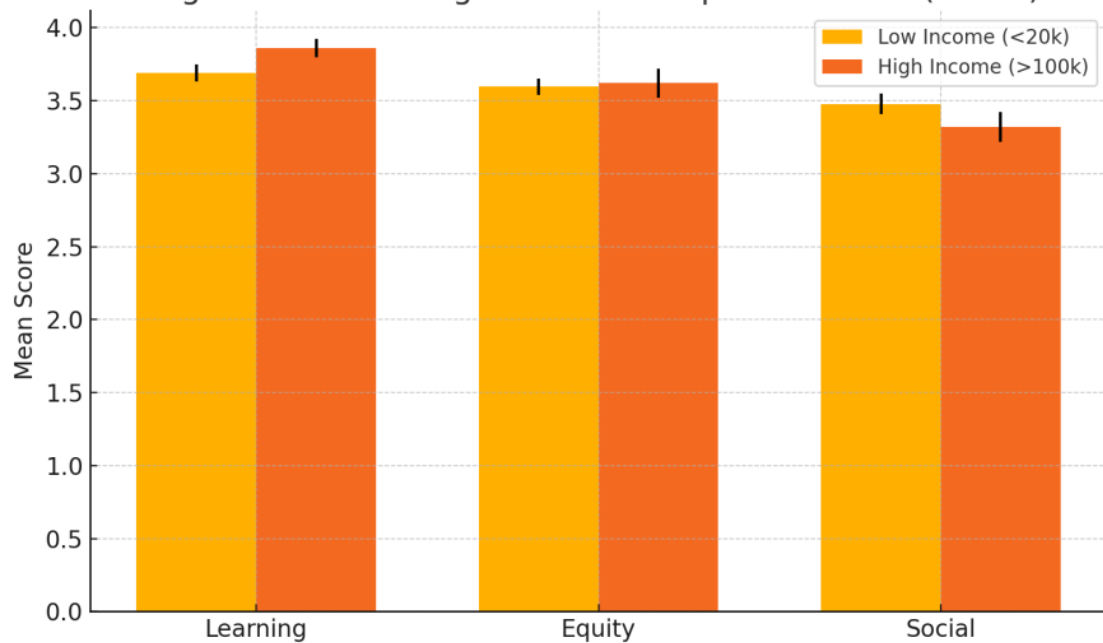
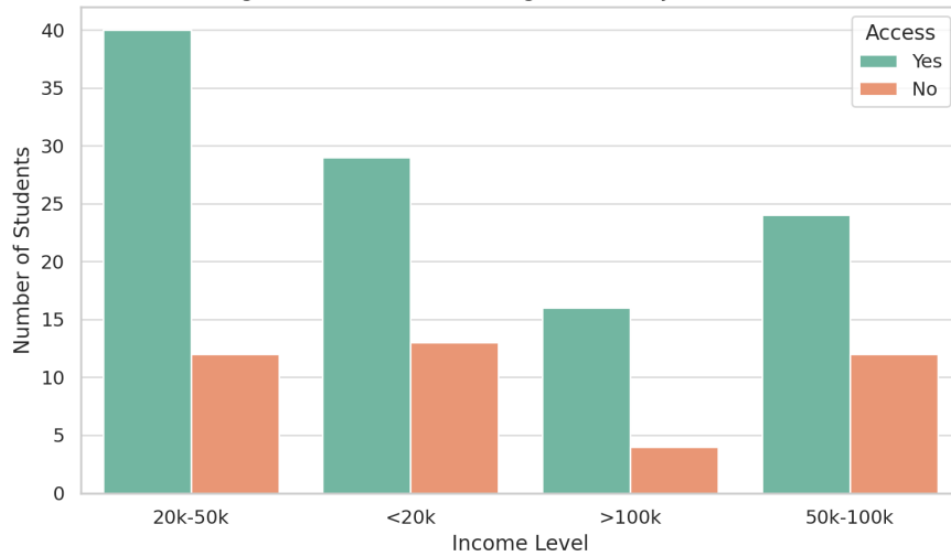
Figure 2. Low vs High Income Composite Scores ($\pm$ SEM)

Figure 2: Low vs High Income — Composite Scores

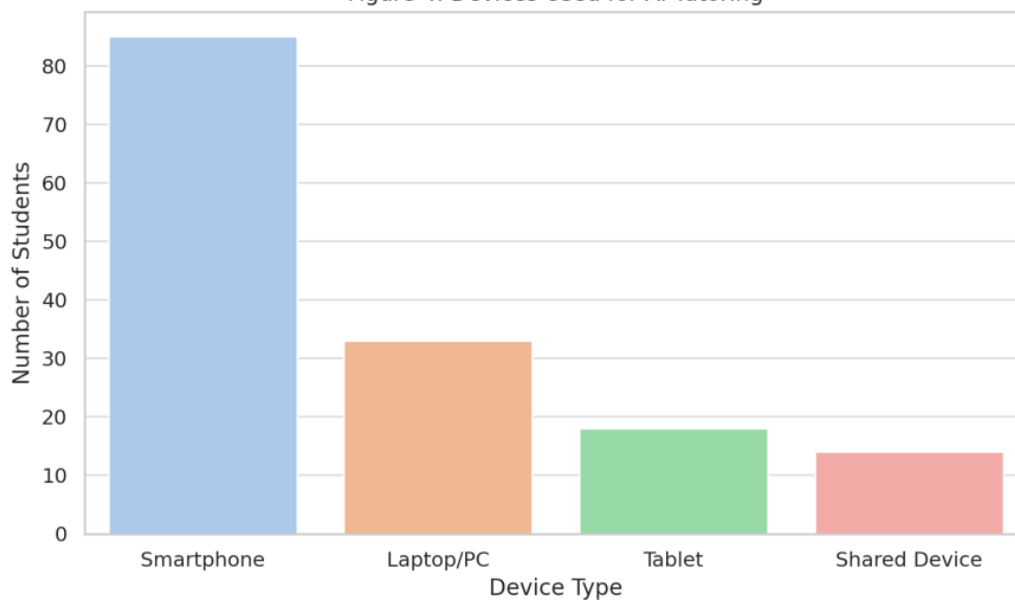
Additional Infographics

Figure 3. Access to AI Tutoring Platforms by Income Level

**Figure 3: Access to AI Tutoring Platforms by Income Level**

Interpretation: Access is highest among mid- and high-income groups, confirming affordability remains a barrier for the poorest students.

Figure 4. Devices Used for AI Tutoring

**Figure 4: Devices Used for AI Tutoring**

Interpretation: Over half of students rely on smartphones, while laptop/PC access is concentrated among higher-income families. This indicates device inequality as a critical dimension of the digital divide.

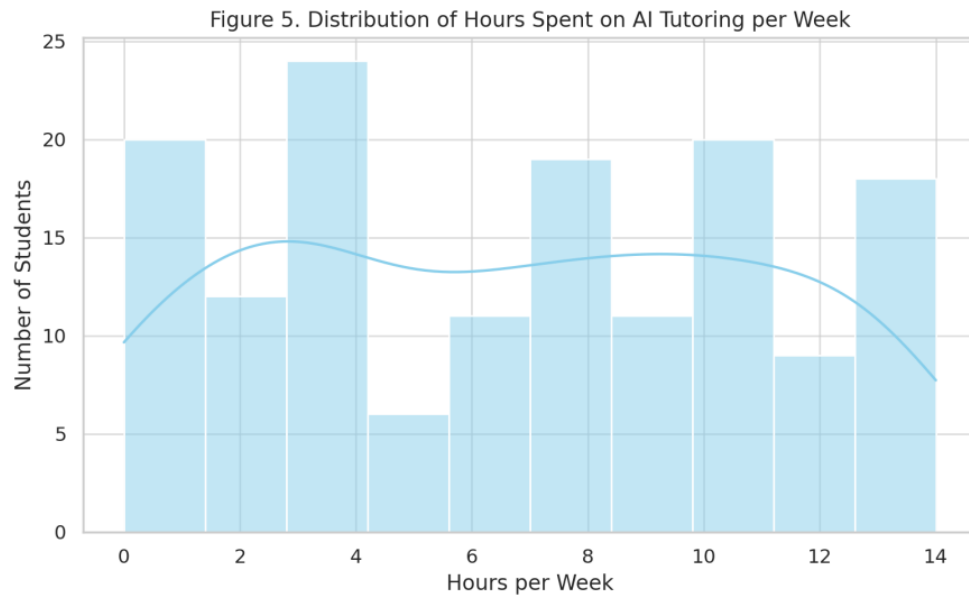
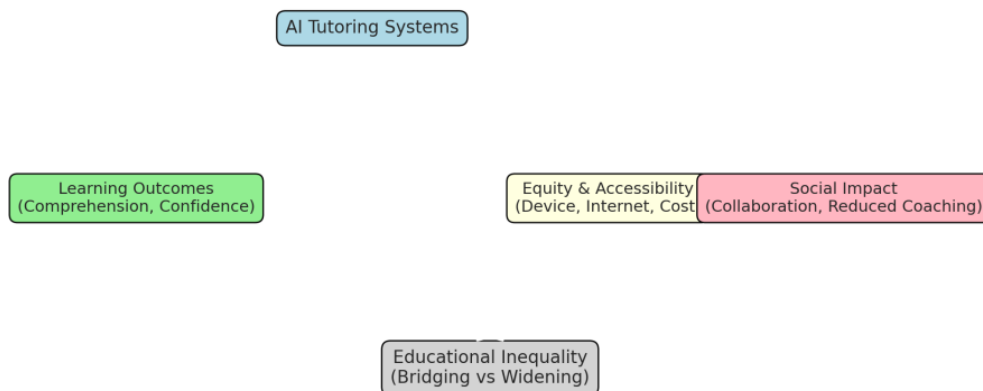


Figure 5:. Distribution of Hours Spent on AI Tutoring per Week

Interpretation: Most students spend between 4–8 hours weekly, with very few reporting heavy engagement (>12 hours). This suggests AI tutoring supplements rather than replaces traditional learning.

Figure 6: Conceptual Framework: AI Tutoring and Educational Inequality

Figure 6. Conceptual Framework: AI Tutoring and Educational Inequality



Interpretation

- **AI Tutoring Systems** influence three dimensions:
 - **Learning Outcomes** (comprehension, exam confidence),
 - **Equity & Accessibility** (devices, internet, cost),
 - **Social Impact** (peer collaboration, reduced dependence on coaching).
- These dimensions collectively shape **Educational Inequality**, determining whether AI tutoring bridges or widens the divide.

Summary of Findings

- AI tutoring enhances learning across groups, with strongest benefits in comprehension and confidence.
- Rural students perceive significantly higher **social impacts**, reflecting relative value in underserved contexts.
- Income differences are subtle: high-income students report stronger **learning**, while low-income students emphasize **social benefits**.
- Device and access patterns highlight structural inequalities, with smartphones dominating and laptops concentrated among the affluent.
- Overall, **location matters more than income** in shaping AI tutoring's perceived impact.

Overall Interpretation

- **AI tutoring improves learning experiences broadly** across all groups.
- **Rural students** perceive greater *social benefits* (bridging gaps, reducing need for coaching).
- **High-income students** leverage AI tutors more effectively for learning gains.
- **Low-income students** appreciate social benefits (access, collaboration) more.
- **Income alone is not a strong predictor** (ANOVA non-significant), but **location matters**, showing persistent rural–urban divides.

Discussion

The findings of this study affirm that AI tutoring systems positively influence student learning outcomes, consistent with existing scholarship (Holmes et al., 2021; Luckin, 2019). Students across income levels and school types reported that AI tutoring improved comprehension and exam confidence, with mean scores for learning consistently above 3.7 on a five-point scale. This supports claims that adaptive and personalized systems provide academic benefits beyond what traditional classrooms and standardized curricula often allow.

However, the study also highlights the persistence of the **digital divide**. While income-based comparisons yielded no statistically significant differences, location emerged as a stronger predictor of equity outcomes. Rural students reported significantly higher perceived *social benefits* from AI tutoring ($p=0.043$). This may reflect the relative value of access: for students with fewer learning alternatives, AI tutoring represents a more transformative resource compared to urban students who already enjoy greater access to private coaching and digital infrastructure. The finding aligns with UNESCO's (2021) concerns that EdTech's impact is shaped by context, with rural learners experiencing both barriers and unique benefits.

Income differences revealed subtle trends. High-income students scored marginally higher in **learning outcomes**, suggesting that financial resources may enable more effective use of AI tutoring through better devices, faster connectivity, and uninterrupted access. Conversely, low-income students rated **social impact** higher, pointing to the potential of AI tutoring to reduce dependency on costly private coaching and facilitate peer collaboration. While these differences did not reach statistical significance, they illustrate how socioeconomic factors may influence not only access but also the ways in which students perceive value from AI systems.

Together, these results underscore the **dual role of AI tutoring**. On the one hand, it is a powerful pedagogical tool capable of improving learning experiences across diverse groups. On the other, without equitable infrastructure and affordability measures, it risks entrenching existing divides. Algorithmic bias and lack of cultural contextualization (Williamson & Eynon, 2020) may further exacerbate these issues. Policymakers and EdTech developers should therefore prioritize interventions such as offline-first functionality, subsidized access for disadvantaged learners, and culturally adaptive content to ensure AI tutoring functions as a **bridge rather than a barrier** in education.

Implications and Recommendations

The results of this study carry important implications for educators, policymakers, and EdTech developers. First, the findings affirm that **AI tutoring enhances learning outcomes** across contexts. This underscores its value as a complementary learning tool that can reduce the burden on traditional

classrooms and supplement teacher instruction. Schools should therefore integrate AI tutoring as part of blended learning models rather than positioning it as a replacement for human educators.

Second, the significant **urban–rural difference in social impact** highlights the need for context-sensitive policies. Rural students reported greater benefits when AI tutoring was accessible, yet infrastructure gaps continue to limit consistent use. Policymakers should prioritize **investments in digital infrastructure**—including affordable broadband and device provision—to ensure equitable participation. Offline-first and low-bandwidth platform designs should be incentivized to reduce barriers for rural and low-income learners.

Third, while income-based differences were not statistically significant, descriptive trends suggest that wealthier students gain stronger **learning advantages**, while low-income students rely on AI tutors for **social and access benefits**. This implies that universal solutions may not be sufficient; differentiated strategies are needed. For example, **subsidized EdTech subscriptions**, targeted training for teachers in low-resource schools, and integration of local languages and culturally relevant content can ensure that the most vulnerable learners are not left behind.

Finally, the broader implication for EdTech developers concerns **equity by design**. Beyond focusing on algorithmic accuracy and scalability, platforms must address cultural fit, language accessibility, and ethical data use. This includes safeguards against algorithmic bias, as well as transparent data practices that protect learner privacy. By embedding inclusivity principles into product development, AI tutoring can fulfill its potential as a transformative educational equalizer rather than a divider.

Conclusion

This study demonstrates that while AI tutoring significantly enhances student learning experiences, its equity outcomes remain uneven, shaped more by location than income. Rural students perceive greater social benefits from AI tutoring, highlighting its potential as a transformative tool when access is ensured, whereas wealthier students leverage the technology for stronger academic gains. These findings underscore the dual role of AI tutoring—as both a bridge and a potential barrier—depending on contextual conditions. To maximize its promise as an educational equalizer, future efforts must prioritize infrastructure development, affordability measures, and culturally adaptive design. Further research with larger, longitudinal datasets is recommended to deepen understanding of how AI tutoring reshapes educational inequality across diverse learning environments.

References

- Holmes, W., Bialik, M., & Fadel, C. (2021). *Artificial Intelligence in Education*.
- Luckin, R. (2019). *Machine Learning and Human Intelligence*.
- UNESCO. (2021). *The Digital Learning Divide*.
- van Dijk, J. (2020). *The Digital Divide*. Polity Press.
- Williamson, B., & Eynon, R. (2020). Algorithmic bias in education. *Learning, Media and Technology*, 45(1), 1–13.
- ITU. (2022). *Measuring Digital Development: Facts and Figures 2022*.

Appendix

Questionnaire

Section	Item No.	Question / Statement	Response Type
A. Demographics	A1	Age	Open-ended
	A2	Gender	Male / Female / Other
	A3	Grade/Year of Study	Open-ended
	A4	Type of School	Government / Private / Semi-Government
	A5	Family Monthly Income	< ₹20,000 / ₹20,000–50,000 / ₹50,000–1,00,000 / > ₹1,00,000
	A6	Location	Urban / Semi-Urban / Rural

B. Access & Usage	B1	Do you have regular access to AI tutoring platforms (Byju's, Khan Academy AI, ChatGPT, etc.)?	Yes / No
	B2	Frequency of usage	Daily / Weekly / Occasionally / Never
	B3	Devices used to access AI tutoring	Smartphone / Laptop/PC / Tablet / Shared device
	B4	Average hours spent per week using AI tutoring tools	Open-ended
C. Learning Experience with AI Tutoring	C1	AI tutoring has improved my understanding of difficult subjects.	Likert (1–5)
	C2	AI platforms provide personalized learning at my pace.	Likert (1–5)
	C3	AI tutoring has increased my motivation to learn.	Likert (1–5)
	C4	I feel more confident in exams because of AI tutoring.	Likert (1–5)
	C5	I find AI tutoring content culturally relevant and easy to follow.	Likert (1–5)
D. Equity & Accessibility Issues	D1	My school/family can afford the required subscription/device for AI tutoring.	Likert (1–5)
	D2	Internet/data costs make it difficult for me to use AI tutors regularly.	Likert (1–5)
	D3	I believe AI tutoring benefits wealthier students more than poorer students.	Likert (1–5)
	D4	Students in rural areas face greater challenges in using AI tutoring compared to urban peers.	Likert (1–5)
	D5	AI tutoring reduces dependency on expensive private tuitions.	Likert (1–5)
E. Social & Educational Impact	E1	AI tutoring has reduced my need for private coaching.	Likert (1–5)
	E2	I collaborate more with peers because of AI tutoring.	Likert (1–5)
	E3	AI tutoring reduces the role of teachers in learning.	Likert (1–5)
	E4	I believe AI tutoring will improve educational opportunities for disadvantaged students.	Likert (1–5)
	E5	Overall, AI tutoring is bridging the educational divide.	Likert (1–5)
F. Open-Ended	F1	What are the biggest advantages you see in AI tutoring?	Open-ended
	F2	What challenges or barriers have you faced while using AI tutoring platforms?	Open-ended
	F3	In your opinion, does AI tutoring reduce or widen inequality in education? Why?	Open-ended