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INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY EDUCATIONAL RESEARCH
ISSN:2277-7881(Print); IMPACT FACTOR :10.16(2026); IC VALUE:5.16; ISI VALUE:2.286
Peer-Peer Reviewed, Refereed & Open Access International Journal - As per UGC Norms
(Fulfilled Suggests Parameters of UGC by IJMER)
Volume:15, Issue:7(2), July 2026
Scopus Review ID: A2B96D3ACF3FEA2A
Article Received: Reviewed: Accepted
Publisher: Sucharitha Publication, India
Online Copy of Article Publication Available: www.ijmer.in

IMPACT OF ARTIFICIAL INTELLIGENCE ON HIGHER EDUCATION IN RURAL AND URBAN REGIONS: A SOCIO-ECONOMIC STUDY

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Abstract

The socioeconomic effects of integrating artificial intelligence (AI) into highereducation(HE) institutions via rural and urb an divisions are assessed in this empirical study.This study examines variations in technology infrastructure, funding capa cities, pedagogical adoption, and learning outcomes using a crossectional dataset of (N=200) institutional respondents [n =100urban; n=100rural] made upof HE students, faculty, and administrative staff.According to statistical study, ruralinstit utions face structural barriers, lesser digital literacy, and severe resource limits, whereas urban institutions use highspeed digital architecture to expand AI integration and global competitiveness.The report describes the strategic policy framewo rks needed to close the digital gap and stop structural educational disparities from getting worse.

Key words: Artificial intelligence, Higher education, Digital divide, Socio-economic, Rural and Urban regions.

1. Introduction

The fast development of predictive analytics, generative AI, and adaptive learning systems has drastically changed how H E is structured around the world.AI offers previously unheardof chances to improve learning results and instructional effic iency, from automated administrative tracking systems to highly customised student tutoring tools.Nevertheless, there is a socioeconomic context in which these technologies are implemented.The advantages of the digital revolution are mostly d ependent on institutional finance, computer literacy, and the physical infrastructure that already has been established. Strong web-based infrastructure, private business investments, and technically skilled faculty pools are characteristics of the strong technological ecosystems that surround urban HE institutions. On the other hand, systemic issues that rural HE institutions sometimes face include unstable electricity grids, limited operating budgets, and remote locations from major centers of technology. The use of AI in education runs the risk of evolving from a democratic tool of facilitation into an institutional divider that exacerbates socioeconomic gaps between metropolitan and regional student demographics in the absence of thorough empirical analysis and focused policy action.

2. Research Objectives

• To compare the availability and structural dependability of AI infrastructure between urban and rural HE institutions.
• To examine how financial and socioeconomic constraints affect the uptake of AI in both demographic areas.
• To evaluate the variations in faculty preparedness, institutional tech resistance, and AI tool pedagogical integration.
• To offer data-driven policy suggestions to guarantee fair use of AI in various academic contexts.

3. Literature Review

This study expands on the triadic paradigm of the Digital Divide, that was divides technology differences into three distinct levels:

a) **I-Level Divide (Access)**: Education, healthcare, and economic development are all impacted by differences in physical infrastructure, dependable hardware, and network connectivity. contemporary education and the provision of high-quality healthcare are hampered by underserved communities' frequent lack of access to contemporary computers and reliable internet. Due to operational difficulties, businesses in these areas are less competitive in the global market. Poverty and inequality are made worse by this digital divide, which disadvantages individuals who

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lack basic resources. In order to ensure that all communities prosper in the digital age and to promote inclusive growth, it is imperative that these gaps be addressed.

b) **II-Level Divide (Capability)**: Racial gaps in digital literacy and technical training pose serious obstacles to personal development and employment in today's technologically advanced society, especially for marginalized communities. Due to limited usage of resources like high-speed internet and high-quality training programs, many people find it difficult to compete for sophisticated technology employment, which exacerbates economic inequality and social isolation. The digital divide is widened by the speed at which technology is developing, underscoring the necessity of cooperation between legislators, educators, and community organizations. It is possible to equip people with the necessary skills for a more equitable digital economy by funding local partnerships and equitable access to digital literacy initiatives.

c) **III-Level Divide (Outcome)**: Significant societal disparities are highlighted by the difference in socioeconomic returns between those who have access and capability and those who do not. Academic performance, employment opportunities, and long-term results like wealth accumulation and social mobility are all impacted by this disparity. Better career pathways are frequently attained by those who have access to high-quality education and mentoring, while those who do not may find it difficult to land lower-paying positions. Communities are affected as well, since poorer economic growth and more poverty are associated with less access to education. Investing in initiatives that promote fairness and benefit society as a whole while offering widespread access to education and capability development is necessary to address these inequities.

3. Methodology

3.1 Research design: This study surveys a localized sample utilizing a quantitative, descriptive, and comparative cross-sectional research design, concentrating on the pedagogical, financial, and infrastructure factors that influence the use of AI in education. In order to explain the differences in AI adoption rates between wealthy and under resourced organizations, statistical research will find correlations and possible causes. Through successful AI deployment tactics, the research aims to offer policymakers and educational leaders' practical advice that will contribute to a more inventive and inclusive learning environment.

3.2 Sample Profile and Selection Criteria: To ensure a comparable distribution between the two research regions, a stratified random selection procedure was used to choose precisely 200 individuals (N=200) for the study's sample size.

- **Total Sample (N)**: 200 participants
- **Urban Sub-Sample**: 10 academic administrators from cities, 25 active faculty members, and 65 undergraduate and graduate students make up the 100 participants.
- **Rural Sub-Sample**: 100 participants, including 10 academic administrators from regional, village-adjacent, or community institutions, 25 active faculty members, and 65 undergraduate and graduate students.

3.3 Data Collection Instruments

A systematic, closed-ended digital survey that was distributed over a three-month period was used to gather the data. Concrete binary tracking markers and a 5-point Likert scale (1 = Strongly Disagree, 5 = Strongly Agree) were included in the survey items to capture institutional reality. The main analytical factors assessed are:

- **Infrastructure Reliability Index (IRI):** It gives IT data centers, cloud providers, and computational networks a comprehensive, composite health score based on network stability, hardware age, and uptime.
- **Financial Capability Index (FCI):** Determined by giving faculty and students access to institutionally licensed or premium software packages.

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- **Pedagogical Integration Index (PII):** It is a specialized statistic that educational institutions use to assess the degree to which AI is integrated into teaching and learning procedures. PII emphasizes actual classroom implementation and the institutional support framework that enables educators to utilize AI safely and efficiently, as opposed to merely monitoring the presence of technology.

4. Data Analysis and Findings: In order to extract significant evidence that answers your main research questions, raw data is methodically processed, cleaned, and assessed at this crucial step of any research endeavor or business report. Across all key variables, the collected field data reveals fundamental differences between the urban and rural educational contexts.

4.1 Infrastructure Accessibility and Availability Measures

Geographically, there are considerable differences in the technology base needed to support continuous AI enquiries. Modern tools are almost universally available in urban areas, but there is significant operational lag in rural areas.

Infrastructure Metric Assessment	**Urban Sample (n=100)**	**Rural Sample (n=100)**
Continuous Fast Internet (5G/Fiber Broadband)	94%	23%
Periodic electrical / network breakdowns (more than three times per week).	4%	61%
Availability of AI-Capable Hardware in Institutional Computer Labs	88%	31%
For Academic Research, Only Use Your Own Mobile Data	12%	68%

According to the findings, 61% of rural participants experience frequent network failures, creating a First-Level Digital Divide that structurally restricts access to real-time AI.

4.2 Equity in Software Licensing and Economic Barriers

By limiting access to necessary digital tools in emerging nations, standard worldwide software pricing causes a severe digital gap.

The Barriers:

Price Blindness: Local purchasing power is disregarded in US currency pricing.

Exchange Shock: Unpredictable billing results from fluctuating currency rates.

Card Locks: Unbanked areas are blocked by the need for worldwide credit cards. Financing models dictate whether students use advanced, updated software or fall behind using restricted, ad-supported free tiers.

Whether students use sophisticated, updated software or lag behind with limited, ad-supported free tiers is determined by financing mechanisms.

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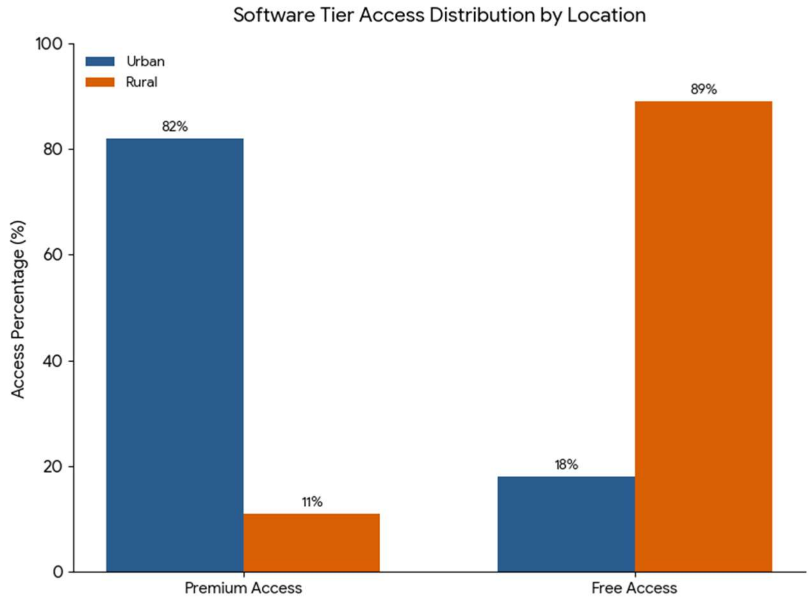

89% of respondents in rural areas are limited to basic free tiers, whereas 82% of respondents in urban areas have access to fully financed, institutionally licensed premium AI (such as sophisticated text generative models and institutional data analysis software). The lack of real-time web indexing, lower token restrictions, and higher rates of hallucinations in free models lead to a significant disparity in the quality of the information.

4.3 Pedagogical Adoption and Faculty Training Profiles

Pedagogical adoption and faculty training profiles offer a thorough summary of how teachers integrate cutting-edge teaching techniques, digital tools, and a variety of evaluation techniques into their classrooms. These profiles aid in classifying teachers according to their present degrees of technological preparedness, receptivity to changes in the classroom, and particular needs for professional growth. Institutions are better able to provide focused training sessions and support systems by determining each educator's current position. This ensures that faculty members can effectively adjust to changing educational standards and maximize student learning outcomes through upskilling and continuous improvement. The effectiveness of technology deployment in the classroom depends on how well teachers integrate it.

- **Urban Faculty Context (n=25)**: 76% say they have attended at least one training on ethical integration or AI literacy at their institution during the past year. AI-powered syllabus builders, plagiarism detection tools, and automated grading aid are all methodically incorporated into day-to-day operations.
- **Rural Faculty Context (n=25)**: Merely 12% of respondents said they have received any official institutional training on AI teaching tools. Tech opposition is significantly higher (72%), with faculty prioritizing digital survival skills and seeing AI software as a tool for academic dishonesty rather than a teaching tool.

4.4 Language Barriers and Academic Results

Software programming has linguistic biases that affect students' confidence and understanding.

- **Performance of Urban Student**: Personalized conversational AI agents are used by urban cohorts for coding support, mock interviews, and English language improvement. They have a discernible advantage in corporate market preparedness as a result.

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- **Performance of Rural Student**: Foundational AI models, according to 64% of rural students, are unable to correctly comprehend national vernacular structures, regional terminology, or localized context. This technical flaw clearly creates learning friction by requiring students to translate prompts more than once in order to obtain simple responses.

5. Conclusion and Policy Recommendations

5.1 Conclusion

Public policy must acknowledge access to strong internet infrastructure as a fundamental academic requirement rather than merely an optional or upscale service in order to prevent AIfrom reinforcing or exacerbating already-existing regional disparities within HE systems. This study unequivocally demonstrates that regional differences are not caused by rural pupils' lack of drive, aptitude, or intelligence, but rather by systemic, long-standing inequities in access to resources and technology that continue to disadvantage those communities. Equal educational opportunities need addressing these discrepancies.

5.2 Practical Advice for Inclusive Development

a) **Universal Broadband Subsidization:** By making significant investments in the construction of dependable and fast regional fiber-optic networks, governments must prioritize the development and enhancement of broadband infrastructure. In order to guarantee uninterrupted access to educational resources, special attention should be paid to rural areas, particularly those that have campuses for HE. This can be achieved by installing solar-powered backup power grids that provide continuous internet connectivity.

b) **Mandatory National Upskilling Initiatives:** To upskill faculty members across various institutions, academic ministries must establish extensive, decentralized, and mandatory bootcamps. In order to ensure that educators can successfully integrate new technologies into their instruction, these bootcamps should concentrate on greatly raising educators' baseline digital literacy. In order to assist educators in navigating potential obstacles and maintaining academic integrity in the digital age, the training must also create clear ethical rules and standards for the responsible use of AI-assisted teaching technologies.

c) **Open-Source Vernacular AI Mandates:** It is imperative that state financing prioritise projects aimed at creating open-source fundamental language models specifically tailored to regional requirements. In order to make these models more accessible in underserved areas, they need be lightweight enough to function properly even with limited processing power or low bandwidth internet connections. In order to promote digital inclusivity and equity, these AI systems must also have strong ability to correctly identify and comprehend a wide range of regional dialects and linguistic peculiarities.

d) **Public-Private Software Pools:** Educational policymakers are urged to work with top IT firms to create consortium-level licensing arrangements. These collaborations can provide regional community colleges with widespread access to high-quality analytical software. Policymakers can guarantee that even institutions with tight budgets have access to high-quality, industry-standard instruments by negotiating subsidized rates. Regardless of their college's financial situation, all students can benefit from cutting-edge software tools thanks to this strategy, which promotes educational equity and helps level the playing field.

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