Integration of ICT in Schools: A Comparative Analysis of Jharkhand and National Averages

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Abstract

In the contemporary educational landscape, Information and Communication Technology (ICT) has emerged as a transformative force, fundamentally altering how teaching and learning processes are conducted. This study focuses on evaluating the state of ICT integration in schools within Jharkhand and compares it with national averages. The advent of digital technologies has enhanced information accessibility, fostered interactive learning environments, and equipped students with essential 21stcentury skills. Despite Jharkhand's rich cultural heritage and growing economic significance, the state faces challenges in educational development, particularly concerning ICT infrastructure. Recent efforts to improve technological resources in Jharkhand's schools have not yet fully addressed the gaps in practical classroom implementation. On a national scale, India has made significant progress in ICT integration through initiatives like the National Mission on Education through ICT (NME-ICT) and the Digital India program, which have strengthened digital infrastructure, teacher training, and student access to ICT resources. However, disparities persist between states, highlighting uneven adoption and implementation rates. This comparative analysis aims to bridge the knowledge gap by examining infrastructure availability, teacher training, and student access to ICT resources in Jharkhand against national averages. The findings provide insights into the strengths and weaknesses of ICT integration strategies in Jharkhand and identify areas for improvement.

Keywords: ICT Integration, Educational Technology, Comparative Analysis

1. Introduction

The integration of Information and Communication Technology (ICT) in schools has become a critical component in modern education systems worldwide. As technology continues to advance, its role in shaping educational practices and enhancing learning experiences has gained significant attention. In India, the disparity in ICT adoption and implementation across different states highlights a need for a comparative analysis to understand regional variances and identify areas for improvement. This study aims to provide a comprehensive comparative analysis of ICT integration in schools between Jharkhand and the national average. Jharkhand, a state with diverse educational challenges and opportunities, presents a unique case for examining how ICT resources and practices are implemented in a regional context compared to broader national trends. With exploring the current ICT infrastructure, teacher training, curriculum integration, student engagement, and policy support in Jharkhand, this analysis seeks to uncover the strengths and weaknesses of ICT integration in the state [1].

2. Review of Literature

Hans, M. A. (2012). They have substantially improved our capabilities to transform the data into information that is valuable thanks to the proliferation of computers and internet networks. It has brought about a new period of civilisation that is devoid of any prejudice and has revolutionised the society in a very short amount of time. Jharkhand, which is located in India, is likewise not immune to the impact of the technological prowess. Over the course of the last decade, several efforts have been undertaken; nonetheless, the development of the information technology (IT) and IT sector has been comparatively gradual in comparison to that of other newly established states in India. As a result of the fact that this state has been generating a

large number of IT-educated human resources, it was decided to conduct research in order to determine the phenomena that are associated with the challenges and opportunities that the Information Technology (IT) and IT sector in Jharkhand experience. It was decided to employ a descriptive study design, and the data collection technique that was chosen was the survey method. Interview Schedules were used to obtain the primary forms of data. A total of 48 information technology companies in Ranchi were interviewed using interview schedules that were prepared and administered in order to gather data for the study. The interview schedules included 19 topics related to difficulties and 21 items connected to prospects of the information technology business in Jharkhand. Secondary data were gathered from a variety of official websites, publications published by the government on information technology, annual plans and working plans created by the department of information technology in Jharkhand, and official documents. In this research, the units of analysis consisted of the heads of different information technology business units in Ranchi. These business units were registered under the STPI as well as other registered IT units. The phenomenon that was connected to the difficulties and opportunities of the information technology and information technology sector in Jharkhand was interpreted and reported using descriptive statistics. The grouping of rotational variables that are linked to the challenges and opportunities facing the information technology sector in Jharkhand was further analysed using factor analysis.

Adebi-Caesar, T. E. (2012). ICT has had an effect, to a certain degree, on almost every aspect of our day-today activities, including but not limited to health, education, sports, and so on. Both at home and at school, children of today are exposed to a wide variety of technological devices as they grow up. The deployment of technology in educational settings has also received a significant amount of support from both educational institutions and government agencies. The majority of Ghanaian senior high schools seem to be teaching ICT literacy rather than a comprehensive integration of the ICT tools into the curriculum in order to improve the teaching and learning process. This is despite the fact that there has been a rise in the number of ICT tools in Ghanaian senior high schools. There were four schools located in the Lower Manya Krobo District of the Eastern Region, and the purpose of the research was to determine whether or not information and communication technology (ICT) tools are really being used to support and increase students' knowledge throughout the teaching and learning process. The research was conducted with the participation of 154 educators in total. A stratum was thought to be comprised of the four (4) schools. When it came time to pick the number of responders from each school, proportional allocation was the method that was used for the calculation. With the assistance of the headmaster and his assistants, the teachers from all of the schools that were used in the research were summoned to the staff common area of their respective schools. A simple random sample method was utilised to administer the questionnaire. SPSS version 17 was used in order to generate the numerous outputs that were subsequently analysed. In addition, some of the graphs were drawn using Microsoft Excel 2007, which was also utilised. One of the most important takeaways from the research was that the majority of educators do not have enough training or understanding about computers, and they have no prior experience in the use of computers. In addition, the lack of suitable information and communication technology (ICT) infrastructure in schools is another important obstacle that is preventing the incorporation of ICT into the teaching and learning process. According to the findings of the survey, the majority of instructors are not making the most of the computers that are available to them, despite the fact that they have access to personal computers. This makes it very evident that there is a pessimistic outlook about the achievement of the educational goal for the 21st century. According to the findings of the survey, almost all of the educational institutions did not possess the necessary quantity of computers for academic purposes, taking into account the total number of pupils. In conclusion, the findings of the survey demonstrated that the majority of respondents believed that the younger generation should be the ones to make use of information and communication technologies (ICTs), and that ICT should be taught as a topic in its own right, rather than being included into all of the other disciplines.

Nchunge et.al. (2013). Due to the fact that globalisation and liberalisation have made intense economic rivalry easier to achieve, there has been a rise in the need for the use of new technologies in order to improve the effectiveness of service delivery. In the realm of public services, information and communications technology (ICT) has a broad range of applications, including in the areas of administration, education, healthcare, and transportation. For the purpose of this research, however, the education sector, and more especially secondary schools in Kiambu county in Kenya, was the focus. The use of information and communication technology in Kenyan high schools has remained low and restricted, despite the fact that it is

efficient, has promise, and plays a seamless role in enhancing productivity and knowledge transfer in regards to the social, economic, and political pillars of development. Using a descriptive research design technique, the study focused on all of the high schools in Thika district, which is located in Kiambu county in Kenya. These schools included both public and private institutions. The findings indicate that there is a positive correlation between the rate of information and communication technology (ICT) adoption and high infrastructure costs, the rate of ICT adoption and inadequate internet connectivity, the rate of ICT adoption and the absence of clear policy guidelines in public and private high schools in the Thika District, which results in low ICT usage and delays the actual integration of technology in schools. Based on the findings of this research, it is suggested and recommended that schools be provided with instructions for the acquisition of fundamental infrastructure and assistance. To address the expenses of information and communication technology (ICT) facilities and connections, the school's ICT infrastructure should be exempt from taxation or given a zero-rated tax rate. This would help to increase the adoption of ICT, as well as improve the quality of services and the dissemination of knowledge via ICT diffusion in high schools and across the whole education sector.

Hsu, S., & Kuan, P. Y. (2013). The incorporation of technology is impacted by a multitude of aspects that are associated with the educator and the atmosphere of the school. A rising number of research have shown that it is helpful to study those elements using multilevel modelling. This is despite the fact that several studies have investigated the factors that impact teachers' usage of information and communication technology (ICT) at the teacher level. It is possible to isolate the effect of instructors from the impact of the school environment via the use of multilevel analysis, which may then give insight into the influence of those components at each level. In this research, multilevel modelling is used to analyse data collected from 3,652 instructors instructing students in grades 1-9 across 289 schools in Taiwan. The findings of this multilevel study reveal that variables at both the school level and the teacher level contribute to the incorporation of information and communication technology (ICT) into the instructional process. When it comes to variables at the teacher level, the beliefs of teachers and the number of hours they had spent training in the preceding year were good predictors of ICT integration competency. ICT integration is influenced by a number of elements at the school level, the most significant of which are training hours and teachers' perceptions of the assistance they get from the school. The degree of assistance provided by the school is not only an important element at the school level, but it is also a powerful predictor at the teacher level. Access to Internet connection, availability of projectors, and the reliability of computers were also identified as key criteria at the school level. As a consequence of these findings, the significance of individual educators and the role that schools play in the incorporation of ICT is increased.

Goktas et.al. (2013). This research was conducted with the intention of identifying the obstacles that Turkish primary school teachers have when attempting to include information and communication technology (ICT), suggesting possible enablers that may help them overcome those obstacles, and comparing the present level of ICT integration (in 2011) with the position of ICT integration in 2005. During the course of Goktas's (2006) doctorate research, a portion of the data that was used for this comparison was collected in the year 2005. In order to study the obstacles and the opportunities, a survey design was used. The data was obtained from a total of 1373 educators working in 52 schools throughout 39 provinces. As a consequence of the findings, it was determined that the most significant obstacles were a "lack of hardware," "lack of appropriate software materials," "limitations of hardware," "lack of in-service training," and "lack of technical support." It was determined that the enablers that received the highest ranking were "allocation of more budget," "allocation of specific units for peer support," "allocation of support offices and personnel for teachers," and "offering higher quality pre-service training for information and communication technology." Other major enablers were "supporting teachers to enable effective use of information and communication technology," "having technology plans," "offering higher quality and more quantity of in-service training," and "designing appropriate course content/instructional programs." Based on the results of an independent t-test, it was found that the majority of the barriers exhibited substantial differences, while the majority of the enablers exhibited moderate or low variations in the impressions that teachers had of their circumstances in 2003 and 2011.

Chakravarty et.al. (2014). The mechanism of women's self-help groups for relieving poverty and empowering women has been operational in a number of different regions of India during the course of the last several decades that have been in existence. The purpose of this mechanism is to encourage women to

participate in activities that generate revenue and, as a result, to enable them to become economically independent. This will be accomplished by providing them with individualised savings and credit facilities that are tailored to their requirements. This will eliminate their dependence on local money lenders in rural areas. In India, self-help organisations are mostly made up of impoverished rural women who make use of the loan facilities that are made available to them via the group. These women use the credit facilities to meet their fundamental requirements and to establish activities that generate money, which further improves their socio-economic position. Based on an empirical study that was conducted across two blocks in the Ranchi District of the state of Jharkhand, the purpose of this paper is to investigate and analyse the potential, role, scope, and limitations of information and communication technology in the context of improving the efficiency of the activities of self-help groups in India.

Chatterjee, B., & Kuddus, K. (2014). In this work, an effort is made to examine the significance of a pronouncement of English that is understandable to those who are not native speakers of the language. More specifically, it focusses on the prevalent pronunciation mistakes that individuals from Jharkhand, India, and India in general make while speaking English. Furthermore, the study draws attention to the significant variables that are responsible for the faults in pronunciation of English that are made by speakers of the language in India, notably in the state of Jharkhand. In this article, elements such as cross-linguistic impact, age, and other non-linguistic characteristics like as personality, attitude, cultural motivation, and exposure to the target language are discussed. The improvement of pronunciation abilities via the use of technology is the primary topic of discussion in this study. The era of globalisation is intimately connected to information and communication technology (ICT) and the English language; hence, ICT can be shown to be crucial to the teaching and learning of the English language in a variety of different ways. For the purpose of developing genuine pronunciation similar to that of native speakers of the target language, several technologically advanced language learning methods, such as CD-ROM multimedia, web-based learning, mobile learning, and language laboratories, have been explored throughout this article. In conclusion, it emphasises the significance of using technology to teach the phonetics and phonology of the second language to those who are learning the second language in order to acquire a pronunciation that is understandable.

Vanderlinde et.al. (2014). This research employs a multilayered framework consisting of many independent school and teacher variables in order to investigate the characteristics that are associated with the use of information and communication technology (ICT) for the purpose of teaching and learning in primary schools located in Flemish (Belgium). The term "institutionalised information and communication technology ye ducators, which receives special emphasis. Within the context of 53 Flemish primary schools, a questionnaire was sent to a representative sample of teachers (N = 433). Both factor analysis and multilevel hierarchical regression analyses have been carried out throughout this process. Based on the findings of the multilevel analysis, it is clear that the phenomena known as "institutionalised ICT use" should not only be seen as a phenomenon that occurs inside the classroom but also within the school itself. According to the null model, variations across schools account for around 14% of the variance in the amount of information and communication technology (ICT) that instructors utilise. "Institutionalised ICT use" was shown to have a positive correlation with the variables "ICT professional development," "ICT competences," "developmental educational beliefs," and "schools' ICT vision and policy," according to the final model.

Jin, S., & Cho, C. M. (2015). In this work, an effort is made to experimentally validate the theoretical premise that elements related to information and communication technology (ICT) impact national economic growth. A research methodology will be used in this study in order to investigate the connection between information and communication technology (ICT) and development by means of statistical data. To represent information and communications technology (ICT) components, they will use IT infrastructure, IT competence, IT investment, and IT trade size as variables. This is because the balancing model of supply and demand makes extensive use of these characteristics. Additionally, this research will make use of a number of socio-economic parameters as control variables. These elements include population size, consumer inflation, national corruption, and education. A panel data analysis was used in order to statistically verify the influence that a nation's Internet of Things (ICT) capabilities has on the growth of that nation. In addition, the purpose of this paper was to identify an intervening variable between information and communication technology (ICT) and national development. This variable could include national corruption, consumer inflation, and national education, all of which have been identified as significant components of national development from both a

political and social point of view. Additionally, the paper aimed to improve the explanatory power of the examination model. It seems from this conclusion that these factors act as mediators between the impacts of ICT capabilities and the economic development of each country that was examined. According to the findings of this research, the statistical importance of the impacts that ICT capability has on economic growth was confirmed.

Blau, I., & Shamir-Inbal, T. (2017). This research investigates the ways in which school administrators and ICT facilitators, who are considered to be leaders in the field of technology integration in educational institutions, evaluate the changes that have taken place in their respective schools. For the purpose of the research, data were gathered from elementary schools in Israel at the conclusion of the third and fourth years of the progressive National Information and Communication Technology program. As part of the study questions, (1) the predictors of the general school ICT culture were investigated, and (2) the changes that have occurred over time in the general school ICT culture and its components were investigated. It was delivered to all of the primary schools in the Northern District, and the principal of each school and the ICT facilitator worked together to fill out the questionnaire that was available online. There were a total of 392 questionnaires that were analysed, with a response rate of 91.2%. Sixty-three percent of the variance in general school information and communication technology culture was explained by the following predictors: the percentage of teachers who use ICT in their lessons on a regular basis; the use of technology to improve pedagogy; teachers' digital competence; the use of digital content; the design of digital content by teachers; pedagogical updates of class websites; school portal updates (a negative predictor); e-communication between teachers and parents; and e-communication between teachers and other school personnel. In terms of the influence of time, the findings demonstrated that substantial changes continue to take place in the general school ICT culture and the majority of its components between the third and fourth years of integrating information and communication technology.

Sarkar et.al. (2017). The rise and convergence of different information and communication technologies (ICT) such as radios, TVs, computers, the Internet, telephones, mobile phones, videos, multimedia, CD-ROMs, software, and hardware present one-of-a-kind possibilities for the promotion of primary and secondary education on a large scale in developing countries. There is a widespread agreement among practitioners and academics that information and communication technology (ICT) can be successfully utilised in a variety of socio-economic and cultural contexts to successfully reach out to a greater number of students, assist in the promotion of learning and the growth of knowledge, and expose students to the technical skills that are required for a wide range of occupations.

Srivastava, K., & Dey, S. (2018). The development of society has been significantly altered as a result of the introduction of digital technology. Due to the paradigm shift in education, it is necessary for contemporary teachers to take on the role of digital networkers in order to foster creativity in their pupils and empower them to be change agents via the utilisation of intelligent technologies. It is possible to develop technology-powered knowledge exchange via the use of smart classrooms and magnetic induction enabled boards in real time. This may help students to retain information for a longer period of time, which is beneficial to the improvement of teaching and learning technique. Due to the availability of more advanced technology in the digital age, there is a pressing need to enhance the performance of all parties involved in the process of information exchange in a flawless manner. The educator of teachers is responsible for ensuring safety, protecting the environment, and managing in a sustainable manner. In this article, they emphasise the concerns and challenges that are associated with the use of digital technology in teaching and learning. These issues and challenges have the potential to serve as a driving force in overcoming hurdles and becoming effective users of technology. It was decided to employ a quantitative research methodology in order to gather data from teacher educators in the state of Jharkhand. The purpose of this study was to analyse the teachers' perceptions on the difficulties that they encountered while using digital technologies in the classroom. In the course of administering the questionnaire to both male and female educators, it was discovered that the following are the most significant issues and challenges associated with the utilisation of digital tools: limited accessibility and network connection; limited technical support; lack of effective training; limited time; and lack of teachers' competency. Based on the findings, it can be concluded that there is a noteworthy disparity between the utilisation of digital technologies by male educators and that of female educators. It is the responsibility of those responsible for incorporating new technologies into the process of teaching and learning to receive the appropriate information and recommendations that are provided by the findings of this study. Having grown

up with technology, the finding implies that digital natives who are now teaching at the Bachelor of Education level are proficient in both fundamental and social communication technologies. Nevertheless, their technological expertise is restricted due to the limited scope of their operations and the lack of appropriate technology-driven activities.

3. Transformative Role of ICT in Education

Information and Communication Technology (ICT) has revolutionized education by enhancing accessibility, engagement, and personalization. Through digital tools and platforms, students and educators can access a wealth of resources beyond traditional textbooks, enabling a more interactive and enriched learning experience. ICT facilitates online learning, breaking geographical barriers and allowing education to reach underserved communities and individuals with disabilities. Technologies such as multimedia presentations, interactive simulations, and educational games make learning more engaging and effective by catering to different learning styles and paces. Additionally, ICT supports personalized learning experiences with adaptive learning systems that adjust content and assessments based on individual student performance, promoting a more tailored educational approach. Moreover, the integration of ICT in education fosters collaboration and communication among students and teachers through platforms like forums, social media, and video conferencing. This not only enhances the learning experience but also prepares students for a digitally connected world. Overall, ICT in education not only transforms traditional teaching methods but also equips learners with essential skills for the future [2-3].

4. Focus on Jharkhand's ICT Integration

- Enhanced Accessibility and Inclusivity: In Jharkhand, ICT integration has significantly improved educational accessibility by providing digital resources and e-learning platforms to remote and underserved areas. This has helped bridge the educational divide, allowing students in rural regions to access quality educational materials and participate in online classes, thus promoting inclusivity and reducing disparities in educational opportunities.
- Skill Development and Teacher Training: ICT initiatives in Jharkhand have focused on enhancing the skills of both students and educators. Training programs for teachers on using digital tools and integrating technology into their teaching methods have been implemented, improving instructional quality and pedagogical techniques. Additionally, ICT-based skill development programs for students prepare them for the job market, equipping them with digital competencies essential for the modern workforce [4-8].

5. Challenges in Jharkhand

Jharkhand's educational development, while advancing, faces considerable challenges due to disparities in technological infrastructure and resource availability. The state's varied levels of progress in ICT integration highlight a mixed landscape that affects its educational landscape. In rural and remote areas, limited access to digital devices, unreliable internet connectivity, and inadequate technical support hinder the effective use of ICT tools in classrooms. This technological divide exacerbates educational inequalities, as students in less developed regions struggle to benefit from digital learning resources available to their urban counterparts. Additionally, there is a shortage of trained educators who can effectively incorporate technology into their teaching methods. Many teachers lack the necessary skills and training to utilize ICT tools, which undermines the potential benefits of digital education. The infrastructure challenges are compounded by inconsistent electricity supply and poor maintenance of existing technology, further impeding the smooth integration of ICT in schools. To address these challenges, targeted investments in infrastructure, increased training for educators, and efforts to improve connectivity and resource distribution are crucial. Bridging these gaps is essential to ensure that the benefits of ICT in education are equitably distributed across Jharkhand, fostering a more inclusive and effective learning environment [9].

6. National ICT Initiatives

India has made significant progress in ICT integration through national initiatives such as the National Mission on Education through ICT (NME-ICT) and the Digital India program. NME-ICT aims to enhance educational delivery by developing digital infrastructure, creating digital content, and providing training for

educators to effectively use ICT tools in teaching. This initiative has facilitated the establishment of online education platforms and digital libraries, enriched the learning experience and expanded access to quality education across diverse regions. Complementing this, the Digital India program focuses on broadening digital connectivity, improving internet infrastructure, and promoting the use of digital technologies in various sectors, including education. By providing high-speed internet access, supporting digital literacy, and fostering the development of e-learning resources, these national initiatives have been pivotal in bridging the digital divide, making ICT resources more accessible to students and educators, and driving overall educational advancement. These efforts collectively contribute to a more inclusive and technologically integrated educational environment, empowering learners and educators across the country [10].

7. Comparative Analysis Framework

A Comparative Analysis Framework involves systematically examining and contrasting multiple entities to identify similarities, differences, and insights. This framework typically includes defining criteria or variables relevant to the entities being compared, such as performance metrics, structural elements, or contextual factors. The process begins with data collection through various methods like surveys, interviews, or secondary data sources. This data is then analysed using qualitative and quantitative techniques to uncover patterns and relationships. With employing this framework, researchers can evaluate the effectiveness, strengths, and weaknesses of each entity in a structured manner, leading to informed conclusions and recommendations. For instance, in comparing HR practices between public and private sector organizations, the framework might assess aspects like recruitment processes, employee benefits, and organizational culture to provide a comprehensive understanding of their respective practices and impacts [11].

8. Insights and Recommendations

Based on a comparative analysis, insights reveal that while both public and private sector organizations exhibit distinct HR practices, their effectiveness varies significantly due to different organizational structures and resource allocations. Public sector organizations often emphasize stability, comprehensive benefits, and adherence to standardized procedures, which can enhance job security and employee satisfaction but may also lead to slower decision-making and less flexibility. In contrast, private sector organizations typically focus on performance-based incentives, innovative recruitment strategies, and rapid adaptability, which can drive higher productivity and employee engagement but may result in greater job volatility and competitive pressures. Recommendations for improving HR practices involve integrating successful strategies from each sector. Public organizations could benefit from adopting more flexible and performance-oriented approaches found in the private sector to enhance efficiency and responsiveness. Conversely, private sector organizations might consider incorporating more robust job security measures and comprehensive benefits packages to address employee turnover and maintain long-term loyalty. Additionally, both sectors should invest in ongoing training and development programs to adapt to evolving industry demands and ensure that their HR practices remain effective and aligned with organizational goals [12].

9. Conclusion

This study provides a critical comparative analysis of ICT integration in schools in Jharkhand relative to national averages. The findings reveal that while there have been efforts to enhance ICT infrastructure and resources in Jharkhand, significant challenges remain. The state's progress in integrating technology into education is hindered by disparities in resource availability and varying levels of technological advancement. National initiatives have fostered improvements across India, yet the uneven pace of implementation highlights the need for targeted efforts in states like Jharkhand. With analysing key aspects such as infrastructure, teacher training, and student access, this study underscores the importance of addressing these gaps to achieve effective ICT integration. The insights gained will inform actionable recommendations for stakeholders, aiming to enhance the educational technology landscape and ultimately improve learning outcomes in Jharkhand.

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