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TRANSFORMATIONS IN EDUCATION: A COMPREHENSIVE REVIEW OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ADOPTION BY INDIAN SECONDARY SCHOOL TEACHERS (2000-2024)

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ABSTRACT
Secondary education in India is in a new shape due to the emergence of Information and Communication Technology (ICT). The modern teaching-learning process has been completely changed after the COVID-19 pandemic. This review explores multiple research papers based on ICT or digital teaching patterns in secondary education. The researcher has gone through more than 200 research papers or review papers. Out of 200 research papers, more than 150 research papers are from Indian writers and the others are from foreign writers. After screening all the papers, the researcher selected 46 papers for analysis. Researcher try to understand, what previous writers have found in their research work. After examining all the research papers, the researcher found that the digital divide exists in the Indian secondary school system. Moreover, the paper explores the barriers that secondary school teachers in India face when integrating ICT into their teaching. The paper also shows a gap between urban and rural infrastructure in terms of ICT. Urban infrastructure is more advanced compared to rural. It also examines how ICT integration in Indian secondary education has been shaped and needs to further support and innovation in order to fully realize the potential of ICT. Nowadays, secondary education has gradually become technology-oriented. Teaching at the secondary level, teachers must be upgraded with technology. Technology has become part and parcel of the modern education system.

Keywords: *ICT; Secondary School Teachers; Secondary Education*

1. INTRODUCTION

In the current context, Information and Communication Technology, or ICT, is crucial to the successful advancement of education. Secondary education is an important phase since it has the greatest ability to shape the next generation of knowledge and manpower. Over the last many years, there has been a big concern for policymakers to reform education with technological development. That is why, in 2012, the Government of India introduced a new ICT policy. To make secondary education more technology-oriented, the government started many initiatives through ICT. Initiatives like Diksha, PM e-vidya, Digital India initiative and Smart classrooms, etc. “ICTs do more than only increase intelligence; they also reveal new facets of the human mind, create a structured framework for a fresh, international culture, and present a plethora of fascinating opportunities for how they might be used to raise educational standards” [36]. ICTs are in the mainstream education system, especially in secondary education, and play a vital role in improving the quality of education. To recognize knowledge in the modern information society, there is a need for the application of ICT. ICTs enable students and the entire community to access and participate in ongoing learning, essential for active involvement in society’s development across all social groups, particularly among students. “Technical schools or technological education programs should ideally be situated near relevant industries and work closely with them to ensure effective collaboration” Secondary Education Commission:1952-1953,[47].

“ICT Policy in School Education is focused on equipping young people to contribute innovatively to the formation, maintenance, and expansion of a knowledge-based society, ultimately leading to the overall socio-economic progress of the country and international competitiveness.” (National Policy on ICT:2012) [19]and ICT integration and literacy have been greatly aided by the government of India’s flagship initiative, the Digital India campaign (2015), which aims to make the nation a knowledge economy and digitally empowered society. “Enabling teachers and students to access a vast array of digital materials and digital resources easily incorporated into classroom procedures will

be the main goal. To expand the number of access points in each school and allow an increasing number of students to utilize the facility regularly, efforts will be made to implement economical and energy-efficient ICT solutions. To improve collaborative teaching and learning, ICT should also be used to network educators and educational institutions within a particular geographic area." Twelfth Five-Year Plan:2012-2017, [70].

India is at the forefront of Information and Communication Technology worldwide. Technological developments in the fields of artificial intelligence, machine learning, blockchains, smart boards, handheld computers, adaptive computer testing, and educational software and hardware will influence students' learning processes as well as the subject matter covered in the classroom. Therefore, thorough research in both technology and education fields will be necessary for these areas and beyond. The National Educational Technology Forum (NETF) will be established as an independent organization to facilitate the sharing of ideas about how technology can be used to improve learning, evaluation, organization, and management. (National Educational Policy:2020,[49]). For the next ten years, vocational education will be gradually incorporated into the curricula offered by all secondary schools. The secondary school will work in tandem with local industry, polytechnics, ITIs, etc. to achieve this. NEP:2020[49]. The aspiring teachers should stay updated on new technologies in order to incorporate them into their careers when needed [2]. The use of technology is increasingly widespread in today's fast-moving society. It has become a lifestyle [60]. Effective ICT tool for enhancing engagement and creating joyful learning environments [46]. In regards to research on individual-level technology adoption, there are many theories to consider [26]. The education process requires modification for increased practicality through the integration of technology [30]. ICT can enhance education accessibility and enhance its quality and relevance [58]. Education delivery models have undergone rapid and transformational changes [52]. The role of technology in our classrooms is to support the new teaching paradigm [55]. ICT is seen as a transformative force in the traditional education system [65]. The scientific importance of ICT in secondary schools lies in its enhancement of knowledge about the benefits and obstacles of integrating ICT into educational tasks [21]. The use of ICT in education is a growing issue in developed and developing nations [8]. Teachers need to feel comfortable with computers in order to integrate IT into their teaching [63]. Using ICT to enhance memory processing in order to promote successful learning [22]. ICT tools were essential for teachers to effectively transition to online teaching during the COVID-19 crisis [37]. The integration of ICT in education transforms the exact framework of the educational process, as well as the duties of its participants (students and teachers) [39]. ICT helps knowledge become more available, and students can grasp learning concepts better when using ICT for hands-on applications [23]. User acceptance of IT was examined by evaluating user attitudes, usage, and satisfaction as primary factors indicating user acceptance [4]. ICT is currently infiltrating the education system as a means for successful teaching and learning [15]. ICT has become a game-changer in education, transforming the methods of teaching and learning for both teachers and students [43]. For technology to have a positive effect on academic success, there must be widespread, enduring efforts that provide adequate access to technology for both students and educators [16].

2. RESEARCH METHODOLOGY:

Review of Related Literature:

Inclusion and Exclusion Procedure

Inclusion: Peer-reviewed journal articles, conference papers, policy documents, government reports, and credible online sources from 2000 to 2024.

Exclusion: Non-peer-reviewed articles, opinion pieces, and sources lacking rigorous methodology or empirical data.

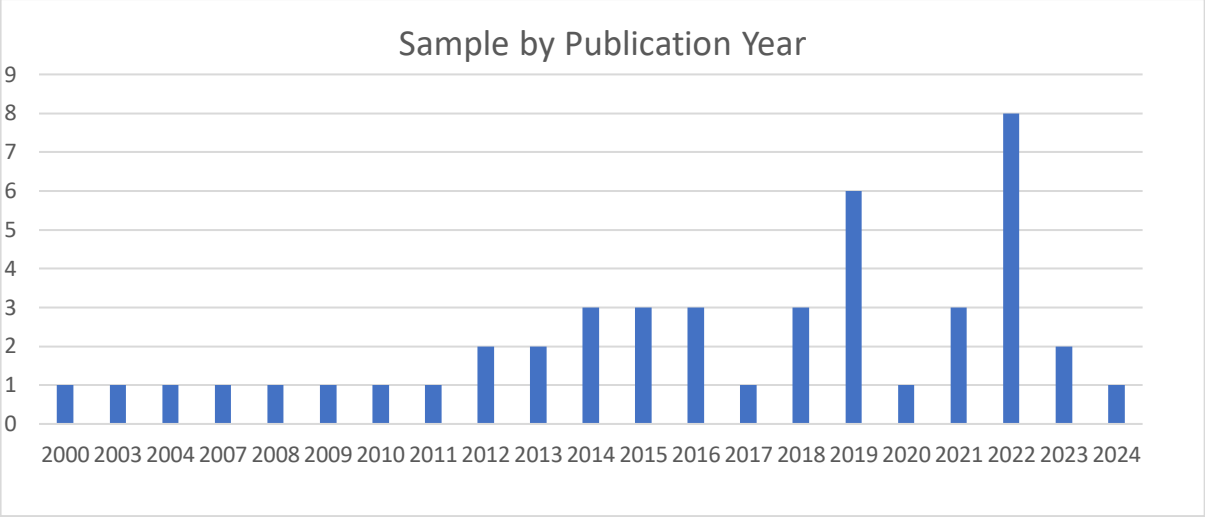

Figure. 1 Publication by year (n=46)

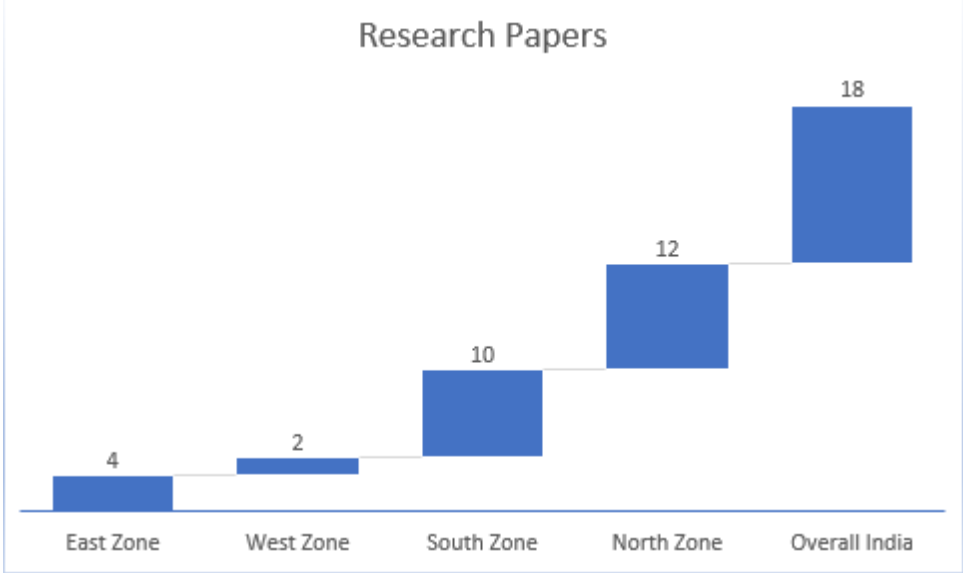

Figure. 2 Zone-wise Research papers distribution

3. MAJOR FINDINGS OF THE STUDY:

Based on the comprehensive analysis of research papers from 2000 to 2024. Researcher has found many impacts of ICT on Secondary school education, here are some major findings:

Mitra, S. (2000). Conducted a study on Minimally Invasive Education for mass computer literacy. The study shows that children learned basic computing skills with little guidance through incidental learning [44].

Bajwa, G. S. (2003). Investigated a study on ICT policies in India in the era of liberalization: its impact and consequences. This paper examines how the Indian government has utilized ICT policies to promote development, with a specific emphasis on fields such as education, health, energy, and transportation. Despite boosting economic growth, ICT still faces many challenges such as the digital divide and uneven distribution of benefits. The paper proposes that an increased focus on social development is necessary in order to get the maximum availability of ICT [10].

Sood, A. D., & Chandrasekharan, U. (2004). Conducted a study on Digital Libraries in India: A Baseline Study. The study explores a digital library is an electronically created database where real or virtual resources are available for access, that can offer multimedia and multilingual data, enabling to access online organized content. The study also says that it will help to reduce storage space, lower

maintenance costs, and broaden access to information. The study also measures many technical problems and infrastructural challenges in creating digital libraries in India [67].

Arora, P. (2007). A research was conducted on The ICT Laboratory: An Analysis of Computers in Public High Schools in Rural India. The paper examines the impact of introducing computers in High Schools in rural India. The paper mentioned several barriers to successful implementation, including inadequate infrastructure, lack of continuous technical support, and teachers' limited proficiency with technology [7].

Digantar (2008). A workshop was conducted by Digantar Consultation on National Policy on ICTs in School Education. The study reveals that the public education system needs to be reformed with technological upgradation and there must be a more extensive focus on the school reform processes. Teacher training program needs more technologically oriented. ICTs can make an important contribution in curriculum framing, development, policy drafting, and teacher development program. Participants stressed that research in psychology and age of the learner is needed before any large-scale deployments of ICTs. Everyone suggested that a pilot project can be started. Every expert in the workshop stressed that there is a greater potential of ICTs at the Secondary level [20].

Ananthasayanam, R., Rajathi, T., & Tamilselvi, B. (2009). Investigated a study on Virtual Classroom: A Boon to Learners. This paper discussed how virtual classrooms make use of technology to provide flexibility to students and teachers, and also provide interactive online learning environments. Using technology makes education more accessible to students to learn from anywhere and at any time. Virtual classrooms provide many tools for communication, collaboration, and personalized learning. It offers a valuable alternative to traditional classrooms [6].

Gopal, G. V., Viswanathappa, G., Kumar, P. M., K, B., & Shariff, N. (2010). Conducted a study on Development of instructional modules for ICT enabled curriculum transaction for various subjects at secondary level for teacher empowerment and their quality assessment. ICT-based teaching modules help secondary school teachers to improve the classroom teaching-learning process. To make lessons more interactive and effective teachers found these modules are very much helpful. To enhance the quality of teaching and student involvement in subjects such as Mathematics and Science modules based on Information and Communication Technology were positively received [24].

R, Vijaykumar. (2011). A research was conducted on Trends and challenges of integrating ICT in Indian education: A paradigm shift in 21 century. The study highlights its potential to transform learning and enhance teachers' skills. It discusses initiatives like the ICT in Schools Scheme but also discusses significant challenges such as accessibility, infrastructure, and capacity-building for effective implementation. To fully realize the benefits of ICT in education need to overcome these challenges [56].

Hooda, P. K., & Lenka, S. K. (2012). Conducted a study on Importance of ICT in improving the quality standard of education in India. The study investigates how ICT can be used to enhance the delivery and quality of the education system, especially in reaching India's large population. It can help overcome cost barriers, lack of teachers, improve the quality of education, time and distance constraints. Computers, laptops, mobile phones, and multimedia ICT tools can be used at many educational phases to improve productivity and engagement in the teaching-learning process. ICT is important in non-formal education for improved management of student information, communication, content distribution, and administration. By using, ICT, projects such as digital libraries, educational resources, and online information systems can be created [28].

Paul, P. K., & Mondal, N. K. (2012). Investigated a study on Integration of ICT in school education: An analytical study in Burdwan District in West Bengal, India. The study investigates how Information and Communication Technology (ICT) improves the quality of secondary school education in the Burdwan district of West Bengal, India. It found that ICT enhances teaching and learning without gender disparities, though challenges in implementation remain. Overall, ICT positively impacts educational quality when properly managed [53].

Nagamani, D., & Muthuswamy, P. (2013). A research was conducted on Teacher's Professional Use of Information and Communication Technology in Secondary Schools in Tamil Nadu, India. The

study analyses how secondary school teachers in Tamil Nadu, India utilize ICT in their professional work. It implies that teachers have decent computer skills, however, there are notable variations in computer usage based on gender, age, and school location. The study shows that teachers between 22 and 30 years old utilize computers and the internet more often than their older counterparts, with urban and semi-urban educators using them more than those in rural areas. The research findings indicate that teachers mainly utilize computers for administrative tasks, with limited integration of ICT in teaching Physical Education, Yoga, and drawing. The paper suggests comprehensive training for teachers to improve their computer knowledge and skills, particularly in rural regions [48].

Bhalla, J. (2013). Investigated a study on Computer use by school teachers in teaching-learning process. The study examines how school teachers in India use computer technology, based on Computer-Aided Learning (CAL), Computer-Managed Instruction (CMI), and Computer-Assisted Instruction (CAI). Despite frequent use for lesson plan preparation and update subject knowledge and skills, computers are less integrated into interactive classroom activities. The study highlights gaps in the effective use of technology in education, calling for more research-oriented techniques and targeted efforts by policymakers to improve its impact on the teaching-learning process [12].

Lal, C. (2014). Conducted a study on Attitudinal Study of User and Non-User Teachers towards ICT in Relation to Their School Teaching Subjects. The majority of secondary school teachers, according to the study, have a positive attitude toward ICT in relation to the subjects they teach in the classroom. ICT user teachers, particularly female teachers, demonstrated a more positive attitude compared to non-user teachers. The research suggests that computer experience and training play a crucial role in shaping teachers' attitudes towards the use of ICT in teaching and learning [40].

Thakur, G. K. (2014). Investigated a study on ICT and Digital Divide in Indian School System. The paper examines ICT and the digital divide in the Indian school system. It reveals that there are several barriers to digital opportunities in Indian government schools. These include lack of ICT infrastructure, shortage of power supply and no proper internet connectivity, less coordinated government initiatives. There is a gap between government and private schools. Private schools generally have better-maintained infrastructure and facilities compared to government schools, leading to a widening digital divide between the two. The paper also emphasizes the costs of bridging the digital divide. It calls for developing collective models involving researchers, social scientists, technologists, etc. to formulate innovative and cost-effective solutions to provide ICT access to all students [68].

Thakur, N. (2014). Conducted a study on A Study on Awareness of Trained Teachers in relation to Information and Communication Technology. The investigator tries to explore the importance of addressing the gap in ICT knowledge and skills, particularly in rural areas of West Bengal, to ensure that all teachers are equipped with the required skills to leverage technology in education system and teaching-learning process effectively [69].

Prasad, Ch. V. V. S. N., Lalitha, P., & Srikar, P. V. N. (2015). A research was conducted on Barriers to the Use of Information and Communication Technology (ICT) in Secondary Schools: Teacher's Perspective. The paper investigates the hurdles that secondary school teachers in India face when integrating ICT into their teaching. Despite the acknowledged benefits of ICT in education, student motivation, and skill development, teachers face significant challenges. The result found critical barriers such as lack of funding, inadequate ICT infrastructure, and insufficient connectivity. The study highlights the importance of addressing these barriers to effectively integrate ICT into secondary education. It stressed the need for professional development programs, improved technical and financial support, and better government policies to nurture favourable environment for ICT adoption [54].

Byker, E.J. (2015). Investigated a study on The One Laptop School: Equipping Rural Elementary Schools in South India Through Public Private Partnerships. The paper examines a program in rural South India where a laptop was introduced to a school with limited resources. Despite challenges like no electricity, the laptop helped students learn computer skills and English. The study emphasizes the importance of considering local social dynamics when implementing technology in education [13].

Karunanidhi, S., & Raja, P. V. (2015). Conducted a study on A study on the ICT interest of the teachers working in the Higher Secondary schools. This research paper is based on interest in using technology (ICT) among Higher secondary school teachers in Tamil Nadu. The research found that most of them showed average interest. It also showed that urban teachers had more ICT interest compared to rural teachers, but there was no difference between male and female teachers. The study highlights that integrating ICT in education needs better infrastructure and teacher development [33].

Kumari, S. V., & D'Souza, F. (2016). Investigated a study on Secondary school teachers' digital literacy and use of ICT in teaching and learning. The study evaluates the level of digital literacy and ICT utilization among secondary school teachers in Mangaluru Taluk. It discovers that mean levels are consistent across urban and rural areas, and there is a direct link between digital skills and the incorporation of ICT. It indicates the necessity of ongoing professional development in order to enhance the utilization of ICT in education [72].

Chandini. (2016). Conducted a study on Attitude of secondary school teachers towards the use of computers in education. The paper examines the attitudes of 50 teachers, divided into two age groups. One group is below 40 years and other group is above 40 years. The study utilized a modified version of Albirini's (2006) 5-point Likert scale to measure attitudes and found significant differences based on age. Teachers those who below 40 years old shows a more positive attitude towards computer use in education compared to those who above 40 years old. The research suggests improving teachers' attitudes toward computer use targeted computer literacy training, especially for older teachers. Apart from that, infrastructure development, such as need well-equipped computer labs and smart classrooms etc. Government policies related to ICT integration in school must have technology-oriented [14].

Pall, A. S., & Batra, R. (2016). Investigated a study on Adoption of ICT in Instructional Setup of Indian School Education Sector. The paper examines the limited adoption of ICT in Indian school education despite significant amount of IT professionals and innovative delivery systems. The study highlights the potential benefit of ICT in improving students' knowledge and skills, teacher teaching delivery system, and overall educational quality. The research also identifies major barriers such as lack of teaching resources, lack of ICT equipment in classrooms, and teacher resistance. It also suggests that supportive policies and development of infrastructure to transform educational practices and increase student engagement [51].

Basargekar, P., & Singhavi, C. (2017). A research was conducted on Factors Affecting Teachers' Perceived Proficiency in Using ICT in the Classroom. The paper explores factors which influence teachers' perceived proficiency in using ICT in Mumbai high schools. The researcher has found that both non-manipulative (Example: age, gender, teaching experience) and manipulative factors (Example: type of school board, language of instruction, training programs) significantly impact proficiency levels. Younger, female, and English-teaching teachers, along with those from private schools, reportedly better ICT proficiency [11].

Kundu, A. (2018). Conducted a study on Prospects of ICT Integration in School Education: An Analytical Study of the Government Schools in West Bengal, India. The paper examines ICT integration in West Bengal's government secondary schools. The study found that it improves educational quality but encounter challenges like lack of infrastructure and resistance to technology. It recommends that effective policy framework and addresses both external (lack of access to technology) and internal (teachers' attitudes and skills) barriers to effective ICT adoption [38].

Payal., & Kanvaria, V. K. (2018). Investigated a study on Learning with ICT: Use & Barriers from Teachers' Perceptions. The research examines the advantages and obstacles of incorporating ICT in government schools in Delhi. The study also identifies that despite the recognized benefit of ICT in improving the quality of education, teachers continue to encounter barriers like limited access, inadequate training, and insufficient technical support. It recommends infrastructure development, and improves teacher training programs, and ensures consistent technical support so that educational standards and student engagement can be realized fully [50].

Amin, S.N., & Jan, H. (2018). A research was conducted on Smart Classroom a New Paradigm for Teaching and Learning: Its Implementation and Setback with Special Reference to J&K. The paper discusses the full benefits of Smart Classrooms in improving the education system through technology but highlights challenges in their implementation, especially in Jammu and Kashmir, due to sub-standard infrastructure and cost issues [5].

Islahi, F., & N. (2019). Conducted a study on Exploring Teacher Attitude toward Information Technology with a Gender Perspective. The article investigates how high school teachers feel about using technology in the classroom. The research indicates that there are not any notable disparities between genders. The researcher found that male and female teachers show the same level of willingness to incorporate technology into their teaching and learning methods [29].

Kaur, P., & Arya, S. (2019). Investigated a study on Attitude towards Information and Communication Technology among Rural and Urban Primary and Secondary School Teachers of Punjab. The paper examines the attitude of primary and secondary school teachers in Punjab towards ICT. The study focuses on rural and urban differences. Rural school teachers and secondary school teachers have a more positive attitude towards ICT. The study stresses the importance for targeted training and support across different teacher groups to improve ICT adoption in education [35].

Kaur, M. (2019). A research was conducted on Role of Teachers' Attitude and Beliefs Regarding Use of ICT in Indian Classrooms. The article demonstrates that secondary school teachers in India, particularly those in North India, are open to using technology in their teaching methods. However, they have issues including inadequate infrastructure, inadequate training, and limited resources. They are less able to employ technology in their classrooms as a result of these difficulties. The research indicates that school teachers should offer better training programs and greater technical assistance. In order to effectively utilize technology [34].

Singhavi, C., & Basargekar, P. (2019). Conducted a study on Barriers Perceived by Teachers for use of Information and Communication Technology (ICT) in the Classroom in Maharashtra, India. The paper reveals the barriers preventing school teachers in Maharashtra, India, from adopting ICT in their teaching-learning process. The study highlights issues like lack of resources, training, and technical support. It addresses these challenges so that to increase teachers' willingness to use technology. The study also suggests policymakers on supporting more effective ICT integration in education [62].

Debbarma, D., & Das, J. (2019). Investigated a study on Attitude of Teachers towards using ICT in Schools: A Study in Tripura. The study found that the majority of teachers in Tripura's Dhalai district have a positive attitude towards using ICT in schools. Though some of them see it in different ways. There were no significant differences in attitudes between rural and urban teachers or between genders. It emphasizes better resources and needs more training for teachers to use ICT in education [18].

Mahalakshmi, R. K., & Eswaran, J. K. (2019). A research was conducted on Digital India Implications in Education Sector. The paper discusses the transformative impact of the Digital India initiative on the education sector. The paper also highlights the benefits of digital technologies in improving teaching-learning and accessibility. It has been addressing the challenges, particularly in rural areas, such as less infrastructure and less digital competency. Despite these challenges, the paper mentioned the potential benefit of digital education to improve the quality of education in India [42].

Goswami, S. (2020). Conducted a study on Secondary school teachers' attitude towards information and communication technology (ICT) in Meerut City: A comparative study. The study finds generally favourable opinions with no significant differences based on gender, subject stream, and school location. It emphasizes the critical role of ICT in education and needs strategic support in its classroom integration [25].

Sehjal, P., Grewal, K., & Kumar, N. (2021). Investigated a study on Teacher effectiveness of secondary school teachers in relation to their attitude towards information technology. The article examines how secondary school teachers' effectiveness is related to their attitudes toward

information technology (IT). The research indicates that there is not a notable relationship between the pair. No notable variances were discovered in the efficiency or IT beliefs of male and female teachers. The study emphasizes the need for teachers to be equipped with IT skills to adapt to modern educational demands [61].

Som, S. (2021). A research was conducted on ICT In Education: Opportunities and Challenges. The paper discusses how technology can improve education in India through programs like MOOC, SWAYAM, and the National Digital Library. The study highlights the benefits of making learning more accessible but also points out challenges like low digital skills and lack of resources. The paper suggests focusing on better infrastructure and support to make the most of technology in education [66].

Hassan, M. M., & Mirza, T. (2021). Conducted a study on The Digital Literacy in Teachers of the Schools of Rajouri (J&K)-India: Teachers Perspective. The paper explores how teachers in Rajouri, Jammu & Kashmir, struggle with using digital tools in school due to a lack of digital skills. The study highlights that having technology is not enough. Teachers need proper training to use it effectively. The paper suggests improving teachers' digital literacy to make learning more engaging and effective [27].

Kapur, A. (2022). Investigated a study on ICT as a Tool for Capacity Building of Teachers. The paper discusses how technology can help improve teacher' skills and teaching methods in India. The study highlights the benefits of using ICT in classrooms and the importance of training and resources for effective implementation. The study also suggests ongoing evaluation to ensure these tech tools meet educational goals [32].

Das, A., & Chetia, J. (2022). A research was conducted on "A Study on Utilization of ICT Facility in School Administration in Secondary Schools of Assam with Special Reference to Kamrup District". The paper examines how secondary schools in Assam, particularly in Kamrup district, use technology for administrative tasks. The study finds that many schools have basic tech tools, their use varies, and some schools need better resources and training. The study also highlights the importance of improving ICT infrastructure to make school administration more efficient [17].

Bajpai, N., & Sharma, A. (2022). Conducted a study on How can Smartphones Bring About a Developmental Breakthrough in School Education? The paper discusses how smartphones can significantly improve education system in rural India by providing affordable access to digital learning resources. The study highlights the potential of smartphones to support teachers and students, especially in marginalized communities. The paper also suggests that smartphones could help bridge the digital divide and make education more inclusive [9].

Joshi, S. (2022). Investigated a study on "ICT In Education". The study highlights the importance of ICT in education but points out challenges like limited teacher training and resources. It also emphasizes the need for ongoing professional development to improve teachers' ICT skills. The ultimate goal is to enhance teaching by effectively integrating technology into the classroom [31].

Adhikari, A., & Biswas, S. (2022). A research was conducted on "Advantages of ICT for higher secondary school education". The study explores how ICT became essential for continuing education during the COVID-19 lockdown, particularly through online learning. It emphasizes the benefits of ICT in enhancing learning and communication. It also notes challenges in accessing technology, especially in rural areas of India. Proper management and government support are needed to enlarge the benefits of ICT in education [1].

Shamim, M., Hussain, M. I., Gorde, S. U., Malik, R., Kumar, P. R., & Nagpal, P. (2022). Conducted a study on "Smart Classes Teaching Using Advanced Techniques for Quality Education". The paper explains how smart classrooms, using technology like projectors and smartboards, make learning more interactive and effective. These classrooms help students better understand and retain information through visual aids and global resources. Embracing this technology is key to improving education and preparing students for a digital future [64].

Mousavi, M. (2022). Investigated a study on "Feasibility and Application of ICT in secondary schools". The study investigates the feasibility and application of ICT in secondary schools. The

researcher has taken a sample size of 48 ICT-enabled schools from the Hyderabad and Ranga Reddy district of Andhra Pradesh, India. Data was collected using opinionnaires for principals, teachers, and students, and also used observational schedule. Principals generally had an average opinion about ICT programs. Private unaided school principals express a better opinion than private aided and government school principals about ICT. Urban school teachers express a better opinion than rural school teachers about ICT. Students, especially boys, had a better opinion about ICT programs compared to girls. Students from private unaided schools had a better opinion than those from private aided and government schools [45].

Vemula, M., Bhukya, D. (2022). A research was conducted on "Behaviour Of Secondary School Teachers Towards The Usage Of Information And Communication Technology". The study examines how secondary school teachers in Warangal, Telangana, feel about using technology in their teaching. It finds that attitudes vary based on factors like age, gender, and subject taught. The study explores that younger and science teachers are very positive about technology. It suggests that more training is needed to help all teachers effectively use technology in the classroom [71].

Mallikarjun. (2023). Conducted a study on "Digital Transformation Trends in Education System". The paper discusses how digital tools are transforming education in India, making learning more personalized and accessible. The study highlights the benefits of smart classrooms and online learning but it addresses challenges like security and data management. The emphasis is on careful planning and effective integration of technology to enhance education. Overall, digital transformation offers great potential for improving education but requires thoughtful implementation [41].

Reang, J.J., & Mohalik, R. (2023). Investigated a study on "ICT competency of secondary school teachers". The paper examines the ICT skills of secondary school teachers in Tripura (Dhalai District), India. The study finds that many have low competency in using digital tools for teaching. It emphasizes the need for more training to help teachers improve these skills, which are essential for modern education. The study also found no significant differences in ICT competency based on gender, subject background, or school location [59].

Raja, P., Mahalakshmi, S.D. (2024). Conducted a study on "Awareness Towards Information and Communication Technology (ICT) Among Higher Secondary School Teachers". The paper explores how school teachers in Tamil Nadu use ICT, finding that urban teachers are more aware of digital tools compared to those in rural areas. It recommends enhancing ICT infrastructure and providing more training for teachers. The study highlights the importance of closing the digital gap between urban and rural schools [57].

4. PHASE-WISE ANALYSIS OF DATA AND INTERPRETATION

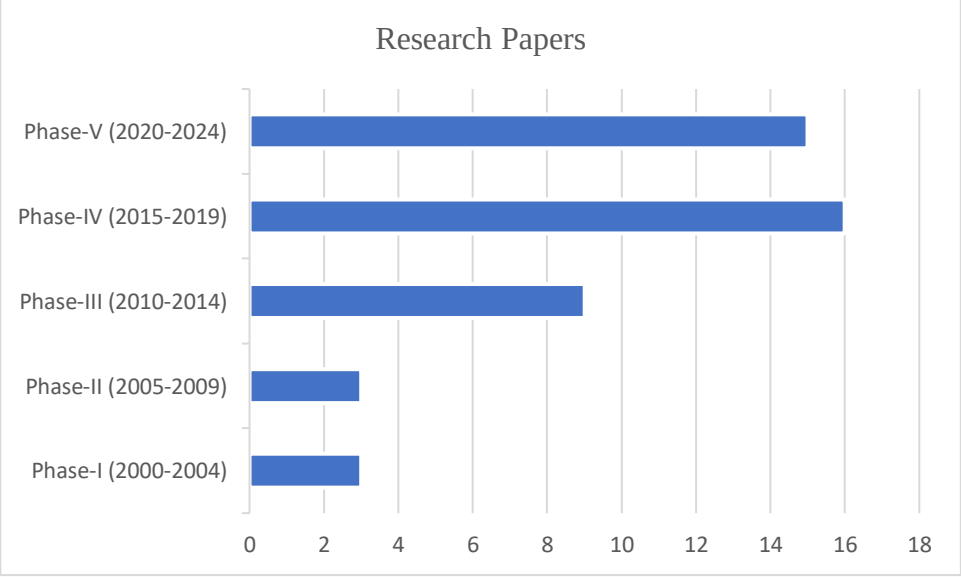

Figure. 3 Phase-wise Research paper distribution

Phase-I (2000-2004)

First of all, the researcher has grouped all the extracted information. Then all the information are shown in tabular form and found that between **2000 to 2004**, Information and Communication Technology (ICT) started to gain momentum in secondary school education in India. Research papers published between 2000-2004 regarding ICT in secondary school education in India typically explore the emerging role of technology in education, the challenges and opportunities associated with ICT integration. These research papers played a crucial role in documenting the early stages of ICT integration in Indian secondary education, providing insights and recommendations that informed future policies and practices.

Phase-II (2005-2009)

ICT adoption between 2005 to 2009 in secondary school education in India advanced rapidly. Research papers published between 2005 to 2009 on ICT in secondary school education in India typically built upon the earlier work from 2000-2004, exploring more mature implementations of ICT, evaluating government initiatives, and addressing ongoing challenges. Many papers provided recommendations for policymakers, suggesting ways to enhance ICT infrastructure, improving teacher training, develop relevant digital content, and ensure equal opportunity and access to technology across all regions. Researcher have found many common themes in research papers such as the evaluation of government initiatives, teacher training, and capacity building, rural-urban divide. These research papers contributed to the growing body of knowledge on ICT in Indian secondary education.

Phase-III (2010-2014)

Researcher analyzed how these advancements improved access to information, facilitated new teaching methodologies, and enhanced student engagement during that time. They also revealed the role of technology in decreasing educational gaps between urban and rural areas. Researchers examined the adoption of mobile learning, e-learning platforms, and digital content creation tools in secondary schools. Researcher also explore the potential of these technologies to transform traditional teaching methods and techniques that enhance the learning experience. Researcher also addressed the distribution of uneven access of technology across different parts of India, often referred to as the "Digital Divide".

Phase-IV (2015-2019)

Many studies showed that technological developments between 2015 to 2019 in India's Secondary school education included the widespread adoption of e-learning platforms and the introduction of mobile learning through educational apps. Digital classrooms are equipped with many technological tools like smartboards and multimedia resources. Collaborations between schools and private tech companies also played a crucial role in driving ICT adoption. Companies like Educomp and BYJU'S provided digital content, training, and resources to schools. During this period, the research community found that the rise of multiple e-learning platforms generated a bulk amount of digital content in the Indian curriculum.

Phase-V (2020-2024)

During the last phase of analysis, researcher found that between 2020 to 2024, research on ICT in secondary school education in India suddenly changed due to the COVID-19 pandemic. This pandemic changes the mindset of the whole community and accelerates the people of the entire nation to bound adoption of online learning platforms and tools. Research focused on the rapid transition to virtual classrooms, the effectiveness of online teaching, and the challenges faced by students and teachers in adopting digital modes of education. After the post-pandemic research community found that, there was a shift towards blended learning, combining online and offline methods.

5. CONCLUSION:

Researcher analyzed all the research papers, taken from different locations of Indian geographical areas such as East India, West India, South India, North India, and the middle part of India, written by different authors. Researcher examine content such as existing literature, policy documents, workshop papers, conference papers, and other authentic documents based on ICT secondary school education in India. After analyzing all the relevant documents, this review paper found that, despite the significant progress in ICT in Indian secondary education, the journey has not been without challenges. Indian secondary school teachers have faced numerous hurdles, including insufficient training, limited access to technological resources, and many other problems. Apart from this, there are various socio-economic lands of India that have led to differences in the implementation and effectiveness of ICT in education, with rural and underprivileged areas often lagging behind urban areas.

This paper also highlights the evaluation of ICT adoption in Indian secondary education, the challenges encountered by teachers, and the impact of technological advancements on teaching and learning outcomes. This paper also emphasizes how ICT integration in Indian secondary education has been shaped and needs to further support and innovate in order to fully realize the potential of ICT. "Policy-makers need to allocate more time for teachers to try out new ICT-based approaches" [3].

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