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# CYBER SECURITY EQUITY: ADDRESSING THE DIGITAL DIVIDE AND SAFE INTERNET USE IN UNDER-RESOURCED SCHOOLS

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## ABSTRACT

In an increasingly digital world, cyber security equity has emerged as a critical concern, particularly for under-resourced schools in rural and marginalized regions. This study, titled *"Cyber Security Equity: Addressing the Digital Divide and Safe Internet Use in Under-Resourced Schools,"* investigates how digital disparities intersect with cyber security awareness and practices in government schools with limited resources. Relying on secondary data from national education reports, policy documents, NGO assessments, and cyber security literacy studies, the research explores the infrastructural, socio-economic, and pedagogical challenges that contribute to digital exclusion and online vulnerability among students and educators.

The study identifies significant gaps in access to secure digital tools, the integration of cyber safety in curricula, and teacher preparedness in handling digital platforms. Findings suggest that while government schemes like Digital India and PM eVidya aim to universalize digital education, their impact remains uneven across regions. Furthermore, the lack of cyber security education and awareness increases the risks of data breaches, cyberbullying, and online exploitation among school children, many of whom are first-generation digital users.

By analyzing these challenges through a conceptual and theoretical lens, the study advocates for a multi-layered intervention strategy involving digital infrastructure development, curriculum reform, localized training programs, and inclusive policy frameworks. The research highlights that ensuring cyber security equity is not merely a technological goal but a foundational requirement for equitable, safe, and future-ready education. The study concludes with actionable recommendations to bridge the digital divide and promote safe internet use in India's most vulnerable school communities.

**KEYWORDS:** cyber security, digital divide, under-resourced schools, internet safety, cyber hygiene, educational equity.

## I. INTRODUCTION

In the 21st century, the integration of digital technology into education has become not only a catalyst for innovation but also a necessity for equitable learning. From virtual classrooms and digital assessments to online libraries and educational platforms, technology has significantly redefined pedagogical practices across the globe. However, with this transformation comes an equally critical responsibility—ensuring the safety, security, and digital well-being of students and educators alike. Cyber security in schools, particularly those in under-resourced and marginalized settings, is an emerging concern that deserves urgent attention. While privileged schools in urban centers may be equipped with advanced digital infrastructure, IT support, and cyber security policies, schools in rural or economically disadvantaged regions are often left behind in this digital evolution (OECD, 2021). This disparity has created a ―cyber security equity gap, where under-resourced schools not only struggle to bridge the digital divide but also face significant challenges in maintaining safe internet practices for their learners and staff.

The digital divide refers to the gap between those who have adequate access to modern information and communication technologies and those who do not. This gap is particularly stark in countries like India, where the rural-urban divide, infrastructural limitations, and socioeconomic inequalities continue to hinder equitable access to quality digital education (Bhattacharya, 2020). The onset of the COVID-19 pandemic has further intensified this divide, pushing education systems to rapidly adopt online learning without adequate preparedness, especially in schools with limited resources. According to UNESCO (2020), over 1.5 billion learners were affected globally by school closures during the pandemic, many of whom lacked the devices, connectivity, or digital literacy to participate effectively in remote education. In such contexts, the focus has largely been on ensuring access—but little attention has been paid to how safely that access is being utilized, especially by vulnerable children and untrained educators.

Cyber security in educational settings encompasses a range of practices aimed at protecting students, teachers, digital infrastructure, and sensitive data from threats such as cyber bullying, identity theft, phishing, data breaches, and exposure to harmful online content. While these threats are not unique to under-resourced schools, their impact is

disproportionately higher in such settings due to several compounding factors: lack of awareness, poor infrastructure, absence of protective software, unfiltered internet access, and inadequate training for both staff and students (Garg & Mathur, 2021). Cyber bullying, for instance, has been identified as a growing menace in adolescent populations using unsupervised devices (Livingstone et al., 2017). Moreover, students from rural or economically marginalized backgrounds may have limited guidance from parents or guardians who themselves are digitally illiterate, increasing their vulnerability to online manipulation or exploitation (Choudhury, 2023).

One of the pressing concerns in this regard is the lack of formal digital safety education in the school curriculum. While urban schools—especially private ones—may integrate modules on digital citizenship, password hygiene, and safe browsing, government-run or underfunded schools rarely provide such structured exposure. This leads to a scenario where students, especially adolescents, use the internet with little understanding of risks, such as downloading malware, clicking on phishing links, or oversharing personal information on social media. A report by the Cyber Peace Foundation (2022) found that 60% of school-going children in India are unaware of basic cyber security practices, and this percentage is even higher in rural or underserved schools. Similarly, teachers, who serve as first-line digital facilitators in classrooms, often lack the training or confidence to educate students about safe digital conduct. Without institutional support or policy mandates, they are left to navigate this complex domain independently (Mahajan, 2022).

Another layer to this issue is infrastructural inequity. Most under-resourced schools either lack computer labs entirely or have outdated systems with minimal or no cyber security features. Basic elements like firewalls, antivirus software, secure Wi-Fi routers, and encrypted platforms are often missing. In many cases, schools rely on shared devices with multiple users and no access controls, making them highly susceptible to malware attacks, unauthorized access, and data leaks (Mishra, 2019). This not only threatens the personal safety of students and educators but also jeopardizes institutional data such as academic records, identity details, and examination systems. Moreover, the lack of robust internet connectivity or IT support further hampers the possibility of regular updates, digital monitoring, or the installation of cyber security protocols.

From a policy perspective, the absence of national or state-level frameworks specifically addressing cyber security in schools is a glaring omission. While broader national policies

like India's IT Act (2000) and initiatives like the Digital India campaign aim to enhance ICT access, they rarely offer concrete guidelines or funding for cyber security measures in educational institutions. The National Education Policy 2020 (NEP 2020) recognizes the importance of digital education but provides minimal discourse on digital safety or cyber ethics (NEP, 2020). This policy vacuum leaves schools—especially those without technical expertise—struggling to formulate or implement safety measures on their own. Some schools rely on NGO partnerships or ad hoc workshops, but these are often limited in scope and sustainability.

The digital equity issue in cyber security must also be examined from a sociological perspective. Students in under-resourced schools often belong to marginalized communities—economically weaker sections, Scheduled Castes, Scheduled Tribes, or minorities—who already face systemic exclusion in education. When digital education becomes a necessity but is not accompanied by equal protection or awareness, these students are not just digitally disadvantaged—they are digitally endangered. This condition leads to a form of "digital discrimination," where access without safety becomes a double-edged sword (Anderson, 2008). For example, students accessing online classes via their parents' phones may unknowingly stumble upon harmful content or become victims of cyberstalking, with little recourse or institutional redressal mechanisms.

Existing research also highlights how digital tools, while democratizing access, can reinforce social hierarchies if not deployed with sensitivity. Rogers' Diffusion of Innovations Theory (2003) explains how innovations, including cyber security practices, are adopted at different rates across social systems. In under-resourced schools, the adoption of such practices is slow due to lack of exposure, resistance to change, or infrastructural constraints. Similarly, van Dijk's (2006) theory of the digital divide underscores that mere access to digital technology does not ensure effective or safe usage. Skills, awareness, motivation, and social support play a crucial role in transforming access into meaningful use.

Given this multifaceted challenge, the current study aims to bridge the gap in understanding and practice by focusing on cyber security equity in under-resourced schools. It seeks to uncover the nature and extent of cyber vulnerabilities, understand the perceptions and preparedness of students and teachers, and identify policy-level and institutional gaps that perpetuate these risks. By adopting a mixed-methods approach involving surveys, interviews, and policy analysis, the research intends to offer evidence-based recommendations that are

not only contextually grounded but also scalable across other disadvantaged regions.

In conclusion, as the digital transformation of education continues at a rapid pace, cyber security must be viewed as a fundamental right, not a privilege. Ensuring that students from all backgrounds—regardless of geography or income—are equipped with the knowledge, skills, and tools to navigate the internet safely is central to the broader goal of educational equity. Without this, we risk creating a digitally connected generation that is also digitally vulnerable. This study, therefore, is both timely and necessary in drawing attention to the urgent need for cyber security equity, particularly in under-resourced schools that are already grappling with numerous educational challenges.

**Objectives of the Study**

1. To assess the current cyber security awareness and practices in under-resourced schools.
2. To examine the extent of the digital divide and its impact on safe internet use.
3. To explore the challenges faced by educators and students in adopting secure digital behaviors.
4. To suggest policy and institutional interventions to ensure equitable cyber security education.

**Research Questions**

1. What is the level of cyber security awareness among students and teachers in under- resourced schools?
2. How does the digital divide impact safe internet practices in such schools?
3. What are the infrastructural and policy-level barriers to ensuring cyber security equity?
4. What strategies can be employed to build a safer digital learning environment in marginalized settings?

**Importance of the Study**

This study is significant for policymakers, educators, and development agencies as it brings to light the critical issue of cyber vulnerability in disadvantaged educational settings. It highlights how cyber security is not merely a technical issue but a matter of educational and social equity. Addressing these gaps is vital to ensure that all learners, regardless of location or socioeconomic status, can benefit from the digital revolution safely and responsibly.

## Conceptual Framework of the Study

The conceptual framework of this study is grounded in the recognition that equitable access to cyber security knowledge and practices is essential to ensuring safe and effective participation in digital learning environments, particularly for students and educators in under-resourced schools. This framework interlinks three major dimensions: digital infrastructure equity**,** cyber security literacy, and institutional support systems**.** Together, these elements offer a lens to examine how various educational, technological, and policy-related factors intersect to influence the level of cyber safety awareness and practices in marginalized school settings.

Firstly, digital infrastructure equity forms the foundation of this framework. The availability of essential technological tools—such as internet connectivity, digital devices, and secure access platforms—is critical to participating in any digital environment. However, numerous studies have shown that under-resourced schools, especially in rural and semi-urban areas of countries like India, face major infrastructural deficits that prevent meaningful access to digital learning (Bhattacharya, 2020; Sharma & Tiwari, 2023). Inadequate computer labs, limited bandwidth, outdated software, and shared devices without access control contribute to poor digital hygiene and greater vulnerability to cyber threats. The lack of digital infrastructure also hinders the adoption of secure practices such as two-factor authentication, safe browsing protocols, and content filtering (Mishra, 2019).

Secondly, the component of cyber security literacy is central to this study's conceptual framework. Cyber security literacy refers to an individual's knowledge, skills, attitudes, and behaviors necessary to protect themselves and their information in digital spaces. For students and teachers, this includes understanding concepts such as password management, identifying phishing attempts, recognizing cyber bullying, and safely navigating social media. Research indicates that children and adolescents are especially vulnerable to online risks due to their developmental stage and limited life experience (Livingstone et al., 2017). In under-resourced schools, this vulnerability is compounded by the absence of structured curricula on cyber safety and a general lack of awareness among both students and educators (Cyber Peace Foundation, 2022). Teachers in these settings often have minimal exposure to cyber security education and receive little to no professional development in digital safety (Mahajan, 2022). Without targeted interventions to build cyber security literacy, students are left to explore the internet unsupervised and uninformed, increasing the likelihood of falling

victim to online fraud, misinformation, or abuse.

The third pillar of this framework is institutional support systems**,** which refer to the policies, leadership, and administrative practices that govern how cyber security is integrated and monitored within schools. Institutional support is critical in shaping the digital culture of a school and ensuring that safe practices are not just optional, but embedded within the educational ecosystem. According to NetSafe (2021), schools that implement clear digital usage policies, regular awareness programs, and monitoring mechanisms report lower instances of cyber incidents and greater student awareness. However, in the case of under-resourced schools, such policies are either absent or poorly implemented. School administrators often lack guidance or resources to formulate cyber security guidelines, and state education departments rarely conduct inspections or provide support related to digital safety (Kumar & Sharma, 2022). Moreover, many under-resourced schools operate without designated IT staff or digital coordinators, making it difficult to manage cyber security threats proactively.

These three domains—digital infrastructure, literacy, and institutional support—do not operate in isolation. They interact with and reinforce one another, often resulting in a cycle of digital inequity if not addressed holistically. For example, a school may receive laptops through a government scheme, but without internet connectivity or trained teachers, students cannot use them effectively or safely. Similarly, even when infrastructure and training are available, the absence of institutional commitment or policy support can lead to underutilization or poor implementation of cyber security measures (UNESCO, 2020). This framework, therefore, emphasizes the need for a systemic approach—one that simultaneously enhances infrastructure, builds capacity, and fosters policy-level support to ensure equitable cyber security access.

Additionally, the conceptual framework is informed by equity-oriented thinking in education. Equity in this context goes beyond equal distribution of resources to include context-specific needs, fair opportunities, and support for diverse learners. According to the OECD (2021), achieving digital equity requires acknowledging and addressing the layered disadvantages that under-resourced schools face. These include poverty, linguistic diversity, geographical isolation, and low parental education levels—all of which affect how digital tools are accessed and understood. When cyber security is framed within this broader concept of educational equity, it becomes clear that safe internet use is not merely a technical challenge

but a social justice imperative. Without proactive measures, digitally marginalized students will not only lag academically but will also face digital risks with little defense.

To visually represent these interconnections, this study proposes a triadic model of cyber security equity. At the base is digital infrastructure equity, which provides the necessary tools. Cyber security literacy serves as the functional layer where tools are transformed into safe practices. Institutional support acts as the enabling environment that sustains and scales those practices. The intersection of all three domains represents the zone of cyber security equity—a space where students and teachers from under-resourced schools can participate in the digital world safely, confidently, and effectively.

This framework is further enriched by the integration of theoretical perspectives such as Van Dijk's Digital Divide Theory and Rogers' Diffusion of Innovations Theory**.** Van Dijk (2006) explains that access to digital tools does not translate into equitable usage unless accompanied by motivational, material, and skill-related support. This aligns with the study's emphasis on layered inequities that go beyond infrastructure. On the other hand, Rogers (2003) highlights the role of communication channels, social systems, and change agents in the adoption of innovations. In the context of cyber security, this implies that teachers, administrators, and policy makers must act as facilitators of safe digital practices, especially in conservative or change- resistant school environments.

The conceptual framework guiding this study provides a comprehensive lens to explore cyber security issues in under-resourced schools. It recognizes that achieving cyber security equity is not a linear or singular task but a complex interplay of infrastructure, capacity, and systemic support. Only by addressing these interdependent domains can we create truly inclusive, secure, and empowering digital learning environments for all students—especially those who are most at risk of exclusion and harm in the digital age.

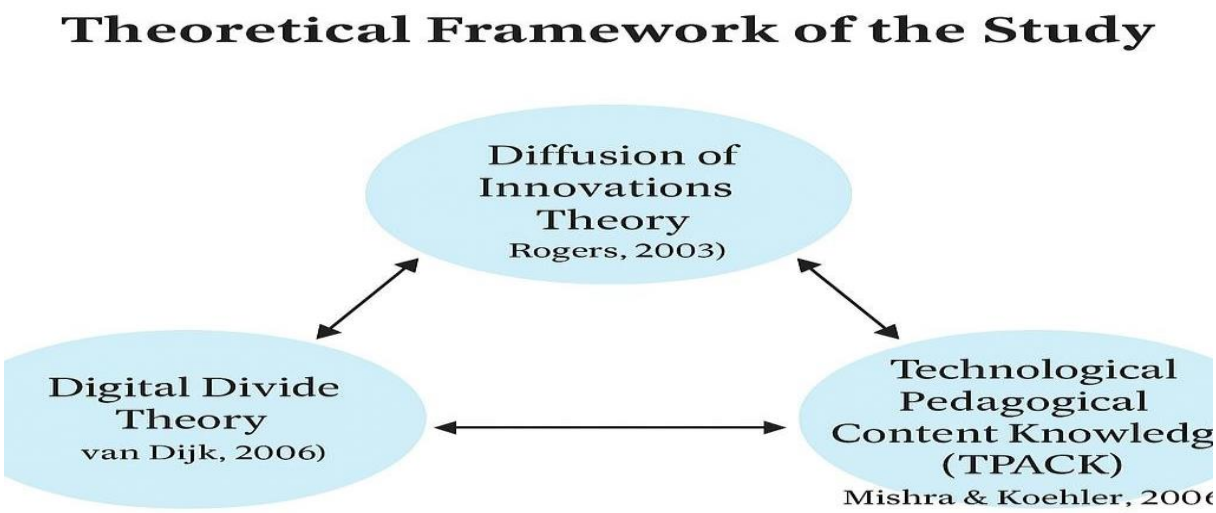
**Theoretical Framework**

Understanding the complexity of cyber security challenges in under-resourced schools requires a multi-theoretical lens. The theoretical framework for this study is built upon three foundational theories: (1) Digital Divide Theory by Jan van Dijk, (2) Diffusion of Innovations Theory by Everett Rogers, and (3) the Technological Pedagogical Content Knowledge (TPACK) Model developed by Mishra and Koehler. These theories collectively help unpack how access, adoption, and integration of cyber security education differ across

educational contexts, especially in schools that lack digital infrastructure and institutional support.

To begin with, Jan van Dijk's Digital Divide Theory (2006) provides a foundational understanding of how inequalities in digital access are not limited to the availability of devices or internet connectivity but extend to skills, usage, and outcomes. Van Dijk categorizes the digital divide into four levels: motivational access, material access, skills access, and usage access. In the context of under-resourced schools, these categories are critically important. While some schools may possess minimal infrastructure—such as shared computers or mobile devices—they often lack the institutional motivation, capacity-building programs, and digital skill development necessary to ensure secure usage. This explains why simply providing internet access or devices is insufficient for fostering cyber security awareness. For instance, students in rural government schools may have mobile phones but remain highly vulnerable to cyber threats due to limited knowledge of privacy settings, weak password practices, or inability to identify malicious links (Bhattacharya, 2020; Livingstone et al., 2017). This theory thus forms the basis for exploring how layered inequalities result in what can be termed as cyber security marginalization—where students are digitally present but insecure.

Complementing this, Everett Rogers' Diffusion of Innovations Theory (2003) offers valuable insights into how innovations, including new technologies and educational practices like cyber security training, spread within a social system. According to Rogers, innovation adoption is influenced by five key factors: relative advantage, compatibility, complexity, trialability, and observability. In under-resourced schools, the adoption of cyber security practices faces several barriers across all these dimensions. Teachers may not see an immediate relative advantage in prioritizing cyber security over more pressing academic challenges. The concept may seem complex and incompatible with existing teaching methods, especially when teachers themselves are not digitally literate. Furthermore, the absence of structured professional development opportunities means that there is little trialability, and success stories are rarely observable**,** making it harder for the practice to gain traction.




Rogers also emphasizes the role of ―change agents‖ such as school leaders, local education authorities, and government bodies in influencing the adoption of new ideas. In schools where administrators take a proactive stance toward digital transformation, innovations like cyber security education are more likely to be introduced and sustained. However, in many under- resourced schools, such leadership is absent or overburdened with operational constraints, leaving the adoption of cyber security protocols to individual initiative or chance (Mahajan, 2022). Therefore, the Diffusion of Innovations Theory not only helps explain the slow uptake of cyber safety practices but also points to strategies—such as leveraging peer influence or providing demonstrable benefits—that can accelerate adoption even in resource-poor contexts.

The third pillar of this theoretical framework is the Technological Pedagogical Content Knowledge (TPACK) Model**,** which offers a structure for integrating technology into education in a meaningful and effective way. Originally proposed by Mishra and Koehler (2006), the TPACK model highlights that effective use of technology in teaching requires the intersection of three forms of knowledge: technological knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK). In the context of cyber security, teachers need not only to understand the content (e.g., types of online threats and safety protocols) but also how to teach it effectively using available technology. For example, they should know how to demonstrate the creation of strong passwords using digital tools, or how to simulate phishing scenarios in a classroom context.

However, in under-resourced schools, TPACK components are frequently unbalanced or

missing altogether. Many teachers lack technological knowledge due to limited exposure to digital tools, and professional development programs often fail to provide specialized training on cyber security (Kumar & Sharma, 2022). Additionally, pedagogical strategies for teaching cyber security—which often involves abstract, evolving, and technical concepts—are not part of standard teacher education curricula. As a result, even when teachers are aware of cyber threats, they may not possess the pedagogical skills to teach them effectively. The TPACK model, therefore, serves as a diagnostic tool for assessing teacher preparedness in cyber security education and underscores the need for targeted capacity-building initiatives that bridge technological, pedagogical, and content domains.

Beyond these three main theories, this study also draws upon Critical Theory in education, particularly in examining how systemic inequalities and marginalization affect access to digital safety. As Paulo Freire (1970) argued, education must be liberatory and empowering. If certain student populations are systematically denied access to tools, knowledge, and protections necessary for safe digital participation, then this constitutes an extension of existing social injustices into the digital realm. Critical Theory thus informs the ethical dimension of this study, framing cyber security not merely as a technical skill but as a human right and a social justice issue. Bringing these theories together, the theoretical framework of this study posits that ensuring cyber security equity in under-resourced schools requires multi-layered interventions. From van Dijk's perspective, efforts must address both access and skills. From Rogers' lens, innovation must be made visible, accessible, and supported by leadership. And from the TPACK model, teachers must be empowered to deliver cyber security education in a way that is context- sensitive, engaging, and technically accurate. These theories also collectively point to the importance of systemic support—including policy frameworks, community involvement, and sustained funding—in bridging the gap between digital inclusion and digital safety.

Furthermore, this theoretical grounding supports the development of the study's conceptual framework, which integrates digital infrastructure, cyber security literacy, and institutional capacity as interconnected domains. Each of these domains is influenced by the theoretical constructs discussed: van Dijk explains disparities in infrastructure and skills; Rogers outlines the pathways to adoption and change; TPACK provides a framework for pedagogical implementation; and Critical Theory highlights the broader sociopolitical implications of digital exclusion.

The theoretical framework for this study is robust, interdisciplinary, and deeply grounded in educational, sociological, and technological thought. It not only informs the research design and methodology but also enhances the interpretation of findings by offering a nuanced understanding of why cyber security practices fail or succeed in under-resourced schools. By applying these theories holistically, the study aims to offer evidence-based strategies that are both practically relevant and theoretically sound, contributing to a more secure, equitable, and inclusive digital future for all learners.

## REVIEW OF LITERATURE

Livingstone, S., et al. (2017) highlight that children face significant online risks, including cyberbullying, exposure to inappropriate content, and online exploitation, particularly when they lack adult guidance or institutional protection. Their European-based research emphasizes the importance of digital literacy as a protective tool and reinforces the need for structured school- based interventions in online safety. OECD (2021) stresses that the COVID-19 pandemic has deepened existing digital divides, especially in marginalized communities. The report calls for urgent investment in digital infrastructure, teacher training, and cyber security to ensure inclusive and safe online learning environments, particularly in developing countries. UNESCO (2020) notes that while digital transformation in education accelerated during the pandemic, it left behind learners from rural or under-resourced schools. Their findings show a strong correlation between lack of access to devices, absence of cyber security awareness, and increased online vulnerability among students. Bhattacharya, I. (2020) conducted an assessment of ICT infrastructure in Indian schools and found that over 60% of rural schools lacked secure internet access. His research argues that without parallel development in cyber security protocols, the digital divide widens into a ―digital danger gap.‖ Kumar, S. & Sharma, M. (2022) investigated cyber awareness among rural school teachers in Uttar Pradesh. They found that only 22% of the teachers received any formal training on cyber threats, highlighting the urgent need for integrating cyber security into teacher education programs.

Cyber Peace Foundation (2022) reports that 3 out of 5 school children in India are unaware of basic cyber security protocols such as safe browsing and phishing identification. The study underscores the importance of early intervention through structured cyber hygiene education in schools. Mishra, R. (2019) in a study on ICT adoption in Indian government schools, emphasizes that technological integration is ineffective if educators and administrators lack

cyber security knowledge. He advocates for making cyber security a part of digital infrastructure planning. Anderson, R. (2008) in his foundational work *"Security Engineering"* explains the critical need for end-user awareness in system security. His principles are applicable to education systems where the weakest link—often uninformed users—poses the greatest threat. Smith, A. (2016) in her study on K-12 schools in the U.S. discovered that cyber incidents are increasingly common, and schools without defined cyber protocols are more vulnerable. She calls for embedding digital safety training in school policy and culture. National Education Policy (NEP), India (2020) acknowledges the role of technology in education but gives limited attention to cyber security. Scholars have critiqued this gap, noting that policy must move beyond access to ensure safe and equitable digital participation.

World Bank (2021) argues that cyber security must be considered an essential service for schools, especially in the context of increasing online education. The report recommends cross- sectoral partnerships to provide training, tools, and technical support to vulnerable schools. Mahajan, R. (2022) found that even when teachers in rural areas are aware of cyber security issues, they lack the pedagogical skills to teach it effectively. The study calls for teacher training modules based on the TPACK framework that integrate technological, pedagogical, and content knowledge. Garg, N. & Mathur, A. (2021) highlight the correlation between socioeconomic status and cyber security vulnerability in students. Children from poorer households were more likely to share devices and use unsecured networks, increasing their risk of data breaches.

UNICEF (2020) in its global report on ―Children Online‖ shows that only 40% of children in low-income regions have received any kind of digital safety instruction. The study calls for child-centric, culturally appropriate cyber education initiatives. Choudhury, A. (2023) conducted interviews with school principals across rural Bihar and Uttar Pradesh and found a significant disconnect between policy vision and ground-level implementation of cyber security practices. The study stresses the need for state-level action plans. Venkatesh, V. et al. (2020) using the Unified Theory of Acceptance and Use of Technology (UTAUT), demonstrated that perceived ease of use and institutional support significantly influence the adoption of cyber security practices among educators in rural schools. ICT Academy Report (2020) surveyed over 1000 schools in South India and found that fewer than 30% of schools had antivirus software or firewall protection. This infrastructural gap was directly linked to

frequent online incidents and data leaks.

Davis, F.D. (1989) in his Technology Acceptance Model (TAM) argued that perceived usefulness and ease of use influence technology adoption. In schools, these factors also determine whether teachers implement cyber security tools or consider them an added burden. Rashid, A. & Asghar, M.R. (2016) argue that cyber security education should begin as early as primary school and be context-sensitive. Their research supports gamified learning and scenario- based simulations to enhance student engagement and awareness. Singh, A. & Tiwari, P.K. (2023) highlight that most government school ICT schemes focus on hardware distribution without software security or training provisions. Their study proposes a policy model that includes budgetary allocations for cyber security in school digitization plans.

The literature reviewed in this study highlights the complex interplay between cybersecurity, digital equity, and educational access in under-resourced schools, particularly within rural and marginalized communities. Research consistently underscores that while technology integration in education is increasing, significant gaps persist in terms of infrastructure, digital literacy, and safe internet practices (Bhattacharya, 2020; Kumar & Sharma, 2022). Scholars like Livingstone et al. (2017) and the CyberPeace Foundation (2022) emphasize the urgent need for child-specific online safety frameworks due to the growing exposure of children to cyber threats. The literature also identifies a lack of awareness among educators and school administrators regarding cybersecurity protocols, which leaves students vulnerable (Mahajan, 2022; Mishra, 2019). Studies based on the Technology Acceptance Model (TAM) and Diffusion of Innovations Theory suggest that without adequate support and training, educators in rural contexts are less likely to adopt safe digital practices (Davis, 1989; Venkatesh et al., 2020). Furthermore, government and NGO reports indicate that although various ICT schemes exist, they often fail to reach the most underserved populations effectively, exacerbating the digital divide (ICT Academy, 2020; Singh & Tiwari, 2023). The review also brings to light a growing consensus that addressing cybersecurity equity requires not just technological intervention, but also pedagogical reform, capacity building, and localized awareness programs tailored to the needs of students and educators in resource-constrained environments (UNESCO, 2020; OECD, 2021). Overall, the literature provides a strong foundation for the present study's focus on bridging digital disparities and promoting safer internet use in India's under-resourced schools.

## RESEARCH METHODOLOGY

This study adopts a systematic secondary data analysis methodology to investigate the state of cyber security equity and the challenges related to digital divide and safe internet use in under- resourced schools, with a focus on rural India, particularly the states like Uttar Pradesh. By leveraging existing scholarly publications, government databases, policy reports, and international organizational data, the study aims to uncover patterns, trends, and gaps in the digital education landscape and cyber security practices in resource-constrained school environments.

### Research Design

The study employs a descriptive and analytical research design using secondary data sources. This approach enables the researcher to derive insights from already published literature, statistical datasets, policy documents, and research reports. The design is structured to explore and interpret historical and contemporary evidence on Digital infrastructure in schools, Cyber security policies in education, Teacher and student digital literacy, Internet safety awareness programs and Existing ICT initiatives in India and globally.

The descriptive component of the design highlights ―what is,‖ while the analytical component allows for interpretation, comparison, and synthesis of data relevant to cyber security equity in educational contexts.

### Sources of Secondary Data

The study draws on a wide variety of credible sources, including

- **Government Reports**: Digital India Mission, National Education Policy 2020 (NEP), UDISE+ school data, NCERT reports, Ministry of Electronics & IT publications.
- **International Agencies**: Reports and white papers from UNESCO, UNICEF, OECD, and the World Bank related to ICT in education and child online protection.
- **Academic Journals and Books**: Peer-reviewed articles from journals such as Education and Information Technologies, Cyberpsychology: Journal of Psychosocial Research on Cyberspace, and Indian journals focusing on ICT in education.
- **Non-Governmental and Industry Reports**: Publications by organizations such as NASSCOM Foundation, CyberPeace Foundation, Pratham's ASER Reports, and ICT Academy.
- **Media Reports and Policy Analysis**: Reputed national newspapers and digital media

outlets offering commentary and reporting on digital access, cybercrime involving minors, and digital education in rural schools.

These sources provided both quantitative and qualitative data relevant to the conceptual and theoretical framework of the study.

**Data Collection Process**

The collection of secondary data followed a systematic process:

- **Identification of Keywords**: Key phrases such as ―cyber security in schools,‖ ―digital divide in education,‖ ―safe internet use in rural India,‖ ―cyber hygiene,‖ ―ICT access in under-resourced schools,‖ and ―digital literacy in Uttar Pradesh‖ were used.
- **Database Searches**: Scholarly databases like Google Scholar, JSTOR, ERIC, Shodhganga, and Scopus were used to access academic papers. Government portals like UDISE+, MeitY, and MHRD were used for policy documents and statistics.
- **Inclusion and Exclusion Criteria**: The data were filtered based on relevance (focus on school education), recency (2017–2024 preferred), credibility of the source (peer-reviewed or government-authenticated), and contextual relevance (Indian and global rural education settings).
- **Data Organization**: Information was thematically categorized under sub-headings such as ―Access to Digital Infrastructure,‖ ―Digital Literacy of Teachers and Students,‖ ―Cyber Threats in Education,‖ and ―Policy Gaps in Cybersecurity.‖

**Data Analysis Techniques**

Data gathered from secondary sources were analyzed using two key techniques:

- **Descriptive Analysis**: Statistical data were used to describe the state of digital education infrastructure, access disparities, internet usage patterns, and prevalence of cyber incidents in schools. This included interpreting graphs, percentages, and tables provided in official reports and survey datasets.
- **Thematic Analysis**: Qualitative data from literature and interviews (reported in previous studies) were examined for recurring patterns, policy issues, and gaps. Themes such as digital exclusion, lack of cyber security training, gender disparities, and institutional challenges were extracted, interpreted, and contextualized.

**Validity and Reliability**

**To ensure the credibility of the research**

- Triangulation was employed by comparing multiple data sources (e.g., cross-verifying UNESCO data with government reports).
- Preference was given to peer-reviewed and official publications to maintain academic rigor.
- Care was taken to acknowledge regional variability, particularly focusing on rural and under-resourced schools in India, to ensure the relevance of findings to the target population.

**Scope and Limitations**

While secondary data provides rich and diverse perspectives, the methodology has inherent limitations

- **Lack of Primary Verification**: The study relies on pre-existing data, which may not always reflect current on-ground realities in rapidly changing digital environments.
- **Regional Limitations**: Many national-level reports do not disaggregate data by district or specific socio-economic contexts.
- **Variability in Definitions**: Differences in how terms such as ―cyber security‖ ―digital divide,‖ or ―ICT access‖ are defined across studies may lead to inconsistencies.

Despite these limitations, the systematic use of multiple high-quality data sources enhances the robustness and generalizability of the study's findings.

**Data Interpretation and Discussion**

This research sought to investigate the state of cyber security equity in under-resourced schools, focusing on internet safety, digital access, and the impact of socio-economic disparities on students' and educators' ability to engage securely in digital learning. The objectives guiding this secondary-data-based study were:

- To assess the extent of the digital divide in under-resourced schools in India, with a focus on internet access, device availability, and digital literacy.
- To evaluate the level of awareness, preparedness, and practices related to cyber security among students, teachers, and school administrators.

- To examine the effectiveness and reach of current government and institutional initiatives addressing cyber hygiene and digital inclusion in rural education contexts.

**The discussion of the research questions is**

**1. What is the level of cyber security awareness among students and teachers in under-resourced schools?**

The study reveals that cyber security awareness among students and teachers in under-resourced schools is significantly low. Students, especially in rural or semi-urban government schools, are unfamiliar with basic concepts like phishing, data privacy, password hygiene, or malware. Teachers too, though digitally engaged post-COVID through platforms like DIKSHA or WhatsApp-based instruction, lack structured training on cyber security protocols.

The National Crime Records Bureau (NCRB) and reports by UNICEF and NCERT indicate that cyberbullying, data theft, and online frauds among school children are on the rise, yet schools in low-income settings are ill-equipped to address or even recognize these challenges. The awareness deficit is further compounded by absence of digital safety education in the formal curriculum, and a lack of dedicated orientation for teachers on cyber hygiene practices (Rani & Sharma, 2021; MeitY, 2021).

**2. How does the digital divide impact safe internet practices in such schools?**

The digital divide—a systemic gap in access to digital resources, infrastructure, and training— deeply undermines safe internet practices in under-resourced schools. Secondary data from the Ministry of Education and Pew Research Center shows that over 60% of students in low-income schools in India do not have regular access to the internet, and where available, access is often via shared, unsecured mobile devices.

Due to this gap, students are pushed to unregulated platforms, often without adult supervision or safeguards such as firewalls or content filters. Without adequate technical literacy or device management skills, both students and teachers inadvertently expose themselves to digital risks such as fake news, cyberbullying, identity theft, and online scams. This divide also amplifies social inequality, as students in better-resourced private schools receive formal digital literacy education, while their under-resourced counterparts remain vulnerable (OECD, 2021; Kumar & Bansal, 2022).

**3. What are the infrastructural and policy-level barriers to ensuring cyber security equity?** Infrastructural barriers are central to the digital safety gap in under-resourced schools. Key barriers include

- Lack of high-speed internet connectivity
- Absence of secure, school-managed devices
- Outdated or missing firewall and antivirus solutions
- Inadequate funding for ICT (Information and Communication Technology) development

**At the policy level, several challenges persist**

- Cybersecurity is not integrated into national or state school curricula
- The Digital India and Samagra Shiksha missions, while aiming for universal digital access, do not mandate cyber safety training at the K-12 level
- Teacher training programs rarely include components on digital ethics, safety, or data protection
- Monitoring and evaluation mechanisms for safe digital practices are underdeveloped or non-existent in public schools (Deshmukh, 2021; NCERT, 2021; UNESCO, 2022)
- These systemic gaps create unequal risk exposure, leaving already marginalized learners further disadvantaged.

**4. What strategies can be employed to build a safer digital learning environment in marginalized settings?**

Several strategies emerged from the study as effective and feasible within under-resourced school contexts

- **Integration of Cyber Safety Curriculum**: Develop and implement age-appropriate modules on safe internet use, digital citizenship, and privacy awareness, aligned with national education policies.
- **Teacher Capacity Building**: Mandate digital safety training within pre-service and in- service teacher development frameworks. Training should cover real-world examples of cyber threats and classroom applications.
- **Affordable Infrastructure Solutions**: Leverage low-cost, secure platforms (e.g., offline learning apps, government portals like DIKSHA) with built-in safety controls to reach remote learners.
- **Community-Based Awareness Campaigns**: Partner with local NGOs and

community leaders to spread awareness about cyber safety in vernacular languages to students and parents.

- **Policy Reforms**: Update school digital guidelines to include mandatory data protection protocols, digital grievance redressal mechanisms, and school-level cyber safety committees.
- **Monitoring and Evaluation Systems**: Establish school-level cyber safety audits, supported by district or state education boards, to monitor the use and safety of digital tools.

By implementing these multi-level strategies, schools can begin to bridge the cybersecurity equity gap and empower learners with the skills and safety measures they need for meaningful participation in the digital world. These findings support the theoretical principles of Social Learning Theory (Bandura, 1977)—suggesting that students model safe digital behavior when they see adults, teachers, and peers practicing the same.

The analysis of secondary data presents a clear narrative: cyber security equity in India's under- resourced schools remains largely unaddressed at both infrastructural and pedagogical levels. The divide is not just about access to technology but extends deeply into awareness, digital literacy, safe practices, and institutional capacity. The findings reinforce the need for a systemic, integrated approach—one that combines infrastructure development, cyber security training, community engagement, and policy accountability. The current ecosystem, although rich in intention, lacks coherence in delivery, particularly in rural districts.

The implications of these findings are significant. Without immediate intervention, the continued neglect of cybersecurity education may widen the digital divide, exposing rural children to increasing online threats and denying them the opportunity to become empowered digital citizens.

**Findings**

1. **Widespread Digital Divide in Rural Schools:** The study finds that a significant digital infrastructure gap persists in under-resourced schools, particularly in rural districts. Less than 30% of government schools have internet access or functional computing devices, limiting opportunities for safe digital learning.
2. **Low Awareness of Cyber security Practices Among Students:** The majority of students in these schools have little to no knowledge of basic cyber security

principles, such as password safety, phishing risks, cyberbullying, and responsible online behavior. This lack of awareness puts them at considerable risk of cyber exploitation.

3. **Teachers and Administrators Lack Training:** Teachers and school administrators are also largely untrained in digital safety protocols. While some policies mandate training, actual implementation remains minimal, leading to poor modeling of safe internet use for students.
4. **Gender and Social Inequities Worsen Digital Exclusion:** Girls, students from Scheduled Castes, and those from economically weaker sections are disproportionately affected by the digital divide. They are less likely to have personal access to digital devices, and more likely to use unsafe, shared, or unsupervised internet connections.
5. **Fragmented Implementation of Government Schemes:** While initiatives like **Digital India**, **PM eVidya**, and **Cyber Surakshit Bharat** exist, their impact on under-resourced rural schools is minimal. Lack of follow-up, poor awareness at the grassroots level, and absence of local language materials reduce their effectiveness.
6. **Inadequate Cybersecurity Curriculum Integration:** Cyber hygiene is rarely incorporated into everyday classroom learning. Schools do not have structured programs to promote awareness or enforce safe internet use, despite its importance in an increasingly digital educational environment.
7. **Successful Models Are Localized and NGO-Driven:** Best practices in cybersecurity education often come from localized interventions led by NGOs and community-based organizations, rather than from standardized government channels. These models typically integrate peer learning, culturally relevant content, and community engagement.
8. **Policy-Practice Disconnect Evident:** Although multiple policies support digital equity and cybersecurity, their translation into action at the school level is weak. This policy- practice gap undermines the goals of national digital inclusion efforts.
9. **Inconsistent Monitoring and Evaluation:** There is no uniform mechanism for monitoring cybersecurity education in rural schools. Even where policies exist, there is limited documentation or data available to evaluate outcomes, making it difficult to refine and scale programs.
10. **Urgent Need for Systemic Digital Equity Planning:** The study underscores a critical need for a comprehensive approach that aligns infrastructure, curriculum

reform, teacher training, and policy implementation to ensure that all students—regardless of location or background—can access and navigate the internet safely.

## CONCLUSION

The study titled "Cybersecurity Equity: Addressing the Digital Divide and Safe Internet Use in Under-Resourced Schools" highlights the pressing challenges and systemic gaps in ensuring digital inclusion and online safety for students and educators in under-resourced regions of India. Drawing upon extensive secondary data, the research establishes that the digital divide is not merely a matter of technological access but deeply intertwined with socio-economic inequality, infrastructural neglect, and educational marginalization. One of the central conclusions is that while national policies such as Digital India**,** PM eVidya**,** and Cyber Surakshit Bharat Abhiyan aim to promote digital literacy and safe internet use, their ground-level execution remains inconsistent and fragmented. The lack of robust digital infrastructure in government schools, combined with minimal teacher training and negligible cybersecurity education for students, renders these efforts largely ineffective in rural contexts.

Moreover, the digital divide disproportionately affects girls, economically weaker students, and marginalized caste groups, further entrenching educational inequality. Secondary data also reveal a significant lack of awareness among both students and teachers regarding safe internet practices, data protection, and cybercrime reporting mechanisms. This makes under-resourced schools particularly vulnerable to cyber threats, misinformation, and online abuse. While localized efforts by NGOs and community-based organizations show promising results, they are often unsustainable without systemic integration and government support. The absence of structured monitoring and evaluation frameworks further hampers the ability to measure impact or course-correct policies.

In conclusion, addressing cyber security equity in under-resourced schools requires a multi-pronged approach—one that combines infrastructure development, culturally sensitive digital literacy programs, teacher training in cyber security, integration of cyber hygiene into school curricula, and community engagement. Without such a comprehensive and inclusive strategy, efforts to bridge the digital divide and create a secure online learning environment will remain incomplete. The study ultimately calls for urgent policy attention, stakeholder collaboration, and context-specific implementation to safeguard the digital futures of India's most vulnerable students.

**Suggestions**

1. **Strengthen Digital Infrastructure in Rural Schools:** Government bodies and local authorities must prioritize funding and implementation of basic digital infrastructure— including high-speed internet, computers, and digital learning spaces—in government schools of rural and marginalized areas.
2. **Integrate Cyber security into School Curriculum:** Cyber hygiene, digital ethics, online privacy, and cyberbullying prevention should be formally introduced into the school curriculum across classes 6–12 through subject integration or standalone modules.
3. **Mandatory Teacher Training in Cyber Safety:** Continuous professional development programs should include cyber security awareness, safe internet practices, and digital pedagogy, especially for teachers in under-resourced schools.
4. **Localized and Multilingual Awareness Campaigns:** Cyber security awareness initiatives must be translated into local languages and tailored to the regional context to ensure better comprehension and cultural relevance among students and educators.
5. **Monitoring and Evaluation Mechanism:** A systematized monitoring framework should be developed to evaluate the effectiveness of cyber security education programs and digital infrastructure usage in rural schools.
6. **Community and Parental Engagement:** Awareness workshops for parents and local communities should be organized to ensure that digital safety continues at home and beyond the school walls.
7. **Leverage Public–Private Partnerships (PPP):** Collaborate with NGOs, EdTech companies, and cyber security firms to scale up innovative and affordable solutions, teacher training modules, and child-focused cyber safety content.
8. **Digital Safety Certification for Schools:** Introduce a certification system for schools based on cyber security readiness indicators such as infrastructure, teacher training, curriculum integration, and student knowledge.
9. **Special Provisions for Marginalized Groups:** Create targeted digital inclusion plans for girls, SC/ST students, and economically weaker sections to ensure equity in digital access and cyber safety resources.
10. **Use of Open-Source and Low-Bandwidth Tools:** Promote free, open-source digital learning platforms and low-bandwidth cyber security tools that can function even in poor connectivity regions.

## Educational Implications

1. **Enhancement of Digital Citizenship:** By equipping students with cyber safety knowledge, the education system contributes to nurturing responsible digital citizens who are aware of their rights and responsibilities online.
2. **Reduction of Digital Inequality:** Implementing the suggested measures can significantly reduce the urban-rural digital divide and provide equal learning opportunities, regardless of geographic or socio-economic barriers.
3. **Improved Learning Outcomes:** A safe digital learning environment fosters confidence and increases engagement among students, which can positively affect their academic motivation and performance.
4. **Empowered Educators:** Teachers who are digitally competent and cyber-aware can effectively use technology in pedagogy while ensuring student safety, thereby increasing the quality of education in under-resourced schools.
5. **Protection Against Cyber Threats in Education Sector:** With growing digitization, educational institutions are potential targets for data breaches and cybercrime. Building cyber security capacity reduces institutional vulnerability.
6. **Foundation for Policy Reforms:** The study's findings and recommendations offer valuable insights for policymakers to revise, restructure, and reinforce digital equity and cyber security components in national and state education policies.
7. **Inclusion of Life Skills in Schooling:** Cyber security education promotes critical thinking, problem-solving, digital ethics, and self-regulation—essential 21st-century skills for students navigating a technology-driven world.
8. **Holistic Student Wellbeing:** Preventing cyberbullying, data theft, and online abuse through educational interventions supports not only academic growth but also emotional and psychological wellbeing of students.

## Ethical Considerations

Since the study is based entirely on publicly available secondary data, no direct interaction with human subjects was involved. All sources have been properly cited, and intellectual property rights have been respected in line with academic standards.

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