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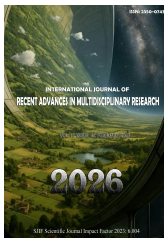

RESEARCH ARTICLE

IMPACT OF SCREENTIME ON COGNITIVE DEVELOPMENT OF ECD LEARNERS: A CASE STUDY OF RURAL PRIMARY SCHOOLS IN HONDE VALLEY IN MUTARE DISTRICT

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ABSTRACT

This qualitative study explores the impact of screen time on the cognitive development of Early Childhood Development (ECD) learners in rural primary schools in Honde Valley, Mutare District of Zimbabwe. Guided by an interpretivist philosophy, the study gathered data from 60 participants identified as key informants. Data collection methods included interviews, focus group discussions, and observations, with thematic analysis used to identify patterns across the datasets. Findings reveal a varied picture, influenced by content quality, access limitations, and socioeconomic factors. Structured exposure to educational digital content showed cognitive benefits, such as improved numeracy, increased curiosity, critical thinking, and verbal engagement, even amid scarcity. However, unregulated recreational screen time, especially involving violent cartoons, was consistently associated with avoidance of educational tasks and aggressive behavioral mimicry. The study also highlights widespread device scarcity, leading to shared use primarily for passive entertainment rather than interactive learning, both at home and in under-resourced schools. Parental mediation varied, often emphasizing economic concerns (data costs) and behavioral control over educational potential. The study concludes that screen time is neither inherently beneficial nor harmful in the ECD context of Honde Valley. Its effects are largely influenced by content purpose and quality, access type, supervision, and broader issues of poverty and digital inequality. To unlock the full potential of screen time for cognitive development, context-specific policies, infrastructure development, teacher training, offline-enabled devices, and community collaboration are essential to move from passive consumption toward equitable, educational engagement use.

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INTRODUCTION

The integration of digital tools into education has undergone a transformative evolution, reshaping pedagogical approaches and learning outcomes globally. Beginning in the 1980s, with the introduction of computer-assisted learning programs, early digital tools featured interactive software designed to reinforce foundational skills in mathematics and literacy. The advent of the internet in the 1990s and 2000s expanded access to vast repositories of knowledge, enabling collaborative learning and democratizing education through platforms like MOOCs (Massive Open Online Courses). In the 2010s, the proliferation of mobile technology and touchscreen devices revolutionized early childhood education (ECE), with applications and gamified learning tools offering personalized, engaging experiences. These advancements accentuated digital tools' potential to enhance cognitive development in Early Childhood Development (ECD) learners by fostering skills such as critical thinking, memory retention, and problem-solving through interactive content (Neumann & Neumann, 2014).

In ECD, cognitive development hinges on stimulating environments that nurture curiosity and exploration. Digital tools, when thoughtfully designed, amplify these opportunities. Interactive apps like ABCmouse and Khan Academy Kids have demonstrated efficacy in improving literacy and numeracy by combining visual, auditory, and tactile engagement, aspects aligned with Piaget's constructivist theory of active learning (Griffith et al., 2020). For instance, touchscreen tablets enable young learners to manipulate virtual objects, reinforcing spatial reasoning and fine motor skills. Such tools are particularly valuable in resource-constrained settings, where traditional materials like textbooks and other manipulatives educational materials are scarce. Studies in sub-Saharan Africa highlight how mobile-based learning interventions have bridged gaps in access to quality early education, particularly in remote communities (Haßler et al., 2020). However, the utility of digital tools is tempered by significant challenges, especially in rural and low-income contexts. In sub-Saharan Africa, where over 60% of the population resides in rural areas, infrastructural barriers such as erratic electricity, limited internet connectivity, and device

affordability constrain equitable access (UNESCO, 2020). In Zimbabwe, economic instability exacerbates these issues, with rural schools is settings such as Honde Valley lacking even basic ICT infrastructure. Here, screen time is mediated by necessity rather than pedagogical intent. Shared family mobile phones are used for passive entertainment such as watching cartoons and skits rather than active learning, reflecting broader socioeconomic pressures (Preston et al., 2020). This contrasts starkly with urban settings, where ECD learners enjoy personalized devices and curated educational content.

The duality of screen-timeas both a cognitive enhancer and a developmental riskis further complicated by disparities in parental and institutional mediation. Global guidelines, such as the American Academy of Pediatrics' (2016) recommendation for co-viewing and time limits, assume a level of parental agency absent in agrarian economies. In Honde Valley, caregivers juggling subsistence farming or informal trade tend to rely on screens as digital pacifiers, inadvertently exposing children to overstimulating non-educational content (Chaudron et al., 2018). Meanwhile, schools face systemic neglect. Zimbabwe's Education 5.0 policy, which prioritizes innovation, remains aspirational in rural regions due to underfunded ICT programs and undertrained teachers (Moyo, 2021). Despite these challenges, digital tools hold untapped potential for learners in rural ECD settings. Offline-enabled apps, low-cost devices, and community-driven digital literacy programs could mitigate infrastructural gaps. Initiatives like Kenya's BRCK Education, a portable Wi-Fi hub preloaded with educational content, demonstrate how context-specific solutions can empower marginalized learners (Wesonga et al., 2021). For Honde Valley, leveraging such models could transform screen time from a mere entertainment tool into a catalyst for cognitive growth, aligning digital engagement with developmental milestones like language acquisition and executive functioning.

This study emerges against this backdrop, seeking to unravel how screen time shapes cognitive development in rural Zimbabwean communities where digital access is fragmented yet increasingly ubiquitous. The study focused on rural primary schools **to** analyse the impact of screen-time on the cognitive development of ECD learners, from the perspective ofteachers, parents, and ECD learners in Honde Valley, Mutare District. The study seeksto bridge the gap between global technological aspirations and localized realities, offering insights into equitable, culturally resonant strategies for harnessing digital tools in ECD.

LITERATURE REVIEW

The proliferation of digital technologies has reshaped early childhood learning globally, yet rural contexts like Honde Valley present unique challenges. Limited access to devices, erratic electricity, and poor internet connectivity create stark disparities in how screen-time is mediated compared to urban settings. Existing literature highlights a paradox: educational screen-time can enhance literacy and numeracy (Neumann & Neumann, 2014), while excessive recreational use correlates with attention deficits and delayed language skills (Radesky et al., 2015). In rural areas, socioeconomic factors further complicate this dynamic, with screen-time often limited to shared family devices used primarily for entertainment (Chaudron et al., 2018)The relationship between screen-time and cognitive development in early childhood has garnered significant attention in recent decades, driven by the rapid proliferation of digital technologies and their integration into educational and domestic spaces. This review synthesizes global and regional literature on the topic, focusing on three interrelated themes: (1) the dual role of screen-time as both a cognitive enhancer and a developmental risk, (2) the mediating influence of socioeconomic and rural-urban divides, and (3) the role of parental and institutional mediation in shaping screen-time outcomes. Screen-time's impact on cognitive development is widely debated. Proponents argue that educational digital content, such as interactive apps and e-books, can enhance literacy, numeracy, and problem-solving skills. Neumann and Neumann (2014), for instance, demonstrated that touchscreen tablets foster emergent literacy in preschoolers by providing multisensory engagement with letters and words. Similarly, a meta-analysis by Griffith et al. (2020) found that well-designed educational programs improve executive functioning and spatial reasoning. These benefits are particularly pronounced in low-resource settings, where digital tools may compensate for limited access to traditional learning materials (Habler et al., 2020).

Conversely, excessive or inappropriate screen-time has been linked to adverse outcomes. Radesky et al. (2015) identified associations between prolonged exposure to fast-paced media and attention deficits, while Lin et al. (2020) correlated recreational screen-time with delayed language acquisition in toddlers. The American Academy of Pediatrics (2016) cautions against screen use for children under 18 months, except video chatting, and recommends co-viewing for older children to mitigate risks. However, these guidelines often presume a level of parental oversight and resource access that may not exist in rural or low-income contexts, where screens frequently serve as unsupervised "digital babysitters" (Chaudron et al., 2018). The digital divide profoundly shapes screen-time experiences, particularly in sub-Saharan Africa. Rural areas, characterized by limited electricity, internet connectivity, and device ownership, face unique challenges. Chaudron et al.'s (2018) cross-European study of young children's digital habits revealed that low-income families are more likely to use mobile devices for passive entertainment rather than active learning, a pattern exacerbated in agrarian economies like Zimbabwe, where subsistence labor limits parental capacity for mediation (Preston et al., 2020). In rural Kenya, for example, shared family smartphones are often the only technology accessible to children, with usage dominated by YouTube videos rather than educational apps (Wesonga et al., 2021).

Educational institutions in rural regions similarly struggle to integrate technology as an emerging pedagogical method. A UNESCO (2020) report highlighted that only 10% of sub-Saharan African schools have reliable internet, stifling the potential of digital pedagogies. In Zimbabwe, despite national policies promoting ICT in education, rural schools like those in Honde Valley lack basic infrastructure, perpetuating inequities (Moyo, 2021). This contrasts with urban private schools, where personalized tablets and e-learning platforms are increasingly common (Janks, 2019). Furthermore, parental mediation**,** defined as strategies to guide children's screen use, varies widely across socioeconomic contexts. Extant literature shows that in high-income settings, restrictive mediation andactive mediation are prevalent (Nikken & Opree, 2018). However, in rural sub-Saharan Africa, survivalist mediation

dominates, with caregivers prioritizing screen-time's pacifying utility over its educational potential (Preston et al., 2020). A Ugandan study found that parents working in informal sectors rely on mobile phones to occupy children during labor-intensive tasks, inadvertently exposing them to violent or age-inappropriate content (Nakabugo et al., 2022). Institutional mediation is equally critical. Schools in resource-constrained regions lack frameworks to align screen time with curricular goals. While Ethiopia's "One Laptop Per Child" initiative improved digital literacy in pilot regions (Habler et al., 2020), similar programs in Malawi faltered due to poor maintenance and lack of teacher training (Chirwa, 2021). This underlines the need for context-specific strategies that address infrastructural gaps and build educators' capacity to leverage technology effectively. Despite the robust body of research on the cognitive effects of screen-time, three key gaps persist in the reviewed literature. Firstly, the majority of studies focused on urban and high-income settings, neglecting the unique dynamics and challenges faced by schools in rural settings. Secondly, the field has been dominated by quantitative metrics that measure screen time hours, sidelining the rich, qualitative insights that are based on lived experiences of people who are affected by the studied phenomenon. Thirdly, the theoretical frameworks underpinning much of the reviewed studies tend to be Eurocentric, overlooking African epistemologies and culturally-relevant perspectives on child development and the use of technology. This study addressed these gaps by centering rural voices, embracing qualitative methodologies, and integrating local cultural frameworks, ensuring the development of contextually-grounded understanding of screen-time's impacts on cognition, not only for ECD learners in Mutare District, Manicaland Province in Zimbabwe, but also for children in rural settings in the Global South.

METHODOLOGY

This study adopted a qualitative research methodology underpinned by an interpretivist philosophy to explore the impact of screen-time on the cognitive development of ECD learners in rural Honde Valley in Mutare District, Zimbabwe. The interpretivist approach was chosen to prioritize the subjective experiences and meanings ascribed to screen time by teachers, parents, and learners, acknowledging the socially constructed nature of reality within this specific context. A case study design was employed to examine the phenomenon holistically and establish context-specific findings deriving from the situated lived experiences of the participants. Purposive sampling was utilized to select 60 participants, ensuring representation across key stakeholder groups comprising 10 ECD teachers,25 ECD learners aged 4–6,and 25 parents from diverse socioeconomic backgrounds, primarily subsistence farmers (70%) and informal traders (30%). Data were collected through semi-structured interviews, focus group discussions (FGDs), and classroom observations. Interviews with teachers lasting 30–45 minutes probed their perception of the impact of screentime on the cognitive development of learners. Interviews with parents helped in establishing screen time for their children, as well as identifying access challenges. Classroom observations, conducted over two weeks, documented learners' behavioral and engagement patterns in response to digital and traditional pedagogies. Thematic analysis was applied to transcribed interviews, FGD recordings, and observational field notes, involving iterative coding, theme development, and contextualization through thick descriptions and verbatim extracts. Ethical considerations included obtaining informed consent, anonymizing participant identities with pseudonyms, and securing approval from relevant institutional authorities. Reflexivity was maintained through researcher journals to mitigate bias, while rigour was enhanced via prolonged field engagement, triangulation of data sources, and peer debriefing. Limitations, such as the case study's limited generalizability and potential observer bias during classroom observations, were acknowledged and mitigated through methodological transparency.

Discussion of Findings

This study, rooted in the interpretivist paradigm, reveals that the impact of screen-time on ECD learners in Honde Valley is not a simple equation but a complex issue woven from threads of opportunity, constraint, mediated content, and lived socioeconomic realities of the research population. The thick descriptions from participant voices and observations paint a vivid picture of this landscape, with five key findings emerging from the study data. Data revealed several perceived cognitive benefits of spending more time interacting with digital tools such as smartphones, interactive boards and television sets, among other platforms. The ECD teachers who participated in this study concur that despite several ICT access challenges faced in Honde Valley, the limited screen time accessed by a few privileged ECD learners provided a glimmer of potential amidst scarcity. As frontline observers in their classrooms, the ECD teachers identified specific cognitive sparks ignited by curated digital content. The potential of educational applications to bolster foundational numeracy skills was a recurring theme within the interview dataset. As Teacher Joyce elaborated,

You see it clearly with the counting games, even simple ones on a phone. Children who get a chance to play them, even briefly, grasp the sequence faster. The colours and sounds make the numbers stick in their minds more than writing on the chalkboard.

This observation highlights the engagement power of well-designed digital tools, offering a potential lever for foundational learning even in resource-limited settings. This finding aligns with observations by several studies (Behnamnia et al., 2023; Nadeem et al., 2023; Hussein et al., 2022)that concur that, beyond numeracy, exposure to specific educational content, like nature documentaries, was observed to stimulate curiosity and verbal engagement. Data also reveal that despite significant ICT infrastructure limitations in Honde Valley's rural schools, strong evidence shows that screen time improves specific areas of cognitive development in early childhood learners, particularly when the content is carefully selected and age-appropriate. The majority ECD learners in schools in rural Honde Valley came from socioeconomic backgrounds with severe device shortages,where a family shares a single phone handsetand rarely enjoyed uninterrupted watching videos. Nevertheless, overwhelming accounts from the participants revealed that exposure to targeted educational digital content showed noticeable benefits regardless of the limited screen time. Teachers consistently observed that after watching interesting videos on television or smartphones, learners exhibit improved levels of critical thinking. As Teacher Martha noted, *After 30 minutes watching a video about migrating birds on my laptop, my ECD 'B' learners*

were different. They asked me many questions about birds, where they sleep, which insects they eat etc. They asked 'why?' questions constantly for days.The video ignited their curiosity.
These lived experiences highlight the capacity of quality screen content to expand horizons and fuel inquiry-based learning, scaffolding learners' cognition beyond what is possible with traditional methods such as textbook content. Educational apps such as numeracy games and nature documentaries, were observed to improve problem-solving skills and stimulate curiosity. These findings align with Neumann and Neumann's (2014) assertion that interactive digital tools can foster emergent literacy and numeracy in ECD learners. For instance, a teacher's observation that children exposed to counting games grasp numbers faster, reflecting the potential of technology to supplement traditional pedagogies in low-resource classrooms in Honde Valley.

The second finding of this study reveals that despite the positive impact of screen time of development of cognition among young learners, the same have its own shadow side. The datasets, particularly from interviews with parents reveals the drawbacks of unregulated, recreational screen time. Parents directly linked exposure to fast-paced and violent non-educational content, particularly action-packed popular cartoons, to observable behavioral challenges such as difficulties in attention regulation and task focus. Parent Mrs. Nyathi shared a common frustration among participating parents.

After watching some action-filled cartoons, it becomes difficult for our children to focus on their homework and other school-related tasks. Schoolwork becomes boring for them. Even if they watch educational content on screen, they always switch to non-educational content. It is a dilemma.

This vivid description points to the shadowy side of screen time and its disruptive effect on crucial learning. Classroom observations powerfully reinforced these parental concerns. Researchers documented instances where playtime became an arena for mimicking aggressive behaviours seen on screen. Teacher Chris confirmed the negative consequences of uncontrolled screen time.

We constantly break up fighting in classrooms as these young learners mimic what they see on TV, the dramatic punches, the kicking, the sound effects. I observed that the fights are not based on real anger, but they disrupt productive play and sometimes they end up escalating.

The above extract supports the arguments that unregulated screen time can result in the development of undesirable behaviours as a consequence of behavioural modelling, a direct negative outcome of media consumed without mediation.The study highlights a paradox consistent with global research show that screen-time simultaneously enhance and hinder cognitive development depending on content quality and usage patterns. Thus, the study finding confirms earlier observations by several studies (Fadhli et al., 2023; Kavak, 2022; Zishiri et al., 2025) that explored the efficacy of digital studies.

The third finding of this study is inextricably bound to the socioeconomic fabric of rural schools in Honde Valley. Device scarcity and passive consumptionwere dominant themes informing this finding that shows that the ideal of personalized, interactive screen-time is a distant reality. As one parent Mrs. Chikomo explained,

There is only one phone in this house, my phone. When I am busy with cooking, fetching water, or working in the fields, my children huddle around it watching music videos and cartoons. It keeps them in one place, safe, while I working. They just watch when I am not using my phone.

The above account illuminates how scarce devices function as digital babysitters, leading to predominantly passive consumption driven by household necessity rather than pedagogical intent. Screen time in such situations was limited and sparse making its impact negligible. This digital resource deficits were further compound by lack of the same resources deficits at 5 of the 6 schools that participated in this study. Teacher Ndlovu's explained this problem stating that;

We have only 3 functional desktop computers at this school. The rest of the donated computers are unserviceable. So, it is 3 computers for 50 learners who want to watch educational content on the screen. They gather around these computers like bees to honey, but most just watch over their counterparts' shoulders.

The verbatim extract above captures the situation that prevailed in 5 of the 6 participating schools while echoing the gap between policy aspirations regarding ICT integration in education and on-the-ground reality. This scarcity creates a stark digital divide compared to urban schools, limiting the screen time and its potential benefit within the school environment. In fact, the study found that there was no meaningful structured screen time available for ECD learners in most schools in Honde Valley District, making it difficulty to establish the exact impact on the cognitive development of these leaners. The fourth finding of this study relates to the parental mediation provided to ECD learners to help them navigate uncertainty of the screen content they watch. Data shows a significant variation on parental approaches to managing screen-time for their children. Some parents, acutely aware of the potential downsides of screen content, enforced strict temporal limits. Participants expressed concerns regarding the behavioral mimicry of cartoon violence observed during playtime further highlighting how inappropriate screen content can disrupt desirable development among ECD learners. Parent Mr. Taguma was emphatic on how he manages screen time for his ECD 'B' learner. He explained;

Thirty minutes at any given time after he returns from school. After that, I take the phone from him no matter how much he cries. Too much screen time is not good for school-going children, besides neglecting their school workthey end up mimicking undesirable behaviours they see on the phone. They waste expensive data watching and learning bad behaviours.

The parent's view echoes the perceptions of many other parents who participated in this study. Mr. Taguma's view highlights how screen-time becomes intertwined with economic concerns that supersedes concerns about content and educational benefit. While the participant's strict control on screen time appear motivated by economic deprivation, it aligned with global health bodies like the WHO, which recommend limited screen exposure for young children. Nevertheless, it was apparent from data that the rural-urban digital divide shapes screen-time experiences in Honde Valley.

Unlike urban households, where children enjoyed the privilege of personal tablets or desktop computers and exhibited higher cognitive development, learners in rural Honde Valley share a single-family device, mostly a mobile phone used intermittently due to erratic electricity and internet connectivity. This scarcity caused passive, entertainment-focused screen time such as watching short videos while parents are engaged in household chores, limiting the potential benefits that are associated with more screen time, contrasting sharply with the intentional, educational screen-time enjoyed by ECD learners in high-income settings. Parent Mrs. Zee confirmed this notion sharing that;

The phone is the only thing that keeps them concentrated. They can watch for hours and they learn a lot from the videos they watch and I have realised that their school performance is improving since the time I allowed them to watch and play games on my phone.

The above quote from Mrs. Zee aligns with findings from several studies (Sharma, 2020; Hussein et al., 2022; Rao & Singh, 2022)that attributed screen time to improved academic performance, which is synonymous with cognitive development. Similarly, a study by Chaudron et al. (2018) found that low-income families globally prioritize survival over structured digital learning, exacerbating inequities in cognitive outcomes between rural and urban based learners.

The fifth finding relates to the link between content watched on screen and its behavioral impacts among ECD learners in primary schools in Honde Valley, Mutare District. This study confirmed that the cognitive and behavioural effects are to a large extend mediated by screen content purpose and quality. The contrast observed was striking. The study found that learners who were exposed to stimulating educational screen content exhibited enhanced curiosity and verbal engagement, while those saturated with recreational screen content displayed hyperactivity characterised by reduced focus. Teacher Gumbo contrasted these two observed strands;

After the watching content created specifically for educational purposes, the learners minds get switched on. In contrast, when they watch entertainment cartoons, they exhibit no specific learning benefit except scattered attempts to mimic their hero cartoons.

The five key findings discussed above decisively show that screen-time for ECD learners in Honde Valley is neither inherently beneficial nor harmful. Its impact is mediated by the quality of content consumed, the nature of access, thedegree and style of supervision, and the overarching socioeconomic constraints that shape family life and school resources in the research setting. While screen content designed for educational purposes offer demonstrable potential for enhancing cognitive development in specific skills like reading, numeracy, stimulating curiosity, and igniting critical thinking, the structural inequities manifesting through digital device scarcity at home and school environments and the economic pressures forcing limited screen time on shared devices, rendered the screen time's contribution in enhancing cognitive development insignificant. While literature demonstrates the benefits of regulated and educational content on screen time, passive consumption, limited screen time due to digital resource and cost of data constraints severely hinder the realization of this potential in the context of ECD learners in primary schools in Honde Valley, Mutare District.

Implications of the Study: This study demonstrates that in Honde Valley, screen-time is neither a panacea nor a pariah. Its cognitive impact on ECD learners hinges on contextual factors that are overlooked in global discourse. The study employed the voices of rural teachers, parents, and learners, to challenge homogenised narratives of the efficacy of digital technology in educational settings without considering the resource constraints that rural schools face. This study reveals the tension between aspiration and reality. While the majority of educators and parents see what technology could do for their learners and children respectively, they lacked the resources to exploit the benefits of screen time to enhance cognitive development of ECD learners. The digital resource scarcity in rural schools in Honde Valley is captured in the five key findings discussed above including the shared single phone handset at home, the 3 desktop computers for 50 eager young hands, parents economizing expensive data and teachers yearning for digital tools they cannot access. The need for stakeholders to harness digital tools to exploit the potential benefits of screen time for ECD learners, is apparent. Only through systemic investment and community collaboration can screen-time evolve from an entertainment to a catalyst for transformative early learning.

RECOMMENDATIONS

To harness screen-time's potential in enhancing cognitive development of ECD learners in primary schools in Honde Valley and other rural schools sharing similar settings, the study recommends the following multi-level strategies.

- The National ECD policies should move beyond generic technology integration rhetoric practical incorporation of context-specific screen-time guidelines for resource-limited rural settings, emphasizing quality over quantity, structured use over passive consumption, while prioritizing teacher training and infrastructure support explicitly.
- The Ministry of Primary and Secondary Education (MoPSE) should partner with telecommunication companies and donors to expand electricity and internet access in rural schools, ensuring equitable technology distribution and bridging of the rural-urban digital divide.
- The Government, through MoPSE should develop screen-time guidelines tailored to rural realities, acknowledging socioeconomic constraints and promoting collaborative mediation.
- The MoPSE should spearhead community-driven digital literacy through training teachers to identify educational content and balance screen engagement with interactive play.
- Development partners such as NGOs should distribute low-cost, offline-enabled devices preloaded with ECD resources that are designed to enhance learners' cognitive development.

Areas for Further Research: Future research should compare multiple regions to identify broader patterns in screen-time's cognitive impacts. Additionally, longitudinal studies tracking learners' development over time could clarify causal relationships, while gender-disaggregated data would shed light on disparities in device access and usage.

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