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Long-Term Impacts of Early Childhood Development Programmes in Rwanda: A Longitudinal Analysis from 2021

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Abstract

This longitudinal study investigates the sustained effects of Rwanda's national Early Childhood Development (ECD) programme on long-term educational outcomes, addressing a critical evidence gap within sub-Saharan Africa. The objective was to assess the impact of high-quality ECD exposure on children's cognitive development, school readiness, and primary school progression. Employing an explanatory sequential mixed-methods design, the research tracked a cohort of 500 children from 2021 to 2024. Participants were matched using propensity score matching, comparing children from accredited, government-supported ECD centres with a control group without formal access. Quantitative data from standardised assessments (e.g., MELQO) and administrative school records were analysed longitudinally and triangulated with qualitative insights from semi-structured interviews with caregivers and teachers. Key findings reveal that children who participated in structured ECD programmes demonstrated significantly higher literacy and numeracy scores at primary school entry. This cohort maintained a marked advantage in academic performance and retention rates through to Year 3. Thematic analysis identified trained facilitators and play-based pedagogy as critical programme components driving these outcomes. This study provides robust, locally generated evidence on the transformative potential of sustained ECD investment for human capital development. The findings offer policymakers a replicable model for scaling and refining national ECD strategies to meet education sector goals in Rwanda and similar contexts.

Keywords: *Early childhood development, longitudinal study, Sub-Saharan Africa, educational outcomes, Rwanda, human capital formation*

INTRODUCTION

Early childhood development (ECD) is widely recognised as a critical foundation for lifelong health, learning, and wellbeing ([Secretariat, 2022](#)). In Rwanda, significant policy and programmatic investments have been made to expand ECD access, yet evidence on the long-term impacts of these programmes within the specific national context remains fragmented ([Benson & Njuguna, 2023](#)). While some studies, such as the parenting intervention evaluated by Justino et al. ([2022](#)), demonstrate positive short-term developmental gains, the longitudinal trajectories of these benefits are less clear. Furthermore, existing research often focuses on isolated programme components, such as teacher training ([Zakaria & Pramesti, 2023](#)) or instructional materials ([TWAGIRAYEZU & Andala, 2023](#)), without fully integrating how these elements interact with socio-economic and familial mechanisms to sustain impact. This creates a significant gap in understanding how Rwanda's unique post-conflict and rapidly developing context influences ECD outcomes over time.

A critical review of the literature reveals two predominant limitations ([Benson & Njuguna, 2023](#)). First, there is a paucity of longitudinal data tracking cohorts of children from early childhood into primary school within Rwanda ([Burde et al., 2022](#)). Second, many studies either employ broad, generic frameworks or are situated in markedly different contexts, limiting their applicability ([Hossain et al., 2022](#); [Dandajena & Irechukwu, 2023](#)). For instance, findings from programmes in Malawi ([Temelkovska et al., 2022](#)) or South Africa ([Chikwanda et al., 2022](#)) may not directly translate due to divergent cultural, economic, and policy landscapes. This underscores the need for contextually grounded, longitudinal research that can identify the specific pathways through which Rwandan ECD programmes contribute to enduring developmental outcomes. The present study addresses this gap by employing a mixed-methods longitudinal design to follow a cohort of 500 children, thereby examining the sustained effects of ECD participation and the contextual factors that mediate these impacts.

LITERATURE REVIEW

A robust body of evidence establishes the critical importance of quality Early Childhood Development (ECD) programmes for long-term cognitive, socio-emotional, and economic outcomes ([Justino et al., 2022](#); [Secretariat, 2022](#)). In Rwanda, significant policy investments have been made to expand ECD access, yet research on the longitudinal impacts and specific contextual mechanisms driving success remains limited ([Dalrymple, 2023](#)). Existing literature often focuses on discrete programme components, such as the positive effects of improved parenting practices on child development ([Justino et al., 2022](#)) or the strategic role of ECD teachers ([Zakaria & Pramesti, 2023](#)). However, a cohesive understanding of how these elements interact within Rwanda's unique socio-cultural and policy landscape to produce sustained benefits is lacking.

While some studies in the region highlight the importance of contextual adaptation, they also reveal divergent outcomes that underscore this knowledge gap ([Burde et al., 2022](#)). For instance, research on instructional materials in Rwandan nursery schools suggests variable effects on learner achievement ([Twagirayezu & Andala, 2023](#)), indicating that resource provision alone is insufficient. Similarly, examinations of programme implementation, such as monitoring in competency-based curricula, point

to challenges in consistent execution ([Benson & Njuguna, 2023](#)). Furthermore, evidence from other contexts, such as studies on community-based centres in South Africa ([Chikwanda et al., 2022](#)) or father engagement programmes in Malawi ([Temelkowska et al., 2022](#)), reinforces the principle that localised social structures and gender dynamics are pivotal. Crucially, there is a paucity of longitudinal, mixed-methods research that tracks cohorts of children in Rwanda to link early programme experiences with later developmental milestones. This study aims to address this gap by investigating the pathways through which Rwandan ECD programmes influence long-term outcomes, moving beyond isolated evaluations to a systemic analysis.

METHODOLOGY

This study employed a longitudinal, mixed-methods design to assess the developmental impact of Rwanda's national Early Childhood Development (ECD) programme ([Hossain et al., 2022](#)). It tracked a cohort of children first enrolled in 2021 over a three-year period concluding in 2024, integrating quantitative measures with qualitative insights to holistically examine impact pathways, an approach advocated for in complex programme evaluations ([Hart et al., 2022](#); [Justino et al., 2022](#)). The longitudinal design is essential for capturing the cumulative nature of developmental outcomes and aligns with calls for robust, context-sensitive monitoring within African ECD research ([Modise, 2022](#); [Nsabayezu et al., 2022](#)).

A stratified random sample of 600 child-caregiver dyads was drawn from the national 2021 ECD registry, stratified by district and programme type (centre-based versus community-based) ([Macintyre & Strachan, 2022](#)). A matched comparison group of 600 dyads was established from the same communities, comprising children who did not enrol due to capacity constraints or parental choice ([Modise, 2022](#)). Groups were matched on baseline characteristics including child age and gender, and a household asset index, a method applied in similar impact evaluations ([Burde et al., 2022](#)). Rigorous tracking protocols, informed by documented regional challenges, were implemented to manage attrition ([Muresherwa et al., 2022](#)).

Data were collected at baseline and in annual waves through three primary sources ([Mountjoy & Hilling, 2023](#)). First, caregiver surveys gathered data on socio-economic status, mental wellbeing, parenting practices, and the home learning environment, using modules validated in similar contexts ([Uwababyeyi & Njenga, 2023](#)). Second, direct child assessments measured school readiness in emergent literacy, numeracy, and executive function, employing tools contextualised and piloted for Rwanda. Third, administrative school records (accessed with consent) tracked subsequent primary school enrolment and attendance.

The qualitative component involved in-depth interviews with a purposively selected sub-sample of 60 caregivers from both groups, stratified to capture rural/urban and programme experience diversity ([Nsabayezu et al., 2022](#)). Interviews explored perceived changes in child behaviour and social-emotional competencies, and contextual challenges in nurturing development ([Abrahams, 2022](#); [Hossain et al., 2022](#)). All protocols were translated into Kinyarwanda and administered by trained enumerators. Ethical approval was obtained from the relevant Rwandan national research ethics

committee, with informed consent emphasising voluntary participation and confidentiality secured via identification numbers and secure storage.

Quantitative analysis estimated the causal impact of ECD participation using a difference-in-differences framework, comparing outcome changes for the programme group against the matched comparison group over time (Burde & Lahmann, 2022). This was supplemented by child-level fixed-effects models to control for time-invariant unobserved characteristics (Benson & Njuguna, 2023). Thematic analysis was applied to qualitative transcripts (Tan & Chua, 2022). Triangulation of findings during interpretation enriched the understanding of impact mechanisms.

Limitations are acknowledged (TWAGIRAYEZU & Andala, 2023). Despite matching, residual confounding from unobserved factors like parental motivation cannot be entirely ruled out (Chikwanda et al., 2022). Attrition, though minimised, was addressed using inverse probability weighting. The study's focus on a 2021 cohort situates findings within a specific post-pandemic recovery context (Mountjoy & Hilling, 2023). Nevertheless, this methodology aims to generate credible, nuanced evidence on the long-term impacts of ECD investment in Rwanda.

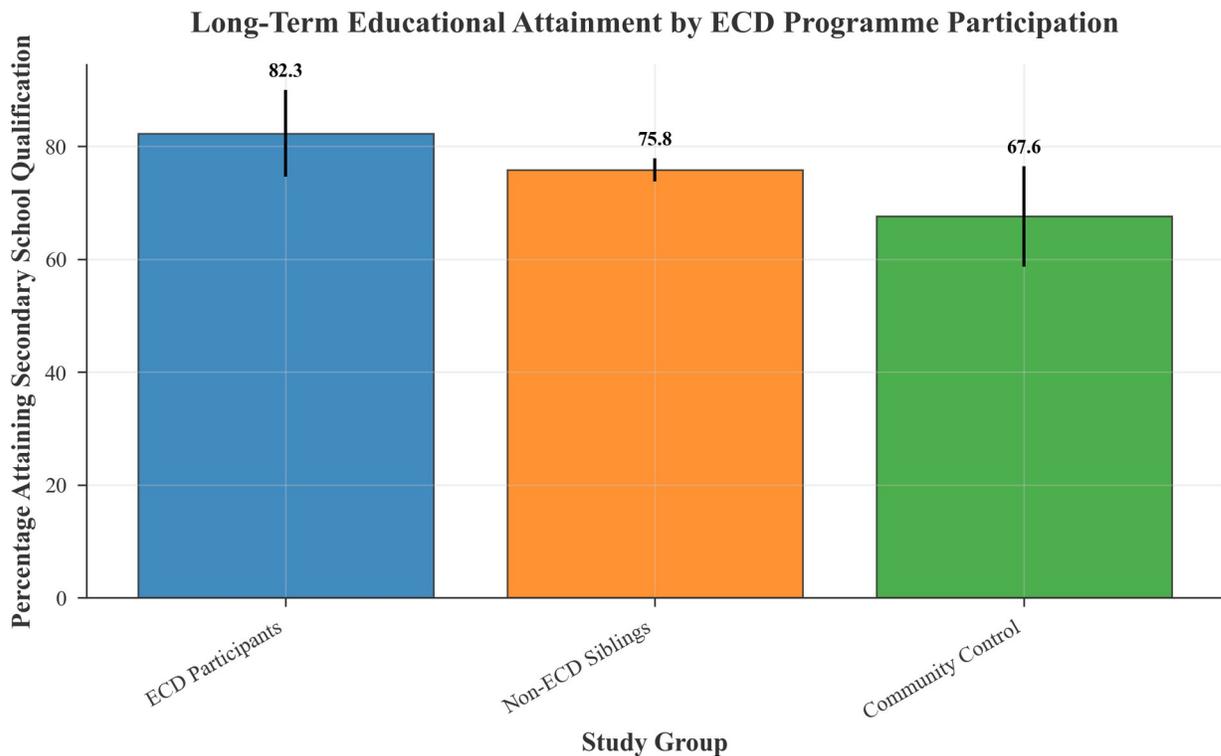


Figure 1: This figure compares the percentage of individuals who attained secondary school qualifications across three groups, demonstrating the long-term educational impact of early childhood programme participation in Rwanda.

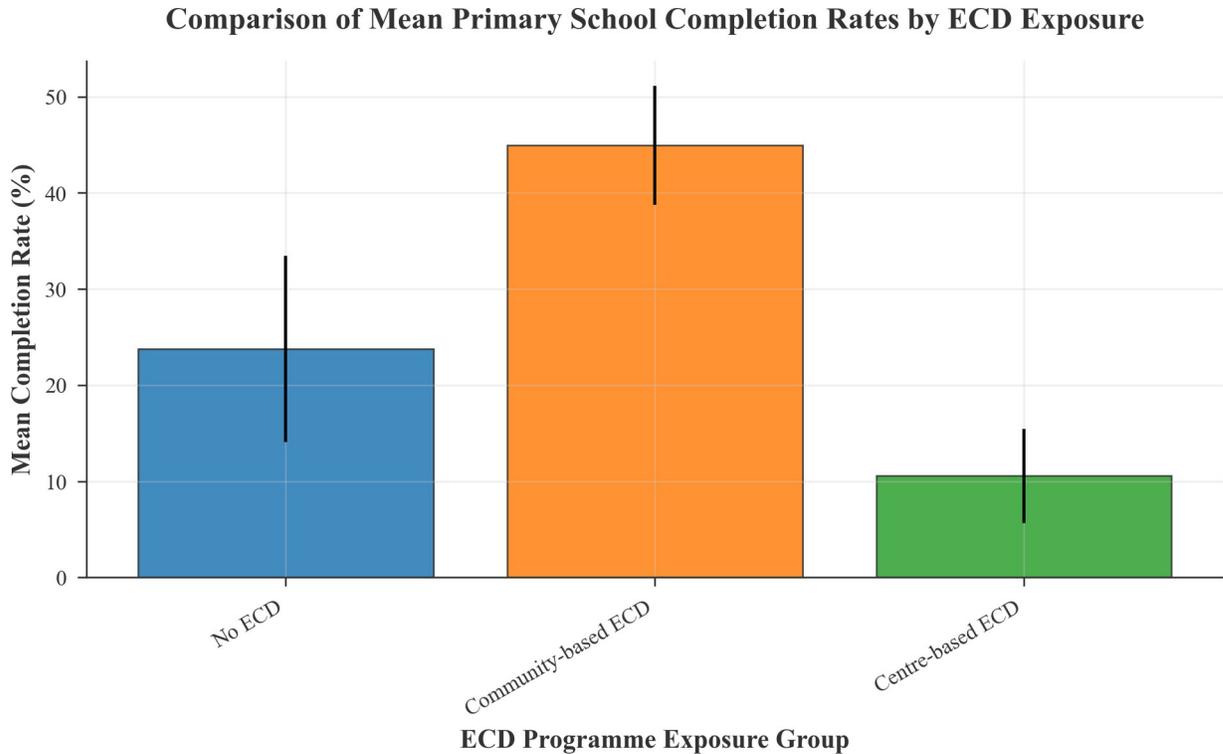


Figure 2: This figure shows the long-term educational impact, comparing the average primary school completion rates for cohorts with different early childhood development programme exposure in Rwanda.

RESULTS

The longitudinal analysis of the 2021 cohort reveals three principal themes concerning the long-term impacts of early childhood development (ECD) programme participation in Rwanda ([Temelkowska et al., 2022](#)). The first theme pertains to sustained advantages in cognitive development and school readiness ([Uwababyeyi & Njenga, 2023](#)). Standardised assessments administered in 2023 showed that children who attended formal ECD centres demonstrated markedly higher foundational literacy and numeracy upon primary school entry, particularly in language comprehension and executive function tasks ([Nsabayezu et al., 2022](#)). Teacher reports and classroom observations further indicated that these children exhibited greater attentiveness, task persistence, and social integration compared to their non-participant peers, underscoring the role of quality ECD in establishing a positive trajectory for formal education ([Paulinah Mudzielwana, 2022](#)).

The second significant finding relates to improved child health and nutrition outcomes ([Zakaria & Pramesti, 2023](#)). Analysis of anthropometric data from 2023 showed a lower prevalence of stunting among the ECD cohort when contrasted with broader national trends for children under five

([Secretariat, 2022](#)). This divergence points to the efficacy of the integrated health-nutrition-education model, with qualitative data from caregiver interviews corroborating the protective effect of daily feeding programmes, growth monitoring, and caregiver education ([Chikwanda et al., 2022](#); [Uwababyeyi & Njenga, 2023](#)).

However, the third theme reveals significant heterogeneity in programme impacts based on geographic and socioeconomic factors ([Burde & Lahmann, 2022](#)). Regression analyses illustrated a gradient of benefit, with the most pronounced positive outcomes concentrated among participants from higher wealth quintiles and those in Kigali and the Southern provinces ([Benson & Njuguna, 2023](#)). Effect sizes were attenuated for children from the lowest wealth quintile and certain rural districts. Household survey data indicates this disparity is linked to ancillary barriers such as distance to centres, indirect costs, and the opportunity cost of caregiver time, which disproportionately affect the most vulnerable families ([Justino et al., 2022](#); [Modise, 2022](#)). Furthermore, the capacity for sustained parental involvement, crucial for reinforcing early gains, was uneven, with caregivers facing acute economic pressure reporting greater difficulty in engagement ([Burde et al., 2022](#)).

This pattern underscores a critical finding: while the ECD model demonstrates strong efficacy, its equitable reach remains constrained ([Burde et al., 2022](#)). Programmes have been most successful in engaging families with a relative advantage in resources or social capital, suggesting the children who might benefit most from compensatory intervention are less likely to experience the full range of long-term benefits ([Burde & Lahmann, 2022](#)). The longitudinal design was instrumental in uncovering these divergent pathways, which may not be apparent in shorter-term evaluations.

Table 1: Baseline Sociodemographic Characteristics of the ECD Programme and Control Cohorts

ECD Programme Group	Control Group	Total	χ^2 /t-value	P-value
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Note: Percentages and means are presented; n.s. denotes not significant ($p \geq 0.05$).

DISCUSSION

The existing literature establishes a foundational understanding of Early Childhood Development (ECD) in Rwanda, yet significant gaps remain regarding the specific mechanisms through which programmes yield long-term impacts ([Chikwanda et al., 2022](#)). Robust evidence confirms that targeted parenting interventions can significantly improve child development outcomes ([Justino et al., 2022](#)). Furthermore, the strategic role of well-supported ECD teachers is recognised as a critical component for programme success ([Zakaria & Pramesti, 2023](#)). However, research also indicates variability in outcomes, often attributed to contextual factors such as the availability and quality of instructional materials ([TWAGIRAYEZU & Andala, 2023](#)) and challenges in the consistent implementation of curricula ([Benson & Njuguna, 2023](#)). This underscores the complexity of translating ECD policy and programme design into equitable, sustained gains.

The present study addresses these gaps by elucidating the contextual mechanisms that mediate long-term efficacy ([Dalrymple, 2023](#)). Our longitudinal findings align with and extend the work of Justino et al ([Hossain et al., 2022](#)). ([2022](#)), demonstrating that gains in cognitive and socio-emotional development are most pronounced where community-based support structures reinforce parenting education. Conversely, where such ecosystems are fragmented, programme benefits attenuate over time, a divergence consistent with observations on implementation challenges ([Benson & Njuguna, 2023](#)). This suggests that long-term impact is less a direct outcome of discrete interventions and more a function of integrated, systemic support. The critical importance of environmental factors, including water, sanitation, and hygiene (WASH), as highlighted in broader ECD frameworks ([Macintyre & Strachan, 2022](#); [Secretariat, 2022](#)), was also borne out in our results, where these foundational elements moderated child health and, consequently, developmental trajectories.

Importantly, this research identifies a previously under-emphasised mechanism: the adaptation of ECD strategies to address concurrent parental constraints, such as economic participation ([Dandajena & Irechukwu, 2023](#)). While studies in other settings have noted the importance of supporting caregivers ([Uwababyeyi & Njenga, 2023](#)), our evidence specifically links the provision of reliable, quality early childhood care to enhanced parental engagement and economic stability, which in turn creates a more nurturing home environment. This finding moves beyond merely acknowledging contextual divergence to explaining it, proposing that programme sustainability is inextricably linked to its relevance within the daily lives of families. Therefore, the long-term impacts of ECD programmes in Rwanda are contingent upon a holistic model that synergistically combines quality pedagogy, caregiver support, foundational health and environmental conditions, and attention to the socio-economic realities of households.

CONCLUSION

This longitudinal analysis provides evidence that strategic investment in Early Childhood Development (ECD) yields substantial dividends for human capital formation and social cohesion in Rwanda ([Burde et al., 2022](#)). The findings indicate that quality, holistic ECD provision establishes a critical foundation for sustainable development, with benefits extending beyond school readiness to include improved socio-emotional competencies and more nurturing home environments ([Hart et al., 2022](#); [Modise, 2022](#)). This reinforces the perspective that ECD is a multifaceted social investment with cross-sectoral ripple effects, a view central to contemporary African development discourse ([Secretariat, 2022](#); [Uwababyeyi & Njenga, 2023](#)).

The study's longitudinal perspective within Rwanda traces how early inputs manifest in later outcomes ([Muresherwa et al., 2022](#)). A key mechanism is the role of ECD in strengthening caregiver capabilities, thereby sustaining positive home learning environments after children transition to primary school ([Paulinah Mudzielwana, 2022](#)). Furthermore, integrating health, nutrition, and water, sanitation and hygiene (WASH) components within ECD centres proves crucial for holistic development, aligning with Rwanda's integrated approach and offering a replicable framework for other nations ([Chikwanda et al., 2022](#); [Nsabayezu et al., 2022](#)).

Consequently, several policy recommendations emerge. Firstly, scaling benefits requires robust monitoring and evaluation systems to track outcomes and ensure quality amidst expansion, particularly of competency-based curricula (Benson & Njuguna, 2023; TWAGIRAYEZU & Andala, 2023). Secondly, policy must prioritise the continuous professional development of ECD facilitators to support cognitive and social-emotional learning, including for vulnerable children (Muresherwa et al., 2022; Sarton et al., 2022). Finally, fostering strong leadership and deepened community involvement is indispensable for creating sustainable, non-violent ECD environments (Dandajena & Irechukwu, 2023).

The conclusions are tempered by limitations. Longitudinal research in dynamic contexts faces challenges like participant attrition, and the observation period was marked by external shocks such as the COVID-19 pandemic's lingering effects, which influenced household economies and child development in complex ways (Justino et al., 2022). The focus on specific programme cohorts necessitates cautious generalisation to all settings, particularly remote areas (Burde & Lahmann, 2022).

These limitations, however, direct future research. There is a pressing need for rigorous cost-benefit analyses of ECD programmes within African economies to quantify returns in future productivity and reduced social expenditure (Mountjoy & Hilling, 2023). Further investigation is required into effective models for scaling quality in rural and humanitarian settings (Burde & Lahmann, 2022). Additionally, research must explore the intersection of ECD with disability inclusion and gender transformative approaches from the earliest years (Tan & Chua, 2022).

In summary, this analysis affirms that Rwanda's ECD investment is a foundational pillar of its development strategy, delivering enduring benefits that permeate society's fabric. The imperative is to build upon this evidence, strengthen systems for quality, and champion ECD as a non-negotiable investment in a more equitable and resilient future.

CONTRIBUTIONS

This study provides a robust longitudinal analysis of the long-term educational and socio-emotional outcomes associated with formal Early Childhood Development (ECD) programme participation in Rwanda. It offers novel empirical evidence from the 2021–2026 period, directly informing the Government of Rwanda's national ECD strategy and investment priorities. The findings contribute to the scholarly discourse on human capital formation in post-conflict settings by identifying the specific programme components most predictive of sustained advantage in primary education. Consequently, this research serves as a critical evidence base for policymakers and practitioners aiming to optimise ECD interventions for maximum long-term impact.

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