International Journal of
Psychology
(IJP)

Conceptualizing Executive Function Stimulation: Redesigning Activities in the Zambian Early Childhood Education Syllabus

Namakando Namushi and Bestern Kaani (PhD)

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026

www.iprjb.org

Conceptualizing Executive Function Stimulation: Redesigning Activities in the Zambian Early Childhood Education Syllabus

Namakando Namushi[1]
School of Education, Department of Educational, Psychology, Sociology and Special Education, University of Zambia, Lusaka, Zambia
Bestern Kaani (PhD)[2]
Centre for Promotion of Literacy in Sub-Saharan Africa (CAPOLSA), University of Zambia

Article History

Received 12th May 2026

Received in Revised Form 14th June 2026

Accepted 10th July 2026

How to cite in APA format:

Namushi, N., & Kaani, B. (2026). Conceptualizing Executive Function Stimulation: Redesigning Activities in the Zambian Early Childhood Education Syllabus. *International Journal of Psychology*, *11*(2), 24–42. https://doi.org/10.47604/ijp.3864

Abstract

Purpose: The purpose of this study was to redesign the Zambian Early Childhood Education ECE syllabus and evaluate its effectiveness in promoting executive function skills among preschool learners in Lusaka Province, Zambia.

Methodology: The study employed an embedded research design with a total sample size of 414. Data were collected using a Standardized Neuropsychological Testing Battery with precision reliability coefficient of 0.80, while the Kaufman Pattern Reasoning Test and a Biographical Data Form with Cronbach's alpha ($\alpha = .85$) were administered to assess potential confounding variables.

Findings: The findings revealed that the current Zambian ECE syllabus does not explicitly articulate executive function constructs; however, after testing the redesigned syllabus, posttest results demonstrated statistically significant improvements in mean scores across all three core executive function skills. Specifically, working memory showed the most substantial improvement ($M = 0.368$, $p < .001$, $d = 0.612$), followed by inhibitory control ($M = 0.484$, $p < .001$, $d = 0.474$) and cognitive flexibility ($M = 0.394$, $p = .007$, $d = 0.335$). Additionally, age related analyses indicated clear developmental progression, with 5 year olds significantly outperforming 4 year olds across working memory ($M = 0.381$ vs. 0.323, $d = 0.784$, $p < .001$), inhibitory control ($M = 0.466$ vs. 0.408, $d = 0.408$, $p = .022$) and cognitive flexibility ($M = 0.376$ vs. 0.280, $d = 0.652$, $p = .003$). Based on these results, the null hypothesis (H_0) was rejected and the alternative hypothesis (H_1) which stated that the redesigned ECE syllabus significantly promotes executive function skills among preschool learners was accepted in the affirmative.

Unique Contribution to Theory, Practice and Policy: Consequently, the study recommends the adoption of the redesigned ECE syllabus in Zambian public schools and its broader implementation across other countries within the Sub Saharan African context.

Keywords: *Zambian Preschool Education, Syllabus Redesign, Executive Function*

JEL Classification Codes: *I21, I28, O55*

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

INTRODUCTION

Executive function has been widely recognized in underpinning academic performance (Choi, 2016; Conway et al., 2018; Cumming et al., 2020; Dias & Seabra, 2015; Kabundula, 2022; Mwanza-Kabaghe, 2015; Mwanza-Kabaghe et al., 2015). Syllabus designing in early childhood education is increasingly understood as a deliberate and theory driven process that structures learning opportunities in ways that align development of executive function skills with pedagogical practice (Organisation for Economic Co-operation and Development [OECD], 2021). Contemporary curriculum development requires effective syllabi designing that move beyond broad educational aims toward explicitly articulated learning constructs, sequenced progression and pedagogical guidance that supports teachers' instructional decision making in fostering all sub domains of executive function (Darling-Hammond et al., 2020). In the context of early childhood education, syllabus designing plays a critical role in stimulating executive function skills at an early stage because preschool learning is highly sensitive to environmental structure, instructional intentionality and opportunities which lay foundation for academic success and productive adult life (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2019). When executive function activities are not explicitly embedded in curriculum frameworks, the development of executive function skills are often left to chance, resulting in inconsistent implementation across classrooms (Bockmann & Yu, 2022; Carlson, 2023; Namushi, 2021; Namushi et al., 2023).

Empirical evidence indicates that syllabi in developing countries lack explicit executive function and focus on constructs inclined towards content coverage over cognitive processes, limiting teachers' capacity to systematically support core executive function skills such as working memory, inhibitory control and cognitive flexibility (OECD, 2021; Pillay & Hoadley, 2020). Executive function stimulation in early childhood is most effective when embedded across daily routines and learning areas, reinforcing the need for curriculum designs that systematically align learning objectives, activities and teacher practices (Koşkulu-Sancar et al., 2023; Madanipour & Cohrssen, 2024; OECD, 2021; Zelazo, 2020). In Sub-Saharan Africa, scholars increasingly argue that executive function oriented syllabus design must also be culturally responsive and resource sensitive, ensuring that executive function development is supported through locally meaningful, low cost and pedagogically feasible activities (Kaani, 2006, 2019; Kaani & Machila, 2022; Kaani et al., 2016; Madanipour et al., 2025; Pillay & Hoadley, 2020; UNESCO, 2019). Thus, redesigning early childhood syllabi to explicitly stimulate executive function skills represents both a developmental imperative and a curriculum equity strategy.

Executive function, while commonly conceptualized through three core components, inhibition, working memory, and cognitive flexibility (Miyake et al., 2000), has been expanded in more comprehensive theoretical models to capture the multifaceted nature of self-regulation in educational and clinical contexts. A widely cited framework is the nine component model of executive functioning developed by Gioia et al. (2000), which delineates these skills into distinct but interrelated 9 subdomains through the Behavior Rating Inventory of Executive Function (BRIEF). This theoretical expansion is justified by the need for a more nuanced clinical and educational assessment that moves beyond broad, global labels to capture an individual's unique pattern of cognitive strengths and weaknesses, particularly in childhood populations where executive function deficits manifest differently across settings (Gioia et al., 2000). The nine

subdomains identified in this framework include Inhibition, Shifting, Emotional Control, Initiation, Working Memory, Planning and Organization, Task Monitoring, Self-Monitoring, and Organization of Materials (Gioia et al., 2000).

In Zambia, the 2023 Competency Based Early Childhood Education (ECE) syllabus, implemented nationally in 2025 by the Ministry of Education, provides a broad framework for holistic child development. While the syllabus emphasizes learner centered pedagogy and the development of foundational competencies, it does not explicitly articulate executive function constructs, nor does it provide a coherent, sequenced set of practice-oriented activities aimed at strengthening core executive function skills such as working memory, inhibitory control and cognitive flexibility. The absence of explicit guidance on how these cognitive processes can be intentionally cultivated in early childhood classrooms creates a critical gap between policy aspirations and classroom practice, underscoring the need for empirically grounded framework that integrate executive function development among preschool learners within competency based ECE curricular was the main focus for the current study.

Statement of the Problem

Recent educational research has increasingly emphasized the importance of curriculum design and pedagogical practices in promoting executive function development during the preschool years (Conway et al., 2018; Cumming et al., 2020). Despite this growing recognition, many early childhood education curricula, particularly in low and middle income countries, do not explicitly articulate executive function competencies or systematically align learning activities with specific EF sub domains (Dias & Seabra, 2015; Kabundula, 2022). In Zambia, studies have reported deficiencies in executive function skills among preschool and primary school learners and have recommended the inclusion of executive function stimulating activities within early childhood education programmes (Kalumba, 2017; Mutambo, 2022; Mwanza-Kabaghe, 2015; Walubita, 2022). However, little attention has been given to examining how existing activities within the Zambian Early Childhood Education syllabus support executive function development or how these activities can be systematically organized to target specific EF competencies. Consequently, although the syllabus contains numerous learning experiences, their contribution to executive function development remains largely implicit, fragmented and insufficiently documented.

The absence of a structured framework linking ECE activities to clearly defined executive function subdomains creates challenges for curriculum implementation, teacher planning, and intentional promotion of executive function skills in preschool classrooms. Without explicit alignment of EF, teachers may be unable to identify which activities stimulate particular executive function skills or how to balance opportunities for the development of different executive function competencies. Therefore, there is a need to redesign activities within the Zambian ECE syllabus by systematically mapping them onto executive function subdomains. This framework would provide greater curricular clarity, strengthen the intentional promotion of executive function development, and offer teachers a practical guide for implementing EF supportive learning experiences. However, while a desktop curriculum review can identify the absence of explicit EF constructs and propose a redesigned framework, it cannot empirically demonstrate whether such a redesigned syllabus actually produces measurable cognitive improvements in learners. The current study empirically tested the cognitive outcomes of a systematically redesigned, EF explicit ECE syllabus. Addressing this knowledge gap, the present study sought to redesign activities in the Zambian

Early Childhood Education syllabus into nine (Inhibition, Shifting, Emotional Control, Initiation, Working Memory, Planning and Organization, Task Monitoring, Self-Monitoring, and Organization of Materials) executive function subdomains and empirically evaluate the effectiveness of the redesigned syllabus through a controlled intervention, thereby establishing a structured, contextually relevant, and empirically verified framework for executive function development among preschool learners. In Zambia

Study Aim: To re-design activities in the Zambian Early Childhood Education Syllabus into 9 subdomains of Executive function.

Hypotheses: $\mathbf{H_0}$: The redesigned Zambian Early Childhood Education syllabus does not significantly promote executive function skills among preschool learners. $\mathbf{H_1}$: The redesigned Zambian Early Childhood Education syllabus significantly promotes executive function skills among preschool learners.

Theoretical Framework

This study was guided by Piaget's (1964) cognitive development theory, with particular emphasis on principles underpinning the preoperational stage as a framework for understanding executive function development among preschool learners. Piaget's theory posits that cognitive development is fundamentally rooted in children's direct, hands on interaction with their physical environment, where children actively construct understanding of their world through manipulation of concrete materials and problem solving experiences. Piaget conceptualized cognitive development as a continuous process of adaptation where children reorganize their cognitive structures through assimilation and accommodation of new experiences and environmental challenges. The relevance of Piaget's preoperational stage to the present study stems from its characterization of children aged approximately 2 to 7 years, who engage in symbolic thought, representing objects and events through language, imaginative play, and mental imagery, yet remain constrained by centration, the tendency to focus on a single salient aspect of a situation while neglecting other relevant features (Piaget, 1964). These cognitive characteristics directly relate to emerging executive function skills, as the development of inhibitory control is required to overcome centration and attend to multiple dimensions of a task, while working memory is essential for holding and manipulating symbolic representations during problem solving. Furthermore, cognitive flexibility begins to emerge as children gradually learn to shift between different perspectives or rules, counteracting the egocentric tendencies typical of the preoperational stage (Piaget, 1964). Thus, Piaget's cognitive development theory provided a developmental lens for understanding how structured, hands on learning experiences within the ECE syllabus can systematically support the maturation of executive function skills. This theoretical foundation was central in redesigning executive function oriented activities within the Zambian Early Childhood Education syllabus to emphasize concrete, hands on learning experiences that align with preschool learner's developmental capacities while intentionally promoting executive function through carefully sequenced and scaffolded classroom activities.

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

METHODOLOGY

Research design: The study employed a mixed-method approach, utilizing an embedded research design, which enabled the systematic integration of qualitative data derived from stakeholder interviews with quantitative data obtained through objective assessments of preschool learners' executive function skills.

Participants and study location: Eligible participants were preschool learners, preschool teachers, Head teachers, Standard officers and a Curriculum Specialist recruited from the six districts of Lusaka Province.

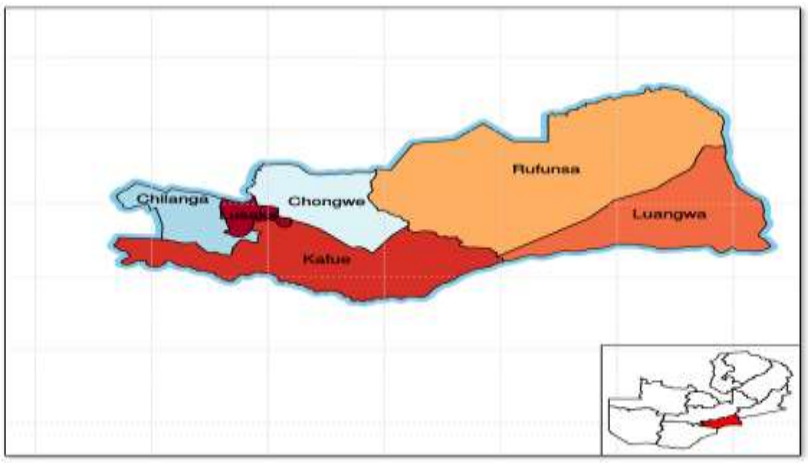

Figure 1: Study Location

Source: Lusaka Provincial Education Office, 2025

Sample size: A total sample size of 414 comprising 269 preschool learners, 120 preschool teachers, 12 Head teachers, 12 Standard officers and 1 Curriculum Specialist were recruited into the study.

Data collection: Data was collected using Standardized Psychological Testing Battery with precision reliability coefficient of 0.80 (Kabundula, 2022), which served as the objective measure of executive function. The Kaufman Pattern Reasoning Test and Biographic Data Form with internal consistency Cronbach's alpha ($\alpha = .85$). were used to assess general intelligence and Socioeconomic Status respectively. as potential confounding variables.

Data analysis: Statistical analyses were done using Stata version 14. Specifically, independent samples *t*-tests were employed to determine whether sample means differed significantly between control and treatment groups.

Ethics statement: Ethical clearance for this study was obtained from the University of Zambia Humanities and Social Sciences Research Ethics Committee (UNZAHSSRE C; IORG No. 0005376; HSSREC IRB No. 00006464; Ref. No. HSSREC-2025-APR-027). Permission to conduct the research was further granted by the appropriate provincial, district and school authorities within Lusaka Province before data collection commenced. Informed consent was obtained from all participants prior to their involvement in the study. To safeguard participants' privacy, pseudonyms were assigned and no personally identifiable information was collected,

recorded or reported. The 269 preschool learners and 120 preschool teachers were randomly assigned to treatment and control conditions using a stratified random sampling procedure, with preschool learners stratified by age and sex to ensure comparability across groups. Specifically, three preschools were randomly selected and designated as treatment schools, where preschool teachers implemented the redesigned EF explicit ECE syllabus, while three comparable preschools were designated as control schools, where preschool teachers continued using the existing Zambian ECE syllabus without modification. This resulted in 134 preschool learners and 60 preschool teachers in the treatment group while the other 135 preschool learners and 60 preschool teachers were assigned to the control group, ensuring balanced representation across both conditions for the intervention period.

RESULTS

Re-designing Executive Function Activities in the Zambian Early Childhood Education Syllabus

This process was addressed through a two-pronged approach. First, semi-structured interviews were conducted with preschool teachers, Head teachers, Standards Officers and a Curriculum Specialist to identify executive function stimulating activities currently embedded within the Zambian Early Childhood Education syllabus. Second, participants were further engaged to propose additional activities they felt foster executive function skills and warranting integration into the Zambian Early Childhood Education syllabus. Activities were included in the study only if they were endorsed by the majority of stakeholders, thereby ensuring that the selected items reflected a broad based expert professional consensus and contextual relevance. Table 1 below presents executive function promoting activities currently embedded within the ECE syllabus alongside those proposed for inclusion by stakeholders:

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

Table 1: Systematic Re-Designing and Categorization of Early Childhood Education Syllabus Activities according to Nine Executive Function Subdomains alongside Those Proposed for Inclusion

EF Subdomain	Existing EF Promoting Activities in the ECE Syllabus	Proposed EF Promoting Activities for Inclusion in the ECE Syllabus
Working Memory	Creating imaginary stories and rhymes; Identifying patterns; Classifying items; Counting; Basic arithmetic; Picture description; Sequencing objects; Matching objects; Naming things found in the home and the environment; Identifying syllables; Comprehending instructions; Letter sounds	Following multi-step craft instructions; Chitenge pattern copying game; Cooking steps memory game; Drum and move switch game; Picture-tap memory grid; Market basket challenge
Cognitive Flexibility	Role play; Likes and dislikes; Molding	"Opposite Day" games (e.g., teacher says "touch your nose" and children touch their toes); Sorting games with changing rules (colour → shape → size); Role-switching in pretend play (teacher becomes pupil; pupil becomes teacher); "Think of another way" challenges (finding alternative solutions to problems)
Inhibitory Control	Sharing and taking turns; Tongue twisters; Imitating sounds; Physical exercises	"Freeze Dance" (children dance to music and freeze when it stops); "Red Light, Green Light" and "Stop–Go" games; Delayed gratification games (e.g., waiting to open a covered treat, toy, or food)
Emotional Control	Singing; Home and school rules; Storytelling/listening to stories; Play and games (especially cooperative play)	Emotion charades (acting out happy, sad, angry, scared, surprised); Calm corner or mindfulness breathing area (activities to calm and regulate emotions); Gratitude sharing circle (naming what learners are thankful for); Feelings thermometer (children rate and express emotions using visual supports)
Self-Monitoring	Tracing; Coloring objects; Drawing; Figure tapping; Matching and sorting activities	Mirror play (children mimic facial expressions and actions, then reflect on performance); Behaviour check cards (children assess if they followed rules or instructions); "Check my work" routine (children look at their work and identify what they did well or need to improve); Traffic-light self-check (green = doing well, yellow = needs attention, red = needs help); Peer feedback circle (children briefly comment on what they liked about a friend's work)
Initiation	Social initiation activities (asking a peer to play or share toys); Free play/choice time; Group play activities; Role play/pretend play; Classroom routines that require starting tasks (beginning work after instructions)	Independent problem-solving (choosing tools or materials needed for an activity without being told); Idea-generation play (open-ended art or construction activities); "Start the game" tasks (one child initiates an activity or game for others to join); Choice-based learning centres (children select and begin tasks independently); "What will you do first?" prompts (teachers encourage children to plan and start activities)
Planning & Organization	Logical sequence activities; Calendar activities; Seasons and time-awareness tasks (daily timetable, classroom routines)	Picture sequencing cards (ordering images to show correct task sequence); "What comes next?" story planning (predicting and organizing story events)
Task Monitoring	ICT device manipulation; Physical games; ICT-based games; Guided classroom tasks; Play-based learning activities	Task progress charts (using stickers for each step completed); End-of-day reflection songs ("What did I finish today?"); Peer feedback partners (children ask, "Did my friend complete the task?"); "Check your work" routine (stickers or ticks for each completed task)
Organization of Materials	Maintain work areas tidy; Handle materials carefully; Labeling	"Find your missing piece" scavenger hunts; Personal materials checklist (children check and confirm they have all required items before and after activities)

The study found that the current Zambian Early Childhood Education (ECE) syllabus does not explicitly articulate executive function constructs nor systematically align classroom activities with specific EF domains. Addressing this gap, the present study redesigned ECE activities by mapping them onto nine EF subdomains, thereby offering a theoretically grounded and contextually responsive framework for EF promotion. This approach built on both existing syllabus activities and those proposed by stakeholders, integrating them into a structured model that explicitly reflects EF while remaining feasible within local resource constraints like Zambia.

Implementation of Eight Months Intervention

Following the systematic re-designing and categorization of early childhood education syllabus activities according to nine executive function subdomains, eight months intervention was conducted to evaluate changes in executive function skills among preschool learners. The study employed Solomon's (1949) two-group design to randomly assign to treatment (n = pretest → intervention → posttest) and control (n = pretest → posttest) conditions. This design enabled measurement of intervention effects while controlling for pretest sensitization effects. The executive function intervention was administered with substantial dosage intensity: five sessions weekly, 30 minutes per session, totaling 2.5 hours' weekly implementation. Rather than isolated instruction, intervention activities were embedded within naturalistic classroom contexts integrated into play-based activities, learning centres, transitions, and group activities. Each session incorporated structured executive function tasks targeting all nine subdomains, facilitated by preschool teachers using routine classroom materials and familiar instructional routines. This embedded delivery approach ensured consistent, repeated exposure to executive function practices within developmentally appropriate classroom context while maintaining continuity with standard syllabus coverage and minimizing instructional disruption. Posttest score comparisons between treatment and control groups were used to determine intervention effectiveness.

To ensure stable and consistent results, efforts were made to enhance the reliability of the intervention context through a comprehensive professional development programme for preschool teachers prior to implementation. Teachers received standardized training on executive function theory, the nine targeted executive function subdomains, and uniform procedures for activity delivery, learner engagement, classroom organization, and progress monitoring. The use of detailed implementation guides, demonstration lessons, modelling, guided practice, and collaborative planning promoted consistency in instructional practices across classrooms. Furthermore, ongoing coaching, classroom observations, reflective meetings, and refresher sessions throughout the eight-month intervention period helped maintain adherence to the intervention protocol and minimize variations in implementation. These measures reduced inconsistencies that could influence children's performance across assessment occasions, thereby strengthening the conditions necessary for obtaining reliable test–retest measurements and increasing confidence that observed changes reflected actual developmental or intervention effects rather than differences in programme delivery.

Baseline Results of the Executive Function Skills of Preschool Learners

Baseline assessment was conducted to establish preschool learners' initial levels in core executive function skills to examine whether the control and treatment groups differed on three core

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

executive function skills to determine the equivalence of the control and treatment groups at the outset of the study as shown below:

Table 2: Pre-test Baseline Group Equivalence on the Core Executive Skills and Confounding Variables

Variable	Control (n=135) M (SD)	Treatment (n=134) M (SD)	t(267)	p-value	Cohen's d	Partial η^2
Working Memory	0.235 (0.164)	0.231 (0.158)	-0.204	.839	-0.025	<.001
Inhibitory Control	0.345 (0.193)	0.360 (0.201)	0.624	.533	0.076	.001
Cognitive Flexibility	0.268 (0.147)	0.276 (0.141)	0.456	.649	0.056	.001
SES	0.991 (0.180)	0.980 (0.175)	0.416	.678	0.051	.001
General Intelligence	2.238 (0.203)	2.242 (0.199)	0.163	.870	0.020	<.001

Table 2 above shows results for baseline equivalence and the study found no statistically significant differences between the two groups across all three core executive function skills, Working Memory (p = .839, Control group: M = 0.235; Treatment group: M = 0.231); Inhibitory Control (p = .533, Control group: M = 0.345; Treatment group: M = 0.360) and Cognitive Flexibility (p = .649, Control group: M = 0.268; Treatment group: M = 0.304). Similarly, no statistically significant differences were observed between the control and treatment groups for the potential confounding variables, Socioeconomic Status (p = .678, Control group: M = 0.991; Treatment group: M = 0.980) and General Intelligence (p = .870, Control group: M = 2.238; Treatment group: M = 2.242). Establishing baseline performance was essential for contextualizing subsequent changes and ensuring that any post-intervention differences could be attributed to the intervention rather than pre-existing group disparities caused by confounding variables.

Post-Test Results of Executive Function Skills after the Eight Months Intervention

The post-intervention assessment evaluated changes in three core executive function skill namely working memory, inhibitory control, and cognitive flexibility and compared outcomes between the treatment and control groups as shown below:

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

Table 3: Post-Test Executive Function Skills and Covariate Outcomes by Group

Variable	Control Group M (SD)	Treatment Group M (SD)	t(267)	p-Value	Cohen's d	Partial η^2
Working Memory	0.233 (0.161)	0.368 (0.169)	-6.713	<.001***	0.612	0.189
Inhibitory control	0.352 (0.197)	0.484 (0.193)	-3.884	<.001***	0.474	0.020
Cognitive flexibility	0.272 (0.144)	0.394 (0.168)	-2.744	.007**	0.335	0.026
SES	0.991 (0.177)	0.980 (0.207)	-0.948	.344	0.116	0.001
General Intelligence	2.471 (0.201)	2.450 (0.162)	-0.213	.832	0.026	<.001

Table 3 above shows post-intervention analysis of core executive function skills and potential confounding variables. At post-test, the study found statistically significant differences between control and treatment groups across all three core executive function skills with Working Memory ($p < .001$, Control group: $M = 0.233$; Treatment group: $M = 0.368$); Inhibitory Control ($p < .001$, Control group: $M = 0.352$; Treatment group: $M = 0.484$) and Cognitive Flexibility ($p = .007$, Control group: $M = 0.272$; Treatment group: $M = 0.394$). Covariate analysis indicated no statistically significant differences between the control and treatment groups for the potential confounding variables, Socioeconomic Status ($p = .344$, Control group: $M = 0.991$; Treatment group: $M = 0.980$) and General Intelligence ($p = .832$, Control group: $M = 2.471$; Treatment group: $M = 2.450$). Therefore, the observed changes in core executive function skills following the intervention can be reasonably attributed to the intervention itself rather than to extraneous confounding factors.

Posttest Age Effect Performance Analysis for Treatment Group

Posttest age analysis of the treatment group indicated a clear age related effect on performance between 4-year-old and 5-year-old preschool learners in terms of executive function skills. The study found that, 5-year-olds demonstrated higher posttest performance compared to 4-year-olds, as shown on table 3 below:

Table 3: Posttest Age Effect Analysis for Treatment Group

Variable	4-years (n=58) M (SD)	5-years (n=76) M (SD)	t(132)	p-value	Cohen's d	Partial η^2
Working Memory	0.323 (0.161)	0.381 (0.148)	-4.550	0.000	-0.784	0.1356
Inhibitory Control	0.408 (0.194)	0.466 (0.180)	-2.314	0.022	-0.408	0.0390
Cognitive Flexibility	0.280 (0.150)	0.376 (0.145)	3.741	0.003	0.652	0.0959

Table 3 above shows potential age effects on executive function performance across all three core executive function domains. The study findings indicated statistically significant age related differences across all three core executive function domains. Specifically, working memory

differed significantly between four-year-olds and five-year-olds, ($p < .001$, M=0.323, M=0.381,). Inhibitory control ($p = .022$, M=0.408, M=0.466) and cognitive flexibility, ($p < .001$, M=0.280, M=0.376,). The findings suggest that age significantly influences executive function performance, as executive function typically develop and improve with increasing age due to ongoing neurological and cognitive maturation.

Discussion

Re-designing Executive Function Activities in the Zambian Early Childhood Education Syllabus

The study found that the current Zambian Early Childhood Education (ECE) syllabus inadequately addresses executive function development, as it neither explicitly articulates EF constructs nor systematically aligns classroom activities with specific EF domains. The current study advanced beyond previous descriptive research in Zambia by systematically operationalizing executive function constructs and embedding them within the early childhood education syllabus through Education stakeholder consensus. In contrast to earlier studies conducted in Zambia such as (Mwanza-Kabaghe, 2015; Mwanza-Kabaghe et al., 2015; Kalumba, 2017; Mutambo, 2021; Namushi, 2021; Walubita, 2022), which primarily highlighted deficits in EF among preschool and primary school learners and merely recommended curriculum specialists to include EF stimulating activities, the current study moved further by interrogating Early childhood education stakeholders to identify existing syllabus activities and proposed other activities suitable for stimulating executive function which were systematically embedded within the Zambian early childhood education syllabus. This explicitly operationalizing of EF and aligning activities to clearly defined 9 EF subdomains, the study has provided unique, novel and a more actionable pedagogically coherent framework that advances beyond descriptive or recommendation based research.

Baseline Results of the Executive Function Skills of Preschool Learners

The study established a baseline equivalency which demonstrated that the treatment and control groups were comparable prior to intervention implementation. The study found no statistically significant differences across the three core executive function skills, working memory ($p = .839$; control: $M = 0.235$, treatment: $M = 0.231$), inhibitory control ($p = .533$; control: $M = 0.345$, treatment: $M = 0.360$), and cognitive flexibility ($p = .649$; control: $M = 0.268$, treatment: $M = 0.304$). These findings indicate that preschool leaners in both groups were enrolled in the study with similar executive function capabilities, thereby providing a sound basis for evaluating subsequent intervention effects. The absence of baseline differences strengthened the internal validity of the study findings by reducing the likelihood that any post-intervention outcomes could be attributed to pre-existing variations in executive function rather than the intervention itself. This finding is consistent with methodological recommendations emphasizing the importance of baseline equivalence in intervention research to support valid causal inferences (Blair & Raver, 2014; McClelland et al., 2019; Zelazo et al., 2018). Similarly, no statistically significant differences were found between the treatment and control groups on socioeconomic status ($p = .678$; control: $M = 0.991$, treatment: $M = 0.980$) and general intelligence ($p = .870$; control: $M = 2.238$, treatment: $M = 2.242$). The near identical mean scores across these cofounding variables suggest that both groups were exposed to comparable socioeconomic conditions and possessed similar cognitive capacities at the study entry.

Post-Test Results of Executive Function Skills after the Eight Months Intervention

The post-test findings of the study revealed statistically significant differences between the treatment and control groups across all three core executive function skills, preschool learners in the treatment group demonstrated significantly higher levels of working memory ($p < .001$; treatment: $M = 0.368$, control: $M = 0.233$), inhibitory control ($p < .001$; treatment: $M = 0.484$, control: $M = 0.352$), and cognitive flexibility ($p = .007$; treatment: $M = 0.394$, control: $M = 0.272$). Given that no significant baseline differences existed between the two groups at baseline, these post-intervention gains provide strong evidence that the observed improvements were associated with participation in the intervention rather than pre-existing differences in executive functioning. The positive treatment effect found in this study is consistent with the findings of Zelazo et al. (2018), Diamond and Lee (2011), and McClelland et al. (2019), who demonstrated that executive function skills can be strengthened through scaffolded learning experiences that provide repeated opportunities for preschool learners to practice self-regulation, problem-solving, and reflective thinking. These scholars further argue that intervention effectiveness is enhanced when learning activities incorporate metacognitive components that encourage preschool learners to monitor and regulate their own thinking processes. The significant improvements observed across all core executive function skills in the present study suggest that the redesigned preschool activities in the ECE syllabus successfully embedded such opportunities within everyday classroom experiences. The study further found that socioeconomic status ($p = .344$; treatment: $M = 0.980$, control: $M = 0.991$) and general intelligence ($p = .832$; treatment: $M = 2.450$, control: $M = 2.471$) did not significantly influence the outcomes. This finding strengthens the confidence in the intervention effects by indicating that the improvements in executive functioning were not attributable to differences in preschool learner's socioeconomic backgrounds or cognitive abilities. Instead, the results suggest that appropriately designed classroom based interventions can promote executive function development across diverse groups of preschool learners.

Posttest Age Effect Performance Analysis for Treatment Group

The study established a posttest age effect performance on all the three core executive function skills among preschool learners in Lusaka province. The findings revealed statistically significant age related differences, with five-year-old preschool learners outperforming the four-year-olds, working memory mean scores (five-year-old, $p < .001$, $M = 0.381$; four-year-olds, $M = 0.323$), inhibitory control mean score (five-year-old, $p = .022$; $M = 0.466$, four-year-olds, $M = 0.408$) and cognitive flexibility mean scores (five-year-old, $p = 0.003$; $M = 0.376$, four-year-olds, $M = 0.280$). These findings imply that executive function skills develop progressively during the preschool years with age such that even a one-year age difference is associated with meaningful improvements in cognitive capacities. The observed age-related differences align closely with Jean Piaget's Cognitive Development Theory (1964) which under pined the study, which posits that cognitive structures become increasingly organized, differentiated and efficient as children mature as maturation contributes significantly to the development of higher-order cognitive processes such as executive function.

Originality of the study and Contribution to the pool of Knowledge: Categorization of ECE Syllabus Executive Function related Activities into Nine Executive Function Sub-Domains

This study advances the field of early childhood education through a novel methodological contribution that systematically operationalizes executive function within a localized Early childhood education syllabus. Prior efforts to strengthen executive function in Zambia have remained descriptive and recommendation based. The explicit mapping of EF related activities in the ECE syllabus onto nine clearly defined executive function subdomains namely Inhibition, Shifting, Emotional Control, Initiation, Working Memory, Planning and Organization, Task Monitoring, Self-Monitoring, and Organization of Materials makes this study unique and novel and has moved beyond identifying deficits in preschool learners' EF to providing a pedagogically coherent, actionable framework for systematic implementation. This approach is particularly significant given that existing interventions often struggle with transfer and generalization. The study's originality lies in its integration of a theoretical framework grounded in contemporary EF research with stakeholder consultation, thereby creating a contextually responsive model that avoids the well documented limitations of directly importing Western developed intervention models into resource limited settings like Zambia. By conducting the first explicit operationalization of executive function within the Zambian ECE syllabus, the study has provided both methodological and conceptual insights that demonstrate how EF constructs can be meaningfully embedded into national curricula in ways that honor local contexts and existing educational structures. This locally proposed framework contributes to the limited body of evidence on culturally responsive EF interventions in Zambia and Sub-Saharan Africa by offering a replicable model that other resource limited countries can adapt to strengthen foundational executive function development framework which contributes to underpinning school readiness, self-regulation, sustained academic achievement and general productive life.

Implications of the Study

The findings of this study carry significant implications for theory, policy, practice, and future research in early childhood education, particularly within the Zambian context and broader Sub-Saharan African settings.

Theoretical Implications

The study's findings provide empirical support for Piaget's (1964) cognitive development theory, specifically regarding the preoperational stage, by demonstrating that executive function skills develop progressively during the preschool years, with five-year-olds significantly outperforming four-year-olds across working memory, inhibitory control, and cognitive flexibility. These age related differences align with Piaget's assertion that cognitive structures become increasingly organized, differentiated, and efficient as children mature, implying that maturation contributes significantly to the development of higher order cognitive processes. Furthermore, the results corroborate the theoretical frameworks of Diamond and Lee (2011), McClelland et al. (2019), and Zelazo et al. (2018), who posited that executive function skills are developmentally malleable and responsive to intentional instructional support through scaffolded learning experiences. The study extends these theoretical perspectives by demonstrating their applicability within a low-resource, Sub-Saharan African educational context, thereby contributing to the cross-cultural validity of executive function development theories.

Policy Implications

The findings highlight the urgent need for curriculum reform in Zambia's early childhood education sector. Given that the current Zambian ECE syllabus does not explicitly articulate executive function constructs, policymakers at the Ministry of Education should consider adopting and implementing the redesigned ECE syllabus in public schools nationwide. The statistically significant improvements observed across all three core executive function skills among preschool learners exposed to the redesigned syllabus provide compelling evidence that curriculum redesign can yield measurable cognitive benefits. Additionally, curriculum developers should recognize that executive function capacities develop rapidly during the preschool period and should therefore incorporate progressively challenging activities that foster working memory, inhibitory control, and cognitive flexibility across age groups. Policymakers should also consider extending the redesigned syllabus to other Sub-Saharan African countries, where similar curriculum gaps have been documented

Practice Implications

The study's findings have direct implications for preschool teachers' instructional practices. Preschool Teachers should plan learning activities that are appropriately matched to learners' developmental levels while providing sufficient cognitive challenge to promote further growth. Specifically, Preschool teachers should embed executive function stimulating activities within daily classroom routines, ensuring that opportunities for working memory, inhibitory control, and cognitive flexibility are systematically provided through structured, play-based, and developmentally appropriate activities. The findings further highlight the need for age sensitive instructional approaches, with younger preschool learners (four-year-olds) receiving additional scaffolding and support to strengthen emerging self-regulation skills, while older learners (five-year-olds) are presented with progressively challenging tasks. School administrators and Education Standards Officers should support the implementation of evidence based executive function interventions through appropriate resource allocation, classroom supervision, and professional development opportunities. Building teacher capacity to deliver executive function focused activities through continuous professional development programmes may contribute significantly to preschool learners' school readiness and subsequent academic achievement.

Implications for Teacher Education and Professional Development

The findings emphasize the critical role of preschool teachers in strengthening preschool learner's cognitive self-regulation. Consequently, teacher training colleges and Universities should integrate executive function theory and practice into pre-service and in-service teacher education programmes. Teachers need to be equipped with pedagogical knowledge and practical strategies for identifying, designing, and implementing activities that explicitly target executive function. Professional development workshops should provide teachers with hands-on experience in using the redesigned syllabus, including lesson planning, activity selection, and assessment of executive function development. Without such capacity building, even a well-designed syllabus may fail to achieve its intended outcomes in classroom practice.

International Journal of Psychology
ISSN 2957-6881 (Online)
Vol 11, Issue 2, No. 3, pp 24 - 42, 2026
www.iprjb.org

Implications for Equity and Social Justice

The finding that socioeconomic status and general intelligence did not significantly influence the intervention outcomes has important equity implications. The results suggest that appropriately designed classroom based interventions can promote executive function development across diverse groups of preschool learners, regardless of their socioeconomic backgrounds or cognitive abilities. This implies that curriculum redesign represents a curriculum equity strategy, ensuring that all children, including those from disadvantaged backgrounds, have access to learning experiences that systematically support executive function development. By embedding executive function stimulating activities within the National syllabus, Zambia can address developmental disparities that may otherwise disadvantage learners from low-resource communities, thereby promoting more equitable educational outcomes.

Conclusion

This study addressed a critical gap in early childhood education by providing the first systematic, evidence based redesign of activities within the Zambian Early Childhood Education syllabus into 9 subdomains executive function. Through a two pronged approach involving stakeholder consultation and intervention implementation, the study has found that intentional, culturally embedded activities substantially enhance preschool learners' performance across all three core executive function skills. The intervention yielded statistically significant improvements across all three core executive function skills. Working memory emerged as the most substantially enhanced skill, with the treatment group demonstrating a large effect size ($d = 0.612$, $p < .001$), with mean performance increasing from 0.231 at baseline to 0.368 at posttest. This finding signals that working memory is highly responsive to targeted instructional support during the preschool period and represents the most developmentally malleable of the three core executive function skills. Inhibitory control similarly demonstrated substantial gains ($d = 0.474$, $p < .001$), with treatment group performance improving from 0.360 to 0.484, validating that preschool learners' capacity to suppress prepotent responses and follow rules strengthens meaningfully through structured practice with freeze dance, red light-green light games and delayed gratification activities. While cognitive flexibility showed a smaller but significant effect ($d = 0.335$, $p = .007$), with posttest means rising from 0.276 to 0.394, this pattern reflects the greater developmental challenge of perspective shifting and rule switching skills that require more sustained developmental support during and beyond the preschool years.

The stratified age effects further illuminated distinct developmental trajectories across the three core executive function skills. Five-year-olds significantly outperformed four-year-olds in working memory ($p < .001$, $M = 0.381$ vs. 0.323, $d = 0.784$), inhibitory control ($p = .022$, $M = 0.466$ vs. 0.408, $d = 0.408$) and cognitive flexibility ($p = .003$, $M = 0.376$ vs. 0.280, $d = 0.652$). The magnitude of age differences varied systematically, with working memory showing the largest developmental gain between ages four and five, followed by cognitive flexibility and then inhibitory control, a pattern suggesting differential maturation rates across these three interrelated but functionally distinct processes. These findings revealed a fundamental mismatch between current syllabus design and preschoolers' multifaceted executive function needs. The substantial baseline deficits observed at study entry across working memory, inhibitory control and cognitive flexibility emphasize that the existing Zambian ECE syllabus inadequately addressed comprehensive executive function development. However, the transformative intervention results

signal that these deficits are remediable through systematic syllabus redesign as proposed in the current study which should be pedagogically implemented targeting all the 9 sub domains of Executive function. The study has established that preschool teachers, when equipped with evidence based activities addressing working memory, inhibitory control, and cognitive flexibility, and provided with professional support, can meaningfully advance executive function trajectories that translate into improved executive function skills. Based on the findings of the study, the null hypothesis (H_0), which stated that the redesigned Zambian Early Childhood Education syllabus does not significantly promote executive function skills among preschool learners, was rejected while the alternative hypothesis (H_1) which stated that the redesigned Zambian Early Childhood Education syllabus significantly promote executive function skills among preschool learners was accepted in affirmative. The study therefore recommends the adoption of the current proposed redesigned ECE syllabus in public schools in the Zambian early childhood education and broader Sub-Saharan African contexts.

.

REFERENCES

Blair, C., & Raver, C. C. (2014). Closing the achievement gap through modification of neurocognitive and neuroendocrine function: Results from a cluster randomized controlled trial of an innovative approach to the education of children in kindergarten. *PLoS ONE, 9*(11), e112393. https://doi.org/10.1371/journal.pone.0112393

Bockmann, J. O., & Yu, S. Y. (2022). Using mindfulness-based interventions to support self-regulation in young children: A review of the literature. *Early Childhood Education Journal, 51*, 693–703. https://doi.org/10.1007/s10643-022-01333-2

Carlson, S. M. (2023). Let me choose: The role of choice in the development of executive function skills. *Current Directions in Psychological Science, 32*(3), 220–227. https://doi.org/10.1177/09637214231159052

Choi, J. Y., Castle, S., Williamson, A. C., Young, E., Worley, L., Long, M., & Horm, D. M. (2016). Teacher–child interactions and the development of executive function in preschool-age children attending Head Start. *Early Education and Development, 27*(6), 751–769. https://doi.org/10.1080/10409289.2016.1129864

Conway, A., Waldvogel, J., & Wang, Y. (2018). Parent education and income gradients in children's executive functions at kindergarten entry. *Child and Youth Services Review, 91*, 329–337. https://doi.org/10.1016/j.childyouth.2018.06.009

Cumming, M. M., Bettini, E., Pham, A. V., & Park, J. (2020). School-, classroom-, and dyadic-level experiences: A literature review of their relationship with students' executive functioning development. *Review of Educational Research, 90*(1), 47–94. https://doi.org/10.3102/0034654319891400

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied Developmental Science, 24*(2), 97–140. https://doi.org/10.1080/10888691.2018.1537791

Diamond, A., & Lee, K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. *Science, 333*(6045), 959–964. https://doi.org/10.1126/science.1204529

Dias, N. M., & Seabra, A. G. (2015). Is it possible to promote executive functions in preschoolers? A case study in Brazil. *International Journal of Child Care and Education Policy, 9*, 1–18. https://doi.org/10.1186/s40723-015-0010-2

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). *Behavior Rating Inventory of Executive Function*. Psychological Assessment Resources.

Kaani, B. (2006). *Nature and prevalence of reading difficulties among school-dropouts: A case of selected school areas in Chipata District* [MED Dissertation, University of Zambia].

Kaani, B. (2019). Pedagogical content knowledge for initial reading instruction: The Peter effect in teacher education in Zambia. *ZANGO: Zambian Journal of Contemporary Issues, 33*, 29–42. https://law.unza.zm/index.php/ZJOCI/article/view/652

Kaani, B., & Machila, N. (2022). The conceptualizations of intelligence among the Tonga people of southern Zambia: A parental perspective. *International Journal of Research and Innovation in Social Sciences, 6*(11), 754–760.

Kaani, B., Mulubale, S., & Mulenga, V. (2016). Teaching word reading across orthographies: Insights in initial instruction from bilingual readers in Zambian schools. *AFTRA International Journal of Teaching and Learning in Africa, 3*(1), 103–111.

Kabundula, P. P. (2022). *The validation of the National Institute of Health (NIH) Toolbox for the assessment of neurological and behavioral function among Zambian children and adolescents in Lusaka Province, Zambia* [Doctoral thesis, University of Zambia].

Kalumba, C. H. (2017). *The role of executive functioning in early numeracy attainment: A case of selected government primary schools in Lusaka District* [Master's dissertation, University of Zambia].

Koşkulu-Sancar, S., van de Weijer-Bergsma, E., Mulder, H., & Blom, E. (2023). Examining the role of parents and teachers in executive function development in early and middle childhood: A systematic review. *Developmental Review, 67*, 101063. https://doi.org/10.1016/j.dr.2022.101063

Madanipour, P., & Cohrssen, C. (2024). Executive functions in early childhood. In S. Garvis & D. Pendergast (Eds.), *Health and wellbeing in childhood* (pp. 209–223). Cambridge University Press.

Madanipour, P., Garvis, S., Cohrssen, C., & Pendergast, D. (2025). Early childhood teachers' understanding of executive functions and strategies employed to facilitate them. *Frontiers in Education, 9*, 1488410. https://doi.org/10.3389/feduc.2024.1488410

McClelland, M. M., Tominey, S. L., Schmitt, S. A., Hatfield, B. E., Purpura, D. J., Gonzales, C. R., & Tracy, A. (2019). Red light, purple light! Results of an intervention to promote school readiness for children from low-income backgrounds. *Frontiers in Psychology, 10*, 2365. https://doi.org/10.3389/fpsyg.2019.02365

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology, 41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Mutambo, L. (2021). *Home literacy environment and socio-economic status as predictors of executive functioning among selected 4th graders: Kitwe, Zambia* [Master's dissertation, University of Zambia].

Mwanza-Kabaghe, S. (2015). *Preschool, executive functions and oral language as predictors of literacy and numeracy skills in first grade* [Doctoral thesis, University of Zambia].

Mwanza-Kabaghe, S., Mubanga, E., Matafwali, B., Kasonde-Ngandu, S., & Bus, A. (2015). Zambian preschools: A boost for early literacy. *English Linguistics Research, 4*(2), 54–69. https://doi.org/10.5430/elr.v4n2p54

Namushi, N. (2021). *The influence of executive functioning on reading comprehension among grade seven pupils in selected primary schools in Itezhi-tezhi district, Zambia* [Master's dissertation, University of Zambia].

Namushi, N., Kabundula, P. P., & Mwanza-Kabaghe, S. (2023). Correlates of executive function and reading comprehension among seventh graders in Itezhi-Tezhi District, Zambia. *International Journal of Research and Innovation in Social Science, 7*(3), 856–863.

Organisation for Economic Co-operation and Development. (2021). *Starting Strong VI: Supporting meaningful interactions in early childhood education and care*. OECD Publishing. https://doi.org/10.1787/f47a06ae-en

Piaget, J. (1964). *Six psychological studies* (A. Tenzer, Trans.; D. Elkind, Ed.). Random House.

Pillay, J., & Hoadley, U. (2020). Curriculum and cognitive development in developing countries. *International Journal of Educational Development, 79*, 102–115. https://doi.org/10.1016/j.ijedudev.2020.102115

United Nations Educational, Scientific and Cultural Organization. (2019). *A world ready to learn: Prioritizing quality early childhood education*. UNESCO Publishing.

Walubita, G. (2022). *Executive function and early literacy development among preschool learners in Lusaka, Zambia* [Master's dissertation, University of Zambia].

Zelazo, P. D. (2020). Executive function: Reflection, iterative reprocessing, complexity, and the developing brain. *Developmental Review, 38*, 55–68. https://doi.org/10.1016/j.dr.2015.07.001

Zelazo, P. D., Forston, J. L., Masten, A., & Carlson, S. M. (2018). Mindfulness plus reflection training: Effects on executive function in early childhood. *Frontiers in Psychology, 9*, 208. https://doi.org/10.3389/fpsyg.2018.00208

Zuilkowski, S. S., Fink, G., Moucheraud, C., & Matafwali, B. (2012). Early childhood education, child development and school readiness: Evidence from Zambia. *South African Journal of Childhood Education, 2*(2), 117–136.