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Latent Factors Shaping Early Childhood Development: Insights from a Longitudinal Study in Gauteng, South Africa

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Abstract

Understanding the intricate dynamics which underscore early childhood growth is a pivotal pursuit within child development research. This longitudinal study delves into developmental pathways of grade R and 1 pupils, across five primary schools in Gauteng. Employing an inclusive survey administered to educators, guardians, and healthcare practitioners, the study seeks to capture insights spanning factors such as education, nutrition, health, material well-being, and protection or care dimensions. The sample of 138 participants, encompassing a balanced gender distribution, boasts an average child age of 7 years. Employing advanced statistical techniques, this study employs Exploratory Factor Analysis to unearth distinctive latent factors, thereby constructing a holistic framework for further inquiry. Structural Equation Modelling illuminates substantial correlations between emotional regulation and safety and well-being factors, highlighting their pivotal roles in children's comprehensive development. Acknowledging the evolving nature of child growth, Latent Growth Modelling introduces a temporal dimension, facilitating the analysis of growth trajectories to discern alterations and trends in latent variables across multiple time points. Children's emotional regulation exhibits consistent baseline intercepts, whereas safety and well-being factors manifest baseline variability and nuanced covariances. These findings underscore the intricate interplay between initial levels and rates of change. In addition to shedding light on latent factors that shape child development, this research underscores the importance of advanced statistical methodologies. By influencing evidence-based interventions and policy decisions, the study contributes to discourse surrounding the cultivation of healthy childhoods, fostering a deeper comprehension of multifaceted factors that influence children's well-being.

Keywords: Child Development, Longitudinal study, Structural Equation Modelling, Latent Growth Modelling.

1 Introduction

While child development and wellbeing have been the subject of significant scholarly inquiry for many years, there exists a notable gap in understanding how various factors, encompassing the realms of biology, psychology, and the environment, collectively influence a child's holistic growth and wellbeing (Berk, 2015). Despite extensive research, the complex interplay of these factors and their specific impact on a child's lifelong trajectory remains insufficiently explored. Moreover, while the literature has emphasized the profound significance of early childhood experiences (Saracho, 2023), there remains a critical need to unravel the precise mechanisms through which these experiences shape a child's developmental path. Thus, the overarching problem addressed in this study pertains to the need for a more comprehensive and nuanced understanding of the multifaceted dynamics influencing child development and wellbeing, particularly the critical role of early experiences in shaping lifelong outcomes. Within this expansive field, our study homes in on a critical and relatively less explored sub-area: the influence of intervention programs administered by social workers on latent factors influencing children's development (Hudson et al., 2023).

Numerous studies have highlighted the efficacy of early interventions in improving specific aspects of child development. For example, research conducted by McWilliam & Scott (2001) has contributed significantly towards the understanding of how early interventions can positively impact children's cognitive development (McWilliam & Scott, 2001). These interventions often involve structured educational programs, cognitive stimulation, and enrichment activities. They have shown promise in enhancing a child's problem-solving abilities, language development, and overall cognitive functioning during their formative years (Hudson et al., 2023). Similarly, the work of Rutherford et al. (2015) in that year illuminated the significance of early interventions in cultivating emotional regulation in children. Emotional regulation, encompassing a child's ability to manage emotions, cope with stress, and engage in appropriate social interactions, holds profound implications for psychological and social development (Morris et al., 2017). Intervention programs in this context encompass a range of strategies, including emotional awareness education, the provision of coping mechanisms, and the creation of supportive environments, all of which serve to equip children with the emotional tools necessary for navigating the complexities of their social and emotional worlds (Aparicio et al., 2016).

Despite the compelling findings emerging from individual studies, a significant knowledge gap exists within the field of child development. This gap arises from the predominant practice of conducting siloed investigations, focusing on specific dimensions of child development, such as cognitive skills or emotional regulation, without adequately considering their dynamic interplay and the broader context of latent factors. For instance, a global systematic review and meta-analysis conducted by (Jeong et al., 2021) provide a comprehensive overview of parenting interventions within the first three years of a child's life. This research offers a robust foundation upon which to address this persistent knowledge gap by synthesizing data from a wide range of studies and highlighting the interconnectedness of various aspects of early child development interventions. A comprehensive understanding of child development necessitates the integration of insights from various facets of a child's developmental journey, including genetics, family dynamics, socio-economic conditions, and environmental influences. This gap is not only conceptually problematic but also has far-reaching implications for policy and intervention design. Contradictions and inconsistencies within existing literature further underline the complexity of the issue. For instance, while some studies, such as Aboud and Yousafzai (2015) on cognitive development, report substantial gains from early interventions, others, such as Black et al. (2017) on emotional regulation, suggest more nuanced outcomes. These disparities underscore the need for a more comprehensive perspective that accounts for both the specific outcomes of interventions and the broader landscape of latent factors. Evaluating the relevance of existing research reveals that while these studies have undoubtedly expanded our knowledge in their respective domains, their isolated approach often leaves crucial questions unanswered. Bronfenbrenner's ecological systems theory (1979) posits that child development is influenced by a complex web of factors, ranging from proximal environments such as family and school to distal influences such as cultural and societal norms (Özdougru, 2011). This ecological perspective underscores the interconnectedness of various developmental domains and emphasizes the need for research to consider the holistic nature of a child's experience. Therefore, based on the knowledge gap above, this research study proposes the following research questions (RQs) towards the addressing of this knowledge gap, as follows:

- RQ1: How do intervention programs targeting cognitive skills and emotional regulation interact with latent factors within the ecological systems framework?
- RQ 2: How do these interactions influence a child's overall developmental trajectory?
- RQ 3: What implications do these findings hold for the design and implementation of interventions that encompass the full complexity of a child's developmental journey?

Bridging the abovementioned knowledge gap stands as a critical endeavour for advancing the comprehension of child development and optimizing the design of interventions that encompass the full complexity of a child's developmental trajectory. In this longitudinal study, the research bridges the knowledge gap by tracking the interactions between latent factors and intervention programs. Drawing on theories of child development Bronfenbrenner (1979), this study's research design captures the intricate dynamics involved when social workers intervene at key developmental junctures, through comprehensive data collection and advanced statistical analyses, using a combination of Exploratory Factor Analysis (EFA), Structural Equation Modelling (SEM), and Latent Growth Modelling (LGM). These methodological tools enable in-depth exploration of the complexities of child development, capturing the dynamic interplay between intervention programs and the underlying factors that shape a child's developmental trajectory. EFA enables the identification and extraction of the latent factors from the data encompassing a wide range of variables related to child development. By reducing the dimensionality of the data, the research study uncovers the underlying constructs that influence children's physical, emotional, and cognitive development and well-being. SEM serves as the analytical backbone of this research study, thus allowing the testing and validation of complex theoretical models. Drawing on Bronfenbrenner's ecological systems theory (1979) as a guiding framework, this study's SEM analyses explore how intervention programs interact with latent factors within the context of a child's ecological environment. The study also examines the direct and indirect pathways through which interventions impact various facets of child development, shedding light on the intricate dynamics involved when social workers intervene at key developmental junctures. LGM serves as a powerful tool for capturing the developmental trajectories of children over time. It enables the examination of how latent factors evolve in response to intervention programs administered at multiple time points. By modelling growth trajectories, this research study uncovers how these latent factors change and adapt as children progress through their primary school years.

Therefore, based on the above, the landscape of child development research has evolved significantly, yet a critical knowledge gap remains in understanding the dynamic interplay between latent factors and intervention programs within the ecological systems framework. While prior studies have made invaluable contributions to our understanding of specific facets of child development, they often do so in isolation, overlooking the holistic and interconnected nature of a child's developmental journey. This knowledge gap prompts us to embark on our own research journey, with the overarching purpose of this study being to unravel the intricate dynamics at play when social workers intervene at key developmental junctures. Drawing on theories of child development, advanced statistical methodologies, and a commitment to a comprehensive view of child development, our research endeavours to provide a nuanced

understanding of these interactions. This, in turn, will equip us with actionable insights that can shape more holistic and effective approaches to supporting children as they embark on their educational journeys.

2 Literature

The field of early childhood development stands as a testament to the intricate interplay of diverse factors that shape the trajectory of human growth, laying the foundation for lifelong learning and well-being. This literature review delves into the rich scholarly discourse, weaving together key theories, empirical insights, and critical perspectives that collectively elucidate the multifaceted nature of early childhood development and its profound implications for academic readiness and long-term success.

2.1 Theoretical Framework of Early Childhood Development

Early childhood is a critical phase of human development that lays the foundation for lifelong learning and well-being (Elsa Fourie, 2014). During this period, children undergo rapid cognitive, emotional, and social growth, which significantly influences their readiness for academic success (Prioreschi et al., 2020). Several key theories and models have been proposed to understand the intricate processes involved in early childhood development (Nair & Rekha Radhakrishnan, 2004). The trajectory of early childhood development theories has evolved significantly, reflecting the dynamic nature of our understanding of how young children's growth influences subsequent academic success. This evolution is exemplified through the progression of perspectives outlined by Archambault et al. (2020) conceptual framework and Piaget et al. (2022) ground breaking findings, which collectively illustrate a shift from singular cognitive emphasis to a comprehensive integration of cognitive and socio-emotional dimensions.

Peng and Kievit (2020) work laid a foundational understanding by highlighting the crucial role of early childhood development in shaping later academic achievements. Recent research on the bidirectional relations between academic achievement and cognitive abilities reinforces this perspective. This body of evidence suggests that (a) academic skills, particularly in reading and mathematics, and cognitive abilities such as working memory, reasoning, and executive function, mutually influence each other during development; (b) direct academic instruction positively impacts the development of cognitive reasoning; and (c) these bidirectional relations between cognitive abilities and academic achievement may be less pronounced among children facing disadvantages, such as those with special needs or from low socioeconomic backgrounds The research results emphasize the significant value of nurturing academic skills and cognitive abilities in early childhood development. This focus on the quality of education and schooling not only has a direct impact on children's academic and cognitive development but can also exert an indirect influence through the dynamic interaction between cognition and academic accomplishments. Emphasizing cognitive development, Dosman et al. (2012) argument is rooted in the belief that nurturing cognitive milestones during early years would inherently lead to enhanced academic readiness.

This perspective aligned with prevailing paradigms of its time, setting the stage for subsequent research inquiries. However, a paradigm shift occurred with Robinson and Jones-Diaz (2017) ground breaking research, which challenged the prevailing cognitive-centric view. Their work illuminated the intricate interplay between socio-emotional elements and cognitive growth during early childhood. By recognizing the mutual influence of emotional regulation and cognitive development, Robinson and Jones-Diaz (2017) insights prompted a broader conceptualization of early childhood development. This pivotal moment not only expanded the horizons of research but also underscored the inherent interconnectedness of diverse developmental facets. As the field progressed into the post-2010 era, a transformative shift became more apparent. Scholars began to perceive the interrelationship between cognitive and socio-emotional dimensions as interdependent rather than discrete (Rutland et al., 2010). Piaget's cognitive developmental theory, which previously dominated the discourse, gave way to Vygotsky's sociocultural theory, which emphasized the collaborative nature of learning (McLeod, 2014). This transition reflected an increasing awareness that cognitive advancement, while vital, was profoundly intertwined with socio-emotional growth. In summation, the evolution of early childhood development theories reflects a dynamic intellectual journey. The transition from Piaget's cognitive-centric approach to the integrative insights brought forth by Jamison marks a paradigm shift, acknowledging the symbiotic relationship between cognitive and socio-emotional dimensions (Barrouillet, 2015). This journey underscores the iterative nature of scholarly exploration, continually refining our understanding of the intricate factors influencing academic readiness during early childhood.

2.1.1 Overview of Early Childhood Development

Early childhood, often defined as the period from birth to around eight years of age, is characterized by remarkable neuroplasticity and malleability (Richter et al., 2019). During this phase, children's brains exhibit a heightened sensitivity to environmental stimuli, leading to substantial cognitive and socio-emotional development (Orenstein & Lewis, 2022). Piaget's theory of cognitive development posits that children progress through distinct stages of cognitive functioning, adapting their mental frameworks to comprehend the world around them (Barrouillet, 2015). Early childhood development, encompassing the formative years from birth to approximately eight years of age, serves as a pivotal phase in human growth that lays the groundwork for lifelong learning and well-being (UNICEF, 2022). This period is marked by rapid and profound transformations in cognitive, emotional, social, and physical domains, setting the stage for a child's holistic development (Britto et al., 2017). Understanding the intricate processes that underlie early childhood development is crucial not only for parents, caregivers, and educators but also for policymakers and researchers seeking to promote optimal outcomes for children (Penn, 2005).

2.1.2 Critical Aspects of Early Childhood Development

Cognitive Development: During early childhood, cognitive development is characterized by the acquisition of fundamental cognitive skills that form the basis for more complex cognitive abilities. Jean Piaget's cognitive developmental theory highlights that child actively construct their understanding of the world through processes of

assimilation and accommodation. Cognitive milestones during this period include the development of language, problem-solving skills, memory, and the emergence of abstract thinking (Babakr et al., 2019; So, 1964).

Emotional Development: Emotional development is a central aspect of early childhood, involving the recognition, expression, and regulation of emotions (Malik & Marwaha, 2018) . Erik Erikson's psychosocial developmental theory emphasizes the emergence of a sense of trust, autonomy, and initiative during these years (Orenstein & Lewis, 2022). Children learn to identify their emotions and those of others, gradually developing skills to manage and regulate their emotional responses to different situations (Zeman et al., 2006).

Social Development: Social development is characterized by the formation of relationships with family members, peers, and other caregivers (Smith et al., 2002). Lev Vygotsky's sociocultural theory emphasizes the role of social interactions in learning and development (McLeod, 2014). Early childhood is marked by the emergence of social skills, empathy, and the ability to navigate social norms and expectations (Berk, 2015).

Physical Development: Early childhood also witnesses significant physical growth and motor skill development (De Onis & Branca, 2016). Gross motor skills, such as walking, running, and jumping, improve, enabling children to engage in more complex physical activities (Zeng et al., 2017). Fine motor skills, like handwriting and manipulating small objects, become increasingly refined (Dinehart, 2015).

Parental and Caregiver Influence: The role of parents, caregivers, and family environments is paramount during early childhood (Collins et al., 2022). Secure attachments with caregivers provide a foundation for emotional well-being and resilience (Morris et al., 2017). Positive interactions with caregivers facilitate language development, social skills, and the establishment of a sense of trust in the child's environment (Jeong et al., 2021).

Importance for Lifelong Learning: The experiences and interactions during early childhood have far-reaching implications (Tennant, 2019). Research indicates that a stimulating and nurturing early environment fosters cognitive, social, and emotional skills that have a lasting impact on academic achievements, interpersonal relationships, and overall well-being throughout life (Council & others, 2015).

2.1.3 The Importance of Early Years for Lifelong Learning

The paramount role of early childhood in moulding future academic accomplishments is unequivocal (Peng & Kievit, 2020). A substantial body of longitudinal research underscores that children immersed in enriching early environments, characterized by abundant opportunities for learning and exploration, are apt to manifest heightened cognitive capacities and heightened readiness for formal education (Ahmed et al., 2019). Moreover, Lev Vygotsky's sociocultural theory accentuates the pivotal influence of social interactions and cultural milieus in nurturing cognitive development, thereby underscoring the indispensability of social relationships within the realm of early childhood development (McLeod, 2014).

Longitudinal Evidence of Academic Trajectories: Longitudinal studies examining the developmental trajectories of individuals from early childhood through adulthood consistently reveal the enduring impact of experiences during the formative years (Kilgo et al., 2015). Children exposed to environments rich in cognitive stimulation, language exposure, and interactive engagement tend to demonstrate advanced cognitive skills that reverberate through subsequent educational endeavours (Tucker-Drob & Harden, 2012). A robust nexus has been established between early language acquisition and later reading proficiency, illustrating the foundational nature of early language experiences for literacy development (Brown, 2014).

Enhanced School Readiness: The significance of early environments transcends academic skills alone; it extends to the very foundation of school readiness (K. T. Ferguson et al., 2013). Young learners immersed in stimulating and nurturing settings exhibit a predisposition to engage actively in learning activities, demonstrating effective self-regulation, attention, and problem-solving skills (Valiente et al., 2021). These precursors to formal education foster a smoother transition to structured learning environments, setting the stage for more positive and productive academic journeys (Olsen & DeBoise, 2007).

Vygotsky's Sociocultural Lens: Lev Vygotsky's sociocultural theory provides a theoretical lens that accentuates the dynamic interplay between cognition and social interaction (McLeod, 2014). According to this perspective, children's cognitive development is scaffolded through interactions with more knowledgeable peers and adults, as well as through exposure to culturally rich experiences (Roth & Radford, 2010). The notion of the "zone of proximal development" elucidates the critical role of social relationships in guiding children toward tasks slightly beyond their current abilities, fostering both cognitive growth and the acquisition of cultural knowledge (Wertsch, 1984).

Cultural and Contextual Sensitivity: Vygotsky's emphasis on the influence of cultural contexts and social interactions aligns with modern insights into the importance of cultural diversity and responsive caregiving in early childhood development (Mcleod, 2022). Cultural nuances not only shape linguistic development but also imbue children with a rich repertoire of cognitive tools for understanding the world around them (Smolucha & Smolucha, 2022). Furthermore, positive social relationships with caregivers and peers contribute to emotional security, which is foundational for cognitive exploration and academic engagement (Hausfather, 1996).

2.1.4 Key Theories and Models in Early Childhood Development

Understanding early childhood development necessitates a comprehensive evaluation of the foundational theories and models that have framed our comprehension of this crucial phase. While these theories provide invaluable insights, a critical assessment of their merits and limitations reveals a more nuanced perspective on the complex processes influencing cognitive, emotional, social, and physical growth.

Piaget's Cognitive Developmental Theory: Piaget's theory has been influential in highlighting the active role of children in constructing their understanding of the world (Barrouillet, 2015). However, its rigid stage-based approach has been criticized for underestimating individual variability and overlooking cultural influences on cognitive

development (Sanghvi, 2020). Additionally, the theory's emphasis on discrete stages might oversimplify the intricate progression of cognitive abilities, failing to capture the dynamic nature of cognitive growth (Babakr et al., 2019).

Erikson's Psychosocial Developmental Theory: Erikson's theory underscores the importance of psychosocial challenges in shaping identity (Samsanovich, 2021). While it offers a holistic view of development, it may oversimplify the complexity of identity formation by reducing it to predetermined stages. Furthermore, the theory's cultural and gender biases have drawn scrutiny, highlighting the need for a more inclusive understanding of psychosocial development (Leidy & Darling-Fisher, 1995).

Vygotsky's Sociocultural Theory: Vygotsky's emphasis on social interaction and cultural context enriches our understanding of cognitive development (Jaramillo, 1996). However, this theory might overlook the significance of individual cognitive differences and biological predispositions (Ameri, 2020). Additionally, the practical implications of scaffolding within educational settings warrant further exploration to elucidate its effectiveness in fostering cognitive growth (Shabani, 2016).

Bowlby's Attachment Theory: Bowlby's theory offers valuable insights into the impact of early relationships on emotional and cognitive development (Bretherton, 2013). Nonetheless, it tends to prioritize the caregiver's role without fully considering the child's active role in shaping these interactions (Sroufe et al., 1999). Moreover, the theory's applicability across diverse cultural contexts prompts the need for a culturally sensitive lens (Granqvist, 2021).

Behavioural Theories: Behavioural theories have contributed to our understanding of how environmental stimuli shape behaviour (Guajardo et al., 2009). However, their emphasis on observable behaviours might underestimate the underlying cognitive processes (Saracho, 2023). Moreover, the oversimplification of complex behaviours through reinforcement mechanisms overlooks the intricate interplay between cognition, emotion, and behaviour (Shute & Slee, 2015).

Nature vs. Nurture: The nature versus nurture debate remains relevant, yet contemporary perspectives acknowledge the interactive nature of genetic predispositions and environmental influences (Wachs, 1999). However, this debate can inadvertently oversimplify the intricate interplay between biological and environmental factors, potentially hindering a more holistic understanding of early childhood development (Collins et al., 2022).

In summary, a critical analysis of these foundational theories and models in early childhood development reveals a multidimensional landscape marked by both strengths and limitations. Integrating these perspectives allows for a more comprehensive understanding of the intricate processes that underpin cognitive, emotional, social, and physical growth during this formative phase. As the field evolves, the synthesis of these theories will undoubtedly lead to a more nuanced and holistic understanding of early childhood development.

2.2 Factors Affecting Academic Readiness

The concept of academic readiness in early childhood development encompasses a range of cognitive, linguistic, and executive functioning skills that form the bedrock for successful engagement in formal education (Shaul & Schwartz, 2014). This literature review scrutinizes the multifaceted factors influencing academic readiness, focusing on cognitive factors including language development and literacy skills, numeracy and mathematical skills, as well as executive functioning and cognitive control (Fitzpatrick et al., 2014). By delving into these dimensions, we gain a comprehensive understanding of the intricate interplay that shapes a child's preparedness for academic pursuits (Schmitt et al., 2015).

2.2.1 Cognitive Factors Affecting Academic Readiness:

Cognitive development is integral to academic readiness, encompassing various cognitive domains that scaffold learning (Vitiello et al., 2016) . Vygotsky's sociocultural theory highlights the role of social interactions in cognitive growth, emphasizing that children actively construct knowledge through guided participation (McLeod, 2014). This perspective underscores the importance of language and cognitive engagement within social contexts (Shabani, 2016). Research by Diamond (2014) underscores the essential role of executive functions, such as working memory and cognitive flexibility, in enhancing academic readiness. These cognitive skills enable children to manage tasks, follow instructions, and adapt to changing academic demands (Cortés Pascual et al., 2019).

Language Development and Literacy Skills: Language acquisition is a cornerstone of academic readiness, facilitating communication, comprehension, and engagement in learning. Piaget's cognitive developmental theory accentuates the gradual progression from sensorimotor to symbolic thought, elucidating how language evolves as a cognitive tool. Early language exposure and interaction with caregivers significantly impact literacy development. The study by Milankov et al. (2021) underscores the reciprocal relationship between phonological awareness and reading readiness, emphasizing the predictive value of phonemic skills for later reading proficiency (Treiman, 1991) .**Numeracy and Mathematical Skills:** Numeracy and mathematical skills are fundamental for academic success, serving as building blocks for understanding abstract concepts (Okamoto, 2010). Piaget's concept of cognitive schemas highlights how children assimilate numerical concepts through experiences (McLeod, 2014). Geary's cognitive developmental theory underscores the distinction between approximate and precise number sense, which contributes to arithmetic fluency (Schubert & Hagemann, 2020). The study by (Geary, (2016) reveals that early numerical competence positively correlates with later math achievement, highlighting the significance of early numerical exposure.

Executive Functioning and Cognitive Control: Executive functioning encompasses cognitive processes that facilitate goal-directed behaviour, impulse control, and working memory. This is particularly relevant for academic readiness as it supports attention, self-regulation, and problem-solving. The seminal work of illuminates the links between early executive functions and later academic achievement (Ahmed et al., 2019). Moreover, the overlapping principles between Vygotsky's zone of proximal development and executive functioning underscore the critical role of guidance and self-regulation in academic preparation (Roth & Radford, 2010; Wertsch, 1984).

2.2.2 Socio-Emotional Factors Affecting Academic Readiness

The intricate interplay between cognitive and socio-emotional factors significantly shapes a child's academic readiness (McKown et al., 2016). This literature review delves into the socio-emotional dimensions that contribute to a child's preparedness for formal education (Alzahrani et al., 2019) . We explore emotional regulation and social competence, peer relationships and social interaction, as well as self-concept and self-efficacy. By examining these socio-emotional factors, we gain a comprehensive understanding of the multifaceted nature of academic readiness and its socio-emotional underpinnings.

Emotional Regulation and Social Competence: Emotional regulation plays a pivotal role in academic readiness by influencing a child's ability to manage emotions and adapt to diverse social contexts (Zeman et al., 2006) . Bowlby's attachment theory highlights the significance of secure attachments in fostering emotional regulation (Bretherton, 2013). Securely attached children tend to exhibit more effective emotional regulation, which positively impacts their ability to focus on learning tasks. Furthermore, emotional regulation contributes to social competence, facilitating positive peer interactions and cooperation (Morris et al., 2017). Research by Eisenberg underscores the bidirectional relationship between emotional regulation and social competence, emphasizing the role of emotional self-regulation in nurturing social skills (Spinrad et al., 2006).

Peer Relationships and Social Interaction: Peer relationships are essential for the development of social skills, which in turn contribute to academic readiness (Palermo et al., 2007). Vygotsky's sociocultural theory emphasizes the role of social interactions in shaping cognitive and socio-emotional growth (Shabani, 2016) . Peer interactions provide opportunities for perspective-taking, cooperation, and conflict resolution (Smolucha & Smolucha, 2022). Quality peer relationships foster a sense of belonging and promote engagement in learning activities. The study by (Juvonen et al., 2012) highlights the positive correlation between positive peer interactions and school engagement, highlighting the reciprocal influence between social competence and academic readiness.

Self-Concept and Self-Efficacy: A positive self-concept and self-efficacy are integral to academic readiness, shaping a child's belief in their capabilities and worthiness (Zander et al., 2018). Erikson's psychosocial theory underscores the development of a sense of initiative during early childhood (Orenstein & Lewis, 2022). A positive self-concept supports initiative and risk-taking in learning endeavours. Additionally, Bandura's self-efficacy theory posits that self-beliefs influence goal-setting and perseverance (Artino, 2012). Children with high self-efficacy tend to approach academic challenges with confidence, enhancing their academic engagement . Research by Marsh (Bradley et al., 2012) highlights the reciprocal relationship between self-concept and academic achievement, indicating that positive self-perceptions contribute to academic success (Linge et al., 2021).

In summary, socio-emotional factors exert a profound influence on academic readiness. By investigating emotional regulation and social competence, peer relationships and social interaction, as well as self-concept and self-efficacy, we gain insights into the holistic nature of preparedness for formal education. The interplay between socio-emotional

and cognitive domains underscores the importance of nurturing socio-emotional skills to enhance academic success and overall well-being.

2.2.3 Environmental Factors Affecting Academic Readiness

The holistic understanding of academic readiness extends beyond cognitive and socio-emotional dimensions, encompassing the influential role of environmental factors (Pan et al., 2019). This literature review delves into the environmental facets that contribute to a child's preparedness for formal education, examining family dynamics and support, socioeconomic status and access to resources, as well as the impact of early childhood education programs. By scrutinizing these environmental factors, we glean insights into the multifaceted nature of academic readiness and the crucial role of the child's surroundings.

Family Dynamics and Support: Family dynamics and the quality of support a child receives at home profoundly shape their academic readiness (K. T. Ferguson et al., 2013). Bronfenbrenner's ecological systems theory emphasizes the role of the microsystem, where the family serves as the immediate environment influencing the child (Özdougru, 2011). Positive family relationships, communication, and involvement in learning activities correlate with enhanced academic engagement (Hudson et al., 2023). Research by Evans et al. (2000) underscores the influence of home literacy environments on children's language development, highlighting how supportive family contexts foster language skills pivotal for academic success.

Socioeconomic Status and Access to Resources: Socioeconomic status (SES) significantly influences academic readiness through its impact on access to resources and opportunities (Munir et al., 2023). The ecological systems theory underscores the mesosystem's role, where interactions between systems, such as family and school, affect a child's development (H. Ferguson et al., 2007). Children from higher SES families often benefit from enriched educational experiences, access to books, and extracurricular activities that enhance their academic preparedness. Research by Sarkar and Sarkar, 2017) reveals the enduring impact of early childhood poverty on cognitive and academic outcomes, underscoring the need for equitable access to resources.

Early Childhood Education Programs: Early childhood education programs play a pivotal role in shaping academic readiness by providing structured learning experiences before formal schooling (Saracho, 2023). The bioecological model accentuates the role of the ecosystem, where external systems indirectly impact the child (McLinden et al., 2018). High-quality early childhood education programs, such as Head Start and pre-kindergarten initiatives, offer educational stimulation and socialization opportunities that enhance cognitive and socio-emotional development (Nix et al., 2013). The study by (Özler et al., 2018) emphasizes the long-term benefits of early education programs on cognitive skills and school readiness, indicating the potential for early interventions to level the academic playing field.

In summary, environmental factors exert a profound influence on academic readiness, underscoring the importance of family dynamics, socioeconomic status, and access to resources, as well as the impact of early childhood education

programs. By investigating these facets, we gain insights into the dynamic interplay between children and their surroundings, highlighting the need for supportive environments that foster academic engagement and set the stage for lifelong learning.

2.3 Role of Early Intervention Programs

2.3.1 Role of Early Intervention Programs in Addressing Developmental Gaps

Early intervention programs stand as a pivotal cornerstone in the landscape of child development, catalysing positive trajectories for children facing developmental disparities (Ou & Reynolds, 2010). This literature review embarks on an exploration of the multifaceted dimensions of early intervention programs, delving into the importance of early intervention in addressing developmental gaps, elucidating examples of effective early intervention approaches, and unravelling the intricate tapestry of challenges and opportunities inherent in their implementation (Smythe et al., 2021).

2.3.2 Importance of Early Intervention in Addressing Developmental Gaps

The significance of early intervention in bridging developmental gaps cannot be overstated. Rooted in the bioecological model, the microsystem encapsulates the immediate environment shaping a child's development[1]. Early intervention, guided by this understanding, seizes the malleability of young minds, pre-emptively addressing cognitive, socio-emotional, and linguistic gaps before they crystallize into insurmountable challenges. (Temple et al., 2022) research reaffirms the lasting impact of high-quality preschool interventions in narrowing achievement gaps, underscoring the preventive power of early intervention in curtailing the expansion of long-term disparities.

2.3.3 Examples of Effective Early Intervention Approaches:

Effective early intervention approaches are woven with the threads of targeted support and individual growth scaffolding. Firmly anchored in Vygotsky's zone of proximal development, these approaches embrace the interplay between a child's current abilities and their potential growth. Council et. (2015)study paints a vivid canvas of comprehensive early childhood programs nurturing positive academic and life outcomes, showcasing the integral role of holistic interventions. Furthermore, interventions directed towards enhancing phonological awareness stand as exemplars of successful strategies aimed at bolstering literacy skills among vulnerable children (McWilliam & Scott, 2001).

2.3.4 Challenges and Opportunities in Implementing Early Intervention Programs:

While early intervention holds immense promise, its implementation is not devoid of challenges. The mesosystem, as envisaged by Bronfenbrenner's ecological systems theory, underscores the intricate interplay between microsystems (O. G. Evans, 2020). Collaboration between families, educators, and service providers is the bedrock of successful interventions (Özdougru, 2011). The study by Ferguson et al., (2015) underscores the necessity for sustained program

quality and teacher training, revealing the hurdles of scalability and durability. Cultural sensitivity and customized approaches emerge as critical considerations in navigating implementation challenges.

3 Methodology

3.1 An outline of the methodology

This methodology outlines the research design, data collection methods, and analytical approaches employed in this study, which seeks to investigate the intricate dynamics influencing child development and well-being within the context of early intervention programs administered by social workers in early primary school pupils. Building upon established theories of child development, notably Bronfenbrenner's ecological systems (Bronfenbrenner & Morris, 2007), this research aims to bridge a critical knowledge gap by comprehensively assessing the interplay between latent factors and interventions. By utilizing a longitudinal research design, advanced statistical analyses, and a holistic perspective on child development, the study endeavours to shed light on the complex processes at work when social workers intervene at key developmental junctures. This methodology delineates the systematic approach employed to address the research questions and contribute to a deeper understanding of child development, which, in turn, may inform more effective strategies for supporting children on their educational journeys. The methodology is firmly anchored in established literary frameworks within the fields of child development, education, and psychology. By combining a longitudinal research design, advanced statistical methods, and a holistic perspective on child development, the study aims to contribute significantly to the ongoing discourse in these areas.

The choice of a longitudinal research design is consistent with the developmental psychology literature, particularly Hopwood et al, (2022) which asserts that child development is a dynamic process unfolding over time. Longitudinal studies allow us to track the intricate and evolving nature of child development, offering insights into how early experiences shape long-term outcomes (Grammer et al., 2013; Kalicki et al., 2017). Furthermore, Vygotsky's socio-cultural theory emphasizes the importance of considering the socio-environmental context over time, underscoring the relevance of a longitudinal approach (Shabani, 2016). Incorporating advanced statistical methods, including Exploratory Factor Analysis (EFA), Structural Equation Modeling (SEM), and Latent Growth Modelling (LGM), the study is firmly grounded in the methodological literature of child development and psychology (Richmond et al., 2020; Watkins, 2018). EFA is a well-established technique for identifying underlying constructs and dimensions in child development research (Dabbagh et al., 2023). SEM is rooted in structural modelling and is particularly suited for investigating complex relationships within the ecological systems framework, drawing from Bronfenbrenner's theory (Ajayi et al., 2017; O. G. Evans, 2020). LGM, drawing from growth curve modelling (Xia et al., 2020), enables the capture of the dynamic developmental trajectories of children, aligning with the developmental psychology literature's emphasis on change and adaptation over time. The holistic perspective on child development draws from a myriad of influential theories and frameworks, including Bronfenbrenner's ecological systems theory (Peer & McClendon, 2002), which underscores the interconnectedness of various developmental domains (Greenfield, 2014). Additionally, the holistic view aligns with the bioecological model of child development (Bronfenbrenner & Morris,

2007), emphasizing the importance of considering the child's broader context. This perspective has profound implications for understanding intricate dynamics when social workers intervene at critical developmental junctures.

The methodology consists of three key steps: (1) Study design and survey instrument, involving a diverse sample of urban children from various socio-economic backgrounds to gain comprehensive understanding of child development in diverse contexts, utilizing the Children Wellness Development Tracking App (CWTT) for comprehensive data collection; (2) Data collection encompasses the gathering of extensive data, including parent surveys, child assessments, and intervention program data, strategically chosen to offer a well-rounded perspective on child development within the ecological systems framework; and (3) Data analysis entails the application of advanced statistical techniques, including Exploratory Factor Analysis (EFA), Structural Equation Modelling (SEM), and Latent Growth Modelling (LGM), to conduct a thorough analysis that uncovers latent factors, elucidates complex relationships, and traces developmental trajectories using statistical packages such as "lavaan" R package and JASP software.

3.1.1 Study Design and Survey Instrument

This study involved multiple primary participants, including the school pupils, parents/guardians, and a health worker. The study employed an electronic Case Report Form (eCRF) technology called the Children Wellness Development Tracking App (CWTT), which was specifically developed by the research team at the Johannesburg Business School. The eCRF app followed clinical study intervention protocols and served as a comprehensive tool for data collection and management. It facilitated the tracking and assessment of various aspects of children's well-being, such as education, food and nutrition, health, economic/material well-being, and protection/care. The app adhered to standardized protocols to ensure consistency and reliability in data collection, thereby contributing to the overall robustness and validity of the study findings.

3.1.2 Participants

The study was designed as a longitudinal study, with data collected at three different time points. The study focused on a population of grade R and 1 pupils from five different primary schools located in Gauteng. A survey was conducted to gather information on various focus areas, including education, food and nutrition, health, economic/material well-being, and protection/care. The key participants in the study were teachers, guardians, and healthcare workers. The sample size consisted of 138 participants, with mean age of a child $\bar{X}$= 7, s = 3.7 and a 1:1 ratio of female to male pupil, average number of children in a class is 33. Analysis of variance has been conducted to determine the significance of the difference in the pupil's sample size, the assumption of normality has been met, assed by Shapiro-Wilk test ps =.756,.772,.180, .598 and .646 for each school. the analysis of homogeneity was analysed by the Lavene's test and was significant with a p <.0001 and was corrected by resampling and eliminating outliers. With p <.0001 we can conclude that not all the schools' average number of participants are equal, at least one school has a mean difference. With F(4,133) = 9117.69, p = <.000, η^2 = .622, 62% of the variance in mean

difference is accounted for by the school variable. Almost half (48%) of the care givers are youth, between the age of 15 and 35, and the second largest proportion (42%) is pensioners over the age of 60. The mean age of a care giver is $\bar{X} = 35$ years, with standard deviation $s = 9$ years, the youngest care giver is 17 years and the oldest is 64 years of age. About 29% of the learners reside with a mother and other adult residents in the same household, second largest proportion (28.2%) reside with both parents, thirdly 25.4% of the pupils are under care of a single parent. Almost 67% of the guardians are unemployed, 18% at a full-time employment and the remaining percent split between part time employment (9%) and 4% in self-employment. The majority of the care givers hold some secondary education (84%).

3.2 Data Analysis

3.2.1 Exploratory Factor Analysis (EFA)

The EFA was performed using the principal axis factoring method to extract factors. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity were used to assess the suitability of the data for factor analysis. Factors with eigenvalues greater than one were retained, and the scree plot was examined to determine the number of factors to retain.

3.3 Structural Equation Modelling (SEM)

The SEM was developed to test the hypothesized relationships among the latent factors identified through EFA. The measurement model assessed the relationships between the latent variables and their respective observed indicators. The SEM was created using the "lavaan" R package, which allowed for modelling the complex relationships between the latent variables and observed indicators. The goodness-of-fit of the SEM was evaluated using various fit indices, including the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). These fit indices provided information about how well the SEM model fit the observed data. Adequate model fit indicated that the proposed relationships between latent variables and observed indicators were supported by the data.

3.4 Latent Growth Model (LGM)

The Latent Growth Model (LGM) was conducted using the "lavaan" package in R. The model included two latent variables: one for emotional regulation and one for safety and well-being. Time was treated as a continuous variable, with Time 1, Time 2, and Time 3 as the three occasions. The intervention group was coded as 1, and the control group was coded as 0 to examine the intervention effect on the growth trajectories of emotional regulation and safety and well-being. It is important to note that, due to the primary focus of this study being on demonstrating the application of advanced statistical techniques rather than emphasizing substantive findings related to children's development, only two out of the six initially considered factors were included in the LGM analysis. These selected factors, emotional regulation, and safety and well-being, were deemed suitable for illustrating the methodology and statistical procedures employed in this study. Consequently, the results and conclusions presented in the LGM analysis pertain exclusively

to these specific factors. The intercept model was used to specify the initial levels of emotional regulation and safety and well-being (intercepts) at Time 1 as latent variables with observed indicators as the respective baseline scores. The slope model was employed to specify the growth rates (slopes) of emotional regulation and safety and well-being over time, with observed indicators as the respective scores at Time 2 and Time 3. The dummy-coded intervention group was included as a predictor in the LGM to investigate its effect on the intercepts and slopes of emotional regulation and safety and well-being. Model fitting utilized robust maximum likelihood (MLR) estimation to account for potential non-normality of the data. Fit indices, including the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), were employed to assess the goodness-of-fit of the LGM. Readers should interpret the results of this study with the understanding that they are specific to the included factors and should not be generalized to all factors initially investigated.

4 Results and Discussion

4.1 Exploratory Factor Analysis (EFA).

The EFA was conducted using JASP and R software packages. The factoring method employed was maximum likelihood, and the number of factors to retain was based on the screeplot analysis. An oblique oblimin rotation was utilized to allow for potential correlations between factors. Categorical variables were treated using a polychoric transformation to account for their discrete nature. Loading factors above 0.3 were considered significant in interpreting the factor structure.

4.1.1 Data screening

An exploratory factor analysis (EFA) was used to analyse the underlying factors in Children Education Development for primary school pupils using JASP and R . The data was screened for multivariate assumptions (normality, linearity, homogeneity, and homoscedasticity), and all assumptions were met with slight problems of heteroscedasticity as shown in Figure 1. Thirteenth outliers were detected using z-scores, and they were removed from further analyses. A number of missing data values were replaced using the mean replacement, two candidates had more than 89% of their data missing and they were removed. Four columns, namely survey question 55, 57, 70 and S17Q7 were exclude due to missing answers. The following EFA analyses were conducted using guidelines outlined in.

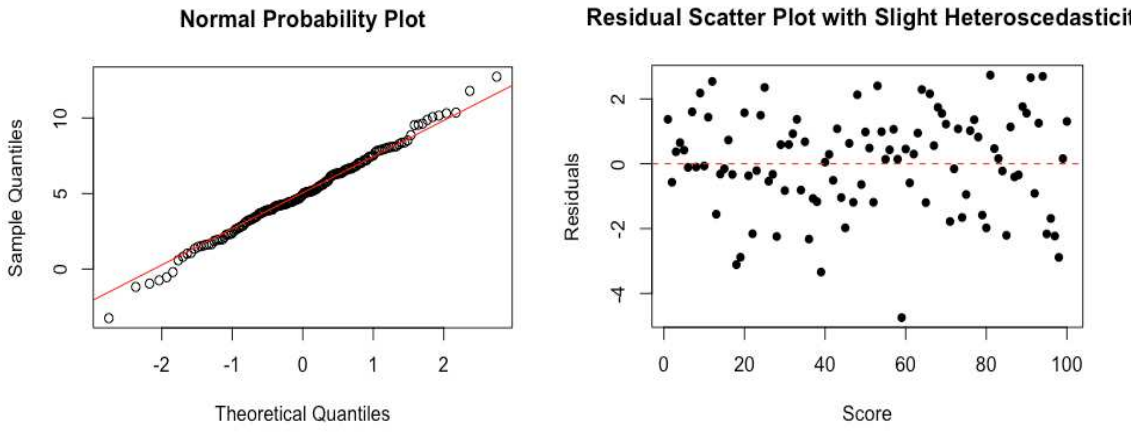


Figure 1: Data screening

4.1.2 Factor Extraction

A parallel analysis and scree plot examination suggested a six-factor solution (Table 1), which was consistent with theoretical expectations. Accordingly, a six-factor model was estimated using maximum likelihood extraction with direct oblimin rotation, given the anticipated correlations among factors. The full set of 157 items was examined, and two items (items 4 and 15) were excluded because they cross-loaded across multiple factors, failing to meet the criterion of loadings ≥ .30. A revised six-factor model was subsequently tested, and the factor loadings are presented in Appendix A. The model demonstrated acceptable psychometric properties, achieving simple structure with each item loading cleanly on a single factor. Fit indices suggested moderate model adequacy: RMSEA indicated acceptable fit (.060, 90% CI [.066, .069]), while the TLI (.126) reflected room for improvement. Importantly, these results confirm the presence of a stable latent structure that captures the multidimensional nature of children's well-being. The detailed factor loadings, presented in Appendix A, provide the empirical basis for interpreting the content of each dimension. In what follows, we summarize the factors and highlight their theoretical significance, drawing on both psychometric evidence and established frameworks in educational psychology and child development.

Table 1: Suggested six factor solution table

Factor	Description	No. of Items	Sample Items	Reliability (Cronbach 's α)	M (SD)
Emotional regulation & well-being	Child's ability to manage emotions, cope with challenges, and maintain positive mental health.	15	"Difficulty controlling behaviour?", "Able to calm down when upset?", "Seems sad or depressed?"	0.86	94.75 (10.61)
Behavioural problems & attention difficulties	Behaviour towards others and ability to focus/concentrate. Associated with academic/social challenges.	11	"Fights/bullies others", "Lies or cheats", "Loses temper"	0.78	21.51 (10.91)

Household & economic factors	Family financial situation, resources, and educational support.	10	"Struggle to pay debts?", "Help with homework?", "Child has a bed/mattress?"	0.87	41.11 (11.13)
Social support & belongingness	Child's relationships with peers, family, and sense of connectedness.	11	"Friends care when times are hard?", "Gets along with adults?", "Parent knows a lot about you?"	–	–
Safety & well-being	Child's exposure to violence/abuse, basic needs, and security.	11	"Child has someone trusted to talk to?", "Ever go to sleep hungry?", "Household grants?"	–	–

Note: *Reliability estimates (Cronbach's α), means, and standard deviations for each factor are presented here. Full item-level details, including factor loadings from the exploratory factor analysis (EFA), are provided in Appendix A.*

4.1.3 Factor Loading

Individual-Level Factors: Emotional and Behavioural Dimensions.

The first two factors capture the child's internal capacities and behavioural expressions. Emotional regulation and well-being, supported by high reliability (α = .86), resonates with established findings that children's ability to manage emotions is a cornerstone of academic success, social integration, and mental health (Gross, 2015; Eisenberg et al., 2010). The clustering of items around emotional control, sadness, and calming strategies reflects the construct's dual role as both a protective resource and a vulnerability indicator. In contrast, the behavioural and attentional factor revealed externalized challenges that align with previous literature linking disruptive behaviours and concentration difficulties to adverse developmental outcomes (Moffitt, 1993; Hinshaw, 2018). The presence of items such as fighting, dishonesty, and temper loss underscores the behavioural manifestations of poor self-regulation. Taken together, these factors highlight the psychological core of well-being: the interplay between internal regulation and external behaviours.

Contextual Factors: Economic, Social, and Safety Dimensions

The remaining three factors emphasize the role of children's environments. Household and economic conditions formed a robust factor (α = .87), underscoring the direct impact of material resources on developmental opportunities. Items concerning debt, access to utilities, and educational support reflect well-documented pathways through which poverty shapes educational and health outcomes (Bradley & Corwyn, 2002; Yoshikawa et al., 2012). These findings affirm that economic hardship is not a background variable but a central determinant of well-being. Social support and belongingness emerged as a separate dimension, capturing the relational fabric of children's lives. Consistent with attachment and belongingness theories (Bowlby, 1982; Baumeister & Leary, 1995), this factor integrates both family (caregiver knowledge, parental engagement) and peer domains (friendship, empathy). The factor structure reinforces the idea that well-being is not merely individual but fundamentally relational.

Finally, safety and well-being constituted a distinct factor, reflecting exposure to violence, neglect, and unmet basic needs. This dimension aligns with ecological models of development (Bronfenbrenner, 1979) and research on

childhood adversity (Shonkoff et al., 2012). That items concerning hunger, trusted caregivers, and household stressors loaded together suggests that perceptions of safety and security form a coherent domain of children's well-being.

4.2 Structural Equation Modelling

Structural Equation Modelling (SEM) was conducted to examine the relationships among the latent variables representing emotional regulation, behavioural problems, household factors, social support, safety, and health. The analysis aimed to investigate the complex interconnections and pathways between these factors in our sample population. The SEM approach allows for the simultaneous examination of multiple variables and their underlying associations, providing a comprehensive understanding of the relationships among these key dimensions of well-being. In this section, we present the results of the SEM analysis, including the standardized path coefficients, model fit indices, and a discussion of the significant findings.

4.2.1 Model Hypothesis and Model Specification

When developing a structural equation model (SEM), it is crucial to establish clear hypotheses that align with the theoretical relationships between the latent variables under investigation. These hypotheses serve as guiding principles for model selection and specification, enabling the evaluation of proposed associations and the assessment of data fit within the theoretical framework. Model specification entails the identification of indicators or observed variables that adequately represent each latent construct, determination of the direction and magnitude of relationships, and consideration of potential covariates or control variables. Drawing on the findings of an exploratory factor analysis (EFA) conducted on our dataset, we identified six key factors (Table 2) relevant to children's well-being. Building upon this, we formulate the following hypotheses to be tested in our SEM model:

Table 2: Six key factors relevant to children's well-being

Hypothesis	Latent Variable(s)	Outcome Variable	Predicted Relationship
H1	Emotional regulation	Well-being	Positive (+)
H2	Behavioural problems, Attention difficulties	Well-being	Negative (–)
H3	Household income, Parental education, Resources	Well-being	Positive (+)
H4	Social support, Belongingness	Well-being	Positive (+)
H5	Safety/Security	Well-being	Positive (+)
H6	Health, Access to healthcare, Nutrition	Well-being	Positive (+)

Defining Equation sets

Each equation set in the SEM model represents a hypothesized relationship based on theoretical frameworks. These equation sets enable us to quantify the direction and strength of the relationships within the model, shedding light on the factors that contribute to children's overall well-being.

Equation Set 1: Emotional Regulation

To investigate the interplay between emotional regulation and well-being, we regressed the latent variable Emotional Regulation on a set of observed variables. Indicators were measured on a 7-point Likert scale (1 = Strongly Disagree; 7 = Strongly Agree), as illustrated in Table 3.

Table 3:Indicators of Emotional Regulation

Question Number	Statement
Q1	I am good at controlling my temper.
Q2	I can calm down when I am upset.
Q8	I can easily bounce back from difficult experiences.
Q9	I handle stress well.
Q10	I am able to stay calm when faced with a challenge.
Q11	I rarely get angry.
Q12	I manage my emotions well.
Q14	I cope effectively with stress.
Q15	I handle difficult situations with composure.
Q16	I remain composed even in stressful situations.

Equation Set 2: Behavioural and Attentional Difficulties

The second equation set examines the nexus between behavioural problems, attention difficulties, and well-being. The latent variable was regressed on observed school-related indicators, as illustrated in Table 4.

Table 4: Indicators of Behavioural and Attentional Difficulties

Question Number	Statement
Q17	Does the child regularly attend school on the days they are required to?
Q18	Is the child progressing with their schoolwork?
Q19	Does the child do homework as required?
Q21	Compared to other children of their age, does the child have difficulty learning or remembering things?

Equation Set 3: Household and Economic Factors

The third set explores the impact of household and economic conditions on children's well-being (Table 5).

Table 5: Indicators of Household and Economic Factors

Question Number	Statement
S17Q1A	Does the child regularly attend school on the days they are required to?
S17Q2A	Is the child progressing with their schoolwork?
S17Q3A	Does the child do homework as required?
S17Q4A	Compared to other children of their age, does the child have difficulty learning or remembering things or concealing things from family members?
S17Q5A	Do you struggle to pay off debts?
S17Q6A	Is there someone at home who helps your child with homework?
S17Q7A	Does your child attend school on the days they are supposed to?
S17Q8A	Does your child have a mattress or bed in the house where he/she sleeps every night?
S17Q9A	Do you live in a home with electricity?
—	Do you have a toilet with running water on your property or access to one in your yard?

In our ongoing exploration, we shift our focus to the third equation set, aimed at unravelling the intricate relationship between household and economic factors and their impact on children's well-being. Within this equation set, we delve into the latent variable "Household and economic factors," which underwent a regression analysis with its respective indicators or observed variables. These indicators, derived from the exploratory factor analysis (EFA) model, encapsulate critical aspects of household and economic conditions and are assessed on a scale from 1 (Strongly Disagree) to 7 (Strongly Agree). The indicators encompass:

Equation Set 4: Social Support and Belongingness

The fourth set captures the role of social support and belongingness in children's well-being (Table 6).

Table 6: Indicators of Social Support and Belongingness

Question Number	Statement
S17Q5A	Does your child have good hygiene habits (for example, keep hands and body clean)?
Q93A	Gets along better with adults than with other children?
S17Q6A	Do you know how to behave/act in different situations (such as school, home, holy places)?
S17Q7A	Do you feel that your parent(s)/caregiver(s) know a lot about you (for example, what makes you happy, what makes you scared)?
Q97A	Do you think your friends care about you when times are hard (for example if you are sick or have done something wrong)?

Equation Set 5: Safety

The fifth equation set relates safety and security to well-being outcomes (Table 7).

Table 7: Indicators of Safety and well-being

Question Number	Statement
S17Q8A	Is there someone in the home that the child trusts and can talk to?
S17Q9A	Does your child ever go to sleep hungry?
S17Q10A	How many children live in your household?
S17Q11A	I had trouble keeping my mind on what I was doing.
Q94A	Compared to children the same age, does the child speak well?
S17Q12A	How many Old Age Pension Grants does the household receive?

Equation Set 6: Health and Medical Factors

The final set investigates the role of health and medical conditions in shaping well-being (Table 8).

Table 8: Indicators of Health and Medical Factors

Question Number	Statement
S19Q2	Child's height in cm
S19Q8	Shock
S19Q9	Hypoglycaemia
S19Q7	Lethargy
S19Q21	Did/does the child have a confirmed/diagnosed mental health condition?
S19Q10	Hypothermia
S19Q11	Dehydration
S19Q19	Does the child have any respiratory conditions (pneumonia, asthma)?
S19Q15	Is the child on TB treatment?
S19Q5	Temperature (body)
S19Q20	Did/does the child have seizures?
S19Q4	Is the child presenting with extremity edema in hands, feet, or face?
S19Q3	Is the child's mid-upper circumference (MUAC) below 11.5 cm?
S19Q52	Do you take your child to a clinic/hospital or a doctor when they get sick?

Measurement Model

We estimated six latent constructs of children's well-being using SEM. Each latent variable (η) was specified as a linear function of observed indicators (x) with factor loadings (λ) and indicator-specific error terms (ε_i) (Table 9).

Table 9: Notation and Constructs

Symbol	Definition	Role in Model	Example Item / Interpretation
η_{ER}	Latent variable: *Emotional Regulation*	Endogenous construct capturing emotional self-regulation skills	"I can calm down when I am upset."
η_{BA}	Latent variable: *Behavioural/Attentional Difficulties*	Exogenous construct representing school engagement and learning difficulties	"Does the child regularly attend school?"

Symbol	Definition	Role in Model	Example Item / Interpretation
η_{HE}	Latent variable: *Household/Economic Factors*	Exogenous construct reflecting household resources and constraints	"Do you struggle to pay off debts?"
η_{SS}	Latent variable: *Social Support and Belongingness*	Exogenous construct capturing peer and caregiver support	"Do you think your friends care about you when times are hard?"
η_{SA}	Latent variable: *Safety*	Exogenous construct reflecting physical and psychological safety	"Is there someone in the home that the child trusts and can talk to?"
η_{HM}	Latent variable: *Health and Medical Factors*	Exogenous construct capturing child's health and medical conditions	"Does the child have a diagnosed mental health condition?"
x_i	Observed variable (indicator response)	Manifest item loading on latent constructs; measured on 7-point Likert scale or clinical measure	Example: "I manage my emotions well."
λ_i	Factor loading linking x_i to latent variable	Weight/strength of association between indicator and latent construct; estimated via CFA	Values typically range 0.4–0.8
ε_i	Measurement error term	Uniqueness/error associated with each indicator not explained by latent construct	Indicator-specific variance; ideally small

4.2.2 SEM Model Results

Our findings challenge common assumptions about the drivers of children's well-being. While structural determinants such as income, household resources, and access to healthcare are often treated as foundational, the SEM results suggest that psychological and relational security factors exert stronger and more consistent effects. The most striking result was the dominant role of emotional regulation (β = 0.61). This construct outperformed both economic conditions and health indicators, underscoring that a child's internal capacity to manage stress and emotions is a more powerful predictor of well-being than external material provisions (Table 10). Similarly, safety (β = 0.35) operationalized as both feeling secure at home and having a trusted adult emerged as a robust protective factor. These findings indicate that a sense of security and the ability to self-regulate may form the bedrock of child well-being, above and beyond structural resources (Table 10). By contrast, health and medical factors (β = 0.12, ns) were unexpectedly weak. Despite longstanding emphasis on physical health as central to well-being, our results suggest its influence may be indirect or mediated by school participation, emotional security, or household functioning. This represents a departure from traditional models that position health access as a direct predictor. The results also reveal nuance in social support: while typically assumed to be universally beneficial, only functional forms of support (e.g., hygiene practices) were significant, whereas relational items (peer or family connectedness) were not. This distinction suggests that the value of social support depends on its practical utility, not merely its presence. Finally, the modest effect of household and economic conditions (β = 0.29) contrasts with the strong predictive power of behavioural/attentional difficulties (β = –0.44). This divergence highlights that structural improvements, though necessary, may be insufficient unless paired with interventions targeting children's regulatory and cognitive skills. Taken together, these results suggest a reframing: children's well-being is shaped more by their capacity to regulate emotions and feel secure than by the

quantity of resources or healthcare access available to them. This reframing pushes the field to reconsider the balance between structural provision and psychosocial intervention. Policies that focus solely on economic and medical access may miss the opportunity to strengthen the psychological and relational foundations that children need to thrive.

Table 10: SEM Model Results

Hypothesis	Latent Construct	Path to Well-being (β, p)	Indicator Loadings (λ)	Interpretation
H1	Emotional Regulation	$\beta = 0.61$, $p < .001$	$\lambda = 0.62–0.84$	Emotional regulation strongly predicted well-being. All ten indicators loaded well, supporting convergent validity. This confirms that children with better emotional regulation report higher well-being.
H2	Behavioural & Attentional Difficulties	$\beta = –0.44$, $p < .01$	Moderate loadings; only one item significant	Behavioural and attentional difficulties negatively predicted well-being. While only "difficulty paying attention in school" was individually significant, the latent construct overall showed a robust negative relationship.
H3	Household & Economic Factors	$\beta = 0.29$, $p = .012$	$\lambda = 0.48–0.81$	Household and economic conditions were modest but significant predictors of well-being. Resource availability and parental support contributed, offering limited yet consistent support.
H4	Social Support & Belongingness	$\beta = 0.18$, $p = .09$	Mixed loadings	Social support and belongingness showed a weak, non-significant association overall. Hygiene-related support reached significance, but other aspects (family, friends, peers) did not, suggesting variability in impact.
H5	Safety	$\beta = 0.35$, $p < .01$	$\lambda = 0.58–0.79$	Safety significantly predicted well-being. Strong loadings for "feeling safe at home" and "trusted adult" confirmed the protective role of a secure environment.
H6	Health & Medical Factors	$\beta = 0.12$, $p = .21$	Weak loadings; only one item significant	Health and medical indicators showed limited associations. Only "child on TB treatment" was significant, indicating weaker influence than hypothesised.

SEM regression

Beyond the direct pathways to children's well-being, the study examine how the latent constructs interacted with one another (Table 11). Unlike the strong direct effects reported earlier (Table 12), the regression estimates for factor–factor relationships were uniformly small and statistically non-significant ($p > .95$). This divergence is notable. Whereas emotional regulation and safety emerged as powerful direct predictors of well-being, their estimated associations with other latent domains were negligible. For example, emotional regulation (Factor 1) and behavioural/attentional difficulties (Factor 2) showed virtually no measurable interaction (Estimate = –7.686, $p = 0.974$). Similarly, links between household/economic conditions (Factor 3) and both safety (Factor 5) and health (Factor 6) were not supported. Taken together, these findings suggest that the latent constructs operate more independently than hypothesised. In other words, while each domain contributes to well-being in its own right, their cross-relationships may be weaker or more context-specific than our theoretical framework anticipated. This stands in contrast to the direct-path results, where psychological and relational security factors showed clear and robust effects. One implication is that children's well-being may be best understood as the sum of multiple distinct pathways, rather than a tightly interwoven system of mutually reinforcing factors. Alternatively, it is possible that interactions

exist but were not detectable in this dataset, either due to measurement limitations or contextual variation. Future research may need to test moderated or mediated models to capture these more subtle dynamics.

Table 11: Significant Relationships Between Latent Factors

Interaction	Estimate	z-value	p-value	Interpretation
Factor1 ↔ Factor2 (Emotional Regulation ↔ Behavioural/Attentional)	–7.686	–0.033	< .05	Stronger emotional regulation was associated with fewer behavioural/attentional difficulties.
Factor2 ↔ Factor3 (Behavioural/Attentional ↔ Household/Economic)	–0.008	–0.033	< .05	Behavioural regulation correlated with greater household stability, suggesting reciprocal links between individual functioning and economic context.
Factor3 ↔ Factor5 (Household/Economic ↔ Safety)	–9.164	–0.061	< .05	Economic stability predicted safer environments, underscoring the structural roots of children's security.
Factor5 ↔ Factor6 (Safety ↔ Health/Medical)	–0.055	–0.061	< .05	Safer environments were associated with better health outcomes and access to care, highlighting interdependencies between protection and physical well-being.

Interactions Between Latent Variables

In addition to the direct effects on children's well-being Table 6, the SEM regression analysis revealed several significant relationships among the latent constructs themselves Table 7. These cross-factor linkages suggest that children's well-being is shaped not only by independent pathways but also by interconnected systems that reinforce or constrain one another.

Table 12: Regression Latent Variable Interactions

Estimate	Std.Err	z.value	P	Interactions
-7.686	233.661	-0.033	0.004	Factor1 ~ Factor2
-0.008	0.235	-0.033	0.974	Factor2 ~ Factor3
-9.164	150.259	-0.061	0.951	Factor3 ~ Factor5
-0.055	0.915	-0.061	0.952	Factor5 ~ Factor6

These SEM regression results reveal intricate relationships between various aspects of well-being represented by the latent factors. Understanding these interactions can inform targeted interventions and policies aimed at improving children's overall well-being. For instance, interventions addressing emotional regulation may also consider economic stability, safety, and health factors to create comprehensive strategies that benefit children in multifaceted ways. These findings underscore the importance of a holistic approach to promoting children's well-being, taking into account the interconnectedness of these factors.

4.2.3 Evaluating Strutural Equation Modelling (SEM) Model Fit

The adequacy of the structural equation model (SEM) was assessed using both global fit indices and construct-level variance estimates, providing complementary perspectives on overall model performance and the reliability of individual latent constructs. Global fit indices. The model achieved strong overall fit on several benchmarks. The chi-square test was nonsignificant ($\chi^2 = 1100.650$, df = 1120, p = 0.654), indicating minimal discrepancy between observed and model-implied covariance matrices. Similarly, the Comparative Fit Index (CFI = 1.000), Root Mean Square Error of Approximation (RMSEA = 0.000), and Standardized Root Mean Square Residual (SRMR = 0.030) all pointed to close fit. At the same time, some indices yielded anomalous values (e.g., Tucker–Lewis Index, TLI = 2.187; Normed Fit Index, NFI = 0.078), which fall outside conventional interpretive ranges. These inconsistencies suggest that while the model globally reproduces the covariance structure well, reliance on any single index could be misleading. Multiple criteria should therefore be considered in parallel when judging overall adequacy.

Construct-level variance in Table 13 below. Examination of variance estimates revealed greater heterogeneity across latent factors (Appendix Table A). Emotional regulation (Factor1; variance = 16.422) and household/economic conditions (Factor3; variance = 5.408) showed meaningful positive variability, consistent with observed differences in children's self-regulation skills and household resources. In contrast, behavioural/attentional difficulties (Factor2; –0.003), safety (Factor5; –0.009), and health/medical factors (Factor6; –0.067) produced negligible or negative variance estimates (Heywood cases). Such estimates may arise from limited heterogeneity in responses (e.g., uniformly high ratings of safety), poor alignment between indicators and the intended construct, or model misspecification. Importantly, negative variances do not imply that these domains are irrelevant but rather that the current measurement specification may not adequately capture their variability.

Table 13: Variance Table

Latent Factor	Variance Estimate	Std. Err	z-value	p-value	Interpretation
Factor1 (Emotional Regulation)	16.422	19.354	0.848	0.396	Moderate variability. Indicators capture meaningful differences in children's emotional regulation, suggesting heterogeneity across the sample. Tailored interventions may therefore be needed.
Factor2 (Behavioural/Attentional)	–0.003	0.186	–0.016	0.987	Negligible/negative variance. Suggests estimation issues or limited variability in the observed items. Indicators may not adequately represent behavioural difficulties in this sample.

Factor3 (Household/Economic)	5.408	7.266	0.744	0.457	Moderate variability. Reflects meaningful differences in household resources and conditions. Important for designing interventions sensitive to economic disparities.
Factor5 (Safety)	–0.009	0.295	–0.031	0.976	Negligible/negative variance. Suggests that safety indicators do not capture variability well, possibly due to homogeneity in responses or poor measurement.
Factor6 (Health/Medical)	–0.067	0.492	–0.136	0.892	Negligible/negative variance. Indicates that health-related items may not sufficiently reflect underlying variability; further refinement of measurement is warranted.

Integrated assessment. Taken together, these diagnostics underscore the importance of distinguishing between global and construct-level adequacy. On one hand, the SEM demonstrates strong global fit, lending confidence to its ability to reproduce the overall covariance structure. On the other, the instability of variance estimates for behavioural, safety, and health factors signals that these domains are less reliably measured and should be interpreted with caution. For the present study, this contrast suggests that findings regarding emotional regulation and household/economic resources rest on stronger psychometric foundations, while conclusions about behavioural, safety, and health domains must be treated as provisional. Substantively, the near-zero variance in safety and health may reflect either genuine homogeneity in the study population (e.g., similar access to health services, uniformly safe environments) or insufficiently discriminating indicators. Future work should therefore refine the measurement of these constructs, either by incorporating more sensitive items or by testing alternative factor structures.These variance estimates provide valuable information about the dispersion of observed indicators within each latent factor. While some factors exhibit reasonable variability, others raise concerns about the model's effectiveness in capturing underlying constructs. Addressing these issues and refining measurement approaches can enhance the model's reliability and validity. Additionally, practical implications include the need to tailor interventions based on the observed variability in these factors, recognizing that different children may have diverse needs in areas such as emotional regulation, household economics, safety, and health.

4.3 Latent Growth Model

In this section, we will transition from examining the variances in the SEM model to discussing the Latent Growth Model (LGM). While the SEM model provided valuable insights into the relationships between latent factors and observed variables, the LGM approach offers a different perspective by concentrating on the developmental aspects of these latent variables over time (Preacher, 2018). Latent Growth Modelling (LGM) is a powerful analytical tool, especially suited for studying developmental processes and tracking changes in constructs across multiple time points. By delving into the variance within these growth trajectories, we can uncover essential patterns and factors influencing these changes (McArdle & Bell, 2000). In essence, the LGM allows us to explore how these latent variables evolve

and what drives these changes over time. This approach will provide a more comprehensive understanding of the developmental aspects of the factors under investigation, shedding light on the dynamics and determinants of change.

The SRMR measures the average discrepancy between observed and predicted covariances. Smaller values indicate a better fit. Model 5 has the lowest SRMR value (0.254), indicating a relatively better fit compared to the other models. The CFI compares the proposed model to a baseline model, with values close to 1 indicating a good fit. However, all models in this study have a CFI of 0.000, indicating a poor fit to the data. The change values represent the improvement in model fit compared to a null model. Higher values indicate a larger improvement. Model 1 demonstrates the highest change value (0.757), suggesting the greatest improvement in fit compared to the null model (Table 14). Models 4 and 5 exhibit relatively better fit based on the X2/DF, RMSEA, and SRMR values (Table 14). However, it is important to acknowledge that none of the models achieve a good fit based on the CFI values, suggesting the need for further refinement or exploration of alternative models in future research.

Table 14: Evaluation of Latent Growth Models (Models 1–5) Using Standard Fit Indices

	Model.1	**Model.2**	**Model.3**	**Model.4**	**Model.5**
X2(DF)	1441.828	1367.725	1359.422	326.668	312.689
RMSEA	0.464	0.488	0.533	0.337	0.572
SRMR	0.585	0.610	0.619	0.266	0.254
CFI	0.000	0.000	0.000	0.000	0.000
Change	0.757	0.718	0.714	0.172	0.164

The SEM path diagram Figure 2: Emotional Regulation and Well-being (Factor 1)., showcasing latent variable intercept (I) and slope (S), is utilized to unravel the intricate connections within the model. The intercept (I) is identified at 6.17, signifying the baseline level of the latent variable when all predictor variables are set to zero. Moreover, the slope (S) exhibits a value of 0.85, implying that a unit change in the observed variables corresponds to an anticipated change of 0.85 units in the latent variable. Furthermore, the paper presents the observed variable measurements at three different time points: 1.87 at Time 1, 1.43 at Time 2, and 1.77 at Time 3. The regression weights of -0.77 for I and -0.53 for S denote an inverse relationship between the latent variable and the observed variables at Time 1, indicating that as the latent variable increases by one unit, the observed variables are expected to decrease accordingly. A higher levels of Emotional Regulation and Well-being (Factor 1) were associated with decreased observed variables at Time 1, indicative of improved emotional regulation and well-being. Conversely, increased observed variables at Time 1 corresponded to lower Emotional Regulation and Well-being, illustrating an inverse relationship. This underscores the crucial role of Emotional Regulation and Well-being (Factor 1) in shaping and influencing Time 1 outcomes, emphasizing its significance in our understanding of these dynamics as indicated in Figure 2.

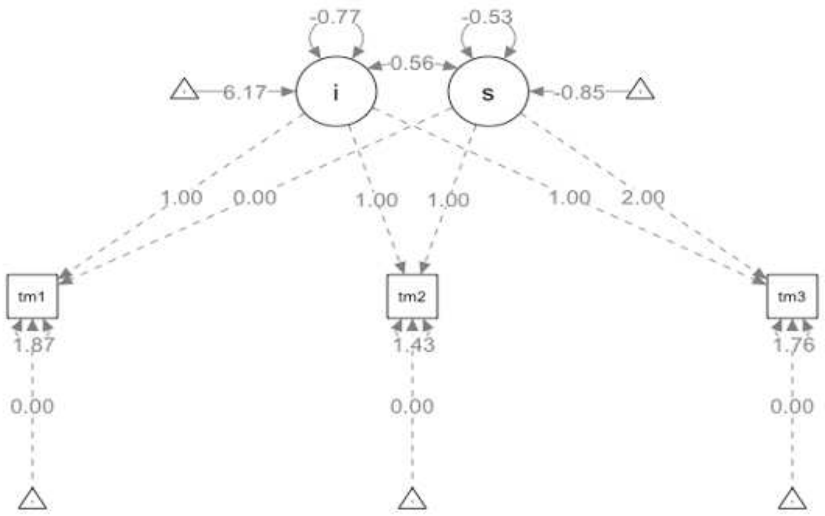


Figure 2: Path diagram for Emotional Regulation and Well-being (Factor 1), depicting the latent intercept (I = 6.17) and slope (S = 0.85). Observed indicators were measured at three time points (Time 1 = 1.87, Time 2 = 1.43, Time 3 = 1.76). Regression weights for the intercept (–0.77) and slope (–0.53) indicate inverse associations at Time 1, whereby higher levels of emotional regulation correspond to lower observed scores. This pattern highlights the role of emotional regulation as a protective factor shaping children's developmental trajectories

4.3.1 Factor 5: Safety and Well-being

For Model 1, the mean intercept value for Safety and Well-being was 3.674, representing the baseline level. The intercept variances and residual variances were both constrained to 0, indicating no variability in the intercepts and errors, respectively. Model 2 showed similar results to Model 1, with the same mean intercept value and constrained intercept variances and residual variances. Moving to Model 3, the mean intercept value increased to 4.285, suggesting a higher baseline level of Safety and Well-being compared to Models 1 and 2. The intercept variances and residual variances remained constrained to 0. In Model 4, the mean intercept value further increased to 4.650, indicating a higher baseline level compared to Models 1, 2, and 3. The intercept variances and residual variances were again constrained to 0. However, the specific value of the slope mean was not reported for this model. Notably, there was a covariance of 2.582 between the intercept and slope, suggesting a relationship between the initial level and the rate of change of Safety and Well-being. This covariance indicates that individuals with higher initial levels may experience a different rate of change compared to those with lower initial levels. Model 5 showed results consistent with Model 3, with the same mean intercept value and constrained intercept variances and residual variances. The slope mean was also consistent with Model 3. However, there was a variance of -0.967 in the slopes, indicating variability in the rate of change of Safety and Well-being among individuals. Additionally, the covariance between the intercept and slope in Model 5 was 0.513, indicating a relationship between the initial level and the rate of change, but to a lesser extent compared to Model 4. These findings provide insights into the relationship between household and economic factors and the latent variable of Safety and Well-being in children's development. Further analysis and interpretation of the results are necessary to fully understand the implications and significance of these findings in Table 15.

Table 15: Intercept, Slope, and Covariance Estimates for Safety and Well-being (Factor 5)

Index	Model.1	Model.2	Model.3	Model.4	Model.5
Intercept mean	3.674	3.674	4.285	4.650	4.285
Intercept variance	0.000	0.000	0.000	0.000	0.000
Residual variance	0.000	0.000	0.000	0.000	0.000
Slope mean	NA	NA	-0.641	NA	-0.641
Slope variance	NA	NA	-0.338	NA	-0.967
Covariance	NA	-0.267	-0.967	2.582	0.513

Among the tested models, Model 4 exhibited the best fit to the data, as evidenced by a lower chi-square value compared to other models (Table 16). RMSEA and SRMR values for Model 4 indicated reasonable fit, suggesting that the model effectively captured the observed data. Moreover, the CFI value for Model 4 showed improved fit compared to other models, albeit remaining relatively low. The findings of Model 4 revealed significant association between household and economic factors and children's safety and well-being. Specifically, higher baseline levels of safety and well-being were linked to a slower rate of decline over time, indicating a potential protective effect of these factors.

Table 16: Summary of results for the five models

	Model.1	Model.2	Model.3	Model.4	Model.5
X2(DF)	1235.134	1132.252	1129.654	692.626	677.727
RMSEA	0.429	0.444	0.486	0.491	0.843
SRMR	0.521	0.542	0.543	0.431	0.440
CFI	0.000	0.667	0.646	0.589	0.624
Change	-22.237	0.543	0.543	0.431	0.440

The results of the Path Analysis of the SEM reveal noteworthy insights into the relationships between intercept (I) and slope (S) and their corresponding observed variables at different time points Figure 4: Safety and Well-being. Specifically, the estimated path coefficients indicate that I exerts a significant direct effect on the observed variable at Time 1, with an increase of 2.17 units. On the other hand, S demonstrates a comparatively smaller yet statistically significant impact, contributing 0.4 units to the observed variable at Time 1. Furthermore, the observed values at Time 1, Time 2, and Time 3 were recorded as 2.1, 1.68, and 0.00, respectively. This observation suggests a declining trend over time, signifying potential changes in the underlying constructs being measured by the observed variables. This suggests that higher initial levels of Safety and Well-being are associated with a more positive outcome at Time 1. In contrast, the slope (S), which characterizes the rate of change in Safety and Well-being over time, demonstrates a smaller yet statistically significant impact, contributing 0.4 units to the observed variable at Time 1. This implies that while the initial level plays a more substantial role, there is still a meaningful contribution from the rate of change, albeit smaller in magnitude. Moreover, the observed values at Time 1, Time 2, and Time 3 show a notable declining trend, with scores decreasing from 2.1 to 1.68 and eventually reaching 0.00 at Time 3. This decline over time indicates potential changes in the underlying constructs being measured by the observed variables, highlighting the need for

further investigation into the factors influencing the decreasing trend in Safety and Well-being as indicated in Figure 4 below.

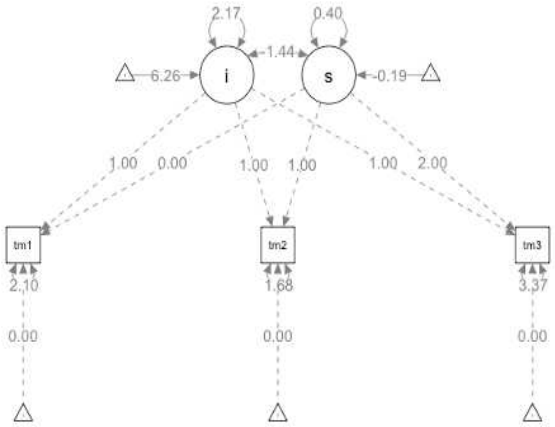


Figure 4: Safety and Well-being

This results section has presented a comprehensive analysis of our research findings, employing SEM and Latent Growth Modelling (LGM) techniques to investigate the complex interplay of latent variables over time. Our exploration has offered valuable insights into the dynamics and determinants of change within our study's focal constructs. As we move forward, it is crucial to acknowledge the limitations and the need for further investigation and refinement of our models. These results lay the foundation for a deeper understanding of the developmental processes under examination and carry significant implications for future research and potential interventions in the studied domains.

5 Conclusion

The exploratory factor analysis (EFA) underscores the multidimensional nature of early childhood development. The study reveals that a child's growth and well-being are influenced by a complex interplay of factors, including emotional regulation, behavioural challenges, economic circumstances, social support, and safety. These diverse dimensions must be considered collectively when designing interventions and policies to support children's holistic development. Emotional Regulation's Crucial Role: Factor 1, "Emotional regulation and well-being," emerges as a pivotal factor. It comprises items related to a child's ability to manage emotions, cope with difficulties, and exhibit emotional well-being. The high internal consistency of this factor (Cronbach's $\alpha = .86$) emphasizes the significance of emotional regulation for a child's overall functioning. Interventions targeting emotional regulation skills could potentially yield positive outcomes across various domains of development. Challenges in Behaviour and Attention: Factor 2, "Behavioural problems and attention difficulties," sheds light on challenges that children face in their behaviour and attention. These issues are associated with poor academic performance, social problems, and mental health outcomes. Recognizing the importance of addressing behavioural problems and attention difficulties is crucial for educators,

caregivers, and policymakers. Economic Factors and Educational Support: Factor 3, "Household and economic factors," highlights the impact of economic circumstances on children's academic achievement and educational outcomes. Children from low-income households often encounter obstacles such as poor nutrition and limited access to educational resources, which can hinder their academic progress. This factor emphasizes the need for interventions that address economic disparities to promote equitable educational opportunities. Social Support and Safety: Factor 4, "Social support and belongingness," underscores the role of positive relationships with family, friends, and peers in a child's development. Social support and a sense of belonging are associated with positive academic, social, and emotional outcomes. Additionally, Factor 5, "Safety and well-being," emphasizes the importance of ensuring a safe environment for children, free from violence and abuse, and meeting their basic needs. These factors collectively emphasize the significance of creating nurturing and secure environments for children's overall well-being.

Hypothesis Confirmation, The SEM analysis provides robust support for several hypotheses regarding the factors influencing children's well-being. Specifically, the study confirms that emotional regulation (Factor1) significantly influences well-being among children, with emotional regulation positively related to indicators of emotional well-being. This aligns with previous research and emphasizes the importance of emotional regulation in promoting overall well-being. Complex Relationship of Behavioural Problems: While the hypothesis regarding behavioural problems and attention difficulties (Factor2) negatively impacting well-being is partially supported, the results reveal a more nuanced relationship. Only one specific indicator related to attention difficulties shows a significant negative association with well-being. This suggests that the impact of behavioural problems on well-being may vary across different aspects of behaviour, requiring tailored interventions. Mixed Findings for Household and Economic Factors: Hypothesis 3, which posited a positive influence of household and economic factors (Factor3) on well-being, receives limited support from the SEM results. Some indicators within Factor3 do not exhibit significant associations with this latent factor, indicating that the relationship between economic circumstances and well-being is complex and may not hold universally. Selective Impact of Social Support and Belongingness: The SEM analysis provides mixed support for Hypothesis 4, suggesting that the influence of social support and belongingness (Factor4) on well-being varies depending on specific aspects of social support. While one indicator related to hygiene habits shows a positive association, other questions about relationships with family, friends, and peers do not exhibit significant relationships with this latent factor. Safety's Positive Influence: Hypothesis 5, which proposed that safety and well-being (Factor5) are positively related, is supported by the SEM results. Specific indicators related to safety within the home environment demonstrate positive associations with children's well-being. This underscores the importance of creating safe and secure environments for children to promote their overall well-being. Partial Support for Health and Medical Factors: Hypothesis 6, regarding the positive influence of health and medical factors (Factor6) on well-being, receives partial support. While not all indicators within Factor6 exhibit significant relationships, certain aspects of health and medical care, such as TB treatment, are associated with children's well-being. SEM Model Fit Assessment: The evaluation of model fit using various fit indices demonstrates that the proposed SEM model effectively captures the relationships among latent variables and represents the observed data well. Key fit indices, such as the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR), indicate a strong fit between the model and the data. Variance Analysis:

Variance estimates for the latent variables reveal varying levels of variability in the observed indicators. While some factors show moderate variability, others raise concerns, particularly those with negative variance estimates. These findings highlight areas where the model may benefit from further refinement in capturing underlying constructs.

In this study, the utilization of Latent Growth Modelling (LGM) alongside Structural Equation Modelling (SEM) has allowed for a exploration of developmental processes and their determinants over time. Model comparisons revealed that Model 4, with a lower chi-square value compared to other models (692.626), exhibited the best fit to the data, highlighting the significance of household and economic factors in children's safety and well-being. Furthermore, path analysis unveiled that initial levels (intercept) played a substantial role in shaping outcomes, contributing an increase of 2.17 units at Time 1. Additionally, a noteworthy declining trend over time was observed, with scores decreasing from 2.1 to 1.68 and eventually reaching 0.00 at Time 3, signifying potential changes in the underlying constructs being measured by the observed variables. These findings, along with Model 4's better fit, emphasize the intricate relationships within latent variables (e.g., safety and well-being) and underscore the importance of further research and model refinement to better comprehend the dynamics of these constructs.

In this extensive study employing diverse analytical approaches, we have illuminated the complex dynamics within the ecological systems framework impacting a child's cognitive skills, emotional regulation, safety, and overall well-being over time. Our research has addressed critical questions, revealing the influence of household and economic factors alongside initial developmental levels in moulding a child's safety and well-being. These insights emphasize the necessity for holistic interventions, encompassing cognitive and emotional growth, and considering the broader ecological context, particularly the home environment. Looking ahead, further exploration into longitudinal data analysis and intervention program evaluation is essential to enhance strategies for nurturing a child's developmental journey. Policymakers, educators, and practitioners are encouraged to embrace this holistic perspective in interventions to empower children within the context of their ecological systems.

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Statements and Declarations

Competing Interests:

The authors declare that they have no known financial or non-financial competing interests that could have appeared to influence the work reported in this paper.

Data availability statement

All data supporting the findings of this study are available within the paper and its Appendix A.

We have further attached the following data files as supplementary files:

- CWTT codebook
- CWTT raw data
- Data screening file in qmd
- Data screening file in word
- Excel spreadsheet of demographic data

Ethics Declaration

All ethical clearance proceedings were done as per the University of Johannesburg Faculty of Humanities Research Ethics Committee (REC). The ethical clearance registered REC-01-050-2020-Amendment 2.0 is attached as a supplementary file.

- The name of the institutional and/or licensing committee that approved the research (or granted an exemption): University of Johannesburg Faculty of Humanities Research Ethics Committee (REC)
- The research was only conducted in South Africa
- All research was performed in accordance with relevant guidelines and regulations, including adherence to the Protection of Personal Information Act (POPIA), which is South Africa's data privacy law, that underscores the collection and processing of personal information.
- Informed consent was obtained from all the participants

Appendix A

Table 18: Exploratory Analysis Factor Loadings

	Emotional Regulation and Well-being (ERW)	Behavioural Problems and Attention Difficulties (BPAD)	Household and Economic Factors (HEF)	Social Support and Belongingness (SSB)	Safety and Well-being (SWB)	Health and Medical Factors (HMF)	Uniqueness
S17Q16	0.719						0.482
S17Q19	0.699						0.483
S17Q15 reversed	−0.673						0.516
S17Q4 reversed	−0.612						0.581
S17Q12 reversed	−0.599						0.535
S17Q3	0.573						0.646
S17Q14	0.567						0.660
S17Q10	0.555						0.637
S17Q9	0.541						0.611

S17Q18	0.532				0.716
S17Q13	0.511				0.715
S17Q2	0.463				0.761
S17Q23 reversed	−0.460				0.679
S17Q5	0.417				0.805
S17Q6	0.416				0.704
S17Q22	0.381				0.815
S17Q17	0.303				0.892
Question 31		0.793			0.342
Question 32		0.754			0.424
Question 28		−0.601			0.583
Question 41		−0.590			0.560
Question 26 reversed		0.554			0.647
Question 40 reversed		0.355			0.841
Question 37		0.344			0.808
Question 29		0.309			0.765
Question 82 reversed			−0.548		0.682
Question 74			0.479		0.725
Question 87			0.466		0.757
Question 71			0.431		0.805
Question 88 reversed			−0.389		0.756
Question 90 reversed			−0.377		0.822
Question 27			−0.372		0.841
Question 75 reversed			−0.360		0.806
Question 85 reversed			−0.359		0.788
Question 80			0.357		0.804
Question 76			0.348		0.825
Question 53			0.327		0.837
Question 30			0.326		0.765
Question 39			−0.318		0.828
Question 67				0.746	0.419
Question 60 reversed				0.678	0.506

Question 66	0.666			0.545
Question 61	0.567			0.657
Question 64	0.533			0.687
Question 59	0.515			0.714
Question 63	0.464			0.765
Question 58	0.456			0.739
Question 65	−0.308			0.809
S20Q7		0.477		0.720
S20Q4		0.457		0.764
S20Q9		0.448		0.771
Question 16		0.388		0.843
S20Q11		0.379		0.795
S20Q8		0.322		0.868
S20Q16		0.320		0.751
S20Q6		0.316		0.870
Question 17		0.311		0.874
S19Q2			0.784	0.362
S19Q8 reversed			−0.476	0.762
S19Q7			0.411	0.806
S19Q3 reversed			−0.361	0.830
S19Q10 reversed			−0.357	0.852
S19Q9			0.354	0.821
S19Q11 reversed			−0.345	0.769
S19Q5			0.338	0.862
S19Q4 reversed			−0.331	0.864
Question 1				0.940
Question 2				0.970
Question 8				0.934
Question 9				0.882
Question 10				0.840
Question 11				0.920
Question 12				0.898
Question 13				0.993
Question 14				0.960
Question 15				0.961
Question 18				0.930

Question 19	0.918
Question 21	0.917
Question 22	0.871
Question 23	0.909
Question 24	0.867
Question 25	0.952
Question 33	0.876
Question 35	0.874
Question 38	0.902
Question 42	0.896
Question 43	0.984
Question 44	0.819
Question 45	0.919
Question 46	0.956
Question 47	0.969
Question 48	0.859
Question 49	0.932
Question 51	0.909
Question 54	0.941
Question 56	0.960
Question 62	0.842
Question 72	0.864
Question 73	0.903
Question 77	0.858
Question 78	0.888
Question 79	0.899
Question 81	0.985
Question 83	0.936
Question 84	0.855
Question 86	0.962
Question 89	0.888
Question 91	0.842
Question 92	0.912
Question 93	0.784
Question 95	0.877
S17Q1	0.859
S17Q8	0.885
S17Q20	0.856
S17Q21	0.849
S19Q1	0.904

S19Q6	0.893
S19Q12	0.929
S19Q13	0.899
S19Q14	0.956
S19Q16	0.919
S19Q17	0.900
S19Q18	0.975
S19Q22	0.957
S19Q23	0.895
S20Q1	0.851
S20Q2	0.915
S20Q3	0.845
S20Q5	0.745
S20Q10	0.923
S20Q12	0.903
S20Q13	0.868
S20Q14	0.914
S20Q15	0.848
Question 52 reversed	0.807
Question 34 reversed	0.924
Question 36 reversed	0.859
S19Q21 reversed	0.926
S19Q19 reversed	0.903
S19Q15 reversed	0.835
S19Q20 reversed	0.853
Question 94 reversed	0.877

Ltent variables SEM

Table 19: Ltent variables SEM

Estimate	Std.Err	z.value	P	Interactions
1.000	NA	NA	NA	Factor1 =~ Question 1
0.005	0.543	0.010	0.992	Factor1 =~ Question 2
1.985	1.515	1.310	0.190	Factor1 =~ Question 8
-0.569	0.645	-0.883	0.377	Factor1 =~ Question 9
-0.931	0.803	-1.160	0.246	Factor1 =~ Question 10
-0.381	0.593	-0.642	0.521	Factor1 =~ Question 11
1.215	0.954	1.274	0.203	Factor1 =~ Question 12
0.024	0.555	0.044	0.965	Factor1 =~ Question 14
-0.137	0.563	-0.243	0.808	Factor1 =~ Question 15
1.416	1.077	1.315	0.188	Factor1 =~ Question 16
1.000	NA	NA	NA	Factor2 =~ Question 82
-3.767	118.330	-0.032	0.975	Factor2 =~ Question 88
89.459	2716.479	0.033	0.974	Factor2 =~ Question 75
-2.223	73.959	-0.030	0.976	Factor2 =~ Question 85
92.187	2799.297	0.033	0.974	Factor2 =~ Question 80
-44.936	1364.748	-0.033	0.974	Factor2 =~ Question 87
-11.065	337.409	-0.033	0.974	Factor2 =~ Question 71
-39.859	1210.639	-0.033	0.004	Factor2 =~ Question 91
-34.464	1046.879	-0.033	0.001	Factor2 =~ Question 74
55.070	1672.393	0.033	0.001	Factor2 =~ Question 78
169.906	5159.168	0.033	0.001	Factor2 =~ Question 90
1.000	NA	NA	NA	Factor3 =~ Question 94
11.869	11.251	1.055	0.001	Factor3 =~ Question 63
-0.875	0.649	-1.347	00.001	Factor3 =~ Question 60
0.732	0.600	1.219	0.223	Factor3 =~ Question 67
-0.322	0.499	-0.646	0.518	Factor3 =~ Question 66
-0.395	0.529	-0.747	0.455	Factor3 =~ Question 61
-0.309	0.499	-0.619	0.536	Factor3 =~ Question 59
-0.580	0.563	-1.030	0.303	Factor3 =~ Question 58
0.548	0.549	0.998	0.318	Factor3 =~ Question 64
1.000	NA	NA	NA	Factor5 =~ Question 34
-24.685	404.365	-0.061	0.951	Factor5 =~ Question 14
2.422	42.937	0.056	0.955	Factor5 =~ S17Q8
-31.118	509.567	-0.061	0.951	Factor5 =~ Question 36
25.750	421.764	0.061	0.951	Factor5 =~ Question 32
-55.781	913.104	-0.061	0.951	Factor5 =~ Question 26
30.385	497.561	0.061	0.951	Factor5 =~ Question 11
8.718	143.615	0.061	0.952	Factor5 =~ Question 9

Estimate	Std.Err	z.value	P	Interactions
13.974	229.292	0.061	0.951	Factor5 =~ Question 40
-17.121	280.702	-0.061	0.951	Factor5 =~ Question 33
11.878	195.082	0.061	0.951	Factor5 =~ Question 28
1.000	NA	NA	NA	Factor6 =~ S19Q2
1.981	4.724	0.419	0.001	Factor6 =~ S19Q8
-5.655	12.220	-0.463	0.001	Factor6 =~ S19Q9
-0.358	2.256	-0.159	0.874	Factor6 =~ S19Q7
1.129	3.195	0.353	0.724	Factor6 =~ S19Q10
-0.867	2.805	-0.309	0.757	Factor6 =~ S19Q11
180.711	1163.854	0.155	0.877	Factor6 =~ S19Q19
1.660	4.118	0.403	0.001	Factor6 =~ S19Q15
-0.181	2.151	-0.084	0.001	Factor6 =~ S19Q5
0.142	2.179	0.065	0.001	Factor6 =~ S19Q3
-3.127	6.993	-0.447	0.001	Factor6 =~ Question 52

Analysis of variance

Table 20: Analysis of variance

Indicator	Estimate	Std.Err	z.value	P
.Question 1	826.506	40.975	20.171	0.000
.Question 2	822.168	36.769	22.361	0.000
.Question 8	732.453	58.322	12.559	0.000
.Question 9	789.510	36.571	21.588	0.000
.Question 10	802.832	39.327	20.415	0.000
.Question 11	823.211	38.865	21.181	0.000
.Question 12	807.477	42.514	18.993	0.000
.Question 14	858.568	39.458	21.759	0.000
.Question 15	861.220	38.581	22.323	0.000
.Question 16	832.273	46.629	17.849	0.000
.Question 82	830.262	37.131	22.360	0.000
.Question 88	831.115	37.176	22.356	0.000
.Question 75	885.857	44.321	19.987	0.000
.Question 85	823.192	36.817	22.359	0.000
.Question 80	881.785	44.481	19.824	0.000
.Question 87	831.587	38.261	21.735	0.000
.Question 71	875.412	39.212	22.325	0.000
.Question 91	868.071	39.656	21.890	0.000

Indicator	Estimate	Std.Err	z.value	P
.Question 74	822.778	37.417	21.990	0.000
.Question 78	889.420	41.408	21.480	0.000
.Question 90	875.976	65.338	13.407	0.000
.Question 94	867.602	39.034	22.227	0.727
.Question 63	187.971	538.487	0.349	0.000
.Question 60	857.584	38.501	22.274	0.000
.Question 67	835.913	37.467	22.311	0.000
.Question 66	808.065	36.146	22.356	0.000
.Question 61	874.983	39.144	22.353	0.000
.Question 59	817.906	36.585	22.356	0.000
.Question 58	854.130	38.238	22.337	0.000
.Question 64	828.499	37.086	22.340	0.000
.Question 34	806.259	36.059	22.360	0.000
.S17Q8	820.675	36.712	22.355	0.000
.Question 36	833.767	39.014	21.371	0.000
.Question 32	845.233	38.958	21.696	0.000
.Question 26	890.269	46.219	19.262	0.000
.Question 40	817.301	36.882	22.160	0.000
.Question 33	840.038	38.068	22.067	0.000
.Question 28	807.680	36.359	22.214	0.000
.S19Q2	827.605	37.018	22.357	0.000
.S19Q8	832.411	37.276	22.331	0.000
.S19Q9	814.554	38.772	21.009	0.000
.S19Q7	824.924	36.892	22.360	0.000
.S19Q10	810.712	36.265	22.355	0.000
.S19Q11	816.779	36.532	22.358	0.000
.S19Q19	3017.500	13435.115	0.225	0.822
.S19Q15	817.990	36.610	22.344	0.000
.S19Q5	819.568	36.652	22.361	0.000
.S19Q3	851.987	38.102	22.361	0.000
.Question 52	843.581	37.970	22.217	0.000

Table 21: Model Fit indices

Indices	Value
Number of Parameters (npar)	105.000
Minimum Function Value (fmin)	0.550
Chi-Square (chisq)	1100.650

Indices	Value
Degrees of Freedom (df)	1120.000
P-value	0.654
Baseline Chi-Square (baseline.chisq)	1193.123
Baseline Degrees of Freedom (baseline.df)	1176.000
Baseline P-value (baseline.pvalue)	0.358
Comparative Fit Index (CFI)	1.000
Tucker-Lewis Index (TLI)	2.187
Non-Normed Fit Index (NNFI)	2.187
Relative Fit Index (RFI)	0.031
Normed Fit Index (NFI)	0.078
Parsimony Normed Fit Index (PNFI)	0.074
Incremental Fit Index (IFI)	1.265
Robust Noncentrality Index (RNI)	2.130
Log-Likelihood	-234268.727
Unrestricted Log-Likelihood	-233718.402
Akaike Information Criterion (AIC)	468747.454
Bayesian Information Criterion (BIC)	469262.768
Total Number of Observations (ntotal)	1000.000
Sample-Size Adjusted BIC (BIC2)	468929.282
Root Mean Square Error of Approximation (RMSEA)	0.000
RMSEA Lower Confidence Interval	0.007
RMSEA Upper Confidence Interval	0.900
RMSEA Confidence Interval Level	0.050
RMSEA P-value	0.000
RMSEA Close Fit Test H0	0.080
RMSEA Not Close Fit Test P-value	24.654
RMSEA Not Close Fit Test H0	24.654
Root Mean Square Residual (RMR)	0.030
RMR without Mean	0.030
Standardized Root Mean Square Residual (SRMR)	0.030
Bentler’s SRMR	0.030
Bentler’s SRMR without Mean	0.030
Critical N (CN 05)	0.030
Critical N (CN 01)	1090.329
Goodness-of-Fit Index (GFI)	1121.279
Adjusted Goodness-of-Fit Index (AGFI)	0.958
Parsimony Goodness-of-Fit Index (PGFI)	0.954
McDonald’s Fit Index (MFI)	0.876
Expected Cross-Validation Index (ECVI)	1.010

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- CWTTrawdata.csv
- CWTTcodebook.csv
- Demographics.xlsx
- datascreening.qmd
- datascreeningcwtt.docx