

Empowering Teaching and Learning through Policies
and Practice: Singapore and International Perspectives 2

Oon Seng Tan
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Early Childhood Development and Education in Singapore

 Springer

Empowering Teaching and Learning through Policies and Practice: Singapore and International Perspectives

Volume 2

Series Editors

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Chapter 1

Introduction to Early Childhood Development and Research in Singapore



Oon Seng Tan, Kenneth K. Poon , Beth Ann O'Brien,
and Anne Rifkin-Graboi

1.1 Why Is Early Childhood Development and Research Important?

Education and well-being care are important throughout life, but especially so during early childhood, a time characterized by profound neural change. Importantly, early life experiences and neurodevelopment, in turn, lay the foundation for the subsequent ways in which neurodevelopment unfolds. As neurodevelopment is influenced by both genetic and environmental factors, it is not surprising that the quality of early childhood experiences has been found to have short- and long-term impacts upon individuals and society. For example, early environments characterized by relative responsiveness from caregivers (Fraley et al., 2013; Raby et al., 2015) may lead to academic and/or social competence even into adulthood. On the other hand, early childhood experiences with poverty and/or low socioeconomic status, exposure to parental mental health difficulties, forms of insecure attachment, and abuse or trauma have been linked to outcomes such as lower levels of school readiness, attentional problems, and/or difficulties in socioemotional development (e.g., Psychogiou et al., 2020; Fearon & Belsky, 2004; Dearing et al., 2001; Enlow et al., 2012).

Because early childhood education and care lay the foundation for the future, many countries worldwide are prioritizing early childhood development. Global institutions – including UNICEF, the World Bank Group, UNESCO, and WHO – have also focused on early childhood development in their work. For example,

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UNICEF promotes the importance of healthy brain development in early years through its “Early Moments Matter” campaign. Some of the efforts in this campaign include raising awareness about the topic, promoting investments in early childhood development programs, and supporting parents and caregivers to give their children the best start in life (Lake, 2017). WHO in collaboration with other partners¹ presents a global framework called the “Nurturing Care Framework” as a way for governments to think about supporting children by guaranteeing five inter-related components, namely, “good health, adequate nutrition, safety and security, responsive caregiving, and opportunities for learning” (WHO, 2018). This framework was created as a roadmap for the ways in which multiple groups (e.g., parents, caregivers, service providers, educational institutions, the private sector, governments and societies, academics, the United Nations, and academia) can strive to support children.

1.2 Singapore: Early Childhood Development and Research

The United Nations (UN) committee has praised the combined fourth and fifth periodic report of Singapore on the steps taken to execute the provisions of the Convention on the Rights of the Child (United Nations, CRC, 2017). These rights include those relevant to multiple aspects of well-being including their right to education, physical protection, food, education, health care, and opportunity. It recognizes the significant developments and investments that Singapore has made to improve the rights of the children, especially in early childhood education (Cheow, 2019).

There is a strong commitment to enhance the quality of early childhood development and education in Singapore. In 2012, Prime Minister Lee Hsien Loong first announced that the government would invest more substantially into the early childhood (EC) sector in Singapore and take on a more active role (Lee, 2012). This announcement was followed by several concrete actions. In 2013, the Early Childhood Development Agency (ECDA) was set up to manage and regulate childcare centers and kindergartens. In March 2018, the National Institute of Early Childhood Development (NIEC) was incorporated with Ms. Chan Lai Fung (then Permanent Secretary of Education, now Permanent Secretary of National Research Foundation), Ms. Lai Wei Lin (then Deputy Secretary of Education, now Permanent Secretary of Ministry of Law and Second Permanent Secretary of Education), and Professor Tan Oon Seng (then Director of the National Institute of Education, now Director of the Centre for Research in Child Development) as the first directors. Mrs. Loke-Yeo Teck Yong who previously led the establishment of Ministry of Education (MOE) kindergartens was appointed as Director of NIEC. The establishment of NIEC signals a major milestone in the early childhood sector for Singapore.

¹WHO, UNICEF, and the World Bank Group, in collaboration with the Partnership for Maternal, Newborn & Child Health the Early Childhood Development Action Network and many other partners.

Teacher quality has always been a hallmark of Singapore's education system. As such, NIEC, which is tasked to develop pre-service and in-service early childhood educators, will help raise the quality of teachers for the sector. Concomitant with the various national developments to enhance early childhood regulation, teacher professionalism and preparation is the recognition of the importance of research to inform and support policy and practice. The Centre for Research in Child Development (CRCD) at NIE was established to give more focus to research in early years with a view of longitudinal and large-scale research to better understand early childhood challenges and development for Singapore.

In 2012, the Singapore Ministry of Education published national guidelines for preschool teachers, called the "Nurturing Early Learners" (NEL) curriculum framework. The NEL curriculum framework guides preschool teachers who teach children aged four to six and is intended to improve the quality of teaching at this important developmental age. Furthermore, the NEL provides a common framework for preschool teachers to follow when it comes to pedagogical practices. Six early childhood education principles form the core of the NEL curriculum framework that is based on the idea of holistic learning. These help children become confident in the early years of their life. While preschools in Singapore do not necessarily have to follow the framework to the letter, they are encouraged to use it as a guiding framework.

A clear policy focus is to support economically disadvantaged children's access to high-quality preschool education. The government has invested in several programs such as KidSTART, Uplift, and KiFAS to achieve this. KidSTART provides health, learning, and developmental support to low-income families. KidSTART, and other similar programs, may help address some of the barriers that constrain children from such families from accessing good-quality early childhood care and education (ECCE). A new inter-agency task force – Uplift (Uplifting Pupils in Life and Inspiring Families Taskforce) – has also been created to promote inter-agency coordination. Different agencies are working under the Uplift umbrella to support and monitor the progress of low-income and vulnerable young children. Since the KidSTART pilot program started in 2016, the Uplift taskforce has reviewed its results (with more than 900 families receiving support through KidSTART) (Goy, 2017). The Kindergarten Financial Assistance Scheme (KiFAS) targets needy families who cannot afford to finance the education of their children. By subsidizing 90% of the monthly fees (or up to \$82 SGD) per month, the KiFAS makes it more affordable for such families to send their children to eligible non-profit kindergartens. Additional help is available through several community organizations that are providing financial support to low-income families through different schemes to cover pre-school education (Tan, 2007). An important step in this direction has been a conscious effort to create platforms and opportunities for parents to develop a better understanding of the importance of holistic development among children and guidance on nurturing children as lifelong learners. The MOE, ECDA, and several other agencies are collectively involved in such efforts (MOE, 2012; ECDA, 2014).

In 2015, the NIE embarked on a Tier 3 project titled the "Singapore Kindergarten Impact Project" (SKIP). SKIP was the first large-scale local study examining how

the early educational environment affects children as they progress from Kindergarten 1 (K1) to Primary 1 (P1) (Goy, 2015). It marked NIE's deeper foray into early childhood education (ECE) research in Singapore.

With the enhanced emphasis on early childhood, there could not be a better time than now to introduce a book on early childhood in Singapore. The present edited book serves to chart the development of Singapore's early childhood sector. It also serves to consolidate the more recent research work that has been done in early childhood, specifically by researchers from the NIE.

1.3 Layout of the Book

The book opens with Prof. Oon Seng Tan and Jallene Chua's Chap. 2, "The Honeycomb of Early Childhood Development: A Big Picture Approach for Supporting Development and Education for Early Years." In this chapter, the authors stress that building character and competence from a young age is at the core of effective ECCE. This requires adopting a big picture approach involving multiple stakeholders and agencies. Therefore, they propose the "Honeycomb of Early Childhood Development" as a conceptual framework that tackles the essential and macro factors that make up early childhood development. The Honeycomb of Early Childhood Development comprises six important factors (the six "E"s): (1) economics, where they talk about ECD as an investment that is practical for the economy and beneficial for children when done early and strategically; (2) equity, where the importance of enabling access to ECCE for every child is highlighted; (3) essence, where they consider ECCE as a crucial phase of life that every child is entitled to; (4) education, where they discuss the types of curriculum and pedagogies that need to be incorporated together; (5) educators, where the role of preschool teachers, teacher education, and teacher policies are discussed; and (6) ecology, where the relevance of various stakeholders and parties in ECD is brought to attention. The chapter concludes with a message that Singapore would benefit greatly from this framework which can be used to drive research, policies, and practice in the future when it comes to the ECCE sector. Parents, educators, policymakers, and other important stakeholders involved in the early childhood journey may also use it as a guide.

In Chap. 3, "Pre-school Teacher Education in Singapore: Developments and Challenges," Dr. Nirmala Karuppiyah reviews key policies and practices to improve preschool education quality and equity initiated in Singapore in recent decades. Efforts in four areas of improvement that have been identified by the MOE for the pre-school sector in Singapore are discussed – regulations, curriculum, training, and research. The author identifies the challenges Singapore faces in preschool education – lack of a stable and well-qualified workforce in the pre-school sector, stress and fatigue among preschool personnel, and challenges in working with young children and their families. Dr. Karuppiyah believes that the setting up of the Centre for Research in Child Development (CRCDD) in 2017 and the National Institute of Early

Childhood Development (NIEC) in 2018 has been a positive step forward in the Singapore government's commitment to invest and improve the provision of the quality care and education for young children and their families. The author concludes that much work involving changing mindsets and reviewing the goals of pre-school education in Singapore would be top priority in the next wave of change.

Chapter 4, "Early Learners Curriculum: Case of Singapore Early Childhood Education Working Toward Quality," investigates curriculum reform in Singapore that has been implemented to improve the preparation for and the quality of early childhood education (ECE). Dr. Heidi Layne describes the origin of the NEL curriculum framework for ECE as a child-centered ideology. First, the chapter contributes to an improved understanding of the meaning of learner/child-oriented curriculum in the field of ECE in Singapore. While the NEL curriculum framework recognizes the child's curiosity and ownership on learning, teachers must manage the process. The author believes that the creative component, which free play emphasizes, and which is also an important part of twenty-first century skills, is missing from the curriculum framework and from the teacher's talk. This calls for further analysis of the role of play in the NEL curriculum and further observations on the quality of play in Singapore. Second, using preschool teachers' reflections on the curriculum and professional practice, the author provides a better understanding of how the teachers interpret and use the curriculum. The chapter makes a case for teacher education programs that prepare teachers to follow such child-centered and inquiry-oriented curriculum.

In Chap. 5, "Researching Well-Being for Children with Low-Income Family Background in Singapore – for Whom and from Whose Perspective?," Dr. Layne, with Mardiana Abu Bakar, Mercy K. Jesuvadian, and Dhannea Rohaizad, discusses the need for a more holistic approach of well-being in early childhood pedagogy in the Singapore context, where interventions are set to meet the needs of individual children and their families and point to the diversity of families within the low-income categorizations. According to the authors, new diversities of Singapore society crisscross the socioeconomic demographics brought about by mixed marriages and immigration. Attention is also drawn to the current body of work on early intervention studies that tend to focus on the outcomes of child development and learning, rather than what is going on in the classrooms, or understanding the circumstances impacting children's and families' well-being. The authors make a case for a shift toward the new type of early childhood education where the child is the focus and where there is a greater emphasis on the quality of learning instead of only concentrating on outcomes. They feel that this is important for early interventions to be effective. The chapter also describes a research initiative on the Child Support Model (CSM) developed by NTUC First Campus. This CSM is a local (Singaporean) model aiming for holistic support (financial, learning, and social) for children from low-income backgrounds and their families. The authors explain why the CSM may provide a more holistic perspective in supporting the child's development, learning, and well-being. They also argue that analyzing the CSM can inform policy makers on how a process orientation can be meaningfully included in their intervention approaches when working with the range of diversities that families and children bring.

Chapter 6, “Early Childhood Intervention for Young Children with Special Needs in Singapore: Where We Have Been and Future Directions,” provides an overview of early childhood intervention programs and research studies in Singapore. It traces the historical roots of early childhood intervention in Singapore followed by a description of the current ECI landscape that has seen a rise of ECI services. Drs. Xie Hui Chao, Yang Xueyan, and Kenneth Poon Kin Loong note that in contrast to earlier approaches that focused heavily on specialized intervention for these children with developmental needs, the newer approaches focus more on support within the preschool environment for the child with developmental needs. Such newer programs that are part of a larger continuum of services are described such as KidSTART, Developmental Support-Learning Support (DS-LS), Integrated Child Care Programme (ICCP), Early Intervention Programme for Infants and Children (EIPIC), and Circle of Care (COC). Through such programs, more and more young children with special educational needs have received intervention and are expecting to actively participate in the community, such as by attending a mainstream preschool. Based on a small but increasing number of studies conducted in Singapore, the authors present a summary of key findings from local research in the domains of identification and assessment, child profile and needs, inclusive education models/programs, support practices and support needs, as well as family-centered service provision. Drawing from a review of local studies, the final section of the chapter suggests three future directions for ECI in Singapore, namely: (1) enhancing systematic universal developmental screening and monitoring through the use of culturally appropriate instruments, (2) advancing toward inclusive early childhood education, and (3) providing professional development and training for ECI professionals. The authors conclude that to provide meaningful preschool experiences for every single child to reach the maximum potential of their development, collaboration and communications between early childhood education and early childhood interventions is needed.

Chapter 7, “Cross-Cultural Considerations for Adapting Valid Psycho-Educational Assessments,” by Dr. Nicolette Waschl and Dr. Mo Chen, highlights the need for locally validated and culturally appropriate measures in Singapore and the factors that may influence the development and adaptation of such measures. The authors point out that because Singapore is at a crossroad of Asian and Western cultures and with advanced technological infrastructure, it stands out as an exciting place to examine and highlight issues of cross-cultural measurement and assessment and to develop smarter assessment tools. Concrete examples are used to show how the use of two broad types of measurement instruments – self- and other-report inventories and norm-referenced standardized tests – may be adapted in the Singaporean context. The chapter also discusses a new use of technology in psychological measurement (i.e., computerized adaptive testing) to allow for more individualized and efficient testing experiences, making assessment faster, smarter, and less expensive. Drs. Waschl and Chen propose that these are important steps in ensuring that constructs are measured accurately while developing a more accurate understanding of child development; without this, it becomes challenging to develop

and improve theories of child development both internationally and, specifically, in Singapore.

In Chap. 8, “The Importance of Positive Environments on Infant and Early Childhood Neurodevelopment: A Review and Preview of Upcoming, ‘BE POSITIVE’, Research,” Dr. Anne Rifkin-Graboi considers animal and human research describing how brain development unfolds, especially in early life. The author highlights why early experiences are important in development, especially from a biological standpoint. The author’s review of research demonstrating effects of the caregiving environment upon neurodevelopment shows gaps in the knowledge base, including how such relations unfold outside of low-risk North American and European homes and school systems. The author describes a new collaborative study in Singapore between CRCD and SingHealth, “BE POSITIVE,” that aims to address these gaps starting in children four months to four years. The “BE POSITIVE” (Beginning Early: Singapore’s Ongoing Study Starting in Infancy of Twenty-First-Century Skills, Individual Differences, and Variance in the Environment) study will focus upon environmental quality and aspects of child development including memory, emotion, pre-academics, and regulatory abilities and will collect data from approximately 1000 families at multiple points in time when underlying brain regions are likely to be exhibiting rapid growth. The author emphasizes the need for such research studies as essential to understanding the ways in which our early and subsequent experiences interact to influence outcomes and may foster greater acceptance of learning differences. Finally, the chapter considers the ways in which such research can be helpful in shaping interventions and policy to increase educational success and positively impact well-being.

Chapter 9, “Mindfulness in Early Childhood – Developing Twenty-First Century Competencies,” discusses mindfulness-based practices in early childhood and how it can foster self-regulation and socioemotional competencies underlying twenty-first-century skills important for children to survive and thrive in a fast-changing world. Dr. Kiat Hui Khng presents that the skills required to be learned to practice mindfulness is minimal – breathing, walking, eating, listening – there is little new that needs to be learned except for the attitude and attention to which we bring to these everyday activities. Dr. Khng stresses that the influence of mindfulness on child outcomes is not restricted to the direct effects of mindfulness-based practices on the children who practice them; mindfulness in parents and teachers can impact the children they interact with in similar ways. Attention is drawn to mindfulness in the local school settings – how Singapore is performing when it comes to providing opportunities for direct child mindfulness training in schools, the state of mindfulness in teachers and parents, and how Singapore can improve further. The author highlights the need for future studies that will examine systems-level approaches involving teachers and parents.

Chapter 10, “Using Guided Play to Facilitate Young Children’s Exploratory Learning,” starts with a review of research highlighting the importance of exploratory play – i.e., children acquire cognitive, social, and motor skills as well as gain content knowledge through exploratory play, and their engagement in exploratory play is related to later developmental outcomes. Dr. Yu Yue presents empirical

studies that show that the guided play framework can facilitate young children's exploratory learning as it has the right balance between child-directed play and adult-directed instruction for optimal learning. The case of guided play is strengthened through studies from different nations that compare the effects of direct instruction, guided play, and free play on children's learning in the domains of numeracy and spatial skills, language and literacy, and self-directed learning. To apply guided play to the Singapore context, more research is needed to verify its cultural validity and parents' perceptions about it. If such research leads to positive findings, guided play has the potential to help educators, caregivers, and policy makers create a child-friendly and purposefully designed environment that promotes exploratory learning, in line with the principles of purposeful play and iTeach recommended by the NEL.

Drs. Stella Tsotsi and Yang Yang examine in Chap. 11, "Master Your Feelings: Emotional Competence in Early Childhood – Parent-Related Antecedents and Child Outcomes," the development and importance of emotional competence in early childhood. Through a review of international studies, they show that children's emotion understanding, emotion regulation, and empathy play an important role in a wide array of their behavioral, social, and cognitive development. Moreover, recognizing emotional cues and understanding their possible causes in the social environment has been shown to promote academic achievement. The discussion moves to the factors that affect children's emotional competence – research shows that parents play an important role in socializing children to understand and regulate emotions, and empathize with others, especially in early childhood. The chapter shows that most existing studies on emotional competence have been conducted among Western, especially European American, children, ignoring the important role of culture in children's emotional development. Therefore, the extensive findings in research in Western cultures may not necessarily apply in Singapore context and much remains unknown regarding emotional competence and its correlates among children in Singapore. The authors anticipate and describe that several ongoing projects and future projects in the Centre for Research in Child Development (CRCD) at Singapore's National Institute of Education may fill this gap by investigating Singaporean children's emotional development. Dr. Tsotsi and Dr. Yang also provide tips on how parents and educators can promote emotional competence based on international and local evidence.

Chapter 12, "Early Arithmetic Skills in Singaporean Kindergartners: What, When, and How?," addresses the development of arithmetic in early childhood. Drs. Pierina Cheung, David Munez, Ee Lynn Ng, Kiat Hui Khng, and Rebecca Bull review key factors across domain-specific and domain-general areas that may support the learning and development of arithmetic skills. The authors also present analyses on data from the Singapore Kindergarten Impact Project (SKIP), a large-scale project on preschool education, and find that children in Singapore have relatively strong counting skills and strong digit literacy. However, children's informal arithmetic skills can be further developed. The chapter concludes with some guidelines for promoting the development of early mathematical knowledge in the classroom and at home. Authors believe that by sharing basic research on child

development with teachers, they can be better equipped with the necessary information so that they know what to look for and can then use the information to analyze children's behavior.

In Chap. 13, "Harmonious Bilingual Development: The Concept, the Significance, and the Implications," Dr. Sun He demonstrates how Singapore society might benefit from implementing the notion harmonious bilingual development in early childhood development. It presents findings that have shown general links between bilingual input and use with children's language proficiencies and with their socio-emotional well-being. The author believes that in Singapore, as in other bilingual societies, the key to achieving such harmonious bilingual development probably lies in the environment of children's mother tongue language learning. Decent mother tongue language and literacy input and use may promote child bilinguals' socio-emotional and behavioral skills. Dr. Sun presents two cost-effective teaching approaches, namely, codeswitching and shared book reading, for their potential contribution to Singaporean children's mother tongue learning and harmonious bilingual development in a long run.

In Chap. 14, "Does Early Language Contribute to Socioemotional Functioning in Preschool and Beyond?," Dr. Shaun Goh provides a bird's eye view of what is known regarding the contribution of language to socioemotional functioning, especially in Singapore's multilingual environments. The chapter starts by providing a framework for understanding the early development of language and explains that language proficiency is a result of a complex interplay between multiple internal and environmental factors. However, it remains unclear if these same factors exert an equal importance across monolinguals and bilinguals, or among different languages of English, Mandarin, Tamil, and Malay. It then presents accumulating evidence from studies about the link between language and socioemotional functioning in early childhood. Although low language ability associates with three major clusters of low socioemotional functioning in childhood – behavioral, emotional, and ADHD type – the author concludes that very little is known about how these relationships come to develop, while even less is known among children who grow up learning two or more languages.

Dr. Ng Ee Lynn and Emily Meow examine in Chap. 15, "Preschool Teachers' Experiences of Work-Related Stress: A Pilot Study of Singapore Teachers," various international and local findings showing that teacher stress has serious consequences for both teachers and children, as well as for the quality of teacher-child interactions in the classroom. The review reveals that teachers may be exposed to many different job demands, which in turn lead to an increase in job strain, burnout, and exhaustion. Moreover, the review also reveals that teachers with access to job resources are more likely to report an increase in motivation and engagement at work, as well as increased job satisfaction. The authors present real-world examples of the ways in which job demands and resources interact to affect job satisfaction and well-being of preschool teachers in Singapore. Considering recent concerns about the high turnover rates of preschool teachers in Singapore and the scarcity of local studies on teacher stress, the authors argue that more systematic research is needed to understand the factors that contribute to teacher well-being.

This book is the first of its kind to cover the development of Singapore's early childhood sector and the latest research conducted by the NIE on early childhood. Most importantly, it is highly relevant for both practitioners and researchers. The topics covered in this book are focused largely on child development and education but also touch on teacher training, well-being, and the development of culturally appropriate assessment. Adopting a comprehensive approach, it is centered on the child, with a consideration of influences in the environment that can impact his/her development. It seeks to help readers understand that a child does not grow in a vacuum. Be it a practitioner in direct interaction with a child, or a researcher doing early childhood research, it will be helpful for him/her to take a holistic view and be mindful of the child as well as his/her environment. Readers will not only walk away with a fuller appreciation of early childhood in Singapore but will also be informed about possible actionable steps to take, both in practice as well as research. With the setup of NIEC and the rapid expansion of the early childhood sector in Singapore, there will be more than 1000 new early childhood teachers every year, for several years to come. This book will be a useful reference.

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Chapter 2

The Honeycomb of Early Childhood Development (ECD): A Big Picture Approach for Supporting Development and Education for Early Years



Oon Seng Tan and Jallene Jia En Chua

Abstract The power of education is far-reaching and universal, impacting people's capacity for adaptation in our world today. Singapore's dearth of natural resources necessitates a strong reliance on its skilled labor force, making education an especially important investment for this nation. Singapore's education system has been lauded for its successful outcomes, but the same success cannot be said for its early childhood system. Greater awareness toward the extensive importance of early childhood care and education (ECCE) has called for heightened efforts to holistically develop the sector in order to adequately prepare our children for the future. At this juncture, it is beneficial to understand early childhood development (ECD) with systematic thinking and connectivity to truly bring about transformation. In this chapter, we propose the honeycomb of early childhood development (ECD) to drive research, practice, and policies in ECD. It comprises six important factors: 1) economics, where we talk about ECD as an investment that is practical for our economy and beneficial for children when done *early* and *strategically*; 2) equity, where the importance of enabling access to ECCE for every child is highlighted; 3) essence, where we consider ECCE as a crucial phase of life that every child is entitled to; 4) education, where we discuss the types of curriculum and pedagogies that need to be incorporated together; 5) educators, where the role of preschool teachers, teacher education, and teacher policies are discussed; and 6) ecology, where the relevance of various stakeholders and parties in ECD is brought to attention.

Keywords Early childhood education · Early childhood development

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Education is one of the most important investments for any nation and impacts on people's capacity for adaptation in today's knowledge-based economy and globalized society. From the time of her independence in 1965, Singapore, a country with hardly any natural resources, has always depended on the development of human resources as the key to her political and economic survival (Tan et al., 2017a, b).

In recent years, Singapore's education system has drawn global interest owing to her remarkable performance on international assessments of student performance such as the Trends in International Mathematics and Science Study (TIMSS), the Progress in International Reading Literacy Study (PIRLS), and the Programme for International Student Assessment (PISA). This can be attributed to multiple success factors, such as its responsive and differentiated learning system; its clear education goals, parental engagement, alignment of policies, practices, and preparation (Lee & Low, 2017); as well as its unique cultural and institutional arrangements and pedagogy (Deng & Gopinathan, 2016). While Singapore's primary, secondary, post-secondary, and higher education sectors are clearly well-invested in and among the best in the world by various yardsticks, the same cannot be said for the early childhood sector. To be truly cream of the crop, the excellence of Singapore's education system needs to extend to its ECCE sector, the "last frontier" we need to conquer.

How do we design good early childhood care and education? Firstly, an understanding of the aim of twenty-first century education is necessary. In the broadest sense, the aim is to produce a "good person" and "contributing citizen" (Tan, 2017a, b). Targeting these two goals, respectively, starts from fostering the two "C"s, character and competence (Colby et al., 1998), as early as during the early years. Character refers to a child's value, cultural, and dispositional set. Positive dispositions like self-directedness, resilience, diligence, and other intrapersonal qualities should be instilled during the early years, through parent-child connection and methods like play. Competence refers to a child's learning and thinking mindset. Prerequisites for future learning and thinking similarly need to be laid during the early years. For example, early year experiences with numbers build the foundations of mathematics in later years (e.g., Jordan et al., 2009; LeFevre et al., 2009), and experiences with narratives and stories build the foundations of learning and reading (e.g., Suggate et al., 2018; Zucker et al., 2013). In addition, relationships through caregiver mediation build roots, culture, values, and wisdom.

Second, implementation must take on a big picture approach through multidisciplinary contributions and multi-stakeholder involvement. Here, a conceptual framework integrating the important systemic thinking and connectivity pertaining to ECD could be highly beneficial. We offer a big picture approach which is in some ways in trend with recent works on ECD such as that of Jay Belsky, Avshalom Caspi, Terrie E. Moffitt, and Richie Poulton, who collaboratively wrote a book entitled "The Origins of You: How Childhood Shapes Later Life," published by Harvard University Press. The authors are researchers who were involved in some of the most extensive and important research projects on human development around the world. The book speaks of human development as a "multidisciplinary science" (Belsky et al., 2020, p.6) that involves psychological science, neuroscience,

sociological science, as well as biological and public-health science. As noted by these researchers, it is psychological in terms of the need to understand emotion, cognition, and behavior; neurological as it unravels the mind and brain; sociological as it is linked to family, neighborhood, and community; and biological as its focus on genetics and health science concerns physical health and well-being.

Drawing inspiration from such contemporary works, we conceptualized and hereby propose the honeycomb of early childhood development (Fig. 2.1), a conceptual framework which brings together the essential and macro factors (called the six “E”s) that constitute the complete, holistic structure that should surround early childhood. The honeycomb lays the groundwork and provides impetus for constructing and improving the early childhood sector and can be used to drive research, policies, and practice in ECD. The six “E”s are the following:

- 1. Understanding the Economics of ECD
- 2. Appreciating the Equity issues of ECD
- 3. Embracing the Essence of ECD
- 4. Building the science and art of early childhood Education

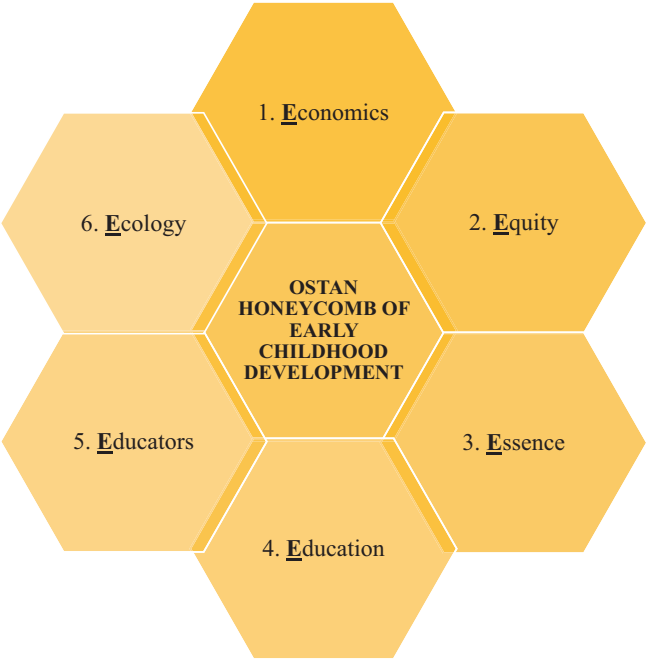


Fig. 2.1 OSTAN honeycomb of early childhood development
Note. The first author of this chapter, Oon Seng Tan, conceptualized the honeycomb model as an integrative and succinct way of framing and discussing key ideas surrounding early childhood development and is meant to be for illustrative and convenient purposes rather than prescriptive. Henceforth, we will be using the acronym OSTAN (for Oon Seng Tan) to represent his conceptualizations in upcoming sections

5. Empowering the Educators (which include the caregivers) of the young
6. Knowing the Ecology of ECD

While Singapore deserves merit for aggressively addressing the ECCE frontier in recent years¹, as we move forward, understanding early childhood development through the lens of this honeycomb framework could significantly help Singapore in her journey to transform the ECCE sector.

2.1 Understanding the Economics of Early Childhood Development (ECD)

Early childhood development is an economic investment for the long haul, as ECD influences economic, health, and social outcomes for individuals and society for decades to come. The quality of ECD impacts people's capacity for adaption, value creation, capabilities for innovation, and adaptability for work life, health, and well-being. These are all critical factors for nation building, such as in terms of long-term economic benefits like workforce development and fiscal stability.

The Dunedin Multidisciplinary Health and Development Study, a longitudinal study of more than 40 years, followed the lives of 1037 babies in New Zealand since their birth (year 1972–1973), assessing health, development, and behavior at age 3, every two years from then till age 15, and subsequently at ages 18, 21, 26, 32, 38, and 45. The Dunedin study's enormous dataset led to the publication of over 1500 papers tracing life trajectories and development from early childhood to adulthood. Many factors in the early years such as health, environment, and temperament were found to impact lives at primary years, teenage years, and even adult years. For example, childhood self-control predicts physical health, financial success, and criminal behavior as adults (Moffitt et al., 2011). Poor neurocognitive functioning (Caspi et al., 2020) and even lead exposure (Reuben et al., 2019) during childhood predicts psychopathology and mental health issues in adolescence and adulthood. Belsky et al.'s (2020) book that was mentioned earlier also highlights how multiple forces during a child's early years often interact in various ways to predict who they will become later in life.

Evidently, the early years are extremely crucial. This is because during this time from birth to age five, “the brain develops rapidly to build the foundation of character and cognitive skills necessary for success in school, health, career, and life” (Heckman, 2012). Thus, investment should be done *early*, as early as possible. Professor Janet Currie, Chair of the Department of Economics at Princeton University, emphasized that increasing access to care for children during their early

¹Examples include: setting up the National Institute of Early Childhood Development (NIE) (Lee, 2017), increasing government-funded preschool places, installing comprehensive preschool facilities, improving mean-tested subsidies, and doubling annual spending on early childhood sector to more than S\$2 billion per year from 2020 onwards (Yang, 2020).

years leads to better life outcomes for children and young adults, citing improved mental health and reduced death rates (Currie, 2018). She advocates the need for well-developed early intervention programs, health insurance, public housing, and food and nutrition programs.

The professional work of Nobel Laureate economist, Professor James Heckman, additionally suggests that investing in ECD will reduce deficits and strengthen the nation's economy. On the other hand, adverse early years environments will hinder the development of skills and abilities, lead to an increase of social costs, add to financial deficits borne by the public, and reduce a nation's productivity. Likewise, early childhood intervention for at-risk children at this stage is additionally effective for reducing social costs needed for availing special education, remediation, and rehabilitation (Heckman, 2012). Indeed, it is estimated that every \$1 invested in ECD yields a return of \$2 to \$17 (Heckman et al., 2010; Karoly, 2017; UNICEF, 2013), making investing in ECD more cost-effective in the long-term than investment at any older age (OECD, 2017).

Apart from investing early, ECD investment should also be done *strategically*. Cannon et al. (2018) conducted a research evaluation of 115 early childhood programs and found that aside from preschool, other types of early childhood interventions like home visiting, parent education, government transfers providing cash benefits, and programs with a combination of more than one of these approaches also produced positive child outcomes and generated positive economic returns. Thus, ECD investment should cover multiple bases and encompass all important components/outlets that have direct impacts on a child's development: 1) parents and caregivers, who are children's first teachers; 2) environment, which impacts children's experiences and growth; and 3) early childhood centers, where children receive quality early years programs to thrive holistically.

The types of interventions in these areas should be enlightened by research-based theories and evidence on early childhood development, such as those from neuroscience, brain studies, education, and psychological studies. For one, theories on cognitive development tell us that children learn through assimilation and accommodation (Piaget, 1971) as well as social interaction (Vygotsky, 1980), suggesting that investments should be made in, for example, developing sound early childhood education programs that capitalize on these cognitive processes and also in teaching parents to communicate with their children with pedagogical intent. Studies on brain development and neuroscience tell us that the brain develops rapidly and is incredibly plastic in the first 1000 days after birth, and thus investment should be made in, for example, ensuring high-quality infant care. For example, UNICEF's Early Moments Matter Campaign (UNICEF, 2017) was introduced based on evidence supporting the importance of the first 1000 days of life as a critical window of opportunity when the foundations of optimum growth and development across the lifespan are established. They propose nutrition, protection, and responsive stimulation as the three healthy ingredients of early childhood development and aim to make these accessible to children from underprivileged countries.

2.1.1 Parents and Caregivers

Parents, being the first adult figures that children encounter and their main caregivers, need to be equipped with the knowledge and skills on how to optimize the holistic development of their children, providing conditions that nurture and empower them to grow and become well-rounded individuals in the future. Investments should be made in providing them with knowledge about pregnancy and after birth care, including how to develop quality interactions, bonding, care and nutrition, security and safety, responsive caregiving, opportunities for early learning, etc. From a systemic point of view, investments should be made to establish support for families at three levels: 1) universal support, such as general health promotion and primary prevention; 2) targeted support, such as for at-risk communities; and 3) indicated support, such as for individual families with additional needs (e.g., disabilities). Currently in Singapore, public and private hospitals and parenting workshops are the main suppliers of knowledge pertaining to pregnancy care and after birth care. Having one of the best healthcare systems in the world, universal support is sound, but targeted and indicated support are often provided by non-profit organizations and may sometimes lack funding.

2.1.2 Environment

In terms of the environment, investments should be made into mitigating factors that disrupt the safe and efficient learning and growing environment for children, such as poor caregiver mental health, malnutrition, illnesses, injuries, neglect, maltreatment, and domestic violence. In a more physical sense, clean water, sanitation, and non-pollution are basic requirements. Singapore has one of the best environments for children in the world (Lee, 2018), where we ranked as the top country for children to grow up in, based on indicators like mortality rate, malnutrition, children out of school, child marriage, child homicide, child labor, and child population displaced by conflict. Nonetheless, support should always be in place to support children who may suffer from detrimental environments.

2.1.3 Early Childhood Centers

Lastly, there is a need to implement and sustain quality curricular and pedagogical integrity in early childhood centers. Investment is needed in teacher's training and professional development, teaching resources, children's learning aids, as well as indoor and outdoor learning spaces. Recent quantum leaps in the government's education budget for the sector suggest increased attention toward this area (Ministry of Social and Family Development, 2018). Forty thousand full-day preschool places

will be created by 2023, and provisions of mother tongue languages (MTL), such as MTL teacher training and increasing the number of Big Books, will be enhanced. The Early Childhood Industry Transformation Map (ITM) is a plan to increase innovation and productivity in EC centers, such as by streamlining day-to-day work processes with IT solutions and piloting with centralized catering and bus services. This will free up time and human resources to be focused toward children themselves.

2.2 Appreciating the Equity Issues of Early Childhood Development (ECD)

The inequity of early childhood development provision and care is a serious challenge (OECD, 2001). Deprivation from access to resources, opportunities, and experiences at the early years stage contributes greatly to deprivation from human flourishing in the future. For example, poverty experiences at 0–6 years have lasting effects on brain development, health, cognitive, and non-cognitive skills. More perilously, a lack of access to ECD in the early years affects the future of the child disproportionately, where children who start behind continue to stay behind and often cannot make up for lost ground (Burt & Roisman, 2010). Any gaps between children who have had and have not had access to quality ECD provisions fail to narrow in the years after early childhood (García & Weiss, 2017). Beyond that, a widening gap in life outcomes may only be a natural corollary. This suggests an urgent need to address equity issues as early as possible. The United Nations’ goal for the early childhood sector, which is to have “by 2030, ensured access to quality early childhood development, care, and preprimary education for all girls and boys, so that they are ready for primary education” (United Nations, 2020), similarly reflects this importance. From a logistical point of view, investments of time and interventions required to close these gaps will also be less costly if done earlier during the early years.

To ensure that every child is afforded equitable opportunities and experiences at early childhood, policies on access and affordability need to be in place, ensuring the availability of universal access and funding models to support the lower socio-economic groups, respectively. The Singapore Ministry of Education’s vision is to provide “a strong start for every child,” which reflects the core belief that the early years are truly a crucial time to nurture children and that every child deserves access to appropriate resources during this time regardless of their background. To advance this vision, the government is committed to increasing government-supported places to 80% by 2025, from just over 50% now (Yang, 2020). This implies an increased supply of places, thereby reducing competition and increasing the likelihood of greater participation across the population. These government-supported centers, mainly MOE Kindergartens (MK) (which also offer care services called Kindergarten Care, KCare), also stipulate school fees at affordable prices, enabling more families to access such services. The monthly fees for MK in 2020 are S\$160 and S\$320 for

Singapore Citizens and PRs, respectively, and the maximum monthly KCare fee is S\$386 (Ministry of Education, 2020a). For comparison, the kindergarten and child-care fees of other private counterparts can cost from S\$500 up to more than S\$3000. In addition, the recent MK-EYC model, a collaboration between MK and Early Years Centres (EYC), provides continued access to quality and affordable preschool services for children aged two months to six years old (Kamil, 2018). Under the model, all eligible Singaporean Nursery 2 children who are enrolled at partnering EYCs will be guaranteed a Kindergarten 1 place in a nearby partner MOE Kindergarten in the year they turn five.

To further assist with affordability, Singapore has a funding model in place that provides support for other ECCE providers and families themselves. The Anchor Operator (AOP) and Partner Operator (POP) schemes encourage eligible operators to offer quality and affordable preschool programs and infant/childcare, respectively, by offering funding with the requirement that they maintain certain fee caps. Singapore has continued commitments to this, with plans to lower the fee caps further from January 2021. In addition, there are also means-tested preschool subsidies available such as the Additional Subsidy and Kindergarten Fee Assistance Scheme (KiFAS), which means needier families receive larger amounts. In January 2020, the gross monthly household income ceiling for KiFAS was raised to S\$12,000 or S\$3,000 on per capita income basis, and subsidy amounts across all income tiers were also increased (Early Childhood Development Agency, 2019).

The journey toward equitable early childhood care and education does not stop here. Apart from accessibility and affordability, there is also a need for inclusiveness, where special attention needs to be paid to disadvantaged, vulnerable, and other diverse groups. The special needs sector in Singapore is decently developed, where there are private preschools that specifically cater to children with special needs and disabilities and other voluntary welfare organizations such as Early Intervention Programmes for Infants and Children Centres (EIPICs) and disability specific Voluntary Welfare Organisations (VWOs) that are often funded or supported by the government. However, more can be done to improve inclusiveness in mainstream EC centers, similar to how there are support structures available for vulnerable children in mainstream primary schools and above, such as access arrangements and on-site allied educators and professionals to aid in learning and behavioral support, therapy, and counseling (see also Chap. 4).

To truly ensure that the entire sector is on board and to enable a greater system-wide support for the cause, there should also be quality assurance and standards for EC provisions in place, such as accreditation frameworks, protocols, and guidelines to ensure standardized enrollment and fair treatment, as well as staff professionalism, where staff must be trained to be sensitive and embracing of children and families from all walks of life. All the above aspects mentioned should then come together to form system coherence and harmony.

Nevertheless, the issues and effects surrounding inequity are profound and go beyond the matter of money. The lack of money and socioeconomic resources generates impacts that spill over to other areas of life, leading to more complex family disadvantages. Understanding inequity through the larger lens of family advantage

and disadvantage will improve how we approach policy making in this area. For example, equity formulas must look beyond extrinsic demographic indicators like family income, parental education, and housing but also consider measures that more closely impact child development such as appropriate parental guidance, nourishment, and positive encouragement. Although these factors are influenced by the amount of money the family has (e.g., insufficient income to purchase pricier foods that can be more nutritious and nourishing for the child or insufficient time to spend guiding children due to heavy work commitments), in order to truly lift families from their disadvantaged positions, policies require a more complex and multi-faceted approach that goes beyond providing economic resources and money. Instead, the truer measures gear toward looking at quality parenting, which encompasses stimulation, attachment, sensitive care, encouragement, and support provided for the child (see Chap. 7). By embracing these characteristics, Singapore can make significant progress in terms of equity.

2.3 Embracing the Essence of ECD

The developmental course from birth to young adulthood (approximately 18 years) is one where later stages are built upon earlier ones (see Fig. 2.2). Education hopes to develop contributing and resilient community builders by the time of around 18 years old. To do this, it is crucial to understand that many of these characteristics are built from the early years. This makes ECD more than just a desire for our children but a prerogative that would set children on the right path in the future. ECD is thus a life phase in its own right, a phase that every child is entitled to and a phase where every child deserves equal opportunity to fulfill their potential with dignity. This importance is also reflected by the World Health Organization (WHO)’s vision, which is for “every child to develop their full potential, leaving no child behind,” as well as their Nurturing Care Framework for Early Childhood Development (WHO,

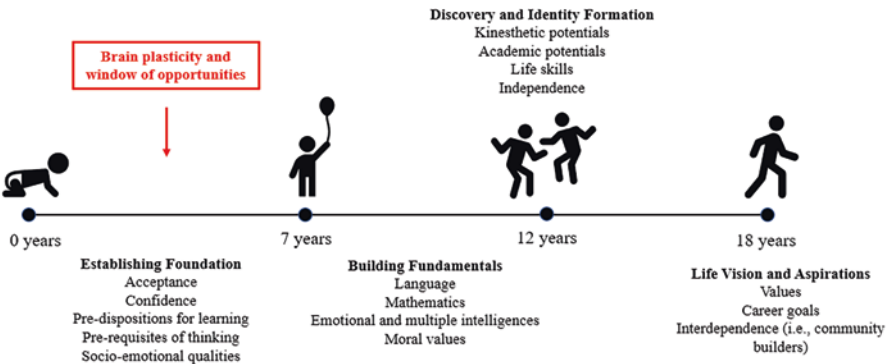


Fig. 2.2 The developmental course from birth to young adulthood

2018), which consists of five inter-related and indivisible components of nurturing care that will help children reach their full potential. Additionally, according to the United Nations Conventions of Rights of Children, early childhood education should aim to maximize every child's fullest cognitive, emotional, and creative potentials. Every child is also entitled the right to be able to survive and thrive; be provided with a safe, secure, and loving environment; and be given the right nutrition to grow.

During the phase of 0–6 years, brain plasticity is present where the child is most susceptible to environmental influences, and it is the window of opportunity to lay foundations of health, well-being, learning, and productivity for childhood, adolescence, and adulthood. This is because the brain is developing and transforming rapidly during this time, especially from 0 to 3 years. During this stage, a child's brain develops an abundance of synapses, producing impressive brain plasticity that enables the brain to learn new skills at a much faster pace than the pruned adult brain (Charlesworth, 2017). Although different brain regions have varying developmental trajectories² (Dean et al., 2015), by 6.5 years old, 95% of the brain has already reached its peak volume (Gerber et al., 2009).

Early childhood development can be said to be a function of genes, environment, culture, and contexts. The genes component is intrapersonal, largely determined naturally and hereditarily. The environment component is interpersonal, determined by the child's surroundings and how the child interacts with them. Culture is inter-generation, referring to teaching and social behaviors as well as ways of life that are being passed down from generation to generation. Contexts refer to curated situations where nurture and care are provided for the child. While genes, culture, and to a certain extent the environment (e.g., the type of country and natural environment you are born in) are largely fixed, the contexts provided for the child can be controlled by the adults around the child. Childhood contexts and experiences interact with neurodevelopmental processes (Center for High Impact Philanthropy, 2015). An adverse atmosphere, such as deprivation or harmful exposure and stress, fails to build and maintain important brain connections, damaging brain development in a lasting manner (Perry, 2002). Thus, during the time where the child's brain is highly plastic and susceptible to such contexts (i.e., critical period), we need to give sustained attention and dosage to the child's growth, encouraging the development of caring behavior and strong cognitive capacities that will benefit them long into the future. Here, parents, caregivers, and teachers should know how to hone appropriate contexts for the child at and from the point of birth. Firstly, they need to provide physical protection, warmth, and sensitive care. This generates countless positive compounding effects for the child's future. For example, protection, warmth, and care create a sense of security in children, which can build self-esteem, acceptance,

²For example, the cerebellum, which is mainly responsible for motor control such as movement and balance, grows rapidly in the first few months after birth; the hippocampus and amygdala, responsible for memory and emotion, grows substantially in early years; the prefrontal cortex, responsible for higher order processes like planning and regulation, continues to grow even in adolescence.

and confidence in later years. This can then impact factors like pro-social behavior and diligence, which further build perseverance and resilience in teenage and adult years, respectively. Secondly, adults should encourage and create learning opportunities for children inside and outside the classroom. These experiences similarly lay the prerequisites for the child's future in terms of academic learning and reasoning. Altogether, these can be done through providing rules, routines, rituals, storytelling, responsive and intentional interactions, and active play.

The benefits of quality experiences and contexts during the early years are far reaching, and this is also similar for the converse where a lack of such quality contexts generates lasting negative impacts. More importantly, these impacts are longer lasting than we think. Research has shown that early deprivation creates marks on genetic endowment that are expressed in future generations. That is, early life experiences can have not only lifelong but also transgenerational effects on neurology and behavior (Roth, 2012). This is due to molecular changes such as sustained change in DNA methylation, which involves chemical modification and silencing of gene transcription (Meaney, 2010).

Understanding the gravity of poor ECD would lead us to strongly believe that the early childhood sector is truly a necessity. It is one that allows us to give children better, wider, and deeper opportunities for active play, a sense of belonging, and communication, something that they deserve in order to grow healthily and something that will benefit generations to come. Thankfully, Singapore provides many of such ECCE services that span the entire early years age range from 0 to 6 years. Singapore has kindergartens, which provide preschool developmental programs for children aged 2 to 6, including playgroup, pre-nursery (or Nursery 1), nursery (Nursery 2), Kindergarten 1, and Kindergarten 2. Most kindergarten sessions range between 2 and 3 hours for playgroup and pre-nursery and between 3 and 4 hours for nursery and Kindergartens 1 and 2. Singapore also has childcare centers, which additionally provide childcare services from age 18 months, with some even providing infant care programs for 2 to 18 months old. Definitely, aside from ECCE services, parent education is crucial to support the development of children from pregnancy to 3 years, as they would be spending more time with parents during this time as compared to when they are a little bit older at 3 to 6 years.

2.4 Building the Science and Art of Early Childhood Education

Children are born ready to learn. We don't have to make them ready to learn. We don't have to teach them how to learn. They are wired from the beginning to learn, and they're wired to experience and to master the world around them. (Shonkoff, 2005)

Every child is born a learning child. Our job as parents, teachers, policy makers, and adults in this world is to welcome every child with open arms, into a world where we provide them with the optimal environment to learn, pursue development,

and thrive. As ECD involves interaction between the child and the environment, adults should support the quality of this interaction by selecting stimuli that is most appropriate for the child's enhanced and effective functioning. This concept is rooted in the mediated learning experience (MLE; Feuerstein, Klein, & Tannenbaum, 1991; Feuerstein, Rand, & Rynders, 1988), in which adults are often the mediating agents, guiding children and offering opportunities for their learning. Appropriate conditions foster the mediation of intentionality and reciprocity, meaning, and transcendence, the three parameters necessary for mediated interaction to take place (Chua et al., 2017). Tan and associates explain that intentionality and reciprocity refer to adults not only having clear intentions and aims to design stimuli for the child but also communicating these to the child and gauging their response. Meaning refers to communicating the significance of said mediated experience to children and in the midst helping them develop positive life aspirations. Transcendence refers to going beyond the immediate primary goal of interaction and leading children toward wider, more important goals, which will build future adaptability to changing environments (Tan et al., 2017a, b).

There is an ancient saying that aptly encapsulates the idea of mediated learning; it goes, "Train up a child in the way he should go, and when he is old, he will not depart from it." To "train up a child," we need to nurture, educate, and cultivate children interactively, intentionally, and sensitively. We should also do this "in the way he should go," meaning responding to each child's personal interests, tastes, as well as mental, physical, and psychological inclinations, taking a child-centered and customized approach. Doing these will ensure that "when he is old, he will not depart from it," where the architecture laid for the child will form foundations that will equip him or her for life. Understanding this ancient wisdom can inspire curriculum and pedagogy design in early childhood education.

2.4.1 Early Childhood Curriculum

Johann Heinrich Pestalozzi, a Swiss pedagogue and educational reformer in the seventeenth century, believed that education should develop the powers of the "head," which refers to knowledge and understanding; the "heart," which refers to passion and belief; and the "hands," which refers to activity and skill. This translates into cognitive and language development, socioemotional development, and physical development in the modern domains of child development. The curriculum of early childhood education programs needs to be designed intentionally to target these holistic needs, fulfilling age-appropriate developmental milestones in these domains. To accomplish this, we propose that EC curriculum should have the following seven elements (see Fig. 2.3) each targeting different "powers" or developmental domains. Altogether, they form the STEWARD curriculum. Do note that the STEWARD curriculum is an illustration of the key elements we feel are most crucial to early childhood curriculum and is not meant to be all-embracing or prescriptive in the Singapore context. Having said that, Singapore's Nurturing Early