Towards Developing a Science-Language Learning Programme for the Equality of Sustainable Learning Opportunities for Young Children

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Abstract

It is imperative to offer equal quality learning opportunities for young children at both deprived and advantaged early childhood development centres (ECDCs). To this end, substantive involvement by young children in the envisioned quality learning that should take place, even in constrained contexts, warrants thoughtful exploration. Consequently, this study investigated the development of young children's communication and mathematical skills to explore the affordances of the South African National Curriculum Framework for children from birth to 4 years in relation to incorporating science concepts. Our proposition for privileging science concepts relevant to early learning and development areas of the curriculum framework was premised on the urge to respond to young children's current learning needs in order to make learning in the future sustainable. We adopted a participatory action research design, undergirded by principles of intra-relationality, to develop an assessment and activity plan consistent with our proposition. Using the principles of free attitude interviews and brainstorming as techniques, rich qualitative data were generated during meetings, workshops, and reflection sessions with study team member participants. The team made the following observations and findings: the transition of young children from ECD to Grade R is marred by challenges that make the learning of young children beyond ECD unsustainable because of the absence of continual communication between the ECD and Grade R teachers and, to some extent, between the parents (home) and the ECDC. Through the knowledge gained from regular participatory action-oriented meetings, workshops, and reflections, the study contributed to the development of participants and benefited the ECDC involved in this study in several respects.

Keywords: early childhood development, early learning and development areas, sustainable learning, science   language, intra-relationality

Introduction

This study aimed to contribute to the operationalisation of the South African national curriculum framework (NCF) for children from birth to 4 years (Department of Basic Education [DBE], 2015) at the Lethabo Early Childhood Development Centre (LECDC) in a typically deprived South African context. The project focused on pre-Grade R (4- to 5-year-old children), and the timing coincided with the process of migrating early childhood development (ECD) from the Department of Social Development to the DBE (Republic of South Africa, 2019). Through the NCF, the DBE envisioned respectful "working with and for all children in early years to provide them with quality experiences and equality of opportunities to achieve their full potential" (2015, p. 2). This vision has critical implications for ECDCs and caregivers who are obliged to operationalise it. The vision is centred on providing better quality learning; it challenges parents, caregivers, ECD practitioners, and monitoring personnel to equalise quality learning opportunities in order to facilitate the unleashing of young children's full potential. Under-resourced ECDCs (like LECDC where young children's learning environments and contexts are entangled in a plethora of barriers to growth and development) warrant corresponding multifaceted approaches to operationalisation. A multifaceted approach would, for instance, facilitate the operationalisation of this vision by developing "a comprehensive ECD learning programme for quality and equality of opportunities," which is identified as Principle 8 under Theme 2 of the NCF (DBE, 2015, p. 7). The elements of this principle resonate with what the literature refers to as principles of learning and development of young children (Rayhan, 2022). For ECDCs with limited or no infrastructure, resources, and requisite training, development and operationalisation of a comprehensive learning programme poses serious challenges. Similar situations may arguably prevail at other ECDCs, and similar solutions may be required for other stakeholders, albeit to varying degrees.

The Problem and Our Interest in Context

The South African NCF for children from birth to 4 years is organised into eight early learning and development areas (ELDAs), namely, well-being, identity, belonging, communication, exploring mathematics, creativity, knowledge, and understanding of the world (DBE, 2015). These ELDAs challenge ECDCs in the same or similar situations as LECDC in ways that surpass their competencies and capacity. Atmore (2019) described the challenge as being related to the dire shortage of trained and competent ECD teachers in South Africa. But despite this unfortunate situation, inadequate capacity, and undesirable conditions, ECDCs remain obliged to operationalise the NCF (Republic of South Africa, 2019). The reality of limited resources and the complex nature of this problem call for a mutually beneficial, collaborative, inclusive approach with earnest commitment to providing services for learning while reaping maximum benefit from the variety of services provided by ECDCs. Thus, this study focused on the theme, "My Learning and Development Is Important," by paying specific attention to the developmental domain of "comprehensive ECD learning programme for quality and equality of opportunities" (DBE, 2015, p. 7). The thrust in this respect is the need to heighten the simultaneous integration of science and technology, which appears to be taken for granted in early learning and development. This integration, we contend, should be considerate of and consistent with children's futures as envisaged by stakeholders (DBE, 2015; Hodson, 2010; Trott & Weinberg, 2020).

The Rationale

The basis of our interest in the stated problem is the global recognition that the early years of children's lives are the ideal phase for passing on to them the values necessary for supporting learning and development, and for building a peaceful and democratic society (Department of Higher Education

and Training, 2017; Department of Social Development, 2006; 2015). The practical implications of recognising the importance of this phase of children's lives are aptly ratified as a "process of emotional, cognitive, sensory, spiritual, moral, physical, social and communication development of children from birth to school-going age" (Republic of South Africa, 2007, p. 28). The reality seems to be that ECD is processual, given that the concept and process of development implied in the construct of ECD are entangled with growth and learning starting from birth and continuing through to school-going age. Thus, it is understandable that instilling requisite values through, and integrating them in, children's early development has the potential to contribute to sustaining their learning as they grow beyond their childhood phase. This created a compelling need to operationalise these sentiments in the context of LECDC, which is characterised by low capacity and poor conditions and is ensnared by a variety of needs, challenges, and untapped opportunities. The purpose of our interest in operationalising these sentiments resided in our collective urge to respond to the limited capacity at LECDC (United Nations Children's Fund, 2022). We hoped to draw strength in this regard from our diverse competencies and capacities, albeit not directly in ECD. We were encouraged by the fact that development is a lifelong process that is mutually dependent on growth and learning processes that should be sustained by instilling requisite supporting values. Furthermore, we derived the rationale for our urge to contribute to sustaining children's development, growth, and learning from the call of the NCF to provide good quality and equal learning opportunities for children. To this end, we responded to the following guiding question: "How can we develop a comprehensive learning programme for young children at an ECD with low capacity and poor development, and contribute to providing quality learning opportunities?"

Underpinnings

The proposition that can be drawn from our rationale and interest in the context, as well as from the guiding question of this study, comprises the process of developing learning programmes that cater for children's social development and cognitive development. It also implies the entanglement of the processes of development, growth, and learning of children—in this case, with and in belief systems of human entities including those of the children's parents and other family members, ECD teachers and caregivers, as well as community members they encounter during growth and becoming. Also critical, are the nonhuman entities children encounter in their learning environments for learning purposes—which include plants, animals, toys, and other inanimate objects—and the ethics of dealing respectfully and caringly with the vulnerability of young children. Additionally, the transformation of the learning environments (Boström et al., 2018) of young children to a socially just learning situation is imperative, especially in light of persistent historic inequities, the quality of learning by young children so that it becomes sustainable, and equalisation of the quality of learning opportunities for disadvantaged children. This proposition warranted consistent underpinnings of intra-relationality based on process, entanglement, becoming, transformation, and ethics (Ceder, 2019). Accordingly, we explore how to develop a comprehensive learning programme that equalises science-language opportunities that are instrumental to the sustainability of young children's holistic development. Walsh et al. (2021, p. 74) advised us to consider tapping from "the rich possibilities offered by relational thinking." The reason for considering this advice was our inevitable collaboration and entanglements with the families, daycare centre, and schools that pursue the children's sustainable, holistic learning. Understanding children's implied science-language development entanglements and the inherently rich possibilities they can offer, presents a complex reality that requires in-depth qualitative exploration.

Nurturing Growth and Sustaining Development

Recent changes in, and commitments by, the government to improve the ECD sector in South Africa have suggested the need for comprehensive and inclusive approaches in order to ensure achievement of these goals set on sustainable foundations. For instance, the changes related to the migration of

responsibility for ECDCs to Basic Education come with the requirement "to substantially improve reading comprehension in the first years of school" and provide "two years of compulsory ECD for all children before they enter Grade 1" and the immanent skills to effectively use "digital workbooks and textbooks" as per the State of the Nation Address of 2019 (Republic of South Africa, 2019, n.p.). Consistent with these changes, a comprehensive learning programme that would ensure quality and equality of opportunity was identified as one of the principles underpinning the learning and development of young children in South Africa (DBE, 2015). This principle identified the elements such a comprehensive learning programme should adhere to in order to realise children's holistic development. The operationalisation of the principle, consistent with key features of the undergirding policy, is instructive. In this regard, the key feature reminding us of the "urgent need to effect social transformation through integrated care and education" (DBE, 2015, p. 1) is compelling and inescapable despite the devastating contextual realities of inequality in and across diverse aspects of society (Ryan & Cotton, 2013). However, the principle of a comprehensive learning programme that develops young children's language and mathematics content areas does create enormous affordances for sustainable learning (Chong & Proctor, 2020; United Nations Educational, Scientific and Cultural Organisation, 2017).

The inclusion of science and technology learning needs for young children is vital, considering the impactful role science and technology are likely to have for present and future generations (Hodson, 2010; İrez & Çakir, 2006; Mbajiorgu, 2019; Padmavathi & Krishnamurthy, 2014; Pepperell, 2003). Consequently, we sought to give considerate attention to developing children's potential in aspects that include the developmental domains, and in the disciplines of science and technology, while fostering strong links with family and school. The NCF's promotion of solid links between young children and their families and the school are seen as a blurring of the boundaries between these diverse and complex entities of society. The interdependence of growth, development, and learning processes is characterised by intricate entanglements to the extent that the transformation of one equitably affects and justifies changes in the others. Accordingly, considering the competencies and resources available, however limited in this case, we focused our attention on the learning processes through which we could contribute to redressing persistent ECD imbalances. In this way, LECDC served as a point of need at which the learning of co-researchers about how to support ECD, as explained earlier, took place. Woolis (2018) referred to this learning as sustainable pedagogy and contended, furthermore, that sustainable pedagogy thrives on the use of personal reflection combined with reflective communities of practice, which enable multiple teachers to reflect with one another. In addition, Trott and Weinberg confirmed our concerns about ECDCs such as LECDC pertinently by indicating that there is:

> *A need for rapid societal transformation to sustainability in ways that substantively involve children and young people in [climate change] learning and action as well as a need to redefine science . . . as a collaborative process to envision and enact sustainable futures today. (2020, p. 2)*

The implications of these averments for LECDC relate to the principles we inferred—that, to be sustainable, our nurturing of children's growth should consider social, economic, and environmental problem-solving aspects and issues.

Why Lethabo ECDC?

Despite facing challenges relating to inadequate resources not limited to low educational levels of ECD caregivers and teachers, a lack of infrastructure appropriate for ECD, and poor working conditions for practitioners, LECDC remains a beacon of hope for children from destitute families—especially in the trying times exacerbated by Covid-19 and the "new normal" it has imposed (Cahapay, 2020).

Enrolment at LECDC has increased since its establishment in 2015, from two children to over 30. In 2022, applicants had to be turned away due to limited capacity. LECDC also gives hope to the young women who continue to endure the challenges confronting the centre and provide care to the children. The reality of continuing care for young children makes LECDC a special case that is worthy of sustainable learning during the 21st century period known as the new normal, and which is characterised by technological advancement.

Positionality

The author is a social transformation activist who has experience of working with community-based development organisations, some of which he co-founded. He is an active member of the church that accommodates LECDC. He is also the chairperson of the first LECDC management and governance committee. LECDC is a practical instrumental case that allows him to pursue social transformation through the scholarship of engagement, consistent with his formal employment requirement to provide opportunities that contribute to community development. LECDC was the study site, at which we endeavoured to develop our understanding and learn more about ECD. At the same time, we contributed to the sustenance of ECDCs by developing and using responsive learning programmes.

The author worked with a team of four LECDC caregiver teachers, who were participants and co-researchers. One of the caregivers is the co-founder of LECDC and the centre manager. The team also comprised three parents, one of whom was a foundation phase teacher at a nearby primary school and the second, a social worker dealing with children's rights. The second parent's child represents one of the many unique cases at LECDC because of their timely introduction to ECD. This child started attending LECDC from 2 months of age, and was 2 years old at the time of this project. The third parent worked at a local retail store and her child, 4 years old at the time of the project, also attended LECDC.

Design

The components of critical participatory action research (CPAR), namely, research, participation, and action that leads to social change (Fine & Torre, 2021; Liebenberg, 2018), guided our approach to the study. Consistent with and pursuant to social change-oriented action, we adopted qualitative instrumental case study design principles as proposed by Ebneyamini and Sadeghi Moghadam (2018). The data sets were subject to situational analysis of documents for requisite content, observation of young children aged 3 to 5 years who were due to graduate from the LECDC soon, and reflection meetings that were conducted using brainstorming and principles of the free attitude interview technique. The discourses that ensued were interrogated further using critical discourse analysis to fully understand and learn about the quality of the learning opportunities that were available (DBE, 2015).
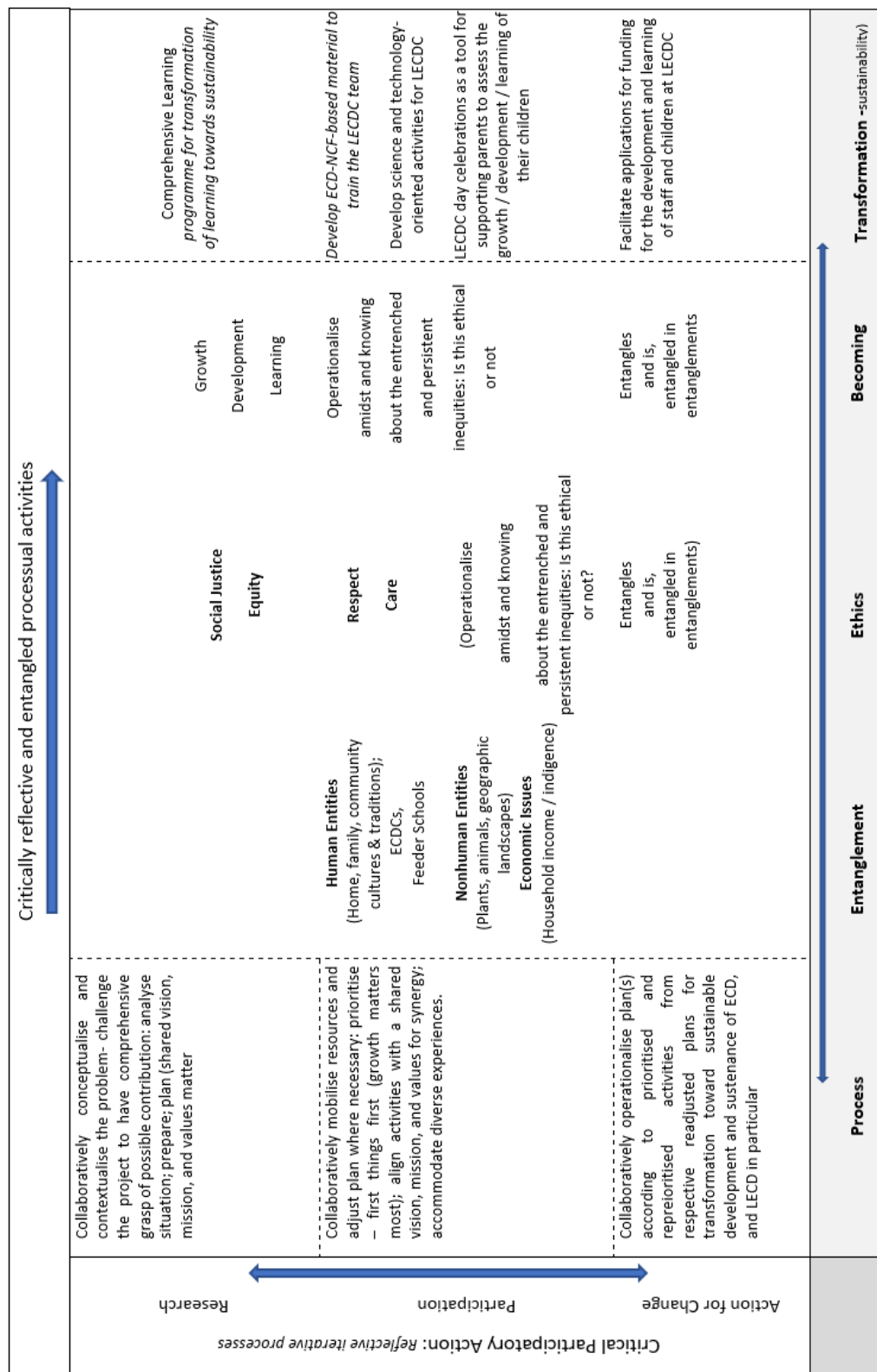
Data Generation Processes

We used the underpinnings of relationality theory in conjunction with the stages of CPAR to organise and categorise the data. Initially, this data organisation was presented in tabular form, with the underpinnings of relationality theory as columns and CPAR components as rows of the resulting table. We split the CPAR rows further according to each component's respective aspects for mapping data, with the CPAR stage and relationality principle easing our categorisation of data according to respective aspects, which facilitated our attempts to deepen our understanding of the situation at LECDC.

In Figure 1, the certainty of the interdependencies among the components of CPAR (vertical) and the relationality theory (horizontal) principles as a continuum are indicated with arrows at each end. The

vertical CPAR components are labelled as a "Reflective Iterative Process." The critically reflective and entangled processual activities are indicated by an arrow that indicates the eventual direction in which the relationality–CPAR process should progress as they permeate children's growth, development, and learning for sustainability.

Figure 1: Relational-Critical Participatory Action-Based Data Organisation and Categorisation

Critically reflective and entangled processual activities

Process	Entanglement	Ethics	Becoming	Transformation -sustainability)
Collaboratively conceptualise and contextualise the problem- challenge the project to have comprehensive grasp of possible contribution: analyse situation; prepare; plan (shared vision, mission, and values matter		Social Justice Equity	Growth Development Learning	Comprehensive Learning programme for transformation of learning towards sustainability
Collaboratively mobilise resources and adjust plan where necessary: prioritise – first things first (growth matters most); align activities with a shared vision, mission, and values for synergy: accommodate diverse experiences.	**Human Entities** (Home, family, community cultures & traditions); ECDCs, Feeder Schools	Respect Care	Operationalise amidst and knowing about the entrenched and persistent	Develop ECD-NCF-based material to train the LECDC team Develop science and technology-oriented activities for LECDC
	Nonhuman Entities (Plants, animals, geographic landscapes) **Economic Issues** (Household income / indigence)	(Operationalise amidst and knowing about the entrenched and persistent inequities: Is this ethical or not?	inequities: Is this ethical or not	LECDC day celebrations as a tool for supporting parents to assess the growth / development / learning of their children
Collaboratively operationalise plan(s) according to prioritised and reprioritised activities from respective readjusted plans for transformation toward sustainable development and sustenance of ECD, and LECD in particular		Entangles and is, entangled in entanglements)	Entangles and is, entangled in entanglements	Facilitate applications for funding for the development and learning of staff and children at LECDC

Research Participation Action for Change

Critical Participatory Action: Reflective iterative processes

The second tier of the data generation process used the techniques referred to in the design section, and involved discussions of observations and findings.

Situation Analysis and Preparation Phase

I (the author) spent eight weeks, that is, 40 days, at LECDC for an average of three hours per day. This period was mainly the preparatory phase, the first part of which was about gaining an understanding of the situation of LECDC. I also provided additional support while becoming acquainted with, and encouraging, children and staff to become accustomed to my presence at centre activities including being part of, and observing, children's participation in their activities. The second part focused on engaging the founder and centre manager casually on the history of the centre, how it came about, and what they intended to achieve (vision) and how (mission), and the support provided by and role of parents, government, and other stakeholders. The third part concentrated on the status of the LECDC administration and management; this coincided with the process of the DBE of incorporating some sections of ECDCs into primary schools. The first and second parts of the preparation phase used observations, interviews, and reflection to generate data, and the third part mainly involved document analysis.

Collaborative Planning Sessions

The activities of the situational analysis included training LECDC caregivers and teachers on the NCF in response to a request by staff, the affected persons. The other activities are listed in the transformation for sustainability column in **Figure 1.** This paper focuses on a general concern related to the request for training, namely, that the workshop the staff had attended appeared to have been of limited use to them; this prior training had been based on the NCF. Pursuant to the need to learn and understand the concerns of staff members about this initial workshop (not conducted by us), the authors made time to attend a similar workshop in a nearby town in response to an invitation from the workshop facilitators. My role at that workshop was to observe, and I subsequently came to understand the concerns raised earlier. Accordingly, our planning sessions resulted in staff being prepared for the training workshop, which involved virtual sessions among team members and face-to-face preparation sessions.

The Workshop

The workshop served as a learning space for all the attendees and as a data-generating tool. The workshop material included a comprehensive agenda indicating item numbers, descriptions of the items, the purpose of the workshop, its duration, and the resources. The team members shared responsibilities according to their areas of competence and experience in relation to the different items. Among the resources used were the vision, mission, and values of LECDC; the NCF, relationality theory; CPAR data collection grid; communication activity; assessment plan for pre-Grade R for ELDA 3 and 4 (communication and exploring mathematics); and finally, a pro forma performance report card for children. The proceedings of the workshop were video recorded with participants' consent.

Main Findings and Observations

The study findings and observations are based on the overall project reflection that followed the workshop because of the magnitude of the support that had to be organised for LECDC. **Figure 2** illustrates how we engaged with the data at the textual level.

Figure 2: Relationality-CPAR Data Presentation Matrix

	Process	Becoming	Entanglement	Transformation	Ethics
Observations / findings	Scholarship of engagement through service learning: the project affords opportunities to learn through and from research while contributing to the scholarship of engagement. (a)	Sustainable learning helps the process of becoming – growth and development in various areas – parents & staff development; children's meaningful learning, promote creativity & innovative teaching (b)	Values that support learning and development instilled in children at ECD have disentangling potential to influence and sustain future development and learning positively. (c)	The practical integration of values, vision, and mission statements of an ECD has the potential to transform learning and achieve sustainability. (d)	Equitable access to resources for ECD can be facilitated using available skills, experiences, and expertise. Power differential-related barriers can be levelled off by adopting values of respect, human dignity, and fairness (social justice) (e)
			Categorised data according to the key tenets of relationality theory		
CRITICAL PARTICIPATORY ACTION: Plan, Action, evaluate, reflect	We really wish to appreciate the support and assistance that has encouraged us to arrange more active learning-based workshop at our centre *[BH's supported view on]*	*Dipale tseo re di phetelang bana re leke hore di bue le maemo a kajeno. (We should try to relate the stories we narrate to young children to their situations / backgrounds) [MFT]* *E ka kgona re be le boiqapelo bo ka hlahisang ho ruta ntho tse fapaneng jk dipalo, puo le kamano tsa tsona (We should be able to be creative to teach different subjects e.g., numeracy, language and how they relate to one another) [NML]* *Pale e kang ya dibere tse tharo jwale ebile di bua e ka ba le ditlamorao tse kang ho se be le nnete [bere ha e buel], hape bere ha se phoofolo eo re ka qalang ka yona pele ho tse tsebahalang tsa lehae (A story like that about three bears that talk have the potential to mystify the reality / truth, bear cannot speak human language, besides, bears are not animals we may start with they are not familiar) [MFT]*	*Bana ba LECD tjhehe le ba creche tse ding ba bua sekgowa ha ba fihla sekolong ba be ba rutwa ka Sesotho. Ekare re ka etsa ho hong hore bana ba se sokole ka puo ho ya pele (Children from ECD centres are taught to express themselves through medium of English however at school they are taught strictly in their mother tongue. It feels like we must do something to help children not to struggle with language that serve as medium of learning and teaching viz, English) [BH]*	*Children from ECDs progress better and adapt to the schooling programme relatively quicker and quicker than children who do not. (BH teachers' information from school)* *Timely introduction of children to ECDs tends to facilitate cognitive and social development (PS: Parent and caregiver's perspective based on the observation of children who started at LECD from age 1 year and who, at times, resided with the matron at her residence) {SOCIAL CHANGE}*	Bana ba bangata ha ba sebetse hantle sekolong ka baka **la tshwaro e mpe** e salokang malapeng, kapa setjhabeng jk ditlhekefetso tsa mefuta. Kgodiso e sa lokang e ama kgolo hampe *(many children perform poorly at school because of abusive encounters from homes and communities, and inappropriate upbringing) [PS] {ETHICS & ENTANGLEMENT}* Nna ke dumela hore bana ha ba Tshwane. Ke se nne ke bone ba bang a kgona ho bua a sokodiswa ke ho tshwara pene, e mong a di kgone di le pedi *(I believe that no two children are the same. I have observed one who can speak well but struggles to hold /handle a pen to write with, another one be able to master both skills) [PT] {ETHICS & BECOMING}* Se hlokehang ke hore re ithute hore re hlwaya bana jwang ho ya ka bokgoni le ho ba thusa ho ya ditlhoko tsa bona re sa ba kgahlapetse kapa ho ba kgesa [PT] *(what is required is that we should learn how to assess children and support them according to their needs) {ETHICS & SOCIAL CHANGE}*

Figure 2 depicts, in the first row, the main observations and learning points that emerged from the

author's overall self-reflection on the project. The data, that is, excerpts plotted in the matrix in Figure 2, were subjected to critical discourse analysis in their respective contexts. As an illustration, this paper presents the translated versions of the data on becoming to indicate how the overarching main learning point or observation was arrived at. The conversation depicted below took place when the workshop interrogated the storytelling activity as part of the NCF's ELDA 3 on communication. It refers to the old story of the three bears (father, mother, and child bear) who arrived home late from hunting and found their food eaten, their chairs broken, and their beds slept in. The team discussed the story after it was read eloquently (according to the feedback given after reading) to the workshop attendees:

> *MFT (in a thought-provoking manner): The stories we tell our children should relate to the current situation [of the children and the community].*

> *NML (response): We should be creative to the extent of being able to teach different knowledge areas from the same story, areas like new words (communication), numbers (mathematics) etcetera.*

> *BH (adds): The story, like the one just being read, may have some misinformation and create misconceptions. Children might grow up knowing that bears can talk, prepare food, and make beds in the same way human beings do.*

> *PS (adding another view): The story, however, provides an opportunity to talk about a bear as an animal, its habitat, what it eats, adaptation to the environment, etcetera. It also affords mathematical information—they were three, 3, and can draw three bears just to represent one number etcetera.*

The conversation on the story led to the emergence of a number of topics and learning points—to the excitement of the caregivers who contended to not have thought about the story in that way. All workshop attendees generally reflected on specific learning points they took from the exercise. The workshop resolved that the team should consider developing specific learning materials for LECDC that can be used to teach children principles and, hence, provide better quality learning materials and relatively less quantity.

Upon reflection, I realised that, by providing a service I regarded as voluntary, I had learned to develop material, organise a workshop involving parents and caregivers and, finally, engage with the NCF and the literature. Doing so opened my eyes to what matters most, namely, sustainability! My realisation of the entangled realities pertaining to growth, development, and learning was an eye-opener. Thus, I was convinced that service learning affords academic opportunities through the scholarship of engagement in order to respond to the sustainable staff development needs of teachers at low-capacity ECDCs.

Conclusion

This paper demonstrates how apparently distinct areas of academic specialisation, vastly expansive academic statuses, and other power differential-related elements can be levelled off by the values of humility, respect, and care in support of early learning and development. It also demonstrates how relational theory and CPAR can be used to organise, analyse, and interpret data that were generated to develop recommendations for the transformation of learning, development, and growth with the aim of achieving sustainability. To this end, in Figure 1 (in the column on transformation for sustainability), the report provides comprehensive albeit not exhaustive indicators pointing to the work that still needs to be done to realise the promise of working with the ECDC towards developing a science-language learning programme for the equality of sustainable learning opportunities for t h e

young children. Figure 1 also indicates that the process of developing a comprehensive learning programme for the transformation of learning and achieving sustainability has yet to develop ECD/NCF-based material to train LECDC staff and parents, develop science and technology-oriented activities for LECDC, arrange open day celebrations for LECDC to support parents in assessing the growth/development/learning of their children, and facilitate applications for funding for the development and education of staff and children at LECDC.

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