CHAPTER 15

Teacher Professional Development in Environment and Sustainability Education

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Introduction

No education policy, no matter how well designed, can succeed without a teacher (Sanyal 2013). Additionally, a change in policy alone is not sufficient to improve an education system (Livingstone 2012), no matter how well meaning. The quality of teachers' professional practices determines to some extent the quality of teaching and learning in the schooling sector. Teacher quality, and not only teacher supply, is important for learning; hence, teacher professional development should be a priority in all education and development strategies (Unesco 2015a).

According to Villegas-Reimers (2003), professional development for teachers is a lifelong process that begins with initial teacher training and continues until teachers retire. Initial teacher education cannot cover all the knowledge that a teacher will need throughout their teaching career (Unesco 2015a). The development of professional practices is a continuing process that lasts for the duration of one's teaching career (South Africa DBE & SACE 2008). Continuing professional teacher development is essential for upgrading and updating teachers because the rate of social and educational change makes initial teacher training an inadequate basis for long-term professional competence (Luneta 2012). Teachers need to constantly update their knowledge and skills to be relevant to changing contexts. Continuing professional teacher development is therefore an essential component of any education system that aims to improve the quality of teaching and learning.

It is important to note that teacher professional development is not an event but a process (Harwell 2003). The process of learning and transformation in teaching practice resulting from professional development is time-consuming (Villegas-Reimers 2003). Teachers and other professionals do not change overnight. Any form of professional development requires a long-term, gradual progression to change.

There is no single form of continuous professional development programme that is appropriate for all teachers. What is required is an optimal mix of activities that suit particular teachers at different stages in their individual development (Guskey 2003). A 'one size fits all' approach to professional development does not work. Teachers tend to be at different stages of their development at different times in their careers, and these stages need to be considered because teachers' needs and dispositions may vary during the different stages (Villegas-Reimers 2003).

Significantly, with reference to the South African context, the Department of Basic Education has observed that:

Much professional development is still organised as isolated and onetime trainings, lacking a coherent strategy, monitoring and follow-up. Research has indicated that these one-off initiatives often fail to have durable effects on teaching and learning. Research also stresses the importance of working together as a cornerstone of effective professional development. (South Africa DBE 2015: 4)

Irrespective of which approaches are used to develop teachers professionally, there should also be a focus on aligning programmes with changing societal needs and challenges, such as sustainable development concerns. Internationally, in the field of Environmental Education or Education for Sustainable Development (ESD), many researchers have investigated professional development models used in addressing teacher challenges related to environment and sustainability education. A key finding emerging from these studies in 2011 was the need for a national synergistic effort to strengthen the systemic impact of Environment and Sustainability Education teacher education efforts (Lotz-Sisitka 2011). This led to the conceptualisation and implementation of the Fundisa for Change Programme (Fundisa for Change Programme 2013; Songqwaru 2019). Since the establishment of the Fundisa for Change programme in South Africa in 2011, researchers have explored similar issues within the Fundisa for Change programme itself. It is with this more recent focus in mind that this chapter provides literature on professional development in environment and sustainability education and includes case examples of research that has been done in the Fundisa for Change programme, exploring effective professional development models as well as how these models can be evaluated.¹

1 Earlier synthesis studies on professional development in Environment and Sustainability Education Teacher Professional Development can be found in Janse van Rensburg and Mhoney (2000), Reddy (2011), Lotz-Sisitka (2011), and Schudel (2017). These studies provide wider background and complementary texts to this chapter.

Teacher professional development modalities

Researchers have different views on what effective professional development is. From the United Kingdom, Guskey (2003: 749) asserted that effective professional development requires that teachers work together, reflect on their practice, exchange ideas, and share strategies. Desimone (2009), writing from the United States, observed that professional growth of teachers can best be understood within the social contexts of their work. Writing from the same context, Darling-Hammond, Wei, Andree, Richardson and Orphanos (2009) argue that the most effective professional development is sustained, intensive, ongoing, connected to practice, and addresses the teaching of the specific curriculum content. Mokhele and Jita (2010) from South Africa observed that in order for professional development to be effective, it has to be aligned to teachers' personal circumstances and motivations.

Professional development for environment and sustainability education needs to be contextual, responsive, emergent, participatory, critical and praxiological (Robottom & Kyburz-Graber 2000; Janse van Rensburg & Mhoney 2000; Reddy 2011; Schudel 2017). This allows teachers opportunities to be active, reflective and responsive within their own teaching practice (Fundisa for Change Programme 2013). Such professional development enables teachers to be not merely passive recipients of others' expertise, but creators, disseminators and preservers of knowledge in their own right (Wood 2007). Teachers are intellectuals who can think, inquire and conceptualise their own knowledge (Wood 2007; Janse van Rensburg & Mhoney 2000; Reddy 2011; Schudel 2017).

There are different modalities of professional development. Among these are: seminars, conferences, workshops, coaching, mentoring, formal courses and collaborative models (Stoll et al. 2006; Mizell 2010; Darling-Hammond et al. 2017). Professional development also happens in informal contexts such as conversations with colleagues, independent reading and research (Mizell 2010). Seminars, workshops and conferences are traditional models of professional development (Darling-Hammond et al. 2017). These modalities are grounded in the assumptions that the purpose of professional development is to convey knowledge to teachers (Vescio et al. 2008). Most of these professional development activities last for only a few hours. They are generic, discuss one or two structured topics and are disconnected from teachers' classroom activities (Darling-Hammond et al. 2009). Traditional models of professional development usually do not allow teachers time to reflect on their classroom practice and thus have a minimal effect on teachers' practice and learners' achievements (Wood 2007). More collaborative professional development models represent a fundamental shift away from the traditional models, by assuming that teachers are not only implementers of others' ideas but also creators of knowledge, and that practice is a central aspect of this knowledge co-creation process for teachers (Wood 2007; Janse van Rensburg & Mhoney 2000).

Collaborative models allow for ongoing, sustained professional development activities and enable teachers to focus on one issue at a time in detail (Stoll et al.

2006). These models recognise the importance of teachers' agency (South Africa DBE 2015; Schudel 2012). Teachers who participate in collaborative models have greater confidence, develop enthusiasm for collaborative working, greater commitment to changing practice, and are willing to try new things (Darling-Hammond et al. 2017). The lesson study is an example of a collaborative professional development model (Lewis & Hurd 2011). This approach continues to be a paradigm shift for most educators outside Japan. The lesson study model has been experimented with in some parts of South Africa (i.e. the Western Cape, Mpumalanga and Free State provinces) to help new teachers (especially in Maths and Science) begin their journey, and experienced teachers to deepen their work (Mokhele & Jita 2010). This approach provides teachers with a learning structure to reflect on their own practice, build a shared knowledge base, foster intrinsic motivation and build a culture that emphasises continuous improvement and collaboration (Lewis & Hurd 2011). Lewis and Hurd point out that the lesson study model allows teachers to seek answers from one another, from specialists, from research and from carefully studying their learners during lessons. Unlike other professional development models, these models are not 'one size fits all'. They are usually teacher directed, teacher driven and teacher orientated. Professional Learning Communities (PLC) is one of the collaborative professional development models being promoted in the South African policy landscape and has been explored in some of the Fundisa for Change research, as discussed later in this chapter and elsewhere in this book (see Tshiningayamwe and Lotz-Sisitka, Chapter 16 and Thomas and Songqwaru, Chapter 17).

Teacher professional development in environment and sustainability education

Environmental issues and risks are global concerns experienced worldwide (Le Roux & Ferreira 2005). The 2016 Global Education Monitoring (GEM) Report (Unesco 2016) states that the planet is in a dire state due to overexploitation of natural resources, loss of biodiversity and a rise in carbon levels leading to climate change. There have been various responses at global, regional and national level to the environmental challenges facing us. Policy, legislation, agreements, treaties and conventions have been established to address environmental degradation in an attempt to mitigate, combat and reverse some of the environmental threats. Education programmes have also been developed in formal and informal sectors to address these issues and risks. There is an urgent need for all sectors of society to work together to address environmental challenges and create a sustainable world (McKeown & Hopkins 2014).

In 1998 a call was made to the United Nations Educational, Scientific and Cultural Organization (Unesco) to develop guidelines for reorienting teacher training to address sustainability in education (Unesco 2005). In 2013, the United Nations Economic Commission for Europe (UNECE) developed guidelines that support the empowerment of educators for a sustainable future. The guidelines share principles that underpin an educational change process that reflects the ethos of competence in ESD

(UNECE 2013). One of the principles resonates with the Fundisa for Change teacher professional development programme as it speaks about understanding, and building on, the context. This principle calls for the utilisation of existing structures and making use of ongoing processes and initiatives.

Subsequent to the UNECE guidelines, the Global Action Programme was launched with an emphasis on building the capacity of educators. The Global Action Programme is a post-2015 development agenda, a follow-up to the Decade of Education for Sustainable Development (DESD) that recognises that sustainable development cannot be achieved by political agreements, financial incentives or technological solutions alone (Unesco 2014). GAP Priority Area Three calls for the integration of Education for Sustainable Development (ESD) into pre-service and in-service teacher education programmes to increase the capacities of educators and trainers for the delivery of ESD (Unesco 2014).

At the end of 2015 there was a launch of seventeen global Sustainable Development Goals (SDGs). Goal Four of the SDGs focuses on quality education which seeks to ensure that all learners acquire the knowledge and skills needed to promote sustainable development. To achieve this, teachers need to be trained to use appropriate and relevant teaching and learning methods and relevant content that meets the needs of all learners (Unesco 2015b). Educators are viewed as change agents who can deliver the educational responses needed to achieve SDGs (Unesco 2017). In the southern African region a programme called 'Sustainability Starts with Teachers' has been established by Unesco to support teacher educators to integrate ESD into teacher education (www.sustainabilityteachers.org).

International imperatives have shaped and influenced how South Africa has integrated environment and sustainability education in the education sector. In 1995, a policy initiative on the integration of environmental education was tabled in South Africa, which led to the integration of environmental education as a principle of the 1995 White Paper on Education and Training (RSA 1995), which was one of the first post-apartheid policies to guide the restructuring of the education and training system in South Africa. This policy called for the integration of environmental education into all levels and phases of the education sector, including teacher education. In the schooling system this call was translated into a guiding principle that continues to underpin the national school curriculum. The principle highlights a relationship between social justice, human rights, a healthy environment and inclusivity (South Africa DoE 2002). Integration of environment and sustainability education into the schooling sector has implications for how teachers are supported to engage with this kind of education. Ongoing international policy developments and reviews, and new strategies on integration of environment and sustainability education, have continued to influence South African national policies and strategies, as well as the implementation of environment and sustainability education in both formal and non-formal education sectors. However, due to challenges related to limited resources and educators' capacity, implementation of environment and sustainability education has not been fully successful. Different interventions have been put in place to address

these challenges. Among other initiatives, Fundisa for Change was implemented to capacitate teachers with regard to environment and sustainability education, in order to enhance the systemic impact of programmes orientated towards supporting implementation of environment and sustainability content in the school curriculum. The Fundisa for Change programme continues with various other forms of support with this in mind. The Department of Higher Education and Training is currently revising the teacher education minimum qualification requirements to integrate ESD as a cross-cutting concern for teacher education, which offers an important platform for taking the Fundisa for Change teacher education work forward in South Africa.

Teacher professional development in environment and sustainability education in South Africa

Stevenson (2007) argues that collaborative teacher professional development models are recommended for environment and sustainability education. He observes that teachers have their own ideas that emerge from experience, circumstances and understanding of teaching and learning, a point also made by Janse van Rensburg and Mhoney in 2000 in the South African Learning for Sustainability project. There have been many initiatives in South Africa which aimed at supporting teachers in environment and sustainability education in the post-apartheid period. The Learning for Sustainability project was piloted in the Gauteng and Mpumalanga provinces between 1997 and 2000 (Janse van Rensburg & Lotz-Sisitka 2000). The project followed a three-pillar approach of integrating environmental education in the curriculum: teacher development, curriculum development and materials development. The Learning for Sustainability project was shaped by influential educational theories such as learner-centred education, critical pedagogy and reflective practitioner theories (Janse van Rensburg & Lotz-Sisitka 2000).

In the year 2000, the National Environmental Education Project for General Education and Training (NEEP-GET) expanded upon the Learning for Sustainability Project, taking it into all nine provinces (NEEP-GET 2004). NEEP-GET was established by the South African Ministry of Education to support professional development of subject advisors and teachers. NEEP-GET also aimed at strengthening environmental learning in the South African curriculum, within an outcome-based, learner-centred curriculum framework, which was the policy of the national government at the time (NEEP-GET 2004). Professional development processes and programmes were structured around a spiral, cluster-based model (Du Toit & Sguazzin 2000; Lotz-Sisitka 2004). NEEP supported the emergence of a draft Education for Sustainable Development Strategy in South Africa (Lotz-Sisitka 2011). In the NEEP-GET synthesis report, Lotz-Sisitka (2004) discussed the key outputs of the project as well as achievements and challenges. One of the outputs she highlighted was the implementation of teachers' professional development in environmental education within which she observed the following achievements:

- Improved understandings of environment and environment in the curriculum;
- broader exposure to, and knowledge of available teaching and learning support materials for environmental learning;
- a more in-depth understanding of the contextual nature of environmental issues, and contextual approaches to lesson plans; and
- improved understanding of active learning processes. (2004: 13)

However, despite the above gains, the project was not able to develop an in-depth focus on the environmental aspect in the learning areas, and there is still an issue of superficial interpretations of environmental knowledge in these learning areas (Lotz-Sisitka 2004: 13). This is a point made in earlier research in the Learning for Sustainability Project (Janse van Rensburg & Lotz-Sisitka 2000). Lotz-Sisitka recommended further support for teachers in environmental learning to ensure that learners are not exposed to superficial knowledge on environmental issues, a noticeable trend in South Africa over the years. In more recent work, Lotz-Sisitka (2011) acknowledged the good practices and positive influence of the above-mentioned projects (Learning for Sustainability Project and NEEP-GET) on the curriculum. She emphasised, however, that very little has been achieved in ensuring that environment and sustainability issues are consistently and coherently integrated into teacher education (2011: 33). Due to inadequate capacity to make a wide systemic impact, achievements were noted mainly at the pilot level. Fundisa for Change was established in 2011 as a response to this (Lotz-Sisitka 2011). Since then, research has been conducted on how Fundisa for Change has provided professional development to teachers on environment and sustainability education (Schudel 2012; Songqwaru 2012; Tshiningayamwe 2016; Thomas 2019; Songqwaru 2019; Nkhahle 2021; Heath 2021). Details of some of these studies are elaborated in other chapters of this book (see Songqwaru, Chapter 19; Tshiningayamwe and Lotz-Sisitka, Chapter 16; Thomas and Songqwaru, Chapter 17; Heath and O'Donoghue, Chapter 5).

Below are elaborations on two of the studies conducted to explore how Fundisa for Change enhanced teachers' professional development.

Professional Learning Communities (PLC) as a potential model for teacher professional development in environment and sustainability education

PLCs are 'teachers who work collaboratively to reflect on practice, examine evidence about the relationship between practice and student outcomes, and make changes that improve teaching and learning for the particular students in their classes' (McLaughlin & Talbert 2006: 3–4). Fulton, Doerr and Britton (2010) unpacked the concept of PLC by noting that *professional* means engaging educators in the development of their professional practice; *learning* means focusing on both the learning of the educators and of the students; and *community* requires common vision, goals, purposes and a

shared sense of trust, as well as collaborative work (p. 6). Reflected in these definitions of PLCs is that the focus of learning is not on individual teachers' professional learning but rather on professional learning within the community context. The community aspect of a PLC enables collegial support for individuals (Stoll et al. 2006). Salomon's (1993) notion of distributed cognition presumes that members of the community take responsibility for their contribution to the group and to individual learning processes.

Reviews of the PLC literature conclude that PLCs support teachers' acquisition of new knowledge and skills, thus improving teachers' content knowledge and professional practice (Stoll et al. 2006; Vescio et al. 2008). PLCs provide spaces for teachers to raise questions about their teaching, discuss content knowledge, and experiment with diverse models of students' problem-solving methods, resulting in improved teaching practice. Vescio, Ross and Adams (2008) pointed out that teachers in PLCs share successful teaching strategies, develop new approaches to shared problems and share the specific subject content knowledge. Tshiningayamwe and Songqwaru (2017) conducted a review of PLCs and collaborative models of professional developments in Namibia and South Africa. In their review, they noted that PLCs have proven to be effective models of teachers' professional development. Therefore, for effective ESD, PLCs should be considered in the planning of teacher professional development initiatives. This will support teachers to address challenges of quality teaching, learning and sustainable development issues.

To pilot the concept of PLCs in Fundisa for Change, a study explored the conversion factors, functionings (valued doings and beings), agency and structures in Professional Learning Communities with regard to Life Sciences teachers' biodiversity knowledge (Tshiningayamwe 2016). The teachers' valued beings and doings, as well as conversion factors associated with these beings and doings, were discussed within the conceptual framework of the capability approach using three PLCs in South Africa (see Tshiningayamwe and Lotz-Sisitka, Chapter 16; Thomas and Songqwaru, Chapter 17). The PLCs involved in this study were course initiated and were positioned in the Fundisa for Change programme. To illuminate constrained capabilities and how, and to what extent, the Life Sciences teachers' empirical actions are related to these, the concepts of the capability approach were underlaboured with critical realism's causal view of human action (Tshiningayamwe 2016). A critical realist theory of causation was useful in explaining how the teachers' valued beings and doings, conversion factors and capability sets can be partly accounted for via an understanding of underlying mechanisms that are generative of events and empirical experience. This is similar in some ways to the work of Brundrit (see Chapter 18) which shows how contextual dynamics filter teachers' abilities and agency for change.

Tshiningayamwe (2016) reported four main functionings valued by teachers: subject content knowledge; teaching practices; assessment practices; and use of teaching and learning support materials. These functions were also reported by Thomas (2019), who further explored how PLCs in the Fundisa for Change programme contribute to the development of teachers' capabilities and achievement of valued functionings related to teaching environmental education (see Chapter 17). Tshiningayamwe discussed these

valued functionings in light of the beings and doings in the PLCs and the underlying mechanisms related to teachers' biodiversity teaching. Conversion factors associated with the teachers' valued beings and doings were discussed in line with the capability approach's environmental, social and personal conversion factors (Tshiningayamwe 2016). The study found that most of the conversion factors within the PLCs and the Fundisa for Change professional development programme (such as good facilitation, collaborative learning space, individual teachers' capabilities, teaching and learning support materials, and policy documents) were enablers to the teachers' capabilities for biodiversity teaching, and thus enhanced teachers' knowledge for biodiversity teaching. The study further found that teachers realised some of their achieved functionings in their actual teaching of biodiversity content in the Life Sciences curriculum (see Chapter 17).

Evaluating environment and sustainability education teacher professional development programmes

A re-thinking of the process of professional development and how programmes are evaluated can assist in addressing some of the challenges that indicate that teacher professional development programmes are inadequate for improving the quality of education, particularly in South African schools (Bertram 2011; Mokhele & Jita 2012).

According to Haji, Morin and Parker (2013), the acknowledgement of the minimal effect of professional development programmes on intended outcomes should lead to a conclusion that either little of what is done makes a difference, or that current programme evaluation approaches are inadequate to capture what is of interest. It thus seems that questions asked are inadequate to reveal the full scope of what should be focused on to improve professional development programmes.

To extend our knowledge of teacher education programmes, Borko (2004) suggested that focus should be on four key elements that make up any professional development system, namely: the professional development programme; the teachers who are the beneficiaries of the programme; the programme facilitators; and the context in which the professional development occurs. Additionally, there is a need to look at how each element works in relation to the others. Fullan (2007) argued that professional development programmes sometimes fail to give teachers the support they need partly because of the assumptions of programme designers and implementers about how change in practice occurs. What needs to be changed often varies inversely with knowledge about how to work through a process of change. Programmes are conceptualised based on professional experience, insights and beliefs about interventions in a particular field (Birckmayer & Weiss 2000). Surfacing programme assumptions can assist in explaining why certain professional development programmes, and their variants, work in the ways they do to produce the desired results (Desimone 2009).

It has been noted in the past that there are two constraints under which environmental education programmes operate: limited financial resources, and the criticism that environmental education is ineffective (McDuff 2002) in the face of the

challenges it is aiming to address. According to Scott and Gough (2003), evaluations of environmental educational programmes tended, at that time, to focus on measuring the effectiveness or quality of a programme, and participants' knowledge after attending the programme.

McDuff (2002) suggested that a needs analysis be conducted prior to designing both training and programme evaluations. He reasoned that this would enable programme designers to design programmes that respond to the needs of the participants, and the evaluation would therefore focus on how and whether those needs were met or not. Another suggestion from Rovira (2000), also writing around the same period of approximately 20 years ago, is that social differences need to be taken into account when evaluating an environmental education programme. She argued that the social context determines the potential for environmental education programmes to effect actual change of attitudes and behaviour in participants, a point that was made by Janse van Rensburg and Lotz in 2000 when they argued for contextual profiling in environmental education evaluation research.

Zint, Dowd and Covitt (2011: 471) stated that evaluations are critical to the success of individual environmental education (EE) programmes and can contribute to advancing the field of EE. They argued that when evaluation results are analysed and synthesised they can add to the body of knowledge regarding the benefits of environmental education and effective environmental education practices.

While these important points were made many years ago, what has emerged is that environmental education literature lacks a systematic approach to the development and evaluation of environmental education programmes (Riemer et al. 2014). According to O'Donoghue (1986: 20–21), evaluation in environmental education, when viewed as an emergent process of facilitating change, should have the following characteristics:

1. Context-specific and grounded in action.
2. Participatory and collaborative without necessarily being directed by an outside researcher or evaluator.
3. Emergent as a continuous process wherein new constructs illuminate and stimulate further inquiry.
4. Simple, evolving towards increased sophistication.
5. Theory-driven and seeking to illuminate and understand rather than merely to provide evidence of worth and success.

O'Donoghue (1986), more than twenty years ago, advocated for rejection of a limited conception of evaluation as a means of measuring outcomes and instead called for an integrated critical approach to evaluation within a process of social change.

More recently, Tao (2012) noted that evaluations of environmental education programmes have been challenged by a lack of clearly articulated programme objectives. This critical step is essential for identifying outcomes and structuring an appropriate evaluation plan. A related challenge identified is a misalignment between the programme's stated objectives and actual programme activities. Goals and objectives

should be explicitly linked but what has been observed is that there are environmental education programmes that either have not identified their programme objectives, or have incorporated activities not aligned with programme objectives. There tends to be a mismatch between long-term outcomes of the programme and actual programme activities. Tao (2012), drawing on critical realism, suggested that evaluations of environmental education programmes can assist with identification of the underlying assumptions framing the programme, to provide clarity for programme stakeholders in aligning their short and long-term goals with programme activities.

Early proponents of theory-based evaluation, Karachi, Abbott, Catalano, Haggerty and Fleming (1999: 713) noted that:

A program evaluation enhances its utility by examining the theoretical basis of the program and the intervening and contextual factors that mediate the relationship between the program and the ultimate outcome. Thus, information generated from this type of evaluation can improve intervention conceptualization while it contributes to theory development and validation.

Arguably, without surfacing programme assumptions (which affect the delivery of a programme), even if it is sound, the programme cannot be fully understood. Coryn, Noakes, Westine and Schröter defined a theory-based evaluation as

any evaluation strategy or approach that explicitly integrates and uses stakeholder, social science, some combination of, or other types of theories in conceptualizing, designing, conducting, interpreting, and applying an evaluation. (2011: 201)

A theory-based approach to evaluation has potential to benefit environmental education programmes (see Songqwaru, Chapter 19). A programme's articulated theory of change would enable programme stakeholders to observe the synergy (or lack thereof) between articulated assumptions and programme activities, as was shown in recent evaluations of the Fundisa for Change programme (Songqwaru 2019; Mukute & Mandikonza 2020) and other environmental learning programmes (such as Enviro Champs).

Astbury and Leeuw (2010) stated that theory-based evaluations unpack programmatic 'black boxes' and explain how and why programmes work (or fail to work) in different contexts and for different programme stakeholders. A 'black box' evaluation refers to the practice or tendency of focusing only on the effects of a programme without attending to how the effects were produced. A focus on the outcomes of a programme, which excludes contexts and assumptions (beliefs, theories) held by all the stakeholders, is inadequate to account for the complexities that exist in educational programmes. It also fails to generate meaningful understanding of factors that lead to programme success or failure, as well as the interaction of these factors in open systems (Haji et al. 2013).

The black box, according to Weiss (2000), can have many theories (assumptions) for the same programme which do not get to be examined. Weiss argued that there are many ideas that implementers, stakeholders and concerned parties have about how a programme should work and these 'theories' need to be brought to light; this is important for contextualisation of programmes, as is shown in Chapters 17, 18 and 19.

Although a theory of change framework integrates both a programme and an implementation theory, it predominantly engages with uncovering a programme's implementation theory (Blamey & Mackenzie 2007). A realist evaluation approach is needed to enable engagement with a programme's programme theory, as is also shown in Chapter 19 (Songqwaru) and the work of the Enviro Champs.

An implementation theory describes the steps to be taken in the implementation of a programme. Programme theory refers to the mechanisms that mediate between the delivery and receipt of the programme and the emergence of outcomes in a particular context (Weiss 1998).

A realist evaluation starts with articulating the initial programme theory, by identifying the mechanisms that are likely to operate, the contexts in which they might operate, and the outcomes that will be observed if they operate as expected. According to Dalkin, Greenhalgh, Jones, Cunningham and Lhussier (2015), mechanisms are what generate observed outcomes. Mechanisms in realist evaluation are a combination of resources offered by the programme and participants' reasoning and responses to bring about intended programme outcomes. A Context-Mechanism-Outcome (CMO) framework is used in realist evaluation to unpack a programme's theory (Pawson & Tilley 1997; see also Chapter 19).

Programme resources, that is mechanisms, may be material, cognitive, social, and/or emotional. Programmes work when these resources resonate with programme participants (Pawson 2003). According to Westhorp (2012), participant reasoning includes preferences, norms and beliefs, and these underpin decisions that lead to particular actions, which in turn enable or constrain outcomes. Partly, the success or failure of programmes is due to the reasoning and personal choices of different participants (Pawson et al. 2005).

Cheyne et al. (2013) stated that the context in which a programme is implemented shapes the mechanisms and the outcomes. Hence a programme evolves when introduced into different contexts, as context tends to influence what people do and how they will act. When a programme is implemented in another context, there are inevitably differences in infrastructure, institutions, stakeholders and participants. Consequently, some critical causal configurations on which programme success depends might be broken by the shift. A programme can still obtain the same objectives in different sites but by different means (Pawson 2001). Pawson and Manzano-Santaella (2012) stated that there will always be multiple contexts, for example, individual, institutional and infrastructural features, that condition the action of the mechanisms.

Pawson and Tilley (1997) argued that all programmes are conceptualised and implemented into pre-existing social contexts. This is also shown by the work of Brundit and Schudel in Chapter 18, Thomas and Songqwaru in Chapter 17, Tshiniganyamwe

and Lotz-Sisitka in Chapter 16 and Heath in Chapter 5. Context has an influence on the success or failure of a programme. Pawson and Tilley (1997) listed four contextual components that may determine whether the new ideas will lead to participants making the programme work or not: (i) the individual capacities of facilitators and participants, (ii) the interpersonal relationships created between them, (iii) the institutional balance and (iv) the wider infrastructural systems.

The four contextual factors that shape the implementation of social programmes were further elaborated on by Macfarlane, Greenhalgh, Humphrey, Hughes, Butler and Pawson (2011) in the following way:

- Individual capabilities are defined as values, roles, knowledge and purposes of programme stakeholders to take the programme forward.
- Interpersonal relationships supporting the programme include communication, collaboration, network and influences that stakeholders have in the social systems where the programme is embedded.
- Institutional settings, informal rules of engagement, culture within the programme, leadership, resource allocation, and local priorities. Leadership that provides strategic guidance and management of the programme.
- The infrastructural system is the political support a programme receives.

The work of authors in this section of the book also points to the historicity of these contextual factors and how this shapes contemporary contextual dynamics, a point that has been highlighted in many professional development studies in South Africa (see Janse van Rensburg & Mhoney 2000; Lotz-Sisitka 2011; Reddy 2011; Schudel 2017). This adds to the complexity of the setting in which professional development is implemented and evaluated (see Reddy 2011).

Recommendations and conclusion

This chapter has revealed that professional development programmes can be an important conversion factor that enables the expansion of teachers' environment and sustainability education in ways that have the potential to reshape teachers' classroom practices. The chapter recommends that teachers' professional development programmes should:

- Promote subject content discussions, as well as group and individual learning.
- Create supportive conditions that will expand teachers' capabilities in teaching environmental content.

- Explicitly take into account teachers' valued functionings and conversion factors that can enable teachers to develop their professional capabilities.

A theory-based approach to evaluation enables evaluators to assess not only whether a programme has worked or not, but also why. In this regard, it is important to identify contexts that condition the operation of programme theories. Insights gained from a theory-based approach to evaluation contribute theoretical knowledge on transferrable lessons about programme implementation theory and programme theory

Programme evaluation should lead to an understanding of the mechanisms that translate intention into action, as well as surface the programme mechanisms and contextual factors that could lead to programme outcomes. The same mechanism can have different degrees of responses with participants, depending on the contextual dynamics. This does not necessarily mean that the desired outcomes are not achieved, but that they are achieved to varying degrees by different participants, influenced by contextual dynamics. It is therefore critical to identify supportive mechanisms and consider the contextual dynamics carefully for various groups and individuals to ensure maximum benefit of professional development programmes. This can help to develop a body of theory that is backed up by practical experience on what works for whom in what conditions. Insights from a theory-based approach to evaluation provide an organising framework which abstracts a particular set of conditions from a programme (in this case, Fundisa for Change), which can then be applied to new programmes. A programme's theory of change can thus be developed further via this contextually iterative and responsive approach. Through this process, a progressive understanding can be developed, and transferable knowledge achieved.

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