CHAPTER 17

Developing Teacher Capabilities and Valued Functionings in Professional Learning Communities: Focus on Environmental Content Knowledge in Natural Sciences

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Introduction

This study explored how professional learning communities can contribute to the development of teachers' capabilities and the achievement of their valued functionings related to teaching environmental content knowledge in the 'Life and Living' strand of Grade 8 Natural Sciences (NS). This is in the context of the Natural Sciences Curriculum Assessment Policy Statement (CAPS) which is strongly content-referenced and is committed to learning approaches that are active and critical, and to environment and sustainability content knowledge (Lotz-Sisitka 2011). The integration of environmental education in the school's curriculum is of significance as it addresses global and local environmental issues by preparing and actively involving learners in the planning, improvement and protection of the environment for the future (Unesco 2012). The successful implementation of CAPS requires that teachers attain necessary subject content knowledge and pedagogical content knowledge (PCK) for the integration of environment and sustainability concerns into the South African National Curriculum (Lotz-Sisitka 2011). Teachers are also required to have the requisite skills to implement pedagogical approaches that support environmental education. However, it is apparent that the implementation of environment and sustainability content knowledge in CAPS

has certain challenges due to teachers' lack of subject knowledge, poor pedagogy and poor assessment practice in relation to environmental education (Songqwaru 2012). Researchers in South Africa (Tshiningayamwe 2016; Songqwaru 2012; Lotz-Sisitka 2011) have noted that there is a lack of adequate environment and sustainability content knowledge among teachers, and that the solution would be for teachers to participate in ongoing professional development activities to enhance their knowledge. However, many of these teacher professional development programmes have been described as once-off in-service workshops, which do not offer continuous meaningful support and training. These once-off trainings do not have a noticeable impact on improving teachers' teaching practices (Moodley 2013).

Teacher professional development

Robottom (1987, in Riordan & Klein 2010) emphasised that teachers' professional development should promote pedagogical approaches which differ from traditional approaches, to support teachers in environmental education. Professional development includes many concepts such as staff development, in-service training, professional learning, and continuing education (Darling-Hammond et al. 2009). Mokhele and Jita (2010) view teacher professional development as involving systematic efforts to bring about a change in classroom practices of teachers, their attitudes and beliefs, and in the learning outcomes of learners. This study uses Evans's concept of professional development, defined as 'all types of professional learning undertaken by teachers beyond the point of initial training, the concomitant skills learnt and developed in these learning processes, and changes in approaches to practice resulting from them' (2002: 134). Effective professional development should offer teachers opportunities to collaborate with each other and to engage with ideas and materials. The focus should be on building teachers' skills, competencies and attitudes, rather than on mere transfer of information (Darling-Hammond & McLaughlin 1995; Du Toit & Sguazzin 2000; Hinde 2003). Furthermore, professional development should provide a foundation for inquiry, reflection and experimentation, and take into account teachers' contexts in teaching and their prior knowledge and experiences. Researchers who focused on teacher development in biodiversity have noted that in South Africa there is a lack of biodiversity knowledge among teachers, and that the solution would be for teachers to participate in ongoing professional activities to enhance their biodiversity knowledge (Lotz-Sisitka 2011; Songqwaru 2012; Chitsiga 2016; Isaacs 2016; Tshiningayamwe 2016).

Literature on professional development contains a lot of critiques regarding the many teacher training programmes which offer once-off in-service workshops. Hargreaves (1995, in Songqwaru 2012) noted that these workshops expose teachers to new curriculum changes without continued meaningful support and training; and as a result they do not have a noticeable impact on improving teachers' current practices. Mokhele and Jita (2010) argued that for professional development programmes to be effective, they need to have personal meaning to teachers who are participating in them, and should be relevant to their needs. They concluded that teacher development

programmes should be continuous and aligned with teachers' personal needs and motivations. To strengthen teacher professional development and promote collective participation in professional activities for professional development, professional learning communities were introduced in South Africa.

Professional learning communities

Professional learning community refers to 'a group of teachers sharing and critically interrogating their practice in an on-going, reflective, collaborative, inclusive, learning-orientated, growth-promoting way to support innovation and knowledge sharing' (Stoll et al. 2006: 223). There are different terms used in relation to the concept of professional learning communities, including professional learning groups, collaborative learning communities, critical friends groups, communities of practice, study groups, teacher research collaboration, and professional networks, to name just a few (Great Schools Partnership 2014; Norman et al. 2015). A general agreement across the different definitions of PLCs is that a PLC emphasises relationships, shares ideas, and develops a strong culture committed to improved student learning.

The Integrated Strategic Planning Framework for Teacher Education and Development (ISPFTED) (South Africa DHET & DBE 2011) clearly indicates that teachers should be the central focus of PLCs, and take leadership roles. This is supported by Brodie and Borko (2016) who argued that if PLCs are to become widespread and truly professional, teachers are the ones who should conceptualise and lead PLCs, with some support from the districts, and other institutions such as universities.

Characteristics of professional learning communities

The benefits for teachers participating in PLCs include reduced isolation, increased commitment to goals, shared responsibility, increased knowledge of effective teaching practices, increased professional aspiration, and embedding systemic change (Hord 1997, in Underwood 2007). The hallmarks of PLCs, according to the ISPFTED, are 'open and democratic collaboration, conflict management and mutual problem-solving, which in turn promote the identification of specific individual and group developmental needs along with actions aimed at addressing these needs' (South Africa DHET & DBE 2011: 80).

PLCs appear to have five main intertwined characteristics as given by Stoll et al. (2006):

- Shared values and vision,
- collective responsibility,
- supportive conditions and shared leadership,
- reflective professional inquiry, and
- promotion of group and individual.

Professional learning communities allow teachers to see themselves as primary agents for change in teaching and learning processes (Wood 2007). They support and encourage teachers to examine their practice, and collectively construct and share new knowledge (Hord 2004). With that point highlighted, this study has focused on how professional learning communities can develop and assist teachers in acquiring the necessary content knowledge and skills to teach and assess environmental topics, as guided by the following research question:

How can professional learning communities contribute to the development of teachers' capabilities and the achievement of their valued functionings as related to teaching environmental content knowledge in the 'Life and Living' strand in Grade 8 Natural Sciences?

Sub-questions

- What functionings do teachers value most in teaching environmental content knowledge in the 'Life and Living' strand of Grade 8 and what conversion factors are associated with these functionings?
- What are teachers' valued functionings in a professional learning community and what conversion factors in the professional learning community are associated with these functionings?
- How can a professional learning community provide Natural Sciences teachers with experiences that develop the knowledge and skills they need to engage learners when they teach environmental content knowledge in the 'Life and Living' strand of Grade 8 Natural Sciences?

The capability approach (Sen 1999) was used as the theoretical framework to explore teachers' valued functionings, as well as the conversion factors related to those functionings.

Theoretical framework

The capability approach developed by Sen (1999) was used in this study. The key concepts in the capability approach are: capability, functioning, agency, human diversity, and public participation in generating valued capabilities (Walker 2005). However, for this study the main concepts being explored are capability and functioning. According to Sen (1987: 36):

A functioning is an achievement, whereas a capability is the ability to achieve. Functionings are, in a sense, more directly related to living conditions, since they are different aspects of living conditions. Capabilities, in contrast, are notions of freedom, in the positive sense: what real opportunities you have regarding the life you may lead.

Sen (1999) further explains that a functioning relates to the various things a person may value doing or being. For this study, functionings are the things that teachers value doing or being in relation to teaching environmental content in Natural Sciences, and in belonging to a professional learning community. Walker (2005) says the capability approach is about freedom and the development of an environment suitable for human flourishing. She further states that capability refers to what people are actually able to be and do, rather than what resources they have access to. Robeyns (2005) clarifies further, claiming that the difference between a functioning and a capability is similar to the difference between an achievement and the freedom to achieve something, or between an outcome and an opportunity. She emphasises that the core characteristic of the capability approach is its focus on what people are effectively able to do and to be. The capability approach focuses on developing people's capability to choose a life that they have reason to value. For this study, capabilities are what Natural Sciences teachers are able to do in a classroom and/or in the PLC, what they value from belonging in the PLC as well as the kind of teachers they can be if the PLC provides a suitable environment for their professional development. Understanding teachers' functionings and capabilities is important in their professional development.

Also of importance in the capability approach is the concept of conversion factors. They are factors that can enable teachers in PLCs to convert resources into new functionings (Robeyns 2005). Functionings and capabilities can be both expanded or constrained by conversion factors, which can be grouped into the following categories:

1. Personal conversion factors (such as intelligence, physical condition, and skillsets). In this study, personal conversion factors may be the teachers' qualifications, experience in teaching Natural Sciences, level of confidence, and personal time.
2. Environmental conversion factors (such as geographical location, infrastructure and logistics). The schools surrounding or in the location where the PLCs are held would fall into this category because they could have an influence on how teachers approach environmental content lessons.
3. Social conversion factors (such as public policies, social norms, gender relations, roles and identities). In the case of this study, social conversion factors may be school practices, power relations, teaching resources, the national education policies, or school codes and systems. The PLC, its activities and how they are conducted, and the role of each participant, are also examples of social conversion factors. (Robeyns 2005)

According to Robeyns, the personal, environmental and conversion factors are interconnected.

Methodology

Research site and participants

The study was conducted in Mahikeng, in the North West Province. Data was generated through observations, semi-structured interviews and questionnaires. The research participants were 13 Natural Sciences teachers who filled out a questionnaire; two of these were observed in the classroom and interviewed post observation, and four were interviewed post PLC observation. The teachers' qualifications ranged from Diploma of Higher Education to master's degree, with years of experience in teaching Natural Sciences that ranged from three months to fifteen years. Of the thirteen teachers, eight majored in Education while five had Bachelor of Science degrees (B.Sc.) with Postgraduate Certificates in Education (PGCE). The teachers majored in different specialisations such as Life Sciences (Biology), Natural Sciences, and Mathematics.

All the teachers were from different schools, and all were part of the professional learning community under study. Those who attended the PLC session on the day of observation numbered around 35, but only 13 of them returned the questionnaires.

Classroom observations were done with two teachers, two lessons being observed for each teacher. Both teachers were qualified to teach Natural Sciences. One of the teachers had a Further Diploma in Biology teaching with an Advanced Certificate in Education (ACE), and 23 years of teaching experience, two of them in teaching Natural Sciences. The other teacher had a Biomedical Sciences degree and a PGCE; with one year's teaching experience. The purpose of classroom observation was to get some insight into how teachers teach environmental content in Natural Sciences. An observation of the PLC was also done to develop a deeper understanding of teachers' valued beings and doings in the PLC, and how these related to their functionings in teaching environmental content in the classroom. A further purpose was to get insight into conversion factors related to those valued beings and doings. The data was analysed using the capability approach.

Findings and Discussion

The study found that teachers have different valued functionings related to teaching environmental content in the 'Life and Living' strand of Grade 8 Natural Sciences. Teachers' valued beings and doings related to teaching environmental content are discussed under the three conversion factors of the capability approach, namely: personal, social and environmental. The study found that teachers' qualifications, experiences, passion for environmental content topics, level of confidence, availability and access to teaching and learning resources, as well as learners' interest and participation, support from subject advisors, and school and classroom environments were among conversion factors that either enabled or constrained teachers' valued functionings in teaching environmental content.

Findings also revealed that teachers have different valued functionings related to belonging to the PLC, namely: shared responsibilities, shared values and vision, collaboration, and discussion of environmental subject content knowledge aspects. The conversion factors related to these functionings were found to be learning space, timing and duration of the PLC activities, types of activities in the PLC, teaching and learning resources, teaching experience, and facilitation.

Teachers' valued functionings related to the PLC

Sharing responsibilities among teachers and the subject advisor

Teachers valued taking active roles in the PLC and sharing responsibilities with the subject advisor. They noted that they had limited roles in the PLC. It emerged that the subject advisor did almost everything in the PLC, from setting up the agenda to giving presentations, leading discussions, and providing materials. For example, one teacher commented as follows: *'She does everything. She would normally start the meeting with some motivation. Then she goes into policies and administration things. Hey, she takes a lot of time in that. Then she will talk about school performances for previous exams. Basically, she does almost everything in the PLC.'* Teachers mentioned some of the roles they would like to play in the PLC, such as helping with the planning of activities, facilitation, and doing more practical tasks. This is in accordance with what is stipulated in the ISPFTED, that teachers should be at the core of PLC activities and take leadership roles (South Africa DHET & DBE 2011). Professional learning communities should offer supportive conditions and shared leadership as argued by Hord (2004).

Shared values and vision to guide the discussions

PLCs are spaces where teachers can have conversations that can help them to reflect on their classroom practices. It was evident that another valued functioning was having shared values and vision, and the freedom to make decisions about points of discussion in the PLC meetings. Teachers commented as follows: *'I wish the subject advisor could allow us teachers to come with our own points of discussion. Especially for content discussions'; 'If we could be given an opportunity to say what we as teachers want to discuss'.* Other aspects that teachers wanted to discuss besides subject content were teaching strategies and experiences, classroom challenges, and topics that are difficult to teach. A shared value-base provides a framework for shared, collective, ethical decision-making, and a vision focused on student learning and shared values guides discussions and decisions about teaching and learning, while enabling individuals to act autonomously (Stoll et al. 2006).

Collaboration

Collaboration is one of the key characteristics of effective professional development (Darling-Hammond & McLaughlin 1995). In the interviews and questionnaires, there were teachers who indicated that it would be beneficial to invite different organisations to offer workshops on different topics; and to have other subject specialists in some of the PLC meetings. Another form of collaboration suggested by teachers was for neighbouring schools to have their own mini PLC sessions and workshops.

Discussion of subject content

Most teachers valued discussing subject content, especially on topics they find difficult. What was observed and what teachers expressed was that much of the PLC time was spent on administration-related activities. Teachers thought it would be better to have separate PLC sessions: one that dealt with administration only, and another that focused on subject content only. One teacher noted the following: *'We need more workshops that deal with administration and then ones that deal with content, that supply past question papers that have been written and then us as teachers we break it down and come up with ways to improve the subjects.'* Other teachers shared similar sentiments. The following extracts give evidence of the teachers' views: *'I will like us to discuss content...'; 'I am interested in discussing content'; 'Spend more time discussing subject content, that's what matters at the end of the day'; 'Focus on how to teach biodiversity. Hear from other teachers, or even have the subject specialist teach the topic, or other teachers'.* Effective professional development should offer meaningful intellectual engagement with ideas, and take explicit account of the contexts of teaching and the experience of teachers (Hinde 2003). This assertion is supported by Du Toit and Sguazzin (2000) who note that professional development should enable teachers to build increasingly sophisticated understandings of their work and context. A focus on environmental content discussions will enhance teachers' knowledge, understanding and teaching practice. Teachers' valued functionings related to teaching environmental topics in Natural Sciences were also explored, and are discussed in the next section.

Teachers' valued functionings related to teaching environmental topics in Natural Sciences

Through questionnaires and interviews, teachers expressed their valued functionings in teaching environmental topics in Natural Sciences. A summary is given in Table 1 below.

Table 1. Teachers' valued functionings in teaching environmental topics in Natural Sciences

Expanding knowledge in environmental topics	Improving teaching practices	Field work	Support
<ul style="list-style-type: none"> • Studying further for short courses like Nature Conservation. • Affiliating with certain programmes to develop in teaching and get more knowledge. • Learning more about the topics, improving skills in teaching them, and having the confidence to teach them. 	<ul style="list-style-type: none"> • Getting interactive teaching materials. • Having small numbers of learners in the class. • Finding an easy way of making the learners relate the topic to the real environmental issues. • Being helped with better teaching strategies for those topics. • Relating the topic to the real environmental issues that are local. • Bringing back learners' interest in NS. 	<ul style="list-style-type: none"> • Taking learners on excursions to Mahkeng Game Reserve. • Doing outdoor lessons. 	<ul style="list-style-type: none"> • Getting help with topics of adaptation, conservation of ecosystems, extinction and biodiversity. • Attending different workshops. • Support from the subject advisor.

Conversion factors related to teachers' valued functionings

The conversion factors related to teachers' functionings were clustered under Robeyns' (2005) conversion factors: the personal, environmental, and social. Conversion factors are factors that can enable or constrain teachers. Through questionnaires, post-classroom and PLC observation interviews, teachers noted the conversion factors that either enabled or constrained them in achieving their valued functionings.

Personal conversion factors

Teachers' qualifications and experience

For some teachers, their qualifications were an enabling factor to teaching Natural Sciences and environmental topics specifically. For example, one teacher said: *'I am a Life Sciences major, and have a bit of chemistry from my qualification. Therefore, I can teach and enjoy teaching topics related to the environment.'* Other teachers expressed how their qualifications were a constraining factor; one teacher noted that he had to teach Natural Sciences because there was no science teacher at that school. He explained that he did not enjoy teaching the subject because he did not know the content; his majors were Electronics and Computer Science. This shows that the teacher did not have the freedom to choose what he valued doing and being.

It was also evident that the difference in experiences enabled teachers to work together and learn from each other in their schools. For example, one teacher, who had

two years of teaching experience, expressed: *'... I have two senior teachers who are helping me ... Everytime I need help with some topics that I find difficult I go to them.'*

However, in the PLC it appeared that experience was a constraining factor, mainly due to how the PLC sessions were structured. Teachers with more years of teaching experience noted that they no longer found the PLC beneficial to them because the focus is, most of the time, on orientating new teachers. They felt there was a need to have a separate session for inducting new teachers.

Passion and interest in environmental topics

One of the teachers who was observed during a lesson demonstrated passion in the way she delivered her lesson on conservation of ecosystems. Her enthusiasm (the tone of her voice, facial expressions and body language) in presenting the lesson showed passion. The learners were showing interest in the lesson because of how she taught the topic. Learners were actively involved during the lesson, asking and responding to the teacher's questions. In her interview she said: *'I love teaching the Life and Living topics in term one. It's part of what I teach in Life Sciences ...'*

There were, however, teachers who indicated that they do not have passion for teaching Natural Sciences and environmental topics. In a follow-up interview one teacher said: *'Honestly I don't enjoy it because I have never taught it before ... It's not for me. I am just doing it for those children.'*

Acquisition of knowledge and skills

Teachers noted the need to gain knowledge and skills in teaching environmental topics as an enabling factor. Another teacher observed: *'Maybe if they made it possible for us to register for short courses like Nature Conservation, so that we can increase our knowledge in those topics.'*

Findings in this study revealed that there are still challenges around teachers' in-depth knowledge of environmental content, as pointed out by other researchers (Lotz-Sisitka 2011; Songqwaru 2012; Chitsiga 2016; Tshiningayamwe 2016). Teachers valued enhancing their knowledge of environmental topics but the PLC, as mentioned earlier, did not offer them time to engage in subject content discussions.

Environmental conversion factors

Learning space

The PLC was viewed by some teachers as a space that enables collaboration among them and learning from each other. Teachers used phrases such as *'learning from each other'*, and *'gaining knowledge'*, when commenting on the PLC as a learning space. This resonates with what Hipp and Huffman (2000) emphasised, that PLCs should have supportive conditions that allow time for collaboration, empowering teachers and reducing isolation.

However, it emerged that some of the teachers who have been part of the PLC for many years did not find it to be a learning space for them. This was noted by one

teacher, who said: *'Not anymore. The meetings are mainly aimed at empowering beginner teachers. They are now becoming less and less relevant for us experienced teachers.'* The teachers' participation in the PLC was to some an enabling factor to achieve their valued functionings, while to others it was a constraining factor.

Physical space where the PLC is held

The PLC was held in a school situated in the urban area. The venue for some teachers was in itself a constraining factor because they had to travel a very long distance to attend the session, and leave before the end of the session. Also, the classroom used for the session was not an enabler; it was too small, and the seating arrangements did not promote space for engaging in discussions or working in groups. PLCs should develop an environment suitable for teachers to flourish and achieve their valued functionings (Robeyns 2005).

Social conversion factors

Duration of PLC activities

Time emerged as a main conversion factor that constrains teachers from achieving their valued functionings in the PLC. Teachers expressed that the frequency as well as the duration of the PLC sessions were not enough. They wanted extended time so that they can discuss different topics, as one of them noted: *'If the Department can schedule PLC meetings during school holidays to allow us more time to engage in content discussions and other issues. 2 hours is not enough.'* The issue of time was emphasised in the ISPFTED (South Africa DHET & DBE 2011), noting that time should be scheduled for teachers to participate in PLCs and engage in quality teacher development.

Natural Sciences CAPS document

The CAPS document was used in the PLC session and it enabled teachers' achievement of their valued functionings. The subject advisor used it to orientate teachers who were new in teaching Natural Sciences. Teachers were also given an opportunity to use it during a group activity of setting practical tasks for assessment. They were not familiar with the skills that must be assessed in a practical activity. The use of the CAPS document in PLCs should not be a mere transfer of information, but should be used to build teachers' skills, competencies and attitudes to enable them to achieve their valued functionings in teaching the environmental topics and the Natural Sciences subject in general.

Availability of and access to teaching and learning resources

During the PLC, teachers were given subject policies, but there were no materials to expand teachers' knowledge in environmental topics or in the Natural Sciences subject generally. Teachers mentioned their need to be supplied with materials, and they perceived availability of and access to teaching and learning materials as an enabling factor in teaching Natural Sciences. For example, one teacher stated: *'... another thing*

is lack of enough resources. I need charts, videos ... I would love to get help with teaching materials that are interactive, like videos, for learners to see how different animals adapt to the environment.' The ISPFTED clearly states that it is the role of Districts to support PLCs with resources and expertise on facilitation skills, development of teaching resources, and the use of Information and Communication Technology.

Activities in the PLC

There were a few activities that took place in the PLC, and teachers had different perceptions about them. Experienced teachers noted that the presentations by the subject advisor, which were focused on administration, analysis of results and orientation of new teachers, were a constraining conversion factor for them. Although the Department of Education's (2015) PLC guideline highlighted these topics as some of the activities to be done in PLCs, balancing the activities to accommodate all the teachers is crucial. There should be a balance in terms of meeting the needs of both novice and experienced teachers.

One teacher noted that *'workshops are mostly aimed at empowering beginner teachers; about 80% of the time is spent on admin issues. I don't benefit from that unless there are new requirements.'* Group discussion activities were identified as an enabling conversion factor; teachers saw it as an opportunity to learn from each other, share knowledge and discuss subject content. For PLCs to be effective in developing teachers, they should consider what teachers value and incorporate that in the activities of professional development.

Conclusion

Findings revealed that teachers have different valued functionings related to their professional development in the PLC and the teaching of environmental content. Teachers valued active participation, taking leadership roles and responsibility, discussing subject content, learning from each other, and being provided with teaching and learning resources. There were conversion factors that were, to some teachers, enablers, while to others they were constraints. This suggests that teachers' professional development programmes within PLCs need to identify teachers' functionings and align them with the programmes' activities. Teachers' individual professional needs should be taken into account. PLCs need to offer teachers a platform to create knowledge collectively by having more time to engage in discussions on subject content, classroom practices, and sharing ideas and strategies. For PLCs to be effective in developing teachers' capabilities and valued functionings, teachers must be at the centre of the system, take the lead with their own professional development, and be offered continuous support through the PLCs.

The findings from this study can inform the Department of Basic Education (DBE) towards establishing new PLCs and strengthening existing ones. The DBE could look into the already existing teacher clusters to see how they can be strengthened to become better functioning PLCs. Additionally, other teacher development programmes can see how they can support professionals within PLCs.

References

- Brodie K & Borko H (2016) *Professional Learning Communities in South African Schools and Teacher Education Programmes*. Cape Town: HSRC Press
- Chitsiga C (2016) An examination of teaching strategies for mediating the construction of environmental content knowledge: A case study of Grade 11 Life Sciences teaching in two Eastern Cape schools. Unpublished Master's thesis, Rhodes University, Makhanda
- Darling-Hammond L (2008) Teacher learning that supports student learning. *Teaching for Intelligence* 2: 91–100
- Darling-Hammond L & McLaughlin MW (1995) Policies that support professional development in an era of reform'. *Phi Delta Kappan* 76(8): 597–604
- Darling-Hammond L, Wei RC, Andree A, Richardson N & Orphanos S (2009) *Professional Learning in the Learning Profession*. Washington DC: National Staff Development Council
- Du Toit D & Sguazzin T (2000) A Cluster Approach to Professional Development Support for Teachers in South Africa: An Illustrated Proposal. Johannesburg: Learning for Sustainability Project
- Evans L (2002) 'What is teacher development?' *Oxford Review of Education* 28(1): 123–137
- Fleming ML (2009) Environmental education professional development needs and priorities study. <http://cms.eetap.org>
- Great Schools Partnership (2014) *Professional Learning Groups*. <https://www.greatschoolspartnership.org/resources/professional-learning-groups-toolkit/>
- Hinde E (2003, 3 August) Reflections on reform: A former teacher looks at school change and the factors that shape it. *Teachers College Record*. <https://www.tcrecord.org/content.asp?contentid=11183>
- Hipp K & Huffman J (2000) Creating communities of learners: The interaction of shared leadership, shared vision, and supportive conditions. Paper presented at the Annual Meeting of the American Educational Research Association
- Hord SM (2004) *Learning Together, Leading Together: Changing Schools through Professional Learning Communities*. New York: Teachers College Press. Introduction
- Isaacs D (2016) An exploration of what Grade 7 Natural Science teachers know, believe and say about biodiversity and the teaching of biodiversity'. Unpublished Master's thesis, Rhodes University, Makhanda
- Lotz-Sisitka H (2011) National case study. Teacher development with an education for sustainable development focus in South Africa: Development of a network, curriculum framework and resources for teacher education. Paper prepared for the Association for the Development of Education in Africa Conference, February 2012
- Mokhele ML & Jita LC (2010) South African teachers' perspectives on continuing professional development: A case study of the Mpumalanga secondary science initiative. *Procedia-Social and Behavioral Sciences* 9: 1762–1766
- Moodley G (2013) Implementation of the curriculum and assessment policy statements: Challenges and implications for teaching and learning. Unpublished Master's thesis, University of South Africa, Pretoria
- Norman PJ, Golian K & Hooker H (2015) Professional development in schools and critical friends groups: Supporting student, novice and teacher learning. *The New Educator* 1: 273–286
- Riordan M & Klein EJ (2010) Environmental education in action: How expeditionary learning schools support classroom teachers in tackling issues of sustainability. *Teacher Education Quarterly* 37(4): 119–137
- Robeyns I (2005) The capability approach: A theoretical survey. *Journal of Human Development* 6(1): 93–114
- Robottom I (1987) Towards enquiry-based professional development in environmental education. In: I Robottom (ed.) *Environmental Education: Practice and Possibility*. Victoria, Australia: Deakin University Press. pp. 83–119

Teaching and Learning for Change
Education and Sustainability in South Africa

- Sen AK (1987) *The Standard of Living*. Cambridge: Cambridge University Press
- Sen AK (1999) *Development as Freedom*. Oxford: Oxford University Press
- Songqwaru NZ (2012) Supporting environmental and sustainability knowledge in the Grade 10 Life Sciences curriculum and assessment policy context: A case study of the Fundisa for Change teacher education and development programme pilot project. Unpublished Master's thesis, Rhodes University, Makhanda
- South Africa Department of Basic Education (DBE) (2015) Professional Learning Communities – A Guide for South African Schools. Pretoria: Department of Basic Education
- South Africa Department of Higher Education and Training (DHET) & Department of Basic Education (DBE) (2011) Integrated Strategic Planning Framework for Teacher Education and Development in South Africa, 2011–2025. Pretoria: Technical Report, DHET/DBE
- Stoll L, Bolam R, McMahon A, Wallace M & Thomas S (2006) Professional learning communities: A review of the literature. *Journal of Educational Change* 7: 221–258
- Tshiningayamwe SAN (2011) Implementation of environmental learning in the NSSC biology curriculum component: A case study of Namibia. Unpublished Master's thesis, Rhodes University, Makhanda
- Tshiningayamwe SAN (2016) Enhancing Life Sciences teachers' biodiversity knowledge: A professional learning community approach. *Southern African Journal of Environmental Education* 32: 38–50
- Underwood JM (2007) A study of the implementation of a professional learning community in one middle school in Georgia. Unpublished doctoral thesis, Statesboro, Georgia
- United Nations Educational, Scientific and Cultural Organization (Unesco) (2012) The Education for Sustainable Development Sourcebook. Education for Sustainable Development in Action Learning and Training Tools. No 4. Paris: Unesco
- Walker M (2005) Amartya Sen's capability approach in education. *Educational Action Research* 13: 103–110
- Wood DR (2007) Professional learning communities: Teachers, knowledge, and knowing. *Theory into Practice* 46(4): 281–290