

Transformative pedagogy adoption by Natural Sciences pre-service teachers in a South African university

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Transformative pedagogy is based on the principle that learning requires concerted effort to critically examine beliefs, values, and assumptions, and places learners at the heart of the learning process. The development of pre-service teachers' lesson planning skills is considered key in raising effective teachers to close the gap between theory and practice. Lesson planning enables pre-service teachers to think through what they teach, how they teach, and how to evaluate their teaching. This study sought to analyse lesson plans of final year natural science pre-service teachers to gain insights regarding the integration of principles of transformative pedagogy based on Mezirow's theoretical model of transformative pedagogy. The sample focussed on the written data derived from three lesson plans structured by the selected natural science pre-service teachers at a selected university in South Africa. This study employed a purposive sampling technique and thematic analysis to analyse the data. The findings revealed all three lesson plans included principles of transformative pedagogy, namely, open dialogue, critical consciousness and autonomy. The pre-service teachers could structure lessons that would enable learners to critically reflect on their existing beliefs and values that would enable learners to undergo a transitional change in their lifestyle and personal behaviour.

Introduction

Transformative pedagogy is based on the principle that learning requires concerted effort to critically examine beliefs, values, and assumptions, and places learners at the heart of the learning process (Mezirow, 2003). Central to transformative pedagogy is the reciprocal collaboration between teachers and learners. Transformative pedagogy is the art of teaching that fosters collaborative learning and encourages learners to think creatively and critically (Harrell-Levy & Kerpelman, 2010). Khedkar (2016) believed that transformative pedagogy is a combination of constructivist and critical strategies to empower learners to examine their existing experiences, to develop a reflective base, appreciate multiple perspectives, and develop critical consciousness. Transformative pedagogy focuses more on the processes of learning (Mezirow, 2003) rather than the accumulation of knowledge. In following such an approach, knowledge is not regarded as absolute but rather perceived as a product of engaging practices.

The development of pre-service teachers' lesson planning skills is considered key in raising effective teachers and the lesson planning helps pre-service teachers to close the gap between theory and practice (Sahin-Taskin, 2017). Therefore, planning enables pre-service teachers to think through what they teach, how they teach, and how to evaluate their teaching (Ruys et al., 2012). Notably, Choy et al. (2013) stated that lesson plans reflect teachers' interpretations of subject matter, as well as the way they adopt instructional materials, as influenced by the extent to the teachers are informed about learners' prior knowledge and the topic to be presented.

In the South African context, the *Minimum Requirements for Teacher Education Qualifications* policy governs processes and practices related to teacher education (DHET [Department of Higher Education and Training], 2015), and reiterates the importance of teacher education programs exposing pre-service teachers to the principles of transformative pedagogy. During years 1 to 3 of the Bachelor of Education study at this article's selected university in South Africa, the teacher development program is constructed in such a way that Natural Science pre-service teachers are exposed to the theoretical ideas of transformative pedagogy. As such, pre-service teachers are required to obtain an understanding of transformative pedagogy through exploring the various theories that underpin transformative pedagogy, such as social constructivism and critical theory. In doing so, pre-service teachers are not only required to learn theory and understand why theory is important, but also learn to apply theory in practice, hence the phrase from "theory to practice" (Epstein, 2019). Consequently, pre-service teachers are made aware of how the values of social justice, human rights and democracy are not divorced from, but rather are infused within the teaching and learning process, thus staying true to the notion of transformative pedagogy.

Therefore, in this study, we wanted to analyse how pre-service teachers transformed learning theory into practice. Arguably, classroom practices that employ transformative pedagogy apply the philosophy that prioritises investment in learners' engagement, participation, ownership, and in making learning processes interesting and exciting (Wangdi, 2016). It is with this argument in mind, through an analysis of Natural Science pre-service teachers' lesson plans, that this study sought to gain insights regarding the integration of some principles of transformative pedagogy. In doing so, this will allow us to gain a better understanding of how the Natural Science pre-service teachers embraced transformative pedagogy in their lesson plan designs.

Transformative pedagogy as a theoretical frame of thinking

This study employed Mezirow's theoretical model of transformative pedagogy (Mezirow, 1978). Drawing on Jack Mezirow's (1991) transformative theory, transformative pedagogy is best described as a constructive orientation that is based on the ways learners interpret and reinterpret experiences, in order to make meaning of a learning process. The theory posits that individuals learn best through questioning the premises and contents of their practices and experiences (Harrell-Levy & Kerpelman, 2010). Arguably, the theory promotes learning that enables individuals to reflect critically and think autonomously (Baecher & Chung, 2020), which is fundamental to a democratic society. Key to transformative pedagogy are principles such as open-dialogue, critical consciousness and autonomy (Mezirow, 1997). It is for this reason that Garza et al, (2016) called upon initial teacher education programs to facilitate the pre-service teachers' transition towards teaching in a more inclusive, self-reflective and integrated manner. In order for transformative pedagogy to emerge in a Natural Science classroom, the Natural Science teacher must be deliberate in designing a lesson plan that will ultimately give expression to three essential transformative pedagogy concepts namely, open-dialogue, critical consciousness, and autonomy (Branchetti et al., 2021).

Open dialogue

Open dialogue is defined as an approach where both teachers and students make substantial and significant contributions to classroom talk and to learning in general (Edwards-Groves et al., 2013). Significant to note is that classroom interaction can be considered dialogic when it fulfils the criteria of being: (1) collective (as a small group or the whole class, students and their teacher address learning tasks together); (2) reciprocal (students and their teacher listen to each other, share ideas and consider alternative viewpoints); and purposeful (teachers plan and steer classroom talk with specific educational goals in mind) (Muhonen et al., 2017).

Arguably, multiple, distinct, and equally valid voices, or points of view, can thus coexist in an open dialogue. In line with this study, Olson et al, (2014) indicated that transformative open dialogue requires presence, an attention to the living moment without a preconceived hypothesis or specific agenda. As such, open dialogue involves being able to listen and adapt to the particular context and language of every exchange, leading to substantive conversations. Open dialogues planned by the teacher to foster interaction in classes should be thoughtful, reciprocal and promote a common understanding.

Critical consciousness

Critical consciousness is associated with freeing individuals from oppression and this freedom stems from the critical reflection that expands self-knowledge. It is necessary for people to think critically about oppressive realities and challenge inequitable social conditions to reclaim their humanity (Freire, 2000). Education should serve the emancipatory role of empowering students to think critically about their education and be able to make a link between education and their social contexts (Freire, 2000). Critical consciousness entails three key aspects, namely, deep reflection on existing power structures and dynamics, a sense of agency to seek and enact change in inequitable systems, and intensive action in working both individually and collaboratively to pursue emancipation from these oppressive systems and structures (King & Casanova, 2021).

In other words, critical consciousness involves reflection and action, and conscientisation is an ever-evolving process that opens up the possibility of new praxis while also allowing for new kinds of awareness (Hernandez et al., 2005). The development of critical consciousness requires interactively analysing, questioning and discussing the status quo and views, and being critically aware of the sociocultural contexts, power dynamics surroundings such as race, gender, sexual orientation, and other aspects of social identity (Garcia et al., 2009; Hatcher et al., 2011). This is consistent with the aim of this study as well as Freirean views, in that social actions should circle back to analysis, critical dialogue and that reflection and social action merge to form praxis.

Autonomy

The concept of learner autonomy in the school setting entails a degree of freedom to act and make informed choices without being constantly commanded by the teacher (Najeeb,

2013). Therefore, the development of autonomy provides learners with the necessary means for adapting to a society in which they must be able to regulate their own learning and take full responsibility for their personal fulfilment. Teachers should value the importance of fostering in learners a sense of ownership of their learning. According to Wangdi (2016), transformative pedagogy promotes social skills and personal organisation that are key in allowing learners to function within a team set up.

Harrell-Levy and Kerpelman (2010) also posited that the use of transformative pedagogy enables learners to critically examine how they think about information themselves and encourages them to also challenge one another's perspectives constructively. As such, learners' autonomous development is not a matter of learning in isolation, but a matter of interdependence and collaboration (De Klerk & Palmer, 2019). Therefore, learner autonomy could be regarded as social in nature in the sense that learners are empowered to make choices and decisions on their own (Murray, 2014).

Lesson planning and transformative pedagogy

The structuring of a lesson plan is a teacher quality and a crucial activity that enables the teacher to plan teaching materials, lesson objectives, teaching methods and learning procedures (Laia, 2019). Seminal work from McCutcheon (1980) in relation to lesson planning indicates that the implications of lesson planning are two-fold. In the first instance, the planning of a lesson enables the teacher to feel more confident and at ease with the lesson presentation process. Secondly, lesson planning further assures that the lesson is aligned with educational policy and responds to curriculum expectations. Setyono (2016) indicated that lesson planning is a complex process that requires the teacher's understanding of subject content matter, pedagogical knowledge and the use of critical thinking skills. Arguably, teachers should be able to plan lessons effectively to teach the subject matter sufficiently.

In the school of education at a selected South African university, the teacher development program is structured in a manner that requires pre-service teachers to develop and present lessons that makes reference to teaching materials, lesson objectives, teaching methods and learning procedures for an authentic teaching experience. In addition, pre-service teachers are also expected to demonstrate insights into transformative pedagogy by integrating the principles of transformative pedagogy in their lesson plans during teaching practice opportunities that is done on an annual basis. The latter serves as a valuable approach to determine whether pre-service teachers are in fact able to integrate the principles of transformative pedagogy in their lesson plan designs. It is for this reason that we are interested to uncover whether the pre-service teachers were able to embrace transformative pedagogy in their teaching. In particular, it would be interesting to examine how the pre-service teachers went about responding to the principles of transformative pedagogy within lesson plan components such as teaching materials, lesson objectives, teaching methods and learning procedures.

For Tilaar (2012), in making use of transformative pedagogy, the teacher should undergo a process of becoming, developing through dialogic interaction and serving an active participatory emancipatory role. Drawing on this view of Tilaar (2012) it will be interesting to uncover how Natural Science pre-service teachers could embrace transformative pedagogy in their lesson plan designs through (a) creating spaces whereby learners could be made aware of social issues that are rife in society; (b) allowing learners to reflect critically on existing assumptions pertaining to societal issues; (c) enabling learners to enter an open dialogue that allows them to share personal accounts and experiences of societal issues, hence transitioning to a transformative learning approach; (d) challenging learners to explore possible strategies to circumvent issues identified; and (e) permitting learners to reflect back on the effectiveness of the strategies in order to redefine the strategies for improved results.

Method

For this study, the research sample deliberately focused on the written data derived from three lesson plans that were structured by final-year Natural Science pre-service teachers at a selected university in South Africa. Natural Science is informed by knowledge areas that deal with life and living, matter and materials, energy and change, and earth and beyond. These topics stem from various disciplines such as biology, chemistry, physics, and earth and space sciences (DBE, 2011). These lesson plans would provide valuable evidence on whether the Natural Science pre-service teachers were able to integrate the principles of transformative pedagogy in lesson plan components such as teaching materials, lesson objectives, teaching methods and learning procedures. The pre-service teachers made use of a lesson plan template during their teaching practice sessions, and they specialised in Natural Sciences teaching at a university in South Africa.

This study employed a purposive sampling technique. Purposive sampling is a type of non-probability sampling in which researchers choose individuals from the public to participate in their data collection process based on the researcher's own judgment (Goacher et al., 2017). Of significance here is the argument for making use of only three lesson plans that were structured by the pre-service teachers. As researchers, we are of the view that three completed lesson plans are adequate for this qualitative study. Kim (2016) reminds us that in conducting qualitative research the focus should rather be on the richness of the data provided.

The data material in this study has mainly been collected from the lesson plans of final-year Natural Science pre-service teachers in an attempt to realise whether they could embrace transformative pedagogy in their lesson plans. A document analysis was conducted to make sense of the qualitative data that derived from the lesson plans. Document analysis, as a data-collection method, is a procedure for the identification, verification and consideration of documents that are related to the objects investigated (Moreira, 2009). In this case that included the lesson plan designs of three final year Natural Science pre-service teachers who agreed to share their lesson plans with the researchers. These lesson plans demonstrated diverse lesson ideas in terms of diversity

and were a perfect fit for the study. The three lesson plans also made sufficient reference to transformative pedagogy. Notably, the Natural Science pre-service teachers made use of a lesson plan design template during their teaching practice sessions which guided the structuring of the lesson plans.

The researchers used thematic analysis to analyse the data extracted from the lesson plans of the three pre-service teachers. Creswell and Creswell's (2017) steps were considered in analysing the data which were extracted from the lesson plans. Drawing on the theoretical tenets of transformative pedagogy, the literature review, as well as data collected for this paper, three main themes emerged. These themes centred around the sparking of critical consciousness amongst learners, the realisation of open pedagogy for active engagement and the cultivation of autonomy amongst learners in a classroom context.

Ethical clearance

Ethical clearance to use the lesson plans of the Natural Science pre-service teachers was obtained from the Senate Ethics committee at the selected university since the content of the lessons was regarded as intellectual property. Permission to use the lesson plan designs was also granted and obtained from the sampled Natural Science pre-service teachers. The lesson plans for which permission had been granted were de-identified, implying that the names of the Natural Science pre-service teachers were removed for the sake of anonymity. A confidentiality clause was included in all the lesson plans and other related documents signed by participants to ensure confidentiality of the use of their lesson plans. Pseudonyms ("Angel", "Dineo" and "Shaheem") were used to protect the identities of the students.

Positionality of the researchers

Positionality refers to the researcher's preferred viewpoint within a given research study and recognises that researchers are a part of the social environment in which they are involved, and that this reality has been shaped by existing social variables (Lowe, 2021). Consistent with the underpinnings of transformative pedagogy, the researchers would like to disclose their positionality within the educational research setting. The individual's worldview or 'where the researcher is coming from' concerns ontological assumptions (an individual's beliefs about the nature of social reality and what is knowable about the world), epistemological assumptions (an individual's beliefs about the nature of knowledge) and assumptions about human nature and agency (an individual's assumptions about the way we interact with our environment and relate to it) (Grix, 2019; Marsh & Furlong, 2018).

Ontologically, the researchers envision social reality as fragmented, unpredictable, and context bound. For the researchers, transformative pedagogy is co-constructed by the interaction of individuals and is shaped by the world views and experiences of both the researcher and the participants involved. As a result of this ontological view, epistemologically, the researchers adhered to an emic perspective, where the researcher must come into contact with the participants and therefore affect both data analysis and

interpretation of results (Morales, 2020). Furthermore, the researchers were aware of their roles as insiders and so approached the study with a high degree of honesty and reflexivity.

Findings and discussion

The interpretation of findings and subsequent discussion were framed against the background of information derived from the lesson plans of three participants. The written content in these lesson plans was given special attention because it included information on the lesson themes chosen, instructional strategies employed, teaching materials considered, assessment methods used, and lesson conclusions produced. The lesson plans were then thoroughly analysed, interpreted, and described in accordance with transformative pedagogy concepts and themes identified, namely, critical consciousness in lesson plan integration, open pedagogy for active engagement and cultivating autonomy.

Theme 1: Critical consciousness in lesson plan integration

Mustakova-Possardt (2004) posits that levels and degrees of critical consciousness are the result of the interaction between moral motivation, structural cognitive development, and an empowered unity of rational understanding, intuitive knowing and inner vision. Conscientisation strives to arouse pride, a sense of dignity, personal confidence, and self-reliance among the learners through the utilisation of individual and group experience (Mlekwa, 2020). In the coming sections we report and discuss how Angel, Dineo and Shaheem integrated the principle of critical consciousness in their lesson plans.

The principle of critical consciousness came to the fore in Angel's lesson with her intention to make learners aware of the "*the intricacies of genetic inheritance and discrimination amongst individuals*". Discrimination is a societal issue that is rife and more evidence of the principle of critical consciousness surfaced when student Angel posed open-ended questions such as "*Why do you think are we different?*"; "*Are we as human beings really so different from a genetic point of view?*"; and "*Do you think it's fair to discriminate against others, now that you know that the genome affects phenotypical features of an individual?*". The questions allowed learners to reflect critically on their existing assumptions pertaining to the issue.

Dineo's lesson plan on "*Substance abuse and its impact on the nervous system*" seemed to encourage the learners to be critically aware in terms of perspectives of relationships between self and society. This lesson necessitated a metacognitive experience in which one must think about their thinking and be aware of the existence of consciousness (Houser & Overton, 2001). As a result, the chance provided for learners in their "*discussion in class*" as well as being able to "*investigate rehabilitation support in communities*" should teach them about the world while also inspiring confidence (Maseko, 2015). Dineo also made learners aware of the negative aspects of substance abuse in the lesson by referring to the effects on the nervous system and also allowed learners to participate in the discussion by reflecting on the question, "*What do you experience in your communities?*". Watt (2007) noted that critical consciousness will seek opportunities to develop awareness and skills that

facilitate effectively addressing issues of social injustice, such as engaging in difficult dialogues that may cause discomfort which is the act of critical thinking when applied to the societal realm.

The lesson plan of Shaheem was based on hunger and the environment. Shaheem made the aspect of hunger very relevant to what some of the learners might experience and which might be rife in the community. Shaheem's lesson plan asked learners to "*identify the needs of hunger in the community*" and based on the findings from the individual activity, learners would engage in "*planning the vegetable gardens per group*". Shaheem's critical consciousness creation is in essence optimal consciousness, characterised by the integration of the intellectual, emotional, moral and spiritual aspects of a human being (Mustakova-Possardt, 2004). The learners can engage in critical consciousness-raising by questioning assumptions and perspectives, engaging in rational dialogue, revising habits of mind, and planning for different actions based on the transformative experience. Dialogue is thus of critical importance to conscientisation because it allows persons to reinterpret their experiences of themselves, others and their worlds and create new possibilities and opportunities for relationships and interconnections between external and internal worlds (Saari, 2002).

The implication for critical consciousness as a principle of transformative pedagogy is that a lesson plan should include actions that will allow learners to critically examine beliefs, values, and knowledge to develop new epistemologies that centre around multiple ways of knowing (Lopez & Olan, 2018). The use of pedagogy that encourages learners to critically analyse, engage and act, could assist learners to become more aware of the connection between schooling and their society (Taylor, 2019). Furthermore, including critical consciousness as a principle of transformative pedagogy for Natural Sciences pre-service teachers means developing insight into relevant societal issues, and acquiring insight into the intervention strategies that can catalyse change. In planning the lessons, the pre-service teachers should include real-world problems that could be meaningful to them, as well as to make meaning of societal issues that impact their lives (Kaspar, 2018).

Theme 2: Open dialogue for active engagement

According to Olson et al. (2014), open dialogue fosters the co-existence of multiple, separate, and equally valid voices, or points of view. The idea is a reciprocal and sustained dialogue between the learners and the teacher and amongst the learners themselves. This also leads to sustained exchanges where discussions are prompted by previous conversations, and new connections are made about topical issues (Robinson, America & Edwards, 2020). The study also aimed to investigate how open dialogue portrayed in lesson plans of Natural Sciences pre-service teachers is rooted in reality and becomes meaningful and constructive.

Angel posed questions such as "*What comes to mind when you look at the chess board?*" and "*What are your views with regard to each piece's characteristics?*" These questions immediate so that learners could express their individualised thinking in the form of a classroom

discussion (Watts, 2021). In relation to the aspect of how learners perceive racism, open dialogue should take place to allow learners to share their personal understanding and experience of the issue, thus helping learners to adjust to transformative learning.

Dineo indicated in her plan that open dialogue should take place that allows learners to share their *“personal understanding and experiences of the substance abuse in the community and the effects thereof on the human being”*. Dineo planned that the learners would engage in meaningful argument through a debate where all could raise their opinions. According to Edwards (2020), science teaching should shift from cognitive authority to epistemic agency. As such, teachers should make lessons meaningful so that learners can see the value of Natural Sciences in their daily lives and not only textbook driven answers. The latter aspect is supported by Johnson and Golombek (2020) that the lesson plan should enable learners to enter a zone of critical engagement that is underpinned by values of trust, openness and responsibility. As such, open dialogue is fostered which is interpersonal, intrapersonal and discursive in nature.

In the lesson plan of Shaheem, opportunities were created for learners to explore a *“possible strategy to circumvent the hunger identified and plan of action should be taken such as the vegetable garden action plan”*. The learners would discuss in their groups the following questions: *“Why do you think that food is served at school?”*; *“Are you aware of people that are not having food in your communities?”*; *“What causes hunger in communities?”*; *“How can learners assist in combating hunger?”*; *“What are your views about creating a vegetable garden?”*. Coulson et al. (2018) stated that collaborative practices should include participative engagement amongst learners in class, the greater school community and the local community. Arguably, such participative engagement activities are key in empowering individuals irrespective of their status of power, level of education or influence.

To be in a transformative open dialogue with people requires presence. Formenti and West (2018) indicated that educational topics that are engaging and challenging may enhance open dialogue in classrooms. The implication therefore is that lesson plans of Natural Sciences pre-service teachers should consist of educational practices that empower learners to affirm each other's views and inputs in a learning environment free from intimidation and judgement (Formenti & West, 2018).

Theme 3: Cultivating autonomy

In relation to autonomy, Palfreyman and Benson (2019) argued that the role of the teacher is to scaffold attempts carefully and responsively by the learners to take control of their learning decisions and performance. According to Little (1991), autonomy refers to a capacity for detachment, critical reflection, decision-making, and independent action. The Natural Sciences pre-service teachers' lesson plans integrated the principle of autonomy as a transformative principle in the following ways.

First, student Angel created an opportunity for learners to *“explore a possible strategy to circumvent racism and a plan of action”*. Learner autonomy would be displayed by learners understanding the demands of the learning tasks, and set a series of competences, skills,

and habits towards the specific goal (Morales, 2020). Angel's lesson expected learners to *"participate in the design of posters as well as the organisation of awareness campaigns against racism"*. This lesson planning allowed students to think about racism on their own, as well as work together as a group to make sense of societal issues that affect the lives of others (Kaspar, 2018). Learners who participate in this type of critical engagement develop values such as trust, respect, openness and responsibility (Johnson & Golombek, 2020).

Second, Dineo's planned lesson included science facts as well as lived experiences from the learners. The planned lesson regarding substance abuse and the human nervous system envisaged encouraging the learners to identify the problem themselves by perusing the documents in the groups, sharing their ideas and deciding on a suggestion for a possible topic and issue. This allows for higher order thinking and scaffolding of the information. The organisation of the practice of teaching and learning has an essential influence on the development of autonomy among learners (Almusharraf, 2020). The students were thus allowed to reflect critically on their existing assumptions pertaining to the issue as the groups were expected to *"discuss what they experience in towns with regard to substance abuse"*. Thereafter, learners had to *"develop a poster individually of the influence of drugs on the nervous system"* as well as *"the effects of social well-being"*. Little et al. (2017) argued that pedagogical approaches designed to cultivate learner autonomy succeed not only in a subject knowledge gain but also in responding to the need of psychological and social need of human beings, as was the case in this lesson plan.

Shaheem wished to engage in the aspect of hunger in communities. Predominantly within an autonomous learning setting, teacher roles include being the facilitator. In the beginning, Shaheem's lesson stated that there would be a discussion with the learners regarding some of the plans, goals and standards for that section, inviting learners' responses on what they see are the possible challenges and difficulties expected from the learners' perspective. As indicated in Shaheem's lesson plan, he became the psychosocial provider, technical worker, motivator, and guide to assist the learners in overcoming their difficulties (Palfreyman & Benson, 2019). Shaheem invited local farmers to address learners on how to sustain gardens. Thereafter the learners were supposed to *"prepare their own action plan and how to go about with a vegetable garden"*. The learners would also be *"expected as a group to assist at the vegetable garden at the school until their crop is ready to harvest"*.

Shaheem indicated in his lesson that this activity would stretch over a period of time and learners would be expected to give feedback on the development of the activity. Pichugova et al. (2016) stated that autonomous learners should set their objectives, plan their learning, explore available opportunities and resources, interact with others and transfer what they have learned to the wider context. Thus, the creation of the action plan for the vegetable garden and the encouragement of class participation through the discussion to be held, as well as the interaction with the farmers, can help in fostering learners' autonomy.

Autonomy signifies the experience of will and psychological freedom, therefore, learners feel they are autonomous learners when they do interesting tasks and do not feel school activities are a chain of obligations (Núñez, Fernández, León & Grijalvo, 2015).

Concerning the implication for Natural Sciences pre-service teachers' lesson plans, these should include interesting and up-to-date activities with an adequate level of difficulty, identify and develop students' interests and preferences, use open dialogue and interact tolerantly with learners (Núñez et al., 2015). Learners should thus be encouraged to express their ideas and opinions, and possibilities should be created to take decisions on how to learn in class.

Concluding remarks

In this study, we were interested to uncover whether the pre-service teachers were able to embrace transformative pedagogy in their lesson plan designs. The use of a document analysis method, as a data collection technique, enabled us to examine how the pre-service teachers responded to the principles of transformative pedagogy within lesson plan components such as teaching materials, lesson objectives, teaching methods and learning procedures. The *Minimum Requirements for Teacher Education Qualifications* policy (DHET, 2015) which governs processes and practices related to teacher education calls on initial teacher education qualifications to expose pre-service teachers to a socially just and transformative educational experience. The expectation is, therefore, that pre-service teachers at the selected South African university should be able to embrace transformative pedagogy in their teaching practice, which is a form of pedagogy that combines aspects of social constructivism and critical theory (Mezirow, 1997). The analysed lesson plans of the Natural Sciences pre-service teachers made sufficient reference to aspects of critical consciousness, open pedagogy for active engagement and the cultivation of autonomy amongst learners in a Natural Sciences classroom context.

The paper supports earlier findings by Hernández (2007) who declares that lesson planning assists teachers, especially novice ones such as pre-service teachers, to organise content, learning objectives, teaching materials and assessment tasks for a real-life teaching experience. Lesson preparation is thus considered as a key teacher quality that ultimately forms part of the teacher development process. In addition to the structuring of lesson plans, this study also provides evidence on how the Natural Sciences pre-service teachers were able to plan their teaching materials, lesson objectives, teaching methods and learning procedures in a way that (a) sparked learners' critical consciousness of societal issues; (b) enabled learners to partake in open pedagogy for active engagement; and (c) cultivated learner autonomy in the Natural Sciences classroom. We are of the view that the Natural Sciences pre-service teachers made a strategic effort to engage in a lesson planning episode that catered for didactical conditions that were transformative in nature. Freire (2005) posited that transformative pedagogy is informed by practices of self-reflection, self-inquiry and self-learning, which are reflected in the lesson plans structured by the Natural Sciences pre-service teachers.

We were also confident that the lesson plans were structured in a manner that provoked learner interest in topics such as "substance abuse and the impact thereof on the human nervous system"; "food shortages and the effects thereof on the sustainability of communities"; and "the intricacies of genetic inheritance and discrimination". The nature of the lesson objectives further promoted an educational experience that gave expression

to open dialogue. The introduction of the planned teaching strategies followed in the lesson plans provided evidence of educational activities that enabled learners to engage in rich discourse that required the facilitative guidance and coordination of the Natural Sciences pre-service teachers. This exercise, whereby learners work and learn together as a collective, was beneficial in responding to societal ills that affect the lives of others. Activities such as “drawing on the learners’ understanding of seed germination to develop a vegetable garden on the school premises to circumvent food shortages” and “creating an awareness campaign on the negative effects of substance abuse on human physiology” not only empowered learners to participate in active engagement with their peers but further enabled them to develop a level of learner autonomy.

This approach challenged learners to critically reflect on their existing beliefs and values of issues that affect social justice in society. The latter enabled learners to undergo a transitional change in their lifestyle and personal behaviour. An important avenue for further research would be to conduct an empirical study that investigates how pre-service teachers present lessons that integrate the principles of transformative pedagogy in other science subjects, such as life science and physical science.

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