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Voices from the Field: Pre-Service Teachers' First Time Experiences of Teaching Physical Sciences during School-Based Experience

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Abstract. School-Based Experience, commonly known as teaching practice, is widely acknowledged as an essential component of teacher education in institutions around the world. This study explored second-year pre-service teachers' first-time experiences of teaching physical sciences during teaching practice. We contextualised the study within Dewey's Theory of Experience to understand pre-service teachers' experiences at a place of practice. The study utilised a qualitative phenomenological research design with 10 purposively and conveniently sampled pre-service teachers randomly chosen from a higher education institution in the Eastern Cape Province of South Africa. Data from interviews, observations, journal reflections and document analysis were triangulated and analysed using thematic content analysis. The study found benefits and drawbacks that pre-service science teachers experienced during their first time on teaching practice, which provided important clues to understanding differences in what pre-service teachers appear to learn during teaching practices. The study has implications for faculties of universities that are engaged in teacher training to help pre-service teachers balance experiences of doing and undergoing as they progress through a teacher education programme. The study therefore recommends that universities establish partnerships with the Department of Basic Education to train all in-service teachers on specific expectations of pre-service teachers at schools during teaching practice.

Keywords: mentor; physical sciences; school-based experience; pre-service teacher

1. Introduction

The post-1994 social and educational context, particularly the transition to Outcomes-Based Education, requires a complete overhaul of South Africa's teacher training programmes' curricula. In 2011, the post-apartheid South

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African Department of Higher Education and Training (DHET) established the basic standards for teacher education degrees with the intention of "regulating teacher education qualification programmes" (DHET, 2011, p.5). This curriculum provided new teachers with the opportunity to acquire practical knowledge that expanded their professional boundaries through the dynamic application of their theoretical knowledge, with the consequence that what was learned and taught was both suitable and rigorous. Although the purpose of teacher education is to produce effective teachers who meet the challenge of education for social change, the question of how to best prepare pre-service teachers (PSTs) to be "good enough teachers" (Reid, 2019, p.717) and effective classroom practitioners has been discussed by teacher educators around the world for many years. Because outstanding PST education is the foundation of quality education in the country, special attention should be paid to the preparation of PSTs. With continuous guidance and monitoring from teacher educators, these PSTs will learn how to manage not only their daily lessons, but also their learners and classrooms.

In contrast, a substantial body of research has indicated that most teacher education programmes have failed to adequately prepare PSTs for the realities of the classroom (Stuart & Thurlow, 2000). Novice teachers reported having difficulties dealing with issues such as classroom discipline, non-attendance, assessing students' work, dealing with individual differences and interactions with parents (Du Plessis & Mestry, 2019; Vaughn et al., 1997). These challenges often discourage teachers from taking teaching as a profession. Therefore, these issues must be addressed since they may have an impact on PSTs' performance during School-Based Experience (SBE) as well as their perceptions of the teaching profession.

Physical science in South African schools comprises both Physics and Chemistry for grades 10, 11 and 12. The programme covers six strands or units. The units include Matter and Materials, Chemical Systems, Chemical Change, Mechanics, Waves, Sound and Light, and Electricity and Magnetism. However, since independence, Reddy et al. (2022) have raised concerns about the low achievement of South African learners in mathematics and physical sciences. Among the many hypotheses offered is insufficient training for PSTs to implement the current physical sciences curriculum. According to the Curriculum and Assessment Policy Statement (CAPS) for the Further Education and Training (FET) phase (Department of Basic Education [DBE], 2011), physical sciences aims to

> *"promote knowledge and skills in scientific inquiry and problem-solving, the construction and application of scientific and technological knowledge and an understanding of the nature of science and its relations to technology, society and the environment and further prepare learners for the future learning" (p.8).*

If this is to be accomplished among South African learners, then those responsible for teaching physical sciences at the FET phase must possess comprehensive pedagogical content knowledge that informs their teaching proficiencies to improve the performance of learners in the subject. Hence,

teacher educators need to prepare PSTs to enable them to acquire skills in both content knowledge and pedagogical knowledge sufficiently enough to implement the curriculum effectively.

Internationally, there is widespread agreement that SBE is fundamental to the preparation of teachers, as "a good teacher education programme must seek to assist individual teachers in growing and developing as people, providing them with the necessary skills and professional abilities to help them become effective teachers" (Fafunwa, 2001, p. 81). Thus, the concept of SBE is rooted in an effort to cultivate competent and professional educators. This gives PSTs a chance to practice and develop their own theories and approaches to education in a real-world setting. This study aimed to explore PSTs' first-time experiences in teaching physical sciences during SBE.

1.1 The context: Physical sciences teacher education in South Africa

The background of the study considers the four year B. Ed (Senior Phase [SP] and Further Education and Training phase [FET]) Natural Science degree programme at the university where this study was carried out, which begins the early years of the teacher education programme with theoretical courses (with higher credits in both mathematics and physical sciences). During the second semester, first-year PSTs also complete a two-week mandatory school-based observation for their three major subjects. In the second year of study, PSTs are introduced to 12-credit pedagogical modules for each of their three majors and a 16-credit content module for physical sciences. A mandatory micro-teaching activity on campus and student presentation form part of the programme as well as three weeks of SBE in the second semester. In the third year of the programme, PSTs register for a 32-credit physical sciences content course, a 12-credit physical sciences FET Teaching II module and a five-week SBE in the second semester. In the fourth year of study, PSTs register for course work, including physical sciences FET Teaching III of 16 credits. In addition, they undergo a mandatory 10 weeks of SBE. Throughout their training, PSTs also register for mandatory education courses as part of their training programmes. It is anticipated that PSTs would have acquired the appropriate skills and pedagogical content knowledge of the subjects they would teach in high schools at the end of their training.

Accordingly, higher education institutions in South Africa that offer teacher education programmes are obligated by education policies to ensure that PSTs are placed in schools where they may interact with the reality of classroom teaching and the broader educational community (DHET, 2011). The skills that the PSTs acquire during their training are often put to the test during SBE.

While a substantial amount of research on PSTs' teaching experiences appears to have been influenced by the desire of teacher educators to prepare PSTs (Orland-Barak & Wang, 2021), relatively little attention has been paid to how the various players interpret their roles and perceive their impacts on one another. There has also been considerable research on how the triad interacts to shape the PSTs' experiences (Mpate et al., 2021), as well as the mentoring of PSTs in the

field (Smit & Du Toit, 2021) and the influence in-service teachers have on PSTs (Chaliès et al., 2012). However, few studies reflect on PSTs' first time experiences of teaching during SBE (Moosa & Rembach, 2020). The one study that highlighted the PSTs first year of SBE reflected on their encounters with their mentors (Moosa & Rembach, 2020) and did not specifically mention the voices of physical science PSTs from the field in implementing the CAPS curriculum and their experiences with the triad. Hence, this study aimed to fill the gap in the literature by exploring the first-time experiences of physical sciences PSTs during SBE. In doing so, the study contributes to knowledge on how best teacher training programmes and teacher training educators could equip PSTs with skills to implement the curriculum effectively and to meet the goals and objectives of the physical sciences CAPS curriculum.

The following research questions guided the study:
1. What are the pre-service teachers' experiences of teaching physical sciences during the school-based experience?
2. What is the connection between pre-service teachers training and the teaching of physical sciences during the school-based experience?

2. Literature Review

2.1 The practice of teaching within teacher education

According to Marais and Meier (2004), "the term teaching practice represents the range of experiences to which PSTs are exposed when they work in classrooms and schools" (p.221). It is also referred to as school-based experience (SBE) in this context. SBE is the culminating experience in a teacher education programme and is identified in the literature as a context-based activity that exposes PSTs to the actual practice of teaching. Darling-Hammond and Bransford (2007) reiterate that SBE is a common phenomenon world-wide and one where PSTs are exposed to professional development opportunities for the enhancement of content and pedagogical knowledge and skills. Nkambule (2017) concurs with the above assertion and argues that SBE is essential to the training of PSTs in order to help them grow as individuals while equipping them with the required skills and professional competencies to become effective teachers. In addition, PSTs will have the "opportunity to grow their self-confidence in a safe setting while enhancing their skills and awareness of the intricacies of teaching and learning" (Moody, 2009, p. 169).

During SBE, PSTs observe experienced teachers, interact with peers and learners, and use diverse approaches, strategies and skills with the goal of fostering meaningful learning (Kiggundu & Nayimuli, 2009). This experience has a profound impact on the PSTs, who must navigate the responsibilities of teaching, and all that it includes while creating and cultivating connections with one or more in-service teachers in the field of practice. As PSTs begin their SBE, they experience a mixture of anticipation, distress, excitement and uneasiness, and thus need emotional support (Murray-Harvey et al., 2000; Perry, 2004). Therefore, SBE provides PSTs with the opportunity to express their personal educational philosophies, theories and understandings.

In practice, SBE also introduces PSTs to school personnel that include the school management team, teachers, non-teaching staff, learners and parents. These personnel help PSTs apply classroom knowledge to the community and life outside the school. PSTs are offered multiple opportunities to create their own conception of practice by learning from their mentors. The multiple opportunities afforded to PSTs boost their learning (Gardner, 1999) as these experiences enable them to bridge theory and practice (Darling-Hammond, 2014), enhancing their self-confidence.

Although numerous studies have shown the benefits of SBE (Gómez et al., 2019; Marais & Meier, 2004), however, other studies have provided evidence that several PSTs face challenges in their host schools, such as underestimating the conceptual complexity of teaching (Brondyk et al., 2013), especially physical sciences, the teaching of subjects unrelated to their major areas and coping with learners of varying abilities (Annan-Brew & Arhin, 2022). As a result, institutions of higher learning are attempting to enhance SBE. These measures have included boosting funding for PSTs during SBE (provision of stipend), provision of stationery and improving collaborations with schools through Work Integrated Learning (WIL) programmes. Despite these efforts, there are still issues regarding PSTs' preparedness for SBE, the knowledge gained during SBEs, and PSTs' views about the profession in general.

A study was conducted by Heeralal and Bayaga (2011) conducted a study on physical science PSTs' experiences during SBE to determine how to equip them effectively to cope during SBE. The study found that SBE added a substantial amount of experience to their studies that they were able to apply in their future professions. However, the study further indicated that few mentors provided guidance and monitored their progress during the entire SBE process. In agreement, Kiggundu and Nayimuli's (2009) study on PSTs' perceptions of the teaching profession experiences on SBE found that the majority of PSTs found SBE exciting and that they enjoyed teaching. However, the study also found that there were no clear policies governing SBE to direct PSTs in their host schools.

2.2 Experiences of pre-service teachers with the triad and the subject

PSTs partake in SBE in various educational settings, interacting with other PSTs, mentors and their university lecturers of varying personalities and dispositions. Often referred to as the triad, it is crucial that all three parties regard the collaboration as mutually beneficial, multidimensional, and growing as the experience progresses (Rust & Clift, 2015).

The mentor collaborates daily with the PST. During these encounters, it is the mentor's responsibility to ensure that the PST is supported and given the opportunity to learn and experiment (Linton & Gordon, 2015). According to Schaap and De Bruijn (2018), giving PSTs social support helps them develop a positive self-image. However, Izadinia (2017) believes that the mere existence of a mentor is insufficient therefore Hudson (2010) proposes that mentors display professionalism and personal qualities that would assist in the growth of PSTs into competent, capable teachers. Poznanski et al. (2018) add that mentors are

required to give instructional support and provide feedback to help PSTs to model acceptable teaching behaviours. Mentors' enthusiastic participation in guiding PSTs through the processes of creating and delivering lessons has a significant impact on the quality of those lessons and on the learners they ultimately teach.

When PSTs embark on SBE, their university lecturers are required to follow them to assess their progress. The goal is to identify good practices and weaknesses that need to be addressed and provide an overall assessment of their progress to contribute to their professional development (Tillema, 2009). According to Barahona (2019), university lecturers who supervise PSTs should engage in both formative and summative assessments to facilitate their professional development. However, evidence from the literature has shown that the assessment method tends to be summative rather than formative (Dann, 2018). Thus, decreasing the effectiveness of SBE process.

The reflections of PSTs on physical science teaching in their teaching practice point to the learning that occurs during these experiences. According to Sadler (2006), PSTs' experiences in the science classroom emphasise self-reflection as they engage in seminars to exchange ideas on physical sciences, offer encouragement and understanding to one another, and reflect on their own teaching practices. On the other hand, Black's (2004) study on science PSTs' experiences found that there are real challenges for future science teachers making the transition from theory to practice and that PSTs experienced a shortage of resources for the science classroom, time to complete activities within the changing nature of the classroom, and class management concerns.

3. Theoretical Framework

This study was grounded in John Dewey's (1963) Theory of Experience as the theoretical lens to study PSTs' experiences during SBE. Dewey's (1963) Theory of Experience emphasises the process through which human beings learn and grow. Dewey (1963) believed in the continuity of experience and the connection between student learning experiences and students' future decisions and behaviours. Dewey (1963) acknowledges that "everything depends upon the quality of the experience which is had" (p. 27), in this case, the experiences of students in the classroom and in the school. He assessed its quality based on two principles. According to the *interaction* principle, individuals construct meaning from an event by interacting with its physical and social contexts. The principle of *continuity* states that the effect of experience is cumulative, with each experience shaped by prior experiences and, in turn, shaping future experiences. Thus, each experience changes the person undergoing it in ways that influence what may be learned from subsequent experiences (Schmidt, 2010). Dewey suggests that real-world learning experiences provide PSTs with opportunities to enhance their learning in ways not accessible when confined to classroom environments implying that educational experiences provide opportunities to implement new knowledge and validate one's ideas against the experiences of others. This theory was a good fit for this study because, as PSTs engage with

their learners, mentors and other adults in the school, they are continually exposed to new information through these interrelationships.

4. Method

4.1 Research design

The interpretive nature of this study was grounded in the field of qualitative research as defined by Creswell (2009). In this study, we conducted qualitative phenomenological research to hear directly from PSTs while recounting their lived experiences of their first SBE and to understand the interrelation between their classroom practices and their reflection of their practices (Bugg & Dewey, 1934). Our intention was to learn first-hand about their experiences during their first SBE and to gain an in-depth understanding of their experiences as they provided a narrative account of their time at the host schools.

4.2 Participants

This study employed purposive and convenient sampling to select participants from one university in the Eastern Cape Province. These participants were purposively selected because they were considered suitable to reveal the information that was required by this study. The respondents included PSTs in their second year of study towards the degree of Bachelor of Education, majoring in physical sciences and mathematics. Of this number, ten (five males and five females) were randomly selected from one tutorial class using simple random sampling. The selected PSTs were placed in rural township schools in Mthatha district. The university introduced the curriculum offered by these students in the year 2021. This was their first-time SBE as PSTs, where they are required to teach. One of the researchers was the lecturer who taught the module on Physical Sciences Teaching (FET) 1. The content for the first semester was completed before the commencement of SBE. All PSTs taught the same units (chemical change in grade 10 and electricity and magnetism in grade 11) as prescribed for FET for Term 3 of the curriculum according to ATP (Annual Teaching Plan) for 2022.

4.3 Data collection procedures

We were granted permission to conduct the study from the appropriate authorities. Consent was sought and obtained from participants and all participants were informed that the information they provided would be treated confidentially and that their identities would not be disclosed. In order to safeguard their identities, pseudonyms were used. In addition, participants were informed of their right to withdraw from the study at any time if they so desired. Data were collected from the second week of SBE and at the end of the three weeks of SBE through interviews, observations, journal reflections and document analysis. The interview questions were used to gather data about their experiences in terms of interactions (with mentors, staff, learners and supervisors), classroom practices, the subject (topics they taught) and their training. A classroom observation schedule was used to gather information about PSTs' teaching practices (teaching skills, class management and content knowledge of the subject). The document analysis was used to gather information on their lesson plans and module content covered in the semester.

All instruments were piloted and also given to an expert to read. There was only one interview session for each PST, which was conducted at the end of SBE. Non-participant observation was employed throughout data collection. PSTs wrote their journal reflections of SBE, which they submitted with their portfolios at the end of the third week of SBE.

4.4 Data analysis

We transcribed all data. Then, we immersed ourselves in the data by reading and rereading the transcripts to understand PSTs' individual experiences while preserving the individuality of each participant's lived experience. When we were convinced that the texts had become understandable, we identified, characterised and extracted the main themes, employing thematic content analysis (Braun & Clarke, 2006), paying particular attention to themes that began to develop and interact with one another. For example, we discovered that the responses of PSTs focused primarily on how their programmes facilitated or impeded their progress during SBE. Hence, we categorised such experiences as positive and negative experiences. To ensure the credibility of our findings, we used multiple data sources (interviews, classroom observations, journal reflection entries and document analysis) for triangulation. Finally, we returned all transcripts to PSTs for member checking (Lincoln & Guba, 1986). We presented the data in accordance with the themes and sub-themes that emerged.

5. Results

5.1 Demographic data

Participants provided biographical information regarding age and gender, as we had earlier recorded their year of study and the phase and the qualification they were working towards. According to the descriptive statistical analysis of the demographic data in Table 1, most of the participants (90%) were aged below 30 years. The gender balance was, as expected, even with 50% being female participants and 50% being male participants. Pseudonyms were used for each participant.

Table 1: Demographic information of participants

Gender	Female	5
	Male	5
Age	19 - 24	8
	25 - 29	1
	30 - older	1
Pseudonyms of participants: Asanda, Aviwe, Khaya, Mdu, Nana, Nandipha, Sinazo, Siya, Thabo, Yanga.		10

5.2 Positive and negative experiences of pre-service teachers

Table 2: Generated themes and sub-themes

Research question	Generated themes	Generated sub-themes
What are the pre-service teachers' experiences of teaching physical sciences during school-based experience?	Theme 1: positive experiences	• Preparedness of PSTs for the profession. • Effectiveness of teaching practice to enhance teaching skills. • Support from other stakeholders. • Feedback.
	Theme 2: negative experiences	• Learners' lack of interest in learning physical sciences. • Inadequate university-school partnerships. • Language proficiency fears in physical sciences classroom. • Classroom level and school level constraints.
What is the connection between their teacher training and the teaching of physical sciences during the school-based experience?	Theme 3: teacher training and teaching of physical sciences	• Bridging theory and practice. • How PSTs taught physical sciences

5.2.1 Theme 1: Positive experiences

5.2.1.1 Preparedness of pre-service teachers for the profession

Most participants in this study were looking forward to entering the teaching profession and remaining in the profession after graduation and indicated their level of preparedness for the profession. It was a valuable experience for them because they could put all they had learnt about their methodological courses into practice. One PST shared this sentiment:

> *"My first year of teaching practice was great and a lot of experience was gained from the weeks spent teaching. We spent the first semester preparing for the teaching practice and had the opportunity to do microteaching, where we taught our own classmates and prepared countless lesson plans. Although initially, we had a challenge of lesson plans, however, over time, we became familiar with the techniques of lesson plans, but now I think I am prepared for the teaching profession"* (Asanda, interview excerpt).

Participants were of the view that the module Physical Sciences Teaching 1 prepared them for SBE, especially on the methods of teaching to accommodate all learners in the science classroom. They were also convinced that the module

had equipped them to adequately meet the challenges they would face in schools. Most of these respondents were motivated and determined to succeed as science teachers. One PST gave a narrative account:

> *"Well, the module played an important role in shaping and equipping me with important skills even on how to deliver the lesson to the class in a well meaningful and successful way. I know which method to use to suit the learners' learning styles in each particular lesson."* (Siya, reflective journal entry)

5.2.1.2 Effectiveness of SBE to enhance teaching skills

This theme relates to the effectiveness of SBE in enhancing teaching skills of PSTs. The participants believed that SBE was a crucial component of their training towards becoming science teachers, especially as this was their first time teaching in a real life environment. PSTs acknowledged that SBE taught them some pedagogical skills they did not learn at university. One of the participants narrated:

> *"At the beginning of my teaching practice, I noticed that some of the lesson objectives were not met because I was not quite familiar with the skills of teaching in real authentic classrooms. I normally set so many lesson objectives only to find that I am able to fulfil just a few. However, as time went by, I mastered the skills and was able to set achievable lesson objectives of which I was able to fulfil before the end of the lesson."* (Nana, reflective journal entry).

PSTs revealed that SBE had exposed them to the realities of the classroom. Although they had experienced teaching during micro-teaching, they were relieved to gain insight into effective teaching techniques and approaches, as well as how to execute them during the teaching-learning process, in order to meet the needs of their learners. Their teaching experience prepared them to teach learners with varied learning styles. Nandipha narrated:

> *"To be honest, I was so afraid and wondering if I could be able to conduct my lesson. But then as time went by, I gained confidence in teaching and teaching skills and made my lessons much more interesting. I have also mastered the skills of introducing a lesson, and what is expected when I go to class, how to manage a classroom and how to present a lesson in front of the learners"* (interview excerpt).

5.2.1.3 Support from other stakeholders

PSTs were of the view that they received support from the school management team (SMT), their mentors, and their university lecturers during SBE. Interviews and reflective journals revealed that PSTs were introduced to their mentor teachers and the classes they were expected to teach by the school's management. This increased their confidence in their ability to teach. One pre-service teacher commented:

> "*On my first day at this school, I was welcomed by the SMT as I was the first PST to practice teaching at the school. I was introduced to my mentor, who further introduced me to the learners. I was given a teacher's desk next to my mentor. My mentor handed to me textbooks*

> *and all resources I will need during my practice."* (Thabo, interview excerpt)

The participants believed that they had received support in lesson plan preparations, classroom management strategies, monitoring of classroom teaching and provision of teaching and learning resources from their mentors and other staff in their schools. One PST had this to say:

> *"Well, to me, I will say my mentor supported me with lesson plan preparations and shared her experiences in physical sciences teaching and how to overcome challenges in the classroom, and that increased my confidence. I also had several meetings with her to discuss topics to teach and how to design resources to be used in the classroom."* (Sinazo, interview excerpt)

5.2.1.4 Constructive feedback

Participants were of the view that they received constructive feedback from their module lecturers and their mentors during SBE. During the interviews, it emerged that some PSTs were visited once a week for three weeks by their mentors. Mdu remarked:

> *"I was assessed by my mentor three times during teaching practice. My university lecturer also assessed me. However, she told me that, since it was our first time of SBE, the university will not assess for grading purposes. We had a discussion after the classroom observation. The feedback I received from both my mentor and university lecturer enabled me to develop skills in planning and classroom management, and that has helped me to gain classroom confidence."* (Journal reflection entry)

The participants seemed pleased with the comments they received from their mentors, as evidenced by Yanga's comment:

> *"Hahaha! First comment was writing on the chalkboard. The feedbacks I received from my mentor really helped me a lot especially on matters to do with: writing properly on the chalkboard; setting of formal assessment questions to use during my lessons; how to set clear and achievable lesson objectives; how to prepare suitable teaching resources for my lessons; and provided guidance on how to overcome challenges."* (Interview excerpt).

This indicates that PSTs learned from mentors and university lecturers throughout practicum.

5.2.2. Theme 2: Negative Experiences

5.2.2.1 Learner's lack of interest in learning physical sciences

The majority of the respondents were concerned about their learners' lack of motivation to learn physical sciences. They observed that there was element of anxiety among some learners when it came to physical sciences. Some of the learners complained about the subject being difficult to understand despite the effort put in by their teachers. Khanya lamented:

> *"This school is an underperforming school. I have observed that majority of the learners doing physical sciences are not doing so well. Most of*

> *times, learners return to school without completing their homework. I can attest that they have no interest to learn physical sciences."* (Interview excerpt)

PSTs were of the view that their institution writes letters to schools to request placement for SBEs. The letters further request schools to mentor and assess them during SBEs. The university gives PSTs logbooks and other stationery. The university further visits and assesses them. The interviews revealed that the respondents were observed by their lecturers and mentors. However, some respondents complained that they did not hold any meetings with mentors to discuss their progress afterwards. Aviwe lamented:

> *"I was assessed by both my university lecturer and my mentor. However, I did not have any discussion with my mentor afterwards. Each time she visits my class, she will write some comments in the logbook and just leave."* (Interview excerpt)

It also emerged from the interview that some mentors did not mentor PSTs assigned to them. They rather allocated classrooms and work, and did not visit them in their classrooms. Some PSTs also complained that their mentors did not trust them enough to allow them to teach the grade they were allocated. Nandipha shared her frustration:

> *My mentor never trusted me to handle a class. He gave me two lessons per week, and he goes back to the classroom and teaches the same topic I taught in the previous day. I guess, he never thought I could do anything with the learners."* (Interview excerpt)

5.2.2.3 Language proficiency fears in the physical sciences classroom

Data from document analysis from the CAPS document showed that physical sciences are taught in English. Yet, PSTs observed that most teachers in their practising schools code-switch in their classrooms. This practice also forced them to code-switch, thus spending more time on one topic. This practice also led to learner misconceptions and misinterpretation of key concepts in physical sciences. Nana shared this sentiment:

> "*Eish, I have observed that my learners have this fear of the English language. Even when I try to speak English, my learners will say I must teach in IsiXhosa for them to understand better. I also observed that most of my learners like it very much when I explain physical sciences concepts in IsiXhosa."* (Interview excerpt)

Language limitations prevented most PSTs from implementing the physical sciences curriculum effectively.

5.2.2.4 Classroom level and school level constraints

It emerged from classroom observation and during the interviews that PSTs experienced constraints in the classroom and in the school. PSTs experienced large class sizes, which impeded the effectiveness of physical science instruction. In addition, PSTs complained about limited time allocated to them which was insufficient for them to provide personalised instruction to learners with special needs. Yanga narrated:

> *"Eish, I had 78 learners in my physical sciences classroom. Most of the time, it was difficult to reach out to everyone. Even when I decided to put learners into groups to conduct an activity, I was unable to reach out to every group due to the big numbers."* (Interview and classroom observation excerpt)

Fear gripped PSTs when they were required to deliver lessons on the first week of SBE. One PST had this to say:

> *"On my very first day in class, I experienced nervousness when I saw the large number of learners. I could not speak loudly. I was even sweating on winter morning, and I made a lot of mistakes with words and actions. I guess my learners would have noticed."* (Aviwe, Interview excerpt)

It also emerged that PSTs had difficulties managing their classrooms as a result of the high numbers of learners. This led to misbehaviour and learners who did not take their PSTs seriously.

Most participants also indicated a lack of instructional materials in their practising schools. The lack of resources made it difficult for them to teach successfully. However, PSTs were not able to improvise because of a lack of training. The PSTs also complained about how some of the schools conducted themselves. They mentioned chaos in the schools due to learner misbehaviour, late coming to school, dirty classrooms and a lack of discipline, among other things.

5.2.3 Theme 3: Bridging theory and practice: Contributing factors

PSTs disclosed that the university provided them with the theory through content modules. In addition, the university provided methodology for teaching a particular content course. These modules helped them to gain a holistic view of the subject. Hence, they were able to implement the physical sciences curriculum.

> *"I offered Physics 1 and 2, together with Chemistry 1 and 2 in the first and second year. In the second year, I am offering Physical Science Teaching 1 as a methodological module. These modules enhanced my content knowledge of the subject I taught during SBE."* (Asanda, interview excerpt, document analysis)

PSTs believed the content knowledge acquired from the content courses and the pedagogical knowledge they received from the methodological courses prepared them for SBE. The presentation and microteaching activities prepared them for the actual teaching in a context outside of the university.

However, they expressed frustration with the planning of lessons which they regarded as a laborious chore. Their concern was that, while in the field of practice, they were required to compile a portfolio which contained details of all activities conducted during SBE. Having said that, they appreciated the opportunity to practice what they had learnt and put theory into practice.

5.2.4 How PSTs taught physical sciences

Document analysis of lesson plans showed that the majority of the PSTs were familiar with lesson plans and were able to plan their lessons appropriately before teaching, stating clear and measurable objectives. When the researcher observed PSTs in their classrooms while they taught, she noted that PSTs used different instructional strategies to teach electricity and magnetism (grade 11) and chemical change (grade 10). As a result, participants were able to implement the curriculum in their respective science classrooms. However, only a few PSTs struggled to plan their lessons well and teach the content effectively. When these PSTs were interviewed, Siya lamented:

> *"Eish, I find it difficult to complete my lesson each day during teaching practice. It is either my objectives are too many for a one-hour period or too few. I always struggle to break down my lesson objectives in such a way that I could complete the lesson on time. The topic chemical change I taught was not challenging, only few concepts that I struggled to explain to my learners."* (Interview excerpt, document analysis)

6. Discussion

This study explored the first-time SBE of PSTs. The results of the study indicate the benefits and drawbacks that PSTs experienced through a three week period of SBE. The discussions now focus on how the benefits and drawbacks relate to Dewey's Theory of Experience and pertinent literature.

According to Dewey's (1963) Theory of Experience, opportunities for PSTs to reflect on their experiences can assist them in creating continuity and meaning from those experiences and are therefore an essential element of all educative experiences. Dewey also believes that sharing ideas with others in the community is a crucial component of making sense of and learning from experience (Dewey, 2005). In general, the first-time SBE was a new experience for most of the PSTs. The majority of PSTs were enthusiastic about entering and remaining in the teaching profession after graduating and indicated their level of preparedness for the profession. It was a valuable experience for them because they could put all they had learnt about their methodological courses into practice. This supports the finding of Moosa and Rembach (2020) who indicated that PSTs could learn how teachers acquire and apply pedagogical and subject-matter knowledge to create engaging lessons for their learners during SBE and to provide meaningful learning opportunities for the learners during lesson delivery.

SBE is an integral part of teacher preparation as it provides PSTs with experiences in a real teaching and learning setting. The study found that the benefits of teaching physical sciences during the period was the enhancement of pedagogical and methodological competencies that PSTs were not exposed to during their time at the university. This finding is consistent with the findings of Moody (2009), who believes that PSTs required teaching practice in order to be equipped with appropriate teaching skills and abilities, and to allow them to develop their identities in a safe setting while enhancing their skills and awareness of the complexities of teaching and learning. PSTs interacted with and made sense of their teaching experiences to connect prior and present

experiences in meaningful ways to "learn" particular ideas, as Dewey (1963) described it, and to create continuity in their learning.

PSTs felt support from their school management team, mentors and lecturers during SBE. The findings showed that PSTs received warm welcomes from the heads of their host schools who further introduced them to mentor teachers and their classes. Their mentors further provided support to get them acclimatised to the new environment. This finding corroborates with the finding by Schaap and De Bruijn (2018), who assert that providing social support helps PSTs to improve their sense of self.

The constructive feedback PSTs received from the triad during SBE improved their knowledge and confidence in their subjects. Dann (2018) supports this finding and recommends that, to achieve PSTs' professional growth during teaching practice, university lecturers should engage in continuous assessment and feedback provision to PSTs. Dewey (1963) notes that opportunities for PSTs to reflect on their experiences can assist them in creating continuity and meaning and are therefore an essential element of all educative experiences.

On the other hand, PSTs also experienced some drawbacks that slowed their progress during teaching practice. Findings from this study reveal that PSTs were anxious and uncertain on their first week of SBE. Murray-Harvey et al. (2000) reiterate that SBE is the most difficult aspect of teacher training. Therefore, PSTs needed support from mentors and university lecturers to develop their self-identities. The findings further show that some PSTs did not receive feedback from mentors and university lecturers. Consistent with the literature, Dann (2018) indicates that insufficient feedback hindered the potential for skills development during the practice period.

The findings show that PSTs experienced constraints in both classrooms and in the schools. Most of these schools in the district had large class sizes, which impeded the effectiveness of physical science instruction and learning. Mkhasibe and Mncube (2020) agree with this finding that PSTs struggle to control their classrooms. In addition, PSTs complained that there was insufficient time to provide personalised attention to learners with special needs. This impacted on the science lessons as demonstrations and experiments were not possible. Rodman (2010) also opines that learning is affected by context. In the South African context, physical science teaching could be enhanced through effective teaching and provision of resources for hands-on activities.

The university provides PSTs with the theory through content courses. In addition, the university provides methodological courses for teaching a particular content course. The study found that the content of the physical sciences curriculum PSTs received at the university was similar to those at the high school, but at a higher level. This means that the PSTs received higher content knowledge to teach physical sciences at the high school level. As a result, participants were able to implement the curriculum in their respective

science classrooms. They planned their lessons well and delivered the lessons to the class.

7. Conclusions and recommendations

A mandatory component of teacher preparation is an SBE, where PSTs can practice teaching at a host school. A critical review of the literature shows that basic schools need to be adequately equipped to fulfil their new responsibilities of nurturing PSTs to become professionals. In addition, teachers in the field are expected to play a crucial part in teacher education as mentors. The study, therefore, revealed that SBE plays a critical role in developing future professional physical sciences teachers. However, the PSTs expressed dissatisfaction with the lack of support from the school and inadequate university-school partnerships, citing difficulty with class management, mentors' lack of interest in their mentoring, a lack of teaching-learning resources and language proficiency fears, among others. Thus, as evidenced by the results of this study, there is a need for research on the contexts and practices of mentoring PSTs in secondary schools.

Our findings have significant ramifications for the education of physical science teachers, highlighting the need for the university to (1) strengthen teacher education and professional development programmes by incorporating them into work-integrated learning; and (2) establish an effective collaboration with the DBE to enable in-service teachers to guide PSTs effectively during their SBE in schools. This could lead to a collaboration between the DHET and the DBE to provide in-service training to optimise the triad experience. This could be in the form of incentives such as issuing certificates to mentors.

Dewey's (1963) theory has provided some important clues in understanding what PSTs learn in the university and during SBEs. Our recommendation is that teacher educators recognise the roles that may be played by Dewey's principles of *interaction*, *continuity*, and learning within *community* in shaping PSTs' learning and consider ways to help PSTs balance experiences of *doing* and *undergoing* as they progress through a teacher education programme. It is also recommended that universities develop science resource packs for PSTs practising in deep rural schools to assist them in implementing the curriculum effectively.

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