

EXPLORING CURRENT PRE-SERVICE SCIENCE TEACHER PREPARATION APPROACHES IN ZIMBABWE

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Abstract

Approaches used in preparing pre-service science teachers influence their views of teaching and learning. As revealed by some studies, this assertion is premised on the notion that teachers tend to teach the way they were prepared to teach. Rooted in the interpretivist paradigm, this case study sought to find out pre-service science teachers' views on approaches used during their preparation in two teachers' colleges in Zimbabwe. Data were collected through semi-structured interviews with purposively sampled pre-service science teachers and science educators, In addition, focus group discussions with pre-service science teachers, and document analysis were used to gather data. Through coding, emergent themes were interpreted based on the interpretivist paradigm. Findings show that pre-service science teachers viewed approaches used in their preparation to be contextualised to a greater extent, to prepare them for teaching in diverse teaching and learning environments. The study also revealed that even if science educators may be aware of the importance of applying certain approaches like simulations during preparation, limitations like lack of funding and resources may hinder application of such approaches. This suggests that pre-service science teachers should be equipped during preparation, with skills to understand contextual factors which may limit use of certain teaching and learning approaches, in order to make relevant adjustments.

Keywords: Pre-service science teachers' views; Contextualise teaching and learning approaches; Diverse teaching and learning environments

1. Introduction

Science teaching and learning is becoming increasingly complex worldwide, due to continuously changing diverse teaching and learning environments. Diverse teaching and learning environments comprise combinations in different mixes of various factors like class size, learning and teaching aids, new technologies, national goals, global science and technology views, learners from different cultural and socio-economic backgrounds, different abilities of learners, resource management skills, workload, behaviour management, students' confidence, language skills, students' motivation, attention spans and education for sustainable development goals (SDGs) (Musset, 2010; Mwamakula, 2023; and UNESCO, 2017). Therefore, pre-service teacher training institutions should reflect in their programmes, preparation of teachers to teach in a country's diverse teaching and learning environments (Heeralal and Bayaga, 2011). In this context, pre-service science teacher preparation should be aligned to teaching in diverse teaching and learning environments, to increase the probability of producing the desired secondary school science graduates (Örnek, 2015). The current global perspectives influencing implementation of science education include science for all emphasizing social relevance, science and technology (S & T), science, technology, engineering and mathematics (STEM), and science for socio-economic development. Consistent with global views on teaching science, teacher preparation programmes need to equip pre-service science teachers with skills to use constructivist teaching and learning approaches (Cabrerros and Barbacena, 2024; Kalpana, 2014). Teacher education plays a critical role in shaping the quality of education systems globally (Darling-Hammond, 2019).

Findings by Muir, Rayner. and Cleland (2013) show that there are challenges faced in preparing pre-service teachers to deal with diversity in teaching and learning. Approaches used in pre-service science teacher preparation should empower science teacher educators to take into account knowledge and experiences (Faisal and Muhammad, 2023; Liu, Lin, and Pass, 2014), prospective teachers bring to learning. Therefore teaching and learning in pre-service science teacher classes should be aligned to complex issues like culture, language, disability and inclusion. Premised on this, teacher educators should explicitly employ diverse approaches to learning in pre-service teacher classes (Alahmad, Stamenkovska, and Gyori, 2021; Sharma, 2013), because prospective teachers will ultimately become teachers of diverse learners Walker, Brownlee, Whiteford, Exely, and Woods, 2012). Understanding how cognitive, linguistic, social, emotional, and physical development occurs, recognising that learners as individuals bring differing personal and family backgrounds, skills, abilities, perspectives, talents,

interests and other similar aspects, should be part of exist competences of prospective science teachers. Supervision during teaching practice has been identified as inconsistent and often inadequate (Chireshe & Shumba, 2020).

Consensus exist among researchers, Tubonemi (2013), that teachers tend to teach the way they were taught, based on the views about teaching and learning they developed in pre-service teacher classes during preparation. Consistent with this, if pre-service science teachers are to teach the constructivist way, they should be taught during preparation through constructivist approaches, consistent with 21st century teaching and learning. For instance approaches in pre-service teacher classes should treat pre-service teachers as learners in a manner consistent with the vision of how teachers should treat learners through constructivist approaches in schools. Implementing constructivist approaches is difficult (Ütanir, 2012). As enablers, supportive policies are required for effective preparation of pre-service science teachers to learn teaching using learner-centred approaches embedded in constructivist teaching and learning. Due to continuous changing needs of students in response to changes in the environment, Kalpana (2014) argues that teacher preparation programmes should create enabling conditions for pre-service teachers to learn how to teach in diverse conditions. Kablan and Kaya (2014) observe that constructivist science teacher preparation approaches are intentionally designed to be transformational, not just informational

Approaches used in pre-service science teacher classes should constantly give prospective science teachers opportunities to make new connections in settings focusing on personal empowerment and critical reflection (Lauckner, Paterson, and Krupa, 2012). Therefore, teacher educators should use innovative methods for preparing prospective teachers (Adedeji and Olaniyan, 2011), to teach in continuously changing diverse teaching and learning environments. Knowledge, skills and values that a teacher is expected to possess, make designing teacher preparation programmes complex (Tan, Wettasinghe, Tan, and Hasan, 2010). Challenges can be mitigated through situated learning where teacher educators enable prospective teachers to observe, imitate, explore, and reorganise ideas that they have about teaching (Calavia, et al, 2023). This allows pre-service teachers to experience teaching in authentic diverse classroom settings. If prospective teachers are provided with both pedagogical content knowledge and diverse teaching experience, they are placed in a better position to teach in various contexts. Instructional approaches may include, according to Evagorou, Guven, and Mugaloglu (2014) development of skills and knowledge for thoughtful integration of content, pedagogy and technologies that pre-service teachers should exhibit during attachment teaching practice (ATP). ATP is teaching practice done by a pre-service teacher under the guidance of a mentor. Teaching practice remains a critical but challenging component of teacher preparation in Zimbabwe (Mukeredzi & Mandrona, 2018). Aligning pre-service science teacher preparation to diverse teaching and learning environments they will encounter upon joining the teaching profession, equips them with knowledge and skills to be effective science teachers. Teacher preparation programmes significantly influence professional identity formation (Flores & Day, 2018).

Views of pre-service science teachers on approaches used in science teacher preparation are important, since they help to show the nature of preparation alignment to expected science teacher competences, for teaching in various teaching and learning environments. Against this background, this study sought to explore pre-service science teachers' views on current approaches to science teacher training in two teachers' colleges in Zimbabwe.

2. Method

Located in the interpretivist paradigm, this case study collected data through semi-structured interviews, with purposively sampled pre-service science teachers and science educators. Focus group discussions were used to collect data from pre-service science teachers. Purposive sampling was used to deliberately select particular settings, and willing pre-service science teachers and science educators, in order to obtain important information that could not be obtained from other choices (Taherdoost, 2016; Etikan and Bala, 2017). Purposive sampling aimed at deeper understanding of phenomenon; hence selection of participants was based on researcher's knowledge about ability of participants to provide data in line with research questions (Ishal and Bakar, 2013). At each site (TCP and TCQ respectively) one FGD was done. In each FGD participants were five pre-service science teachers who were at college back from ATP, now doing their final year. The pre-service science teachers were suitable to participate in FGD because they had experienced on ATP, how their pre-ATP preparation at college equipped them with knowledge and skills to teach in diverse teaching and learning environments. A total of 8 participants were interviewed. The interviewees comprised 3 TCP Pre-service science teachers, 2 TCQ science educators, and 3 TCP science educators. Document analysis was also used to gather data from the two teachers' colleges' Chemistry, Biology and Physics syllabuses of the Diploma in Education (Science) programme.

Data credibility and dependability (trustworthiness of data) were ensured through member checking, triangulation of data, and making explicit researcher bias (Cleland, 2017; Thanh and Thanh, 2015). Concurrent data collection and analysis (Sutton and Austin, 2015), which is gathering and analysing data at the same time or simultaneously (Sargeant), was done in line with the qualitative approach chosen for this study. Thematic analysis and interpretation of quotes from participants were used in data analysis (Kiger and Varpio, 2020; Creswell, 2014). For anonymity, actual names of participants were masked through use of pseudonyms. During data analysis and interpretation no identifying information of either individuals or institutions was used, hence there was no violation of privacy (British Educational Research Association, 2018). Through coding, emergent themes were interpreted based on the interpretivist paradigm.

3. Findings

Participants expressed varied views on teaching and learning, which seemed to be linked to various teaching and learning approaches used in the pre-service science teacher classes during preparation at the two teachers' colleges. Findings are presented and discussed under two themes, namely Conceptual understanding of Teaching and Learning, and Hands-on Approaches.

3.1 Conceptual Understanding of Teaching and Learning

Conceptual understanding of teaching and learning expressed by participants varied between teacher-centred and learner-centred approaches. Although not explicitly stated, but responses given by pre-service science teachers during interviews and focus group discussions (FGDs) suggest a link between their conceptual understanding of teaching and learning, and approaches used in their classes by science educators. For instance, one Teachers' College P (TCP) focus group discussion (FGD) participant described teaching and learning as a "process of imparting knowledge by the teacher", while another stated it as a "... process of sharing knowledge by learners given by the teacher ...". Therefore, this suggests that approaches used by science educators might have influenced their understanding of teaching and learning, consistent with Alahmad, et al's (2021) view that teachers tend to teach the way they were taught. Similar sentiments of teaching and learning as a teacher-centred process were expressed by two of the five FGD participants at Teachers' College Q (TCQ) saying:

Teaching is delivering lessons to students so that they gain knowledge (Don), and

It is the giving out of knowledge to learners by the teacher (Mary).

However, three of the five FGD participants at TCQ were at variance with conceptual understanding of teaching and learning as teacher-centred expressing learner-centred conceptual understanding saying:

Teaching and learning involves the teacher organising activities to assist pupils in acquiring knowledge (Conwell),

Making the environment conducive for a student to be involved in activities which enable the student to gain knowledge and apply it to solve problems (Kate), and

It is using active learning strategies by the teacher to facilitate acquiring of knowledge by pupils in a classroom environment (Tecla).

Although these responses have an aspect of learner-centredness, but Tecla's response that: "*Using active learning strategies by the teacher to facilitate acquiring of knowledge by pupils in a classroom environment*" attracted the researcher's attention most. Though this response reflects learner-centred approach but confinement of learning to the "...classroom environment", is a serious limitation on learning in the 21st century. This is particularly important now when ODeL which overcomes barriers due to the classroom, is becoming a popular mode of teaching and learning. The school environment is now an extension of the laboratory where learner-centred teaching takes place (Waite, 2011), hence the need of pre-service science teachers to develop skills to use it (school environment) effectively.

Confining science teaching and learning to the laboratory is now an issue of concern (Glaze, 2018), because the learning environment is often relegated to the laboratory where a pre-service science teacher works with a partner or team to complete tasks in a manual or as written instructions given by science educators. This suggests that the conceptual understanding of teaching and learning expressed by participants which varied between teacher-centred and learner-centred, seemed to be linked to various teaching and learning approaches used in pre-service science teacher classes during preparation at the two teachers' colleges. Contrary to teacher-centred conceptual understanding expressed by some FGD participants, the role of the teacher as a facilitator is articulated by Xhemajli (2016) as coordinating and assessing the process of learning, while the learner negotiates learning through facilitation by the tutor (Saha, 2019). Therefore, teachers' colleges should relook at how best to develop learner-centred understanding of teaching and learning by pre-service science teachers in

line with the Ministry of Primary and Secondary Education (MoPSE)'s expectations (Ministry of Primary and Secondary Education of Zimbabwe, 2015).

A further variation in conceptual understanding of teaching and learning was exemplified by respondents Anna, Jane and John at TCP who were on attachment teaching practice (ATP) doing their second year of the three year Diploma in Education (Science). Expressing the shared understanding John said:

Teaching is the provision of a conducive environment for students to learn. This includes planning learning activities so that students are actively involved. Learning is when students construct knowledge through activities organised by the teacher. Learning can occur both inside and outside the classroom.

In addition, Anna gave a view shared with a fellow TCP pre-service science teacher Jane saying:

Teaching implies organising activities which enable pupils to acquire knowledge. Learning is a process whereby pupils are involved in activities which enable them to gain knowledge and skills applicable in life.

The understanding of teaching and learning by pre-service science teachers (John, Anna, Jane), is broader than that shown by some pre-service science teachers involved in TCP FGD. In addition, John, Anna, and Jane's view of teaching and learning is learner-centred. For instance, John illustrated an extended understanding of teaching and learning as a process in which "...students construct knowledge..." suggesting constructivist approach consistent with 21st century learning (American Association of Colleges for Teacher Education & the Partnership 21st Century Skills, 2010).

John, Anna, and Jane's conceptual understanding of diverse teaching and learning environments was in agreement with TCQ FGD participants Don, Tecla and Conwell who said:

These are teaching and learning situations influenced by many factors like learning resources in a school, qualifications of teachers, and needs of learners (Don),

Teaching and learning that takes place in different schools, some with good science learning aids and textbooks, and some without (Tecla),

Laboratories are not present in some secondary schools, especially those in rural areas, whereas those in towns and boarding schools have them. (Conwell).

These TCQ FGD participants' responses show understanding of diverse teaching and learning environments in a broader sense as "...teaching and learning situations influenced by many factors ..." (Don), location of schools in "... rural areas.....and in towns ...and boarding schools..." (Conwell), and "Teaching and learning that takes place in different schools ..." (Mary). This broad understanding of diverse teaching and learning environments should be reinforced in pre-service science teacher classes, consistent with teaching and learning of science in the 21st century (American Association of Colleges for Teacher Education & the Partnership 21st Century Skills, 2010). Comparatively, some TCP FGD pre-service science teachers reflected a narrow perspective of diverse teaching and learning environments, but a noteworthy aspect of their perspective is linking teaching methods and places, which implies context based teaching and learning, in line with adapting learning to diverse teaching and learning environments. Also teaching approaches which are implied in TCP FGD participants' responses are out door science practical activities. In these science practical activities the environment is used for teaching and learning as suggested by (Waite, 2011), who views the school environment as an extension of the laboratory where learner-centred teaching takes place. TCP FGD participants said diverse teaching and learning environments involved:

Use of different environments, eg Teaching in class or going outside the classroom to observe ecosystems.

Different learning places eg remote areas and urban emphasize different teaching methods.

Multipractice of teaching techniques. A teacher can use more than one teaching approach as the environment permits.

These responses reflect TCP FGD participants' narrow perspective of diverse teaching and learning environments, by limiting teaching methods to places, yet factors which constitute diverse teaching and learning environments are endless. Factors which pre-service science teachers seemed not to be aware of include inter alia, class size, STEM, instructional media, 21st century skills, learners from different cultural backgrounds, and different abilities of learners, (Örnek, 2015).

In the Zimbabwean context, various approaches science educators use should, in addition to developing science teaching and learning knowledge and skills of the 21st century, develop a conceptual understanding of teaching and learning of pre-service science teachers consistent with national aspirations (Ministry of Primary and Secondary Education of Zimbabwe, 2015). Recent studies highlight the importance of transformative learning approaches in Zimbabwean teacher education (Macharaga & Mukeredzi, 2023). These aspirations include inclusivity, lifelong learning, equity and fairness, 21st century skills, gender sensitivity, respect (Ubuntu / Unhu /

Vunhu), responsiveness, STEM, transparency and accountability (Ministry of Primary and Secondary Education of Zimbabwe, 2015).

3.2 Hands-on Approaches

Hands-on approaches are important since they develop competences to facilitate learning through active involvement (American Association of Colleges for Teacher Education & the Partnership 21st Century Skills, 2010). Effective pre-service programmes significantly influence classroom practices, particularly in science and mathematics education (Olawale, 2024). Several TCP FGD participants implicitly identified approaches used in pre-service science teacher classes as hands-on. For instance participants indicated that science educators involved them in group practicals, and tasks to work on, and presentations in class. To illustrate, some TCP FGD participants said:

E-Learning and oral presentations are used. Learners are given tasks which they present in the next lesson. Also the project approach is used.

Group work is used during practicals where pre-service science teachers do practicals in groups of 5. This promotes peer discussion.

Discovery method is also used. Pre-service science teachers are given tasks to work on with minimum assistance from science educators.

These responses by TCP FGD participants show that presentations, project method, group work, practical work, peer discussion, and discovery method are approaches used in pre-service science teacher classes in line with expectations as stated in TCP science syllabuses. By involving pre-service science teachers in hands-on learning, science educators encourage prospective science teachers to develop the conception that science is best taught by interacting with learners.

Beginning science teachers are bound to fail, unless they are equipped with knowledge and skills of facilitating science learning as guided by preparation programme guidelines (Anderson and Piazza, 1996). An analysis of TCP documents namely Chemistry, Biology and Physics syllabuses of the Diploma in Education (Science) programme showed that current approaches supposed to be used during pre-service science teacher training are Group Work, Lectures, Tutorials, Problem Solving, Field Trips, E-Learning, Discussions, Workshops, Demonstration, Seminars, Resource Persons, Simulations, Experimentations, Project Approach, and Exhibitions. While TCP pre-service science syllabuses explicitly state approaches mention above, as those which should be used together with any other appropriate approaches during preparation, one TCP science educator H confirmed attendant challenges associated with using some of the approaches stated in syllabuses saying:

Yaa that's true. Some approaches like simulations and trips are surely stated in the syllabuses, but are rarely or not used at all. Simulations are not used because of lack of equipment. As for trips, economic challenges have constrained financial resources such that trips have been set aside as teaching approach as a cost cutting measure. However, pre-service science teachers are still told that when they teach, if circumstances permit, field trips are good real life experiences to promote learning.

This view is in agreement with Kate a TCQ FGD participant, who noted that, some methods like “... seminars, exhibitions and field trips were not used because of lack of funds”. Kate’s response on the non-use of some approaches stated in TCQ science syllabuses was corroborated by a follow up interview with a TCQ science educator E who said:

This period is very challenging because of inflation. At the moment there is no way the college can raise money to support teaching and learning approaches like workshops, and field trips The tuition fees and cost of meals are very high such that pre-service science teachers cannot afford to fund science field trips.

From Kate and science educators E and H’s responses it is clear that some factors beyond control of science educators inhibit use of certain learning approaches in pre-service science teachers’ classes, which is reality in many teacher preparation programmes (Glaze, 2018).

The perception of engaging in challenging learning experiencing during preparation was shared by TCP pre-service science teachers Anna, John, and Jane, which Anna summarised saying:

During the residential period a lot of challenging practice through peer-teaching and microteaching as approaches is needed to develop ability to interpret the syllabus and formulate SMART lesson objectives.

SMART is an acronym for specific, measurable, attainable, realistic and timely. Corroborating pre-service science teachers Anna, John, and Jane’s views TCP science educator L, stated that “pre-service science teachers observed science educators modelling various approaches in secondary school classes”.

TCQ FGD participants said that hands-on approaches like “group experiments” (Mary), and “... constructivist approaches where by problem-solving ...” (Kate), were used by science educators despite limitations placed on their use by lack of apparatus in the context of large classes.

On managing group work TCQ science educator F said:

I tell the class that presenters for groups will be randomly picked, and every group member should have a write up of the group discussion outcomes which I will check to confirm participation by each group member.

As rightly stated by science educator F, managing group work and presentations in teaching and learning is important to enable every pre-service science teacher to participate. This ensures that both individual and collaborative learning strategies complement each other. Conwell expressed excitement in the project approach which entailed collaboration, while Tecla noted "...E-learning and the internet were used".

Expressing a view shared with Tecla and Don, Mary noted the role of modelling by science educators saying:

It inspires to observe science educators modelling in a secondary school science class what they say works during our theory lessons on how to teach science in a secondary school class environment.

From these TCQ FGD participants modelling is an effective approach in developing desired skills in pre-service science teachers. Consistent with this, Özdaş (2018) asserts that pre-service teachers have a high probability of applying approaches they were exposed to in school learning setup during preparation. Therefore it is necessary to link theory with practice during teacher preparation.

From the foregoing data presentation some of the current approaches used at TCP and TCQ for pre-service science teacher preparation include constructivist approaches, presentations, group work, discovery method, project approach, peer-teaching, microteaching, practicals / hands-on, group experiments, modelling, e-learning, discussion, improvisation, and learner-centred.

4. Discussion

Subsequent approaches pre-service teachers use to translate theory learnt into classroom practice are determined by their conceptual understanding of teaching and learning. This consistent with Anderson and Piazza (1996) who argues that teachers' conception of teaching and learning can play either a facilitating or an inhibiting role in translating curriculum guidelines into the reality of classroom teaching. Learner-centred approaches are modern teaching and learning practices consistent with 21st century trends, while teacher-centred approaches are old outdated practice (Ikwumelu, Oyibe, and Oketa, 2015).

Inclination of pre-service teachers towards learner-centred or teacher-centred approaches depends on preparation (Dejene, Bishaw, and Dagne, 2018). Therefore conceptual understanding of teaching and learning as teacher-centred or learner-centred expressed by pre-service science teachers in this study might have emanated from teaching and learning approaches used during their preparation Dejene, Bishaw, and Dagne (2018), Sharma (2013), at the two teachers' colleges. The aspect of this finding which apparently attracted the attention of the researcher is that a portion of the pre-service science teachers reflected understanding of teaching and learning as teacher-centred. This conceptual understanding is at variance with expectations in Zimbabwean schools as indicated in policy documents like the Teacher Professional Standards (TPS), Curriculum Framework 2015-2022 and science syllabi, which specify that contextualised learner-centred approaches, should be used in secondary school science classes. This means pre-service science teachers should understand teaching and learning as learner-centred. This gap between theory and practice revealed by this study suggests that there are deficiencies in approaches science educators use to prepare pre-service science teachers, at the two teachers' colleges, since teachers tend to teach they were taught (Sharma, 2013). In the Zimbabwean context, teachers' colleges should find ways of how best to develop understanding of teaching and learning as learner-centred by pre-service science teachers in line with the Ministry of Primary and Secondary Education (MoPSE)'s expectations (Ministry of Primary and Secondary Education of Zimbabwe, 2015). Preparing science teachers consistent with MoPSE requires consideration of diverse teaching and learning environments in Zimbabwe, and even beyond (Internationally). This implies pre-service science teachers' colleges should adapt preparation to the needs of diverse teaching and learning environments in schools, both in Zimbabwe and internationally.

Analysis of the two teachers' colleges (TCQ and TCP) Chemistry, Biology and Physics syllabuses (documents) of the Diploma in Education (Science) showed that current approaches which should be used in pre-service science teacher preparation are Group Lectures, Tutorials, Problem Solving, Field trips, E-Learning, Discussions, Workshops, Demonstration, Seminars, Resource Persons, Simulations, Experimentations, Project approach, and Exhibitions. It has been shown by Mandina (2012) that in many cases there is a gap between the intended curriculum and the implemented curriculum. Success in implementing a curriculum is determined by the extent to which the implemented curriculum approximates or is closer to the intended curriculum. Consistent with this, some approaches stated in the syllabuses, were neither observed being used in pre-service science lessons, nor mentioned as being used by interviewed pre-service science teachers. Both pre-service science teachers and science educators stated financial constraints as the reason for not using approaches like simulations, seminars,

workshops and field trips. Glaze (2018) concurs with this finding Glaze (2018) notes that during teacher preparation some factors like community support and economic challenges are beyond the control of educators, yet they affect pre-service teacher preparation. This implies science educators should apply mutual adaptive strategies in order to work within their capabilities, and as circumstances permit.

Presentations, group work, discovery method, project approach, microteaching, peer-teaching, practicals / experiments, modelling by science educators, e-learning, constructivist approaches, like problem solving, presentations, and group experiments, are approaches pre-service science teachers said were used in their classes. When such approaches are used, pre-service science teachers collaborate or interact (Glaze, 2018), consistent with approaches supposed to be used in schools in Zimbabwe (Ministry of Primary and Secondary Education of Zimbabwe, 2015). Therefore, approaches used to prepare pre-service science teachers in the two teachers' colleges are aligned to expectations in secondary schools in Zimbabwe. Interviews with pre-service science teachers and science educators revealed that modelling, microteaching, peer-teaching and home area teaching are broader approaches which were used in pre-service science teacher training practices in the two teachers' colleges. Although these approaches were not stated in the two teachers' colleges Science (Physics, Chemistry, Biology) syllabuses, they were clearly stated and explained in Professional Development Studies (PDS) departmental documents. Science educators stated the importance of practical work in equipping pre-service science teachers as novices, with knowledge and skills on teaching and learning before going for ATP. Buttressing this, view pre-service science teachers in a study by Adu-Gyamfi (2020) expressed the importance of science practical work and its effectiveness in enhancing understanding of science concepts.

As Glaze (2018) notes, preparation of pre-service science teachers should shift from teacher-centred to learner-centred approaches, in which active learning mode or interactive engagement is involved. This implies teaching and learning should shift from lecture method to scientific application of process skills, problem solving and modelling of scientific concepts. There is need to rethink, so that approaches used in laboratory teaching and learning activities allow for more inquiry and discovery learning. Emerging research also reveals gaps in inclusive pedagogical preparation among pre-service teachers in Zimbabwe (Chipika & Mapfunde, 2025). Therefore out of school environments can be used as places for offering practical experience in science teaching and learning, in which pre-service science teachers learn how to teach science (Alahmad, et al. 2021). In order to promote outdoor learning, science educators need to prepare pre-service science teachers to use the environment as an extension of the laboratory (Waite, 2011). This will show learners that science is part of the natural world applicable in life.

5. Conclusions

The foregoing discussion shows that pre-service science teachers viewed approaches used in science teacher preparation in teachers' colleges TCP and TCQ as aligned to greater extent to those expected to be used in diverse teaching and learning environments in schools. However, it should be noted that the two teachers' colleges should put more effort, so that all pre-service science teachers conceptually understand learner-centred teaching and learning consistent with the Ministry of Primary and Secondary Education (MoPSE) goals. Therefore in order to promote outdoor learning as learner-centred approach, science educators need to prepare pre-service science teachers to use the environment as an extension of the laboratory. Out of classroom environments are places which offer practical experience in science teaching and learning, in which pre-service science teachers learn how to teach science. These environments provide first-hand experience showing that science is part of the natural world applicable in life. The study also concludes that even if science educators may be aware of the importance of applying certain approaches like simulations to teaching and learning, limitations like lack of funding and resources may hinder application of such approaches. This suggests that pre-service science teachers should be equipped with skills to understand contextual factors which may limit use of certain teaching and learning approaches. Such understanding may enable them to adapt teaching and learning to the context, hence enhancing achievement of learning objectives.

6. RECOMMENDATIONS

- Pre-service science teacher preparation should be contextualised by including, but not limited to, use of the local environment, for clear understanding of concepts by pre-service science teachers.
- Pre-service science teacher preparation should shift from lecture method to scientific application of process skills, problem solving and modelling of science scientific concepts, hence promoting critical thinking consistent with development of 21st century skills.

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