

# Supporting Natural Science Pre-Service Teachers during Work-Integrated Learning: A Case of a Lesson Study Approach

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**Abstract.** This paper is concerned with the issue associated with final-year Natural Science pre-service teachers' lesson design abilities. This paper reports how the implementation of a lesson study approach served as an intervention to support the lesson preparation abilities of pre-service teachers during a work-integrated learning (WIL) process. The case study generated rich qualitative data from multiple sources such as e-mail communications, WhatsApp responses, video capturing, and focus group team discussions. Couched within the critical emancipatory theory, the study found that the planning and preparation of innovative and inclusive Natural Science lessons are inseparably associated with the collaborative practices and interaction that existed among the team of pre-service teachers. The accommodative and engaging nature of the lesson study sessions empowered pre-service teachers to share their diverse subjective experiences and contextual ideas, which were pivotal to the generation of knowledge and design of Natural Science lessons. Consequently, the lesson study approach not only affected the pre-service teachers' lesson design abilities but also better positioned them for the WIL experience.

**Keywords:** Lesson study approach; critical emancipatory theory; work-integrated learning; Natural Science education; pre-service teacher development

## 1. Introduction and background to the study

The work-integrated learning experience (WIL) is an experiential and practical learning process, whereby pre-service teachers partake in an authentic teaching process that enables them to learn in and from their own teaching practice (Johnston, 2011). This approach allows pre-service teachers to gain a hands-on experience of the teaching profession (Barends & Nel, 2017). During this period,

pre-service teachers are placed at schools and teacher educators are tasked to evaluate and assess the quality of their lesson presentations (DHET, 2015).

Serving as a link between academic theory and the practice of teaching (De Beer, 2017), the WIL process provides a sense of whether pre-service teachers acquired the deemed teacher competencies required for the profession (Tran & Soejatminah, 2016). The rationale for WIL is thus to empower pre-service teachers to engage in a real-world teaching context with the hope to conscientise them about the practice of teaching (Jovanovic, Fane & Andrew, 2018). This is done to instil confidence in their ability to transfer their educational knowledge developed as part of their initial teacher education into the practice of teaching, hence promoting workplace readiness (Matoti, Junqueira & Odora, 2011).

While some consider the WIL process a testing ground for pre-service teachers to demonstrate their teacher qualities (Ngibe, Pylman, Mammen & Adu, 2019), others label the WIL process as a gruelling experience (De Beer, 2017). In the context of teacher education, researchers often refer to the WIL process as the “elephant in the room” because of various issues that manifest from the WIL process (Pham, Bao, Saito & Chowdhury, 2018). The literature is scattered with issues associated with the WIL process, that predominantly stems from the pre-service teacher voice (Choy & Delahaye, 2011; Ngibe et al., 2019). To be specific, a study by Matoti, Junqueira and Odora (2011) reported how pre-service teachers were subject to emotional stress, frustration and anxiety because of issues surrounding lesson preparation for the authentic teaching experience. It was this problem that sparked the researchers’ interest in this study.

This study concerns itself with the issue associated with Natural Science pre-service teachers’ competence in terms of Natural Science lesson preparation. Couched within the critical emancipatory theory, the aim of the study is to describe how a lesson study approach supported the lesson preparation abilities of pre-service teachers during a work-integrated learning experience. To achieve this aim, the study follows a qualitative case study research approach to respond to a couple of pertinent research questions. These include trying to understand “whether the Natural Science pre-service teachers are experiencing issues pertaining to lesson preparation?” Secondly, “how can a lesson study approach serve to support the Natural Science pre-service teachers’ development of Natural Science lessons for an authentic teaching experience?” The response to these research questions will not only be key in honing their lesson preparation skills but would ultimately put them in a good stead for their professional teaching career.

### **1.1 Envisioning a lesson study approach in a school of education**

The lesson study approach has its roots in Japanese education from the mid-19<sup>th</sup> century (Pham, Bao, Saito & Chowdhury, 2018) but has since been adopted in other parts of the world to promote pre-service teacher development (Bjuland & Mosvold, 2015; Fernandez & Zilliox, 2011). The lesson study approach is regarded as an intervention that enables teachers to formulate teaching goals collectively,

prepare lessons and reflect back on past teaching experiences to improve future teaching practices (Larkin, 2017; Sims & Walsh, 2009).

In the context of Natural Science teacher education, the 'lesson preparation' would serve as a means for Natural Science pre-service teachers to brainstorm and share lesson ideas that would enable them to set the tone for the lesson structuring. The next step involved in the lesson study process deals with the 'actual planning' of the Natural Science lesson with a focus to make the lesson innovative and inclusive of nature to cater for the diverse learning needs of learners.

The third and final aspect involved in the lesson study approach includes 'lesson reflection' (Chizhik et al., 2017). Lesson reflection deals with how the pre-service teacher enacted the Natural Science lesson during a WIL process. At the core of the lesson reflection process lies the opportunity for pre-service teachers to share their "rich" subjective experiences of "what worked" and "what did not work" in terms of their Natural Science lesson presentations (Runesson, Martin & Clerc-Georgy, 2015). Akerson et al. (2017) argue that this process allows individuals to learn from each other's teaching practices and experiences. The interconnectedness of these three aspects is vital to the effectiveness of the lesson study approach.

## **2. Aligning critical emancipatory theory with the lesson study approach**

Osanloo and Grant (2014) suggest that the selection of a theoretical framework for a study requires one to first confront your own individualised philosophical orientations about reality. Lysaght (2011) takes it a step further by arguing that the researcher's choice of a theoretical framework is not arbitrary but reflects personal beliefs and understanding about the ontological and epistemological nature of knowledge within a study. This aligns well with the view of Shaull (1974), who decades ago suggested that the theoretical and philosophical orientations are inseparable from one another. Therefore, in an attempt to select a theoretical framework for this study, we first had to confront our own, personal beliefs and understanding about the nature of knowledge and reality as it existed within this study.

Drawing on the views of Osanloo and Grant (2014) and Lysaght (2011), the selection of a theoretical framework for this study rests on the following personal beliefs and understandings. First of all, we share an awareness of the pre-service teachers' challenge associated with Natural Science lesson preparation and acknowledge that this challenge inputs negatively on their WIL experience. Secondly, we are of the view that the lesson study approach could serve as a driver to overcome this particular challenge that they are confronted with. Thirdly, upon implementation of the lesson study approach, we are confident that the pre-service teachers themselves are equipped with the knowledge to support each other in the preparation of Natural Science lessons because of their diverse teaching experiences stemming from diverse teaching contexts. Finally, we are confident that their ability to support each other in preparing Natural Science

lessons collectively would better position them in their quest to teach within an authentic teaching space.

In light of these assumptions, which are linked to aspects of criticality, analyticity and education, critical emancipatory theory fits well as a theoretical framework for the study. Critical emancipatory theory, which emanates from critical theory (Creswell & Creswell, 2017) is concerned with research that emancipates the disempowered, cultivate hope and stimulate lifelong learning opportunities for individuals (Gordon, 1986; Shor, 1988). Drawing on seminal work of scholars such as Paulo Freire, Ira Shor and Cynthia Brown critical emancipatory theory serves as a paradigmatic framework that enables teachers to identify issues related to educational practice and seek practical solutions to overcome the issues identified (Freire, 1972; Shor, 1993; Brown, 2001).

Nested in critical emancipatory theory, this paper describes how a lesson study approach supported the lesson preparation abilities of pre-service teachers during a work-integrated learning (WIL) process. This sharing of subjective experiences allows for the formulation of Natural Science lesson ideas, which, according to Fetterman (2015) aligns well with the concept of practical empowerment. Instead of following a conventional approach characterised by teacher educators assuming the role as the sole providers of absolute knowledge, we opt to turn the conventional approach upside down thus allowing for a stimulating way of information sharing that is innovative and developing in nature. Our roles in this study are thus driven towards facilitating their efforts in preparing lessons. This approach is also referred to a practice of transformative empowerment (Fetterman, 2001; Fetterman, 2009; Zimmerman, 2000).

The drive towards practical and transformative empowerment unlocks the concept of self-determination. Fetterman (2015) defines self-determination as the ability of an individual to demonstrate a range of capabilities. In this study, self-determination among the pre-service teachers surfaced in terms of their ability to identify and express the need for support in lesson preparation, partake in a plan of action to address the issue associated with lesson preparation, identify resources needed for the structuring of Natural Science lessons, implement the prepared lessons in an authentic teaching experience, and finally, re-examine the effectiveness of the lesson study approach with the hope to better the initiative for future implementation.

### **3. Research approach and methodology**

A series of lesson study sessions took place throughout the duration of the study. To document this systematic approach towards the planning of lessons and reflection on lesson presentations, a purposeful sampling qualitative case study research approach was followed.

Permission for this study was granted by the University of the Free State (Ethical clearance nr UFS-HSD2018/0073) and the study formed part of the researcher's PhD project. Thorough protocols were followed to ensure that the research participants from now onwards referred to as the research team gave consent and

was comfortable in participating in this study. As the principal researcher, I assured the research team confidentiality throughout the duration of the study. The team members' actual names were withheld and their faces were blurred from photographs. The team members were also allowed to withdraw from the study at any point of time. All team members signed a consent form and all of the signed copies are safely stored.

The research site was situated in a School of Education at a South African University. The School of Education offers a Bachelor of Education degree with multiple areas of specialisation in intermediate phase (IP), senior phase (SNR) and further education and training phase (FET) teaching. In this study, the research team comprised eight 3<sup>rd</sup>-year undergraduate students specialising in the teaching of Natural Science.

This study relied on multiple data generation sources such as spontaneous free-response e-mail communications, photo-voice methodology and a focus group team discussion to generate and capture empirical data. Critical discourse analysis was used to analyse the qualitative data since it allows for the deconstruction and meaning-making of data in an interpretive, descriptive and exploratory manner (Creswell & Creswell, 2017; Guba & Lincoln, 1988). This approach to analysing data allowed us to be receptive to the subjective, individualised and contextualised experiences of the research team.

To be specific, the use of spontaneous free-response e-mail communications shed light on the first research question of the study, which was to understand the types of challenges Natural Science pre-service teachers encounter regarding lesson preparation. A response to this research question was crucial for justifying their need for lesson study support. Qualitative data that stemmed from the spontaneous free-response e-mail communications were digitally captured, thematically analysed to determine patterns from the team's responses and then transcribed.

Moreover, the use of photo-voice methodology assisted in clarifying research question two where the focus was to determine how a lesson study approach can serve to support the Natural Science pre-service teachers' development of Natural Science lessons? The use of photo-voice methodology and a focus group team discussion enabled the researcher to have an in-depth look at the team's lesson planning encounters. Striking features of the lesson planning sessions were visually captured, thematically analysed and transcribed. At the same time, verbal responses from the focus group team discussion were audio-recorded, transcribed and thematically analysed through an open-and-axial coding method. This approach allowed for the identification and description of patterns, trends and consistencies that existed within the data.

Following the data analysis process, the qualitative data were given back to the research team to evaluate whether the transcribed data were a true reflection of their subjective, individualised and contextualised experiences thus complying to the aspects of credibility, reliability and validity (Guba & Lincoln, 1988).

## 4. Results

The research questions in this study yielded rich qualitative data. Table 1 outlines the two research questions with the corresponding findings in terms of themes and sub-themes.

**Table 1. General overview of findings to the research questions**

| Research questions  | Data collection technique  | Themes  | Sub-themes   |
|---|--|---|--|
| Whether the Natural Science pre-service teachers are experiencing issues pertaining lesson preparation?   | Spontaneous free-response e-mail communication                               | Realising the need for lesson study support                       | <ul style="list-style-type: none"> <li>- Student anxiety, stress, hopelessness and frustration</li> <li>- Unfavourable learning environments</li> </ul>                                      |
| How can a lesson study approach serve to support the Natural Science pre-service teachers' development of natural science lessons for a WIL experience? | Photo-voice methodology  | Designing well-structured Natural Science lessons as a collective | <ul style="list-style-type: none"> <li>- Team-discussions, collaborative brainstorming and sharing of lesson ideas</li> <li>- The detailed structuring of Natural Science lessons</li> </ul> |
|   | Focus group discussion<br><br>Spontaneous free-response e-mail communication | Lesson reflections  | <ul style="list-style-type: none"> <li>- Quality Natural Science learning experience</li> <li>- Quality Natural Science teaching experience</li> </ul>                                       |

### 4.1 Theme: Realising the need for a lesson study support

The first step towards realising the aim of the study, which was to describe “how a lesson study approach supported the lesson preparation abilities of pre-service teachers during a work-integrated learning experience”, was to determine whether the pre-service teachers did, in fact, experience an issue associated with lesson preparation? A response to this question is crucial since it justifies the need to initiate a lesson study approach.

With this research question in mind, a series of spontaneous free-response e-mail communications from the team were collected and analysed, which resulted in one overarching theme titled “Realising the need for a lesson study support”. This theme was supported by two sub-themes, namely “Student anxiety, stress, hopelessness and frustration” and “Unfavourable learning environments”.

#### 4.1.1 Sub-theme: Student anxiety, stress, hopelessness and frustration

Snippets of spontaneous free-response e-mail communication gave voice to the research team's feelings of anxiety, stress, hopelessness and frustration associated with lesson preparation, as witnessed in Figures 1 and 2.

Sir  
 Can I please schedule an appointment to see you about the lessons that I need to prepare at the school before you come?  
 The teacher at Molehabangwe gave me his pace setter and but I'm not sure. I don't know where to start and the lectures are coming sir.  
 Thank you Sir.

**Figure 1. Electronic feedback provided by a pre-service teacher.**

Good day  
 Sir, I've been looking for you the whole week when I'm from teaching practice. I need advice urgently. When can I come see you?  
 Regards

**Figure 2. Electronic feedback provided by a pre-service teacher.**

A closer look at both these responses provided draws one's attention to feelings of hopelessness and frustration with lesson preparation, which in this case is an outcome of the school visitation process. This assumption can be confirmed with the phrases "I don't know where to start", "before you come", "lecturers are coming" and "I've been looking for you the whole week".

#### 4.1.2 Sub-theme: Unfavourable learning environments

In addition, another team member expressed concerns regarding the current status of her teaching during a school visitation opportunity. To be specific, the team member voiced her frustration of the "unfavourable learning environment", which overshadowed her quality of teaching at a certain school. This can be witnessed in the e-mail communication below:

Sir,  
 Can I pls come see you. There is this one class, I'm not sure how but I just want them to engage more.  
 I'm really tired of trying. They just sit there. The test week is around the corner and I'm really worried.  
 The teacher is booked off and I'm teaching. The boys in the class don't take me serious and the teacher is not in class to help.  
 Thanks Sir.

**Figure 3. Electronic feedback provided by a pre-service teacher.**

An analysis of this response delivers multiple meanings. In the first instance, one finds the member's wish to establish a more engaged and meaningful learning experience for the learners. This can be supported by the phrase "I just want to engage them more". Besides boosting learner engagement in the classroom setting, the team member also wishes to better her classroom management for a sustained learning experience. This can be confirmed when the pre-service teacher mentioned that "the class don't take her serious" and "they just sit there". All three electronic responses detailed the severity of the challenge associated with lesson preparation.

#### 4.2 Theme: Designing well-structured NS lessons as a collective

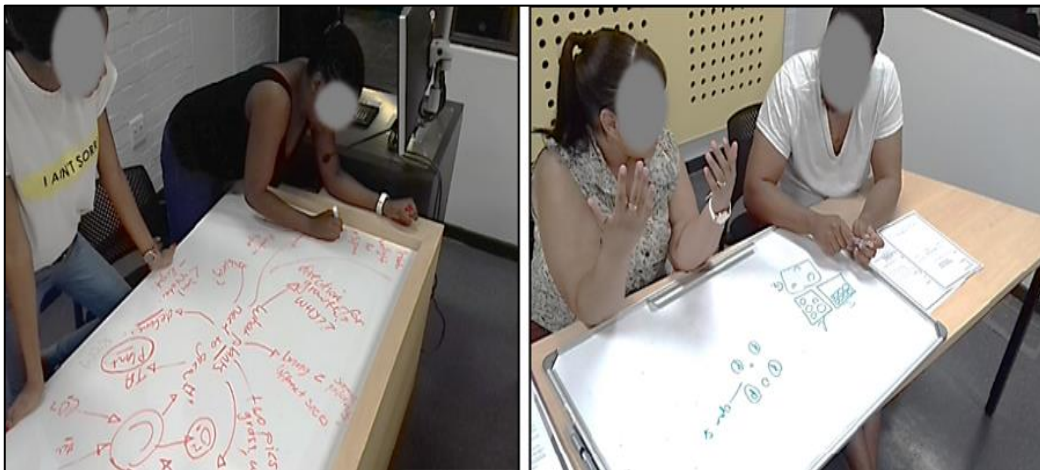
With the challenge associated with lesson preparation confirmed, the next step was to address the second research question of the study, that deals with "How a lesson study approach can serve to support the Natural Science pre-service

teachers' development of Natural Science lessons?". This time around the use of photo-voice methodology and a focus group team discussion were key in determining striking features associated with the lesson study approach.

To be specific, an analysis of a series of photographs taken throughout the lesson study encounters, pointed to 1 broad theme: "Designing well-structured NS lessons as a collective". This particular theme was supported by two sub-themes: "Team-discussions, collaborative brainstorming and sharing of lesson ideas" and "The detailed structuring of a NS lesson".

#### 4.2.1 *Sub-theme: Team-discussions, collaborative brainstorming and sharing of lesson ideas*

During the first lesson study session, the team of pre-service teachers got to work and planned their future NS lessons as a collective. A closer look at figure 4 provides evidence of the discussions, note-making and brainstorming that took place.



**Figure 4. Pre-service teachers preparing NS lessons as a collective.**

A glance at these photographs reveals how the team of pre-service teachers planned their lessons holistically by sharing details about the structure of future Natural Science lessons. They did this in a group format and the team agreed to brainstorm and share their teaching ideas with each other. Part of the lesson planning included their prediction of how the teaching process should unfold. By the look of things, one gets the sense that the team could share ideas on how to make their teaching innovative and inclusive.

#### 4.2.2 *Sub-theme: The detailed structuring of a NS lesson*

Besides the sharing of NS lesson ideas, a closer look at figure 5 suggests that the pair of pre-service teachers described finer details surrounding the objective of the Natural Science lesson when they noted on the whiteboard that the lesson should be "simple, straightforward with one or two action verbs".



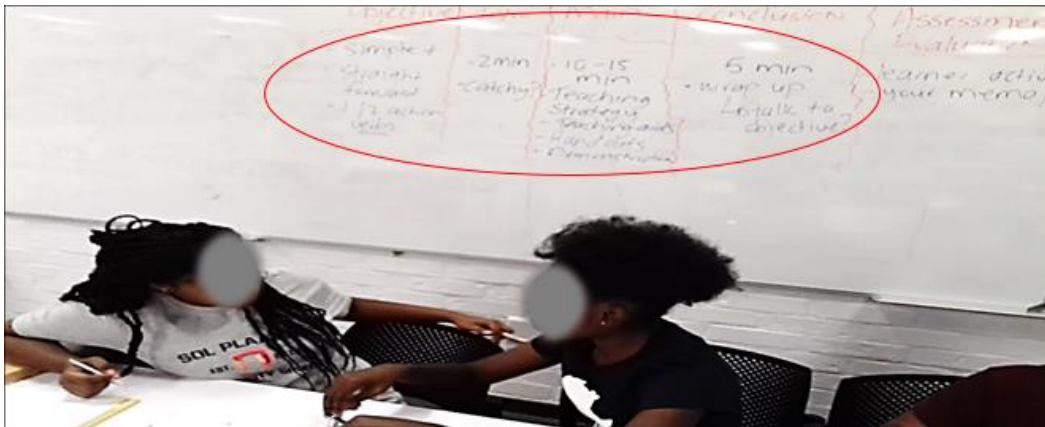


Figure 5. Pre-service teachers focusing on the structural design of a NS lesson.

After that, they focused on the structure of the introduction by suggesting that it be “2 min” long and “catchy”. The pair of pre-service teachers furthermore shared details about the main activity of the lesson when they suggested it be no more than “10 to 15 min long”.

Besides discussing the time-span of the main section of the lesson, they could also brainstorm ideas that might affect teaching and learning dynamics of the lesson. This included a discussion that dealt with aspects such as teaching strategies, teaching aids, learner activities and practical demonstrations. Finally, the pair could also elaborate on a potential conclusion for the lesson when they noted that the conclusion should be “5 min long” and should be focussed on “wrapping up” the lesson.

Coupled with the structuring of the Natural Science lesson outline, a pre-service teacher could unpack finer details of her lesson, as found in figure 6 below.

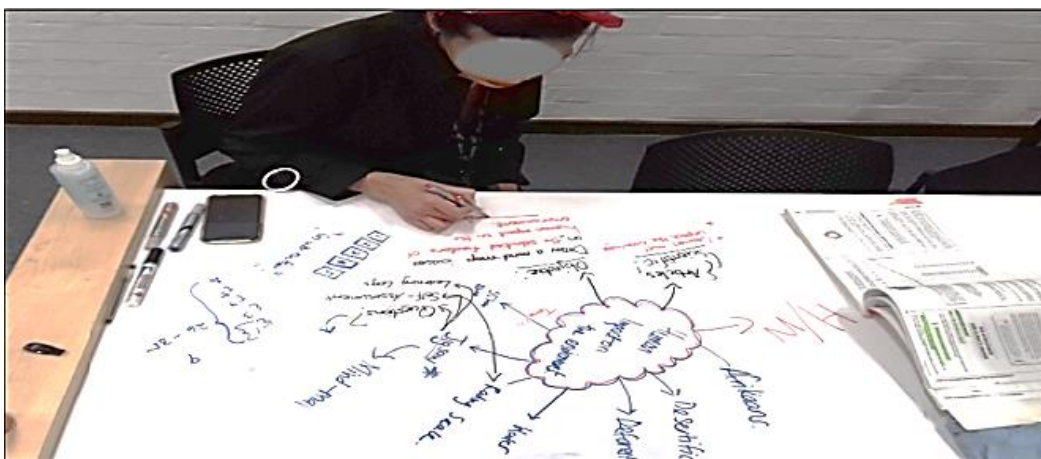


Figure 6. A pre-service teacher focusing on the structural design of a NS lesson.

An analysis of this photograph details how the pre-service teacher structured a lesson that dealt with the topic “factors impacting on the human environment”. In her planning she could unpack the objective of her lesson (for example, learners should be able to draw a mind-map based on the human factors that influence the

environment), consider factors that affect the teaching and learning context (for example, time and language of instruction), refer to the topics that should be included in her lesson (for example, human factors leading to desertification, deforestation and water pollution), consider the teaching strategies that she wishes to implement in her lesson (for example, engage learners in a jig-saw activity within pre-determined groups) and, finally, identify potential assessment approaches (for example, using questioning, self-assessment and learning logs to test learners' understanding).

### 4.3 Theme: Lesson reflections

Following the planning of NS lessons, the team engaged in a focus group discussion to share their lesson reflections with their peers. An analysis of the verbal responses from the focus group discussion pointed to two sub-themes "An improved NS learning experience" and "An improved NS teaching experience", which seemed to correspond with the theme "lesson reflections".

#### 4.3.1 Sub-theme: An improved NS learning experience

Given the opportunity to prepare lessons as a collective, a team member provided a personal account of her teaching experience during the WIL process:

*"Okay, so I had to do a lesson on the topics sorting and sieving of materials with the kids. [Didi] [a member of the research team] then helped me and we designed a lesson where I use a funnel with different materials such as small rocks, sand and different soil types to show the learners that we can sort and sieve things. What was nice about this lesson was that I could start the lesson by asking the grade 5's how to sort the small rocks, fine sand and marbles from each other. They then had to identify different ways to sort it. Then I did a practical demonstration where we sorted the materials using a funnel. I threw the marbles in then the small rocks and then the sand and the sand went through. We could then see that the sand went down into the beaker while the rocks and marbles were stuck in the funnel. This really helped them to understand the concept of sieving. Also, it was really hands-on. Oh of course this would not have been possible without you [Didi]"*

*(Team member 3; focus-group team discussion)*

This particular response confirms the influence of the lesson study intervention on both the lesson preparation and teaching experience of a pre-service teacher. In a nutshell, based on the response provided, the assumption is that the lesson that the pre-service teacher presented provoked the learners' curiosity of the topic "sieving of materials" through acts of self-discovery. The pre-service teacher's lesson objective was focused on allowing grade 5 learners to gain a better understanding of the sieving process by engaging them in a practical demonstration.

To be specific, the pre-service teacher prepared a lesson that required learners to observe how certain materials such as "small rocks, marbles and sand" can be sieved by using a funnel. Aspects of self-discovery surfaced when the pre-service teacher asked the learners the question "how can we sort the small rocks, fine sand

and marbles from each other". This open-ended question was then complemented by the pre-service teacher practically demonstrating how "sand went down into the beaker while the rocks and marbles remained stuck". As part of her lesson reflection, the pre-service teacher also admitted that the lesson was a "hands-on" experience.

Another pre-service teacher provided a more spontaneous verbal response of her experience of her lesson presentation, when she mentioned that:

*"Their vibe was amazing it worked everybody wanted to give [an] answer to the introduction and everybody wanted participated in the problem solving".*

*(Team member 1; focus-group team discussion)*

This response confirms the enthusiasm and excitement of the pre-service teacher of the lesson she presented as part of the WIL process. The phrase "their vibe was amazing" suggests that the learning environment allowed learners to be excited and motivated to learn. When the pre-service teacher mentioned that "they all wanted to participate" confirms the learners' eagerness to engage in the learning process which, in this case, required them to "solve problems".

#### 4.3.2 Sub-theme: An improved NS teaching experience

Besides the verbal feedback provided, another team member spontaneously reported how the lesson study intervention impacted his quality of teaching, as witnessed in an e-mail response below:

I'd like to thank you for your assistance yesterday, it was really helpful, after the lesson presentation I could not explain the feeling I had, how impressed I was. Thank you Mr for availing your fruitful help. Thanks for also coming through when I had no lecturer to come ~~crit~~ me.

Regards

Figure 7. Electronic feedback provided by a pre-service teacher.

The phrases "I could not explain the feeling I had, how impresses I was" "was really helpful" and "fruitful help" confirm the effect of the lesson study approach on the Natural Science pre-service teachers' teaching practice.

## 5. Discussion of findings

From a teacher education point of view, the expectation is that pre-service teachers develop the deemed teaching knowledge, skills and values within a specific period while enrolled in an initial teacher education programme. Unfortunately, as Hadi (2019) point out, not all pre-service teachers develop these expected qualities at the same tempo. Learning to teach, through the eyes of Parfitt (2020) is a developmental process, where some pre-service teachers develop teaching knowledge, skills and values sooner than others. As a result, pre-service teachers often find themselves in a situation where they need additional time and support to develop the required teacher attributes, which in the context of this

study include 3<sup>rd</sup>-year pre-service teachers' skill to effectively prepare Natural Science lessons for an authentic teaching experience.

In light of this, Janssen, Knoef and Lazonder (2019) suggest that it is essential for teacher education programmes to mindfully prepare and support pre-service teachers on their journey to becoming professionally skilled for the teaching profession. Mansfield and Beltman (2019) are of the view, that pre-service teacher support is essential for entering teachers to cope with the expected teaching qualities and values portrayed in national educational policy documents. In response to the preceding argument, which shed light on the expected teacher qualities that pre-service teachers should demonstrate as part of their teacher education, this study acknowledged the need to better support the professional development of Natural Science pre-service teachers in their 3<sup>rd</sup>-year of undergraduate study. This paper describes how a lesson study approach supported the lesson preparation abilities of pre-service teachers during a work-integrated learning (WIL) process.

In the first instance, this paper recognises the need for a lesson study approach in a School of Education through acknowledging the emotional turmoil that the 3<sup>rd</sup>-year pre-service teachers endured that were associated with lesson preparation, particularly during school visitation intervals. This response aligns well with the view of Fetterman (2017) when he cautions that in doing critical emancipatory research, one should be critically conscious of the contextual factors that influence the wellbeing of individuals.

The participants' expressions of anxiety, stress, hopelessness and frustration with lesson preparation signalled their call for support and justified the need for the lesson study approach. Darling-Hammond (2017) reminds us that the WIL process is characterised by teacher educators being tasked to observe and evaluate the pre-service teachers' teaching practice. During this process, the pre-service teachers are expected to follow a school curriculum that requires them to teach specific subjects and perform teacher's duties similar to that of established teachers with vast teaching experiences. More often than not, the pressures of meeting the teaching expectations may have a negative effect on the pre-service teacher's self-esteem, motivation and confidence (Beltman, 2015). This can be substantiated with the participants' responses provided such as "I don't know where to start", "before you come" and "lecturers are coming", "I just want to engage them more", "the class don't take me serious" and "they just sit there".

Secondly, given the issue associated with lesson preparation, this paper describes how a lesson study approach practically empowered the research participants to develop Natural Science lessons within a group format with their fellow peers as a collective. The use of photo-voice methodology and a focus-group team discussion were helpful in detailing the key features associated with the lesson study approach. Evidence suggests that aspects of collective brainstorming and ideas sharing assisted the team of pre-service teacher to collaboratively structure Natural Science lessons. Moreover, the team could also focus on structuring specific components of the lesson plan that includes, the lesson objective (i.e.

“lesson to be straightforward with one or two action verbs”), introduction (i.e. “catchy introduction that is 2min long”), main activity (i.e. “learner activities and practical demonstrations”) and conclusion (i.e. “wrap up of lesson that is 5min long”) of the lesson in detail.

In addition, the participants could also describe their teaching approaches (i.e. “I want them to engage more”) that they wish to follow during these planned lessons. This particular focus on the various aspects that affect teaching and learning aligns well with the work of Larkin (2017), when it is mentioned that the lesson planning process entails a meticulous collection of thoughts and resources concerning what needs to be taught. Lesson planning, as a key feature of the lesson study approach, allows pre-service teachers to proactively decide on the aspects that would be needed to establish a favourable teaching and learning environment aimed at accommodating diverse learner needs (Sims & Walsh, 2009).

Finally, as part of the lesson reflection interval of the lesson study approach, the participants’ verbal responses from a focus group team discussion suggested that the lesson study approach resulted in an improved Natural Science learning experience as one team member indicated that: “Their [learners] vibe was amazing it worked everybody wanted to give an answer to the introduction and everybody wanted to participate in the problem solving” (Team member 1). Given this particular response provided, an expectation of quality Natural Science teaching includes teachers being equipped with the knowledge to develop tasks that would expose learners to acts of self-discovery of scientific knowledge. Molefe, Stears and Hobden (2016) suggest that the aspect of self-discovery can be sparked by engaging and exposing learners to a “hands-on” practical investigation in the Natural Science classroom. Flores (2015) adds, that this approach to teaching allows for a deeper understanding of Natural Science subject matter and the development of scientific reasoning skills.

Furthermore, it was pointed out that the lesson study approach allowed for an improved teaching experience. This assumption can be supported by a participant who mentioned that: “After the lesson presentation, I could not explain the feeling I had, how impressed I was” (Team member 3). A closer look at this particular response suggests that the lesson study approach impacted the pre-service teacher’s self-efficacy and confidence. Given this response, one could assume that the pre-service teacher has undergone an element of transformative empowerment (Fetterman, 2015) since the lesson study approach enabled him to experience the liberating feeling of self-determination in presenting a lesson with confidence. These reflections on lesson presentations provided correspond with the view of Chizhik et al. (2017) when it is suggested that lesson reflection allows teachers to share their “rich” subjective experience of what “worked” and “what did not work” in terms of their teaching practice. This approach, in turn, enables teachers to learn from each other’s teaching experience.

## 6. Conclusion

With the focus on the challenge associated with Natural Science lesson preparation, this study reported on how the implementation of a lesson study approach served as an intervention to support the lesson preparation abilities of pre-service teachers during a WIL process. Couched within critical emancipatory research, implementing the lesson study approach allowed the pre-service teachers to enjoy a significant number of benefits. Although the steps of the lesson study intervention were meticulously followed, the accommodative and engaging nature of the lesson study approach allowed for the existence of the Natural Science pre-service teachers' multiple realities that relate to the WIL process. The study enabled the Natural Science pre-service teachers to enjoy a sense of empowerment towards the sharing of diverse contextual experiences and ideas pivotal to the development of Natural Science lessons for the WIL process.

In this study, the generation of knowledge was inseparably associated with the collaborative practices and interaction that existed between the team of pre-service teachers. Key to this free-flowing of information sharing were the values of respect and trust that existed within the research team (Stebleton, Soria & Huesman, 2014). The lesson study approach allowed for an engaging space characterised by values of trust, respect, support and empathy for each other. The collaborative practices that formed part of the team dynamics challenged the conventional belief that teacher educators are the ones in power who poses absolute knowledge. Instead, recognition was given to the subjective experiences that the pre-service teachers' voice offered. This approach allowed the team to be critically conscious of the contextual factors that impact their teaching experience during the WIL process.

Drawing on Freire's (1972) understanding of collaborative practices, the preparation of Natural Science lessons in this study were not carried out by one for another but rather by one with each other. This approach symbolises the collective role that the team of pre-service teachers played in the structuring of lessons. Ultimately, the activities carried out promoted the principle of emancipation since the lesson study approach served as a means to better position the pre-service teachers for the WIL experience.

## 7. References

- Akerson, V. L., Pongsanon, K., Rogers, M. A. P., Carter, I., & Galindo, E. (2017). Exploring the use of lesson study to develop elementary pre-service teachers' pedagogical content knowledge for teaching nature of science. *International Journal of Science and Mathematics Education*, 15(2), 293-312. doi.org/10.1007/s10763-015-9690-x
- Barends, Z., & Nel, C. (2017). Work-integrated learning within the reading literacy component of foundation phase teacher preparation programmes. *South African Journal of Childhood Education*, 7(1), 1-13. doi.org/10.4102/sajce.v7i1.435
- Beltman, S. (2015). *Teacher professional resilience: Thriving not just surviving*. In N. Weatherby-Fell (Ed.), *Learning to teach in the secondary school*. Melbourne, Australia: Cambridge University Press.
- Bjuland, R., & Mosvold, R. (2015). Lesson study in teacher education: Learning from a challenging case. *Teaching and teacher education*, 52(1), 83-90. doi.org/10.1016/j.tate.2015.09.005

- Brown, C. (2001). *Our side? Critical theory and international relations*. Critical theory and world politics.
- Chizhik, E. W., Chizhik, A. W., Close, C., & Gallego, M. (2017). SMILE (shared mentoring in instructional learning environments) effectiveness of a lesson-study approach to student-teaching supervision on a teacher-education performance assessment. *Teacher Education Quarterly*, 44(2), 27-47. doi.org/10.3390/90010517
- Choy, S., & Delahaye, B. (2011). Partnerships between universities and workplaces: some challenges for work-integrated learning. *Studies in Continuing Education*, 33(2), 157-172. doi.org/10.1080/0158037X.2010.546079
- Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.
- Darling-Hammond, L. (2017). Teacher education around the world: What can we learn from international practice? *European Journal of Teacher Education*, 40(3), 291-309. doi.org/10.1080/02619768.2017.1315399
- De Beer, J. (2017). 'The elephant in the room: the work-integrated learning of student teachers, and the influence of teacher educator scholarship on their professional development.' *Africa Education Review*, 42(3), 1-12. doi.org/10.1080/18146627.2016.1224593
- Department of Higher Education and Training. (2015). *Policy on the Minimum Requirements for Teacher Education Qualifications, as revised 2014*. Pretoria: Government Gazette.
- Fernandez, M. L., & Zilliox, J. (2011). Investigating approaches to lesson study in prospective mathematics teacher education. In *Lesson study research and practice in mathematics education*. Springer, Dordrecht.
- Fetterman, D. M. (2001). *Foundations of empowerment evaluation*. Thousand Oaks, CA: Sage.
- Fetterman, D. M. (2009). Empowerment evaluation at the Stanford University School of Medicine: Using a critical friend to improve the clerkship experience. *Ensaio: Avaliac, ~aoe Politicas Publicas em Educacao*, 17(63), 197-204. doi.org/10.1590/S0104-40362009000200002
- Fetterman, D. M. (2015). *Empowerment evaluation and action research: A convergence of values, principles, and purpose*. In H. Bradbury (Ed.), *The SAGE Handbook of Action Research*. Thousand Oaks, CA: Sage.
- Fetterman, D. (2017). Transformative empowerment evaluation and Freirean pedagogy: Alignment with an emancipatory tradition. *New Directions for Evaluation*, 2017 23(155), 111-126. doi.org/10.3390/laws7010010
- Flores, I. M. (2015). Developing pre-service teachers' self-efficacy through field-based science teaching practice with elementary students. *Research in Higher Education Journal*, 27(1), 1-19. doi.org/10.1080/13611267.2016.1222812
- Freire, P. (1972). *Education for critical consciousness*. New York: Seabury.
- Gordon, B. M. (1986). The use of emancipatory pedagogy in teacher education. *The Journal of Educational Thought (JET)/Revue De La Pensée Éducative*, 2(4) 59-66. doi.org/10.18297/etd/3160
- Guba, E. G., & Lincoln, Y. S. (1988). Do inquiry paradigms imply inquiry methodologies? *Qualitative approaches to evaluation in education*, 1(1), 89-115. doi.org/10.1590/S0104-403620090232
- Hadi, A. (2019). Exploring Preparation of Pre-Service Teachers' English Proficiency and Pedagogy: Stories from an EFL Teacher Education Program. *The Qualitative Report*, 24(8), 1946-1966. doi.org/10.3390/laws7010010
- Janssen, N., Knoef, M., & Lazonder, A.W. (2019). Technological and pedagogical support for pre-service teachers' lesson planning. *Technology, Pedagogy and Education*, 28(1), 115-128. doi.org/10.1080/1475939X.2019.1569554

- Johnston, J. (2011). Interrogating the goals of work-integrated learning: Neoliberal agendas and critical pedagogy. *Asia-Pacific Journal of Cooperative Education*, 12(3), 175-182. doi.org/10.1590/S0104-40362009000200002
- Jovanovic, J., Fane, J., & Andrew, Y. (2018). Giving institutional voice to work-integrated learning in academic workloads. *International Journal of Work-Integrated Learning*, 19(2), 93-109. doi.org/10.1007/s10763-015-1523-x
- Larkin, D. (2017). Planning for the elicitation of students' ideas: A lesson study approach with pre-service science teachers. *Journal of Science Teacher Education*, 28(5), 425-443. doi.org/10.1080/1046560X.2017.1352410
- Lysaght, Z. (2011). Epistemological and paradigmatic ecumenism in "Pasteur's Quadrant:" Tales from doctoral research. Official Conference Proceedings of the Third Asian Conference on Education in Osaka, Japan.
- Mansfield, C., & Beltman, S. (2019). Promoting resilience for teachers: pre-service and in-service professional learning. *The Australian Educational Researcher*, 46(1), 583-588. doi.org/10.1007/s13384-019-00347-x
- Matoti, S. N., Junqueira, K. E., & Odora, R. J. (2011). A comparative study of pre-service teachers' self-efficacy beliefs before and after work-integrated learning. *South African Journal of Higher Education*, 25(6), 1140-1154. doi.org/10.1080/18146627.2013.855423
- Molefe, L., Stears, M., & Hobden, S. (2016). Exploring student teachers' views of science process skills in their initial teacher education programmes. *South African Journal of Education*, 36(3), 1-12. doi.org/10.1108/IJLLS-10-2014-0039
- Ngibe, N.C.P., Pylman, J., Mammen, K.J. & Adu, E.O. (2019). 'Turning Pre-service School Experience Challenges into Strengths.' *J Hum Ecol*, 66(1-3), 33-44. doi.org/10.1080/18146627.2013.853558.
- Osanloo, A., & Grant, C. (2014). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your "house". *Administrative issues journal: connecting education, practice, and research*, 4(2), 12-26. doi.org/10.5929/2014.4.2.9
- Parfitt, A. (2020). Can the concept of the protean career help us to understand millennial pre-service teacher retention challenges? A study of two pre-service teachers' career pathways in England. *Journal of Education for Teaching*, 4(2), 1-12. doi.org/10.1080/02607476.2020.1733403
- Pham, T., Bao, D., Saito, E., & Chowdhury, R. (2018). Employability of international students: Strategies to enhance their experience on work-integrated learning (WIL) programs. *Journal of Teaching and Learning for Graduate Employability*, 9(1), 62-83. doi.org/10.1080/03307476.2020.122303
- Runesson, U., Martin, D., & Clerc-Georgy, A. (2015). Use of theoretical concepts in lesson study: An example from teacher training. *International Journal for Lesson and Learning Studies*, 4(3), 261-273. doi.org/10.1108/IJLLS-10-2014-0039
- Shaul, R. (1974). Foreword. In P. Freire (Ed.), *Pedagogy of the oppressed*. New York, NY: Seabury Press.
- Shor, I. (1988). Working hands and critical minds: A Paulo Freire model for job training. *The Journal of Education*, 170(2), 102-121. doi.org/10.1177/002205748817000206
- Shor, I. (1993). 'Education is politics: Paulo Freire's critical pedagogy.' *Paulo Freire: A critical encounter*.
- Sims, L., & Walsh, D. (2009). Lesson study with pre-service teachers: Lessons from lessons. *Teaching and teacher education*, 25(5), 724-733. doi.org/10.1016/j.tate.2008.10.005
- Stebleton, M. J., Soria, K. M., & Huesman, R. L. (2014). First-generation students' sense of belonging, mental health, and use of counselling services at public research



- universities. *Journal of College Counselling*, 17(1), 6-20.  
doi.org/10.1080/01425692.2015.1044070
- Tran, L. T., & Soejatminah, S. (2016). Get the foot in the door': international students' perceptions of work-integrated learning. *British Journal of Educational Studies*, 64(3), 337-355. doi.org/10.1080/00071005.2015.1128526
- Zimmerman, M. (2000). *Empowerment theory*. In J. Rappaport & E. Seidman (Eds.), *Handbook of community psychology*. New York, NY: Kluwer Academic.  
doi.org/10.1080/02673843.2016.1209120