


Lessons learned from pre-service teachers when implementing the lesson study approach and inquiry-based learning



Author:
Irene Muller¹ 

Affiliation:
¹School of Mathematics, Science and Technology Education, Faculty of Education, North-West University, Vanderbijlpark, South Africa

Corresponding author:
Irene Muller,
12765074@nwu.ac.za

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Background: In the training of pre-service teachers a collaborative lesson study approach was implemented as a teaching strategy, with citizen science as a teaching tool and incorporation of sustainable developmental goals (SDGs).

Aim: The aim of the research was to determine to what extent the lesson study approach (LSA) enabled pre-service teachers to plan lessons in natural science.

Setting: The research was executed at a higher educational institute situated on a campus in an industrial area next to a large river in Gauteng province, South Africa.

Methods: In this participatory action learning and action research pre-service teachers, as co-researchers, indicated their experience when collaborate planning, reflect and present lessons.

Results: The pre-service teachers indicated that the LSA allowed to acknowledge diversity in knowledge and learning. They reported to gain skills like problem-solving, systemic thinking and communication. Inclusion of citizen science and SDGs enhance education for sustainable development.

Conclusion: The inclusion of the LSA has cognitive and affective gains which outcast the challenges of timing and resources.

Contribution: The LSA allows for pre-service teachers to work collaboratively in lesson planning and allows for the inclusion of unique teaching tools such as citizen science and SDGs.

Keywords: Lesson Study Approach; inquiry-based learning; education for sustainable development; sustainable development goals; citizen science; pre-service teachers; diversity in classrooms.

Introduction

Purpose and concept clarification

This research study was executed as part of a National Research Foundation (NRF) project with the aim to implement the lesson study approach (LSA), as part of the professional development of exit-level pre-service teachers who major in Natural Science at a South African university. The LSA consists of four steps namely planning, acting, evaluating and reflecting (Alamri 2020). The following of the steps allowed the pre-service teachers to collaboratively plan, perform and review lessons to improve their classroom praxis. The LSA is derived from the word *Jugyokenkuyu* in Japanese, which means lesson research (Hanford 2015). Inquiry-based learning links well with the LSA as it provides an opportunity for pre-service teachers regarding questioning, investigating and reasoning to collaboratively find patterns, analyse systems, explore relationships and solve problems (Krauss & Boss 2013). Education for sustainable development (ESD) is regarded as:

[E]ducation that empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability, and a just society, for present and future generations, while respecting cultural diversity. (UNESCO 2017)

The sustainable development goals (SDGs) are included in ESD, which focus on crucial challenges humanity faces. The inclusion of SDGs in Natural Science lessons allowed to draw intentional attention of pre-service teachers to global issues such as inequality, unsustainable consumption of natural resources and environmental degradation (UNESCO 2017).

The pre-service teachers working collaboratively in the inquiry-based LSA had to honour the prescriptions of ESD by valuing the input of diverse members and collaboratively decide on a champion version of a lesson to be presented on a specific topic at schools during practical teaching. Citizen science is the collection of scientific data by novices. These novices, usually community members, collect data about a problem or topic of their concern (Buytaert & Zulkafi 2014). Initially, the community participants are regarded as novices of the topic, but the process of being involved in data collection and valued input empowers them to become informed participants who can aid with suggestions to solve the concern or problem (Haklay et al. 2018). Citizen science supports the intent of ESD to provide a tool to promote SDGs. The research methodology and approach delves into the details of the research methodology, - context and - approach.

Research methods and design

The research study followed the participatory action learning and action research (PALAR) approach. The PALAR is a theory of learning that emphasises the connection between real-world learning and shared understanding. This theory explores how social experience is created (Wood & Zuber-Skerritt 2013). Like the LSA, PALAR is cyclical in nature and aims to promote the establishment of a relationship in the first loop and the actual research in the second loop of the cycle. A participatory paradigm was chosen as the research worldview because it supports collaborative engagement, self-awareness through reflection, and the ability to adapt or change (Wood & Zuber-Skerritt 2013).

Context

The research took place at a campus in South Africa in an urban environment next to the second biggest river in the country, namely the Vaal River. The area is known for its large industrial factories linked to the processing of iron ore and carbon fuel (Coetzee & Nell 2018). The position of the campus, next to an important natural water body and in an industrial area, supports the initiative to raise awareness and teach and learn to incorporate ESD and SDGs.

The number of pre-service teachers taking Natural Science as a major subject in the intermediate phase on exit level in the BEd programme amounts to 20. The pre-service teachers are young adults ranging in age from 21 to 30. The pre-service teachers worked collaboratively in groups of four. The responses noted in the findings are therefore a group response. I, the researcher, lectured exit-level pre-service teachers in Natural Science (the intermediate and senior phase) as well as Physical Science. The recruitment of participants for the research study is therefore convenient and purposive (Bertram & Iben 2016) as I am lecturing the Natural Science intermediate phase module in the BEd programme.

Figure 1 aims to guide the discussion about the PALAR and LSA.

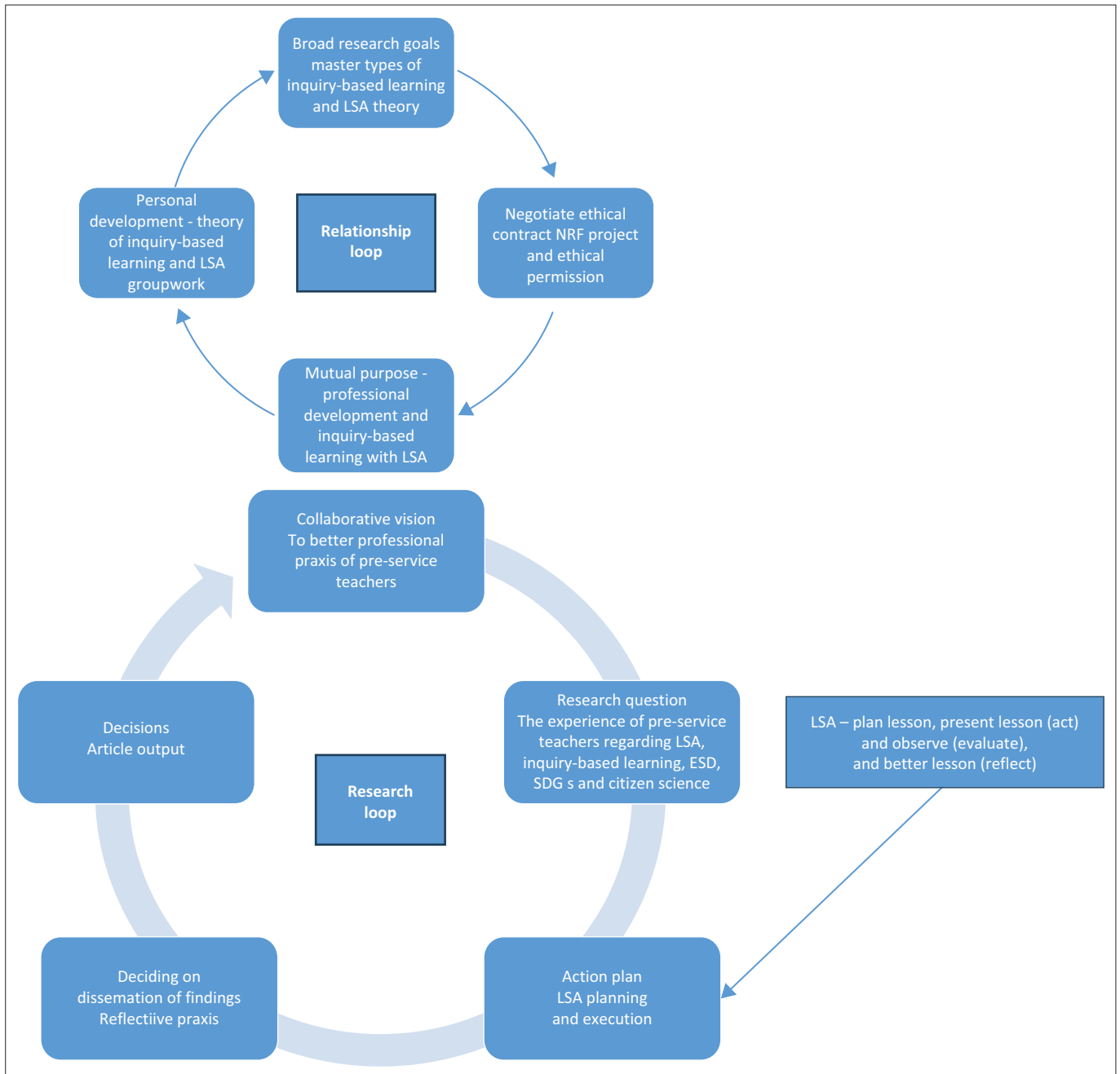
Participatory action learning and action research and Lesson Study Approach

The PALAR cycle begins with a collaborative vision, namely the intention to improve the professional development of pre-service exit-level teachers. The LSA suited the intent as it supports the working of pre-service teachers in groups with peers with the aim to present a champion lesson on a specific topic (Özdemir 2019). The pre-service teachers mastered the theory of both the LSA and inquiry-based learning (IBL) as a first implementation step in the relationship cycle by writing a formative test and all passed. The capability of pre-service teachers regarding the content was revealed in related activities such as practical work and assignments as well as class discussions about the LSA with a focus on ESD, SDGs and citizen science. The group assignments were marked by me, and all the groups showed competence to be able to implement the theory of LSA and IBL in praxis by meeting the average or excellent level of performance. During discussions, the pre-service teachers asked questions about problematic elements when planning lessons such as the formulation of lesson outcomes or the choice of a suitable type of inquiry for a specific topic. As the facilitator, I guide them to motivate their answers and propose follow-up questions to ensure they plan correctly. The pre-service teachers signed consent forms after an independent informant explained the purpose, process and intent of the research study to them. The research loop of the cycle started with the research question, which aims to capture the experience of the pre-service teachers regarding the LSA with added requirements. The following assignment was provided to the pre-service teachers:

In your group, design an inquiry-based lesson by combining topics from term 2 in Grade 7 of the Natural Science CAPS, namely: physical properties of the materials, sorting of materials, waste management and environmental education, introduction to the periodic table, and the use of citizen science as a data collection and - interpretation tool. You can design the lesson using any one of the four inquiry types - either confirmation, structured, guided or open. Remember to motivate your choice of inquiry. Design a worksheet to guide the presentation of the lesson to learners. You will present the lesson to peers, to better it during a lecture. During teaching practice, present the lesson as a revision lesson for term 2 Grade 7 to allow for reflection on the process of planning a lesson, present it to peers, correct it and reflect on the LSA.

I want to accentuate that in South Africa, the intermediate phase curriculum runs from Grade 4 to Grade 6, but Grade 7, which fits in the Senior Phase, forms part of primary school. The pre-service teachers are expected to teach the Grade 7 curriculum when teaching at primary schools. As exit-level BEd pre-service teachers, the topics for implementation of the LSA and inquiry-based learning were therefore from the Grade 7 Natural Science curriculum (DBE 2011) to prepare them for the teaching of the Natural Science curriculum at South African primary schools.

The pre-service teachers planned and created, in a group of 4, an inquiry-based lesson on a topic from the Natural Science Grade 7 school curriculum. The pre-service teachers presented, as a group, their lessons during a lecturing period to peers. The activity student-centred experiment and



Source: Wood, L., 2020, 'Building capacity for community-based research', in L. Wood (ed.), *Community-based research with vulnerable populations – Ethical, inclusive and sustainable frameworks for knowledge generation*, pp. 57–84, Macmillan Palgrave, Geneva

LSA, Lesson Study Approach; NRF, National Research Foundation.

FIGURE 1: The participatory action learning and action research research methodology for the Lesson Study Approach with Natural Science pre-service teachers.

improvisation by plan, do, see and improve (ALEI-PDSI) lesson observation checklist was used by peers to determine learner activity during the lesson, therefore the evaluation step in the cycle. The ALEI-PDSI lesson observation checklist was developed during the implementation of the LSA in Kenya, Africa and relies on the philosophy of activity, learner centred, experiment and improvisation (ALEI) through the approach of plan, do, see and improve (PDSI) (Mugo 2015).

In reflective discussions of presented lessons by a group, pre-service teachers focus on better planning and execution of a lesson to enhance learner activity (Buchard & Martin 2017).

The pre-service teachers were asked to present the created champion lesson at a school during the practical teaching period. After their presentation at schools, the pre-service teachers reflected in a group on the complete experience regarding the LSA and listed requirements such as ESD, SDGs and citizen science by answering the following open-ended questions:

- As a group, reflect on your plan and presentation of the lesson on a certain topic by applying the LSA and indicate the actions you will take to improve the lesson planning and presentation in a written reflective narrative of two pages (800 – 1000 words).

Reflect on the following:

- Your experience of planning a lesson in a group using LSA
- The presentation of the group-planned lesson to peers
- The use of citizen science as a data collection and interpretation tool in inquiry-based learning
- Infusion of ESD and SDGs in the planned lesson.

Data analysis and interpretation

The open-ended reflective answers of the pre-service teachers in groups were analysed by thematic coding utilising the Atlas Ti program. Thematic coding is, according to Braun and Clarke (2020), suitable when you follow the indicated steps: (1) get familiar with the data by finding codes, (2) allocate themes to similar codes, (3) check if the themes match coded quotations, (4) describe and name the themes and (5) generate a report by choosing vivid and explanatory examples that relate to the research question and literature.

Ethical care

The study forms part of a funded NRF project and was approved by a scientific research committee as well as an ethical committee of the higher education institute. The following types of validity was reached in the study: (1) dialogic validity was reached when the pre-service teachers collaboratively engaged in discussing the planned lesson and learner activity when the lessons were presented; (2) outcome validity was reached when the pre-service teachers answered the open-ended reflective questions and their responses were interpreted in terms of the aim of the research, namely to indicate their experience when implementing the LSA and requirements such as ESD, SDGs and citizen science in planning and presenting of lessons; (3) democratic validity was reached when the answers of the pre-service teachers regarding the open-ended questions were discussed during a lecture with them to ensure their experience was correctly interpreted by the researcher; (4) the cyclical nature of both PALAR and LSA ensures process validity where both processes support planning and self-reflection and (5) catalytic validity was reached by the reflective praxis of collaboration between pre-service teachers when planning and presenting lessons as well as discussions between the groups and me (Wood 2019).

Ethical considerations

Ethical clearance to conduct this study was obtained from the North-West University, Faculty of Education Sciences Research Ethics Committee (EduREC) (Reference no.: NWU-00483-17-A2).

Results

The following themes emerged as the lessons learnt from the responses of the pre-service teachers in groups regarding their experience when following the LSA when creating and presenting lessons, which include requirements such as ESD, SDGs and citizen science. The first theme emerges from the value of diverse contributions by group members.

Lesson 1: Diversity in thought, using lesson study approach, leads to recognition of others and growth

A group responded that:

'Although people have different ideas and mindsets, we enjoyed this assignment because 'we were able to build on each other's thoughts and ideas' and 'one person could share an idea that the other never thought of.' (Group 1)

Group 2 supported this notion by indicating that the value of diversity in thought can aid them as *future teachers as it can be of use in their own classes*. This group indicated that *'give up their own point of view in order to sway others and move the conversation along'* can be an asset when negotiating thoughts and knowledge. Group 3 supported the idea when they indicated that *'some situations or times require us to be selective, consider what is best, and compromise to make sure everyone's suggestions were considered and respected.'* Group 5 indicated that *'planning a lesson with others is challenging to the fact that we hardly see things the same'* but later indicated *'working in a group can be a great resource as this is a way to utilise different members' strengths and weaknesses.'* One group supported the notion by indicating:

'[A]s individuals we are different and so are our teaching styles. We have expertise in different areas which enables us to integrate multiple teaching strategies that cater for different learning styles.' (Group 7)

From the responses of the pre-service teachers, I can deduct the following: the pre-service teachers acknowledged that diversity in thought about different topics exists and that the group can be challenged by the diversity in thinking. The pre-service teachers indicated and confirmed with Ebaegu (2018) that they could solve problems and improve their collaborative skills by compromising and weighing the options to choose the best solution. The response of the pre-service teachers agreed with the findings of Stephens (2018) that the difference in thinking about topics can be either a strength or a weakness depending on the group's collaboration. This finding supported Ono and Ferreira (2010) who indicated that leadership in a group can be a challenging factor when implementing the LSA.

Theme 2 links with the diversity of thought and the personal gains of pre-service teachers when implementing the LSA.

Lesson 2: Indicators of skills gained when collaborating in the lesson study approach

All groups indicated different skills gained while participating collaboratively in the LSA. Three subthemes emerged as indicators of skills gained namely, the ability to solve problems, systemic thinking and communication.

Lesson 2.1: Problem-solving skills

The LSA allows pre-service teachers to become more effective in their professional development by becoming reflective practitioners. A group, consisting of four the pre-service

teachers, collaboratively review the attempts of another group of pre-service teachers. The pre-service teachers indicated that they accepted feedback and recommendations more easily from their peers (Dudley 2014) and mastered the art of evaluating and solving problems.

Group 1 indicated that implementing the LSA 'gave us an opportunity to participate in the process of *evaluating and solving problems* as well as *management skills* through working in groups and sharing roles.' The group concluded that following the LSA 'we got to see the different creativity of group members. The *creativity allowed us to expand our way of thinking on an individual level.*' Group 2 supported this by commenting that the LSA '*increases possibilities for critical thinking* and can help us learn and succeed.' Group 4 agreed with Group 1 and indicated 'when we found a reason, *we can provide solutions*' meaning the LSA allows for problem-solving abilities to develop. Group 7 supported the notion of problem-solving skills gained by indicating that collaboration allows for the '*stimulation of innovative ideas and generation of unique solutions.*'

A study carried out in Zambia in 2016 by Jung et al. supports the finding that exposure to the LSA and IBL adds to an increased ability to perform problem-solving. Learners exposed to these approaches in Physics and Chemistry performed 12.4% better than those not exposed. Jung et al. (2016) indicated that teachers involved in the study act as agents of change in classrooms to enhance problem-solving. The pre-service teachers' responses about their ability to evaluate and solve problems supported the research by Vallee-Tourangeu and Vallee-Tourangeu (2017) that such classrooms can be regarded as interactive environments where the teachers were free to manipulate and work on the subject matter, which informed their information processing and improve their performance regarding problem-solving.

Lesson 2.2: Systemic thinking

Systemic thinking allows for the drawing of conclusions after compiling, investigating and considering opinions or findings (Tauifiq, Safarati & Wardah 2017). Tauifiq et al. (2017) report that the LSA can be regarded as a learning management improvement programme for professional training as it accentuates activity and collaboration. The pre-service teachers in the research study were trained through the LSA and relevant activities to reason, analyse and synthesise ideas and inputs.

Vallee-Tourangeu and Vallee-Tourangeu (2017) indicated that systemic thinking consists of the succession of deductive and inductive processing loops. Such a deductive processing loop was indicated by Group 2 who indicated to '*deconstruct challenging tasks into manageable parts and steps.*' This group indicated that their *comprehension* of the task *improved* as they talked about it and explained, therefore a follow-up with an inductive loop. Group 6 supported Group 2 with the remark '*we broke the activity assignment down* as to how it should look like, the end product, and went through it step by step.'

For Group 3, collaboration allows for the '*share of different perspectives and interesting ideas, collective brainstorming, the workload and learnt so much from each other.*' This group indicated therefore their systemic thinking with the cognitive and behavioural outputs which interweaved (Vallee-Tourangeu & Vallee-Tourangeu 2017):

'[I]t was easier to bounce ideas off one another as the members *challenged each other's thinking and planning skills* for the betterment of the project.' (Group 5)

This group indicated that *even the presentation of lessons was better* because of the support of group members. The response of Group 5 agreed with the research of Vallee-Tourangeu and Vallee-Tourangeu (2017) who indicated that systemic thinking allows for the ability to perform actions while attempting to solve a problem.

Lesson 2.3: Improved communication

The relevance of sound communication was accentuated as groups indicated to better understand each other and improve their skill to understand the views and explanations of group members. The acknowledgement of improvement in communication is supported by Agus Susanto and Murwaningsih (2015) who report that students' oral and written communication improved after following the LSA.

Group 1 reported that the LSA allows for 'the opportunity to *improve our communication skills*' and Group 2 indicated that '*oral communication is important* because teaching is centred around it.' Group 3 enhanced their communication by '*improving comprehension by talking about and explaining*' and Group 4 coined that '*ways to improve collaboration is to better communicate and plan.*' Group 6 pointed to '*communicate well* with each other during the planning of the lesson.'

The group responses are coined by Chong and Kong (2012) who indicated that group collaboration and the sharing of tasks and responsibilities are key properties of the LSA. Getting together to plan and reflect on lessons spurs teachers to create better lessons in the interest of their learners. The finding regarding communication among pre-service teachers is supported by Ozawa (2009) who concludes that the response and feedback from peers make teachers more comfortable with the lessons and aid them with vision and clarity regarding curriculum matters. The exchange of views between groups of pre-service teachers on lessons and assessments promotes communication, which helps teachers solve problems with their students. In addition, communication also supports the outcome of Lesson 2.1.

Lesson 3: The combination of citizen science and education for sustainable development enhances learning

As the lecturer of the exit-level pre-service teachers, I opted for an activity including the LSA with additional concepts such as ESD, SDGs and citizen science. The pre-service teachers reported that the inclusion of citizen science and

ESD in lesson planning was daunting to them, but despite the challenge, the pre-service teachers were able to recognise the gain of including citizen science in lesson planning.

Confusion about including citizen science in the planned lesson was indicated by one of the groups:

'[I]ncluding the use of citizen science was a bit challenging.' (Group 1)

As a group, we did not understand what and how to include in the lesson. Group 6 indicated that learners *required clearer instruction and lacked knowledge* about the physical properties of matter as *they were not used to collecting data*. This finding agrees with the research of Peters, Eames and Hamilton (2015) who indicated that citizen science participants as novices in scientific data collection are initially challenged by the task.

The following groups reported the value of including citizen science and ESD as data collection and learning tools:

'[W]e learned that through citizen science learners increase their scientific knowledge and share data collection and how it can be applied to real-life problems.' (Group 1)

Group 2 indicated that *citizen science allowed learners to act as project leaders, with the responsibility in society to lower pollution in their communities*. Group 3 supported that *'citizen science should be integrated into classrooms as it has the potential to boost learner engagement through active and inquiry-based learning.'* Further support their findings by indicating that *learners of all ages can tackle global problems such as climate change, biodiversity loss, inequality and unsustainable use of resources*; therefore, they argue for the importance of ESD. The group means that *citizen science prepares learners to make wise choices to improve society and protect the environment*. The response of the pre-service teachers confirmed the findings of Peters et al. (2015) who place a high priority on the use of citizen science as an educational tool which combines a social activity with scientific enquiry.

I regard the value of citizen science and ESD to be linked with active learning in the real world and the pre-service teachers confirmed this finding when they responded as follows:

'The use of citizen science makes learners be aware of the materials around us in the real world.' (Group 1)

Group 2 indicated that learning that is hands-on helps with sustainability education and another group confirmed that:

'[L]earners and members of the community can find a problem in their neighbourhood and come up with solutions that can help solve the problem.' (Group 3)

Group 6 said that the topic linked with their (the learners) *real life experience* and it was interesting to see how they shared ideas. The ability of the pre-service teachers regarding problem-solving (*Lesson 2.1*) was indicated when a group declared:

'[W]e can improve on the use of citizen science as data collection by encouraging learners to be good observers, as a scientist you observe everywhere you are; by doing so they will master being a citizen scientist.' (Group 6)

The responses of the pre-service teachers assert the findings of Peters et al. (2015) that the research project acts as a catalyst to enhance environmental knowledge, by including citizen science and ESD, and can aid as a relationship-building tool between a school and a local community. The ability of scientist-led projects to transform learners into observers, collectors of data and problem solvers in their communities was also indicated by Makuch and Ackzel (2018) who confirm the feedback of the pre-service teachers and indicate that learners learn about and contribute to environmental knowledge by engagement in citizen science and ESD activities. These activities enable learners to develop environmental awareness, show responsibility and allow for both emotional and physical benefits.

Lesson 3.1: Time and load-shedding constraints

Group 1 indicated *'group decision would take time* because we need to explore the varying perspectives' and *'load-shedding which challenges us in terms of network and data connectivity.'* Group 1 further their concerns by indicating *'it was difficult to get set times* where all the group members were able to give an input at the same time.' Group 2 supported this by indicating *'working in groups can take longer than working alone.'* Group 3 indicated that *they want to improve their time management* when executing a lesson to allow learners to carry out an inquiry and Group 4 stated that *'planning a lesson with others is challenging as the process takes longer.'* Group 4 mentioned that *adapting to the load-shedding schedule* of different group members living in different areas was quite challenging. Group 5 indicated that if they had *a bit more time to prepare lessons* it would be an easy improvement and that *coordinating load-shedding schedules and a changing Internet system* were regarded as obstacles. Group 6 reported that performing practical work in class with learners, *within a fixed time*, was challenging. One group coined the challenge of time by saying:

'[T]ime constraints, it requires scheduling meetings and finding a time that works for everyone. Load shedding is a problem that affected us as we were unable to continue with our work.' (Group 7)

The constraint of time in the LSA is confirmed by the following researchers such as Özdemir (2019), Watanabe (2018) and Alamri (2020). It can be reasoned that the cyclical nature of the LSA requires more time initially to prepare a champion lesson, but in the long run, it is worth the time (Özdemir 2019). The result of Ogegbo, Gaigher and Salagrabam (2019), in a South African study, also confirmed time as a constraint to implement and participate in the LSA.

The impact of load-shedding on teaching and learning in a Music Department was investigated by Yende (2024). According to this researcher, load shedding adds a

stop-start nature to learning which makes it difficult to keep a steady pace. The adaptation to a load-shedding schedule can be mentally challenging and emotionally burdening. The responses of the pre-service teachers agreed with the findings of Yende (2024) when they indicated that load-shedding leads to a stretch in time allocated to tasks and completion.

The LSA is reported to add to the workload of involved teachers (Rahim et al. 2015) and the pre-service teachers confirmed it by indicating that LSA is a process which takes longer time.

Other challenging elements are discussed in Lesson 3.2.

Lesson 3.2: Challenging elements in the lesson planning – Lesson outcomes, available resources

The following elements of lesson planning were reported to be problematic to the pre-service teachers. I regard these elements not as a specific challenge of the LSA but worth mentioning to guide future professional training of teachers.

The first two groups reported that the following elements of lesson planning were problematic:

'The setting of lesson outcomes became a challenge because we did not understand.' (Group 1)

'We managed to outlay the lesson outcomes as they are the most crucial tool or key in lesson planning.' (Group 2)

Group 1 also indicated that the formulation of questions on the learner's worksheet was challenging and stated:

'[W]e did not know what kind of questions we were supposed to ask learners since the topics were broad.' (Group 1)

The response of the pre-service teachers confirmed the finding of Alanzi (2019) who indicated that pre-service teachers find some lesson planning elements extremely daunting. The researcher indicates that exposure of pre-service teachers to planning lessons while training them can overcome this challenge.

The *availability of resources at schools* was mentioned by a group that indicated that:

'[S]ome schools lacked resources, but we managed to adjust our lessons even though in some parts of the lesson it was impossible.' (Group 6)

Another group shared the concern when stating that:

'[W]e are at different schools and *planning one lesson for different context* was a bit of a hurdle.' (Group 7)

'[P]resentation is dependent on the type of resources you have at the school, the learner profile, and the context of the school. It is likely that we may teach the same lesson but present it differently.' (Group 4)

The challenge of resources when implementing the LSA is mentioned by both Stephens (2018) and Watanabe (2018),

which confirms the challenge faced by pre-service teachers. These researchers as well as Ogegbo et al. (2019) in a South African context proposed that the involvement of school management and other educational stakeholders may counterattack the challenge. In Lesson 4, the challenges of the research are discussed.

Lesson 4: Count your losses – Challenges implementing the Lesson Study Approach

Time and load shedding were the major constraints mentioned by pre-service teachers who participated in the research study. It was good to deduct that the challenges the teachers experienced were not related to the LSA but rather to the resources of time and electricity supply.

Conclusion

The lessons learnt from implementing the LSA in combination with citizen science, ESD and SDGs proved to be an enriching experience for both pre-service teachers and me, their lecturer. The guidance provided by the cyclical nature of the LSA in collaboration with a PALAR research methodology ensures that the pre-service teachers deliberately connect and collaborate with each other about the most important elements when planning lessons. The pre-service teachers managed in the process to gain the ability to work together with peers and communicate verbally and in writing. The pre-service teachers realised that there is more to gain than to lose by allowing a diversity of thoughts when planning and implementing lessons utilising the LSA. They demonstrated to master the skill of systemic thinking by breaking down a complex topic into manageable pieces. Facing diverse challenges, they persist and show the ability to work with whatever resources, time, load-shedding or elements of a lesson's challenges they have. The pre-service teachers indicated to be able to adapt to the introduction of new topics, available resources or different types of inquiry approaches when using the LSA and therefore indicated to master the skill of problem-solving effectively.

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Competing interests

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Author's contributions

I.M. is the sole author of this research article.

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Data availability

Data and data analysis, via ATLAS TI that support the findings of this study are available from the corresponding author, I.M., upon reasonable request.

Disclaimer

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References

- Agus Susanto, H. & Murwaningsih, S.P.M.P., 2015, 'Improving students' activity in Mathematics communication through metacognitive learning approach based on lesson study', *International Journal of Education and Research* 3(2), 169–180, viewed 30 November 2023, from <https://www.ijern.com/February-2015.php>.
- Alamri, N.M., 2020, 'The implementation of the lesson study strategy in teaching Mathematic Teachers' perspectives', *Education Research International* 2020(1), 1683758. <https://doi.org/10.1155/2020/1683758>
- Alanzi, M.H., 2019, 'A study of pre-service trainee teachers problems in designing lesson plans', *Arab World English Journal* 10(1), 166–182. <https://doi.org/10.24093/awej/vol10no1.15>
- Bertram, C. & Iben, C., 2016, *Understanding research – An introduction to reading research*, Van Schaik, Pretoria.
- Braun, V. & Clarke, V., 2020, 'One size fits all? What counts as quality practice ireflexive thematic analysis?', *Qualitative Research Psychology* 18(3), 328–352. <https://doi.org/10.1080/14780887.2020.1769238>
- Buchard, J. & Martin, D., 2017, 'Lesson study and its effects', *Research in Education* 6(2), 21–35. <https://doi.org/10.12681/hjre.14809>
- Buytaert, W., Zulkafli, Z., Grainger, S., Acosta, L., Bastiaensen, J., De Bievre, B. et al., 2014, 'Citizen science in hydrology and water sources: Opportunities for knowledge generation, ecosystem service management, and sustainable development', *Frontier Earth Science* 2(16), 26. <https://doi.org/10.3389/feart.2014.00026>
- Chong, W.H. & Kong, A.C., 2012, 'Teacher collaborative learning and teacher self – Efficacy: The case of lesson study', *The Journal of Experimental Education* 80(3), 263–283. <https://doi.org/10.1080/00220973.2011.596854>
- Coetzee, H. & Nell, W., 2018, 'Measuring impact and contributions of South African universities in communities: The case of the North-West University', *Development Southern Africa* 35(6), 774. <https://doi.org/10.1080/0376835X.2018.1475218>
- Dudley, P., 2014, 'How lesson study works and why it creates excellent teaching and learning', in *Lesson study*, Routledge, London, viewed 08 February 2024, from <https://www.taylorfrancis.com/books/edit/10.4324/9780203795538/lesson-study-peter-dudley>.
- Ebaegu, M., 2018, 'Designing Japanese lesson study as a teacher professional development program in a Philippine setting', *Educational Designer* 3(11), 1–15.
- Haklay, M., Bowser, A., Makuch, Z., Vogel, J. & Bonn, A., 2018, *Citizen science: Innovation in open science, society and policy*, UCL Press, London.
- Hanford, E., 2015, *Lesson study' technique: What teachers can learn from one another*, viewed 28 November 2023, from <https://www.kqed.org/mindshift/42021/lesson-study-technique-what-teachers-can-learn-from-one-another>.
- Jung, H., Kwauk, C., Nuran, A., Perlman Robinson, J., Schouten, M. & Islam Tanjeb, S., 2016, *Lesson study scaling up peer-to-peer learning for teachers in Zambia*, Brookings Universal Education, New York, NY.
- Krauss, J. & Boss, S., 2013, *Thinking through project-based learning guiding deeper inquiry*, Corwin, Sage, Thousand Oaks, California.
- Makuch, K.E. & Aczel, M.R., 2018, 'Children and citizen science', in S. Hecker, M. Haklay, A. Bowser, Z. Makuch, J. Vogel & A. Bonn (eds.), *Citizen science: Innovation in open science, society and policy*, pp. 391–409, UCL Press, London.
- Mugo, W.M., 2015, *Influence of strengthening of mathematics and science education training project on pupils' performance in mathematics in Kenya certificate of primary education: A case of public primary schools in Embu West District, Embu County, Kenya*, thesis, viewed 23 November 2023, from <http://hdl.handle.net/11295/90031>.
- Ogebo, A.A., Gaigher, E. & Salagaram, T., 2019, 'Benefits and challenges of lesson study: A case of teaching physical sciences in South Africa', *South African Journal of Education* 39(1), 1680. <https://doi.org/10.15700/saje.v39n1a1680>
- Ono, Y. & Ferreira, J., 2010, 'A case study of continuing teacher professional development through lesson study in South Africa', *South African Journal of Education* 30, 59–74. <https://doi.org/10.15700/saje.v30n1a320>
- Ozawa, H., 2009, *Lesson study approach in Mpumalanga, South Africa*, viewed 12 June 2024, from <https://cice.hiroshima-u.ac.jp/wp-content/uploads/2014/03/5-3-11.pdf>.
- Özdemir, S.M., 2019, *Implementation of the lesson study as a tool to improve students' learning and professional development of teachers*, Mersin University, Education Faculty, Department of Primary Education, Mersin.
- Peters, M., Eames, C. & Hamilton, D., 2015, 'The use and value of citizen science data in New Zealand', *Journal of Royal Society of New Zealand* 45(3), 151–160. <https://doi.org/10.1080/03036758.2015.1051549>
- South Africa. Department of Basic Education, 2011, *Curriculum and assessment policy statement: Grades 4–6: Natural science and technology*, Department of Basic Education, Pretoria.
- Stephens, M., 2018, 'Introduction to the special issue on lesson study', *Educational Designer* 3(11), 1–7.
- Taufiq, M.M., Safarati, N. & Wardah, A., 2017, *Lesson study approach to improve skills students' critical thinking in heat subjects*, *Advances in Social Science, Education and Humanities Research*, p. 584, viewed 30 November 2023, from <https://doi.org/10.2991/assehr.k.211102.054>.
- Vallee-Tourangeau, G. & Vallee-Tourangeau, F., 2017, 'Cognition beyond the classical information processing model: Cognitive interactivity and the systemic thinking model (SysTM)', in S.J. Cowley & F. Vallee-Tourangeau (eds.), *Cognition beyond the brain: Computation, interactivity and human artifice*, 2nd edn., pp. 133–154, Springer, New York, NY.
- UNESCO (United Nations Educational, Scientific and Cultural Organisation), 2017, *Education for sustainable development goals: Learning objectives*, viewed 28 November 2023, from <https://unesdoc.unesco.org/ark:/48223/pf0000247444>.
- Watanabe, T., 2018, 'Japanese lesson study in the United States', *Educational Designer* 3(11), 1–13.
- Wood, L., 2019, *Participatory action learning and action research: Theory, practice and process*, Taylor & Francis, London, Routledge.
- Wood, L., 2020, 'Building capacity for community-based research', in L. Wood (ed.), *Community-based research with vulnerable populations – Ethical, inclusive and sustainable frameworks for knowledge generation*, pp. 57–84, Macmillan Palgrave, Geneva.
- Wood, L. & Zuber-Skerritt, O., 2013, 'PALAR as a methodology for community engagement by faculties of education', *South African Journal of Education* 33(4), 1–15. <https://doi.org/10.15700/201412171322>
- Yende, S.J., 2024, 'Influence of load shedding in South African higher education: A qualitative content analysis of schools of music', *Cogent Education* 11(1), 2359338. <https://doi.org/10.1080/2331186X.2024.2359338>