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Learning Experiences of a Participatory Approach to Educating for Sustainable Development in a South African Higher Education Institution Yielding Social Learning Indicators

Luiza Olim de Sousa 

Community-Based Educational Research (COMBER), Faculty of Education, Potchefstroom Campus, North-West University, Potchefstroom 2520, South Africa; Luiza.desousa@nwu.ac.za; Tel.: +27-18-299-4727

Abstract: A principle of sustainable development is that environmental matters are best handled with the participation of all concerned citizens. The UN has identified a gap between innovative teaching and learning methods and a participatory approach at institutions of higher education (IHE) to support interdisciplinary action. This paper shares the learning experiences of pre-service teacher students who took part in a participatory approach to educating for sustainable development in a South African IHE. A survey research design was used to collect the data from a large group ($n = 376$) of students over one semester. A qualitative research approach used the compulsory module's teaching and learning tasks as intervention. Narratives were completed in groups upon completion of the module. This research established that when including a participatory approach in teaching and learning in an education for sustainable development (ESD) module at a South African IHE social learning indicators (learning, critical thinking, problem solving and dealing with conflict) emerged and students used their different perspectives when reasoning to participate collaboratively to work toward resolving environmental issues. The significance of this paper is that social learning indicators have been identified in multidisciplinary pre-service teaching and learning in a developing country when using a participatory approach in a higher education ESD module.

Keywords: education for sustainable development; higher education; learning experiences; participatory approach; pre-service teacher students; social learning; teaching and learning



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1. Introduction

More than a decade ago, the Bonn Declaration called for the reorientation of teacher education programmes. The programmes were to include education for sustainable development (ESD) through the development, research and sharing of good pedagogical practice in teacher education [1] to produce teachers who recognise their responsibility in building a sustainable future [2–4]. Teachers play a key role in bringing about the changes required to achieve sustainable development [5]. The Global Action Programme recognised teachers as the most influential change agents for establishing an ESD mindset among learners. The Global Action programme outlined how ESD should be integrated into pre- and in-service education and training for teachers [6]. More recently, the United Nations' 2030 Agenda for sustainable development introduced 17 objectives, of which one is relevant to this paper. The Sustainable Development Goal (SDG) 4 seeks to ensure “inclusive and equitable quality education and promote lifelong learning opportunities for all” by 2030. It also wants to ensure that all learners acquire “knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development” [7].

Institutions of higher education (IHE) worldwide increased their sustainability foci accordingly [8], and, through education, ESD began to address sustainability challenges [9].

Currently, the ESD for 2030 framework is focusing on education's role in achieving the Sustainable Development Goals (SDGs) [9]. IHE, as research institutions, are urged to undertake thematic research related to education for sustainable development (ESD) and the SDGs [9].

ESD is framed as action-based, with reflective and stimulating ways of learning that includes cooperative learning; collaboration and dialogue; engaging the whole system; active and participatory learning; curriculum innovation; new teaching and learning experiences [10–12]. ESD invites cross-curricular interaction that is well suited for working within professional learning communities [13]. The skills that teachers must have in order to become effective leaders in ESD [14] are listed as effective communicators, systems and critical thinkers, spatial thinkers, moving from awareness to knowledge to action, cooperative workers, inquirers, acting, judging, imagining, connecting and valuing, as well as developing an aesthetic response to the environment. A case study of US pre-service teachers in a Sustainability Science course researched students' ability to exchange thoughts and ideas with their classmates in group discussions. The reflective discourse helped students to gain content knowledge. Face-to-face collaborative learning proved fundamental when learning about sustainability. Students also identified the need to understand one another's values and perspectives through respectful discussion [15]. In South Africa, communication, critical thinking, and cooperative learning, among other skills, are included in the aims of the National Curriculum Statement Grades R-12. Teachers must, therefore, be able to address the skills in the existing curriculum [16] meaning that module content of pre-service teacher education is crucial. In Africa ESD is only somewhat reflected in its in-service teacher training and education policies and frameworks [17]. By signing Agenda 2065, African leaders have recognised the importance of prioritizing sustainable development initiatives on the continent [18].

2. Problem Statement: Towards a Participatory Pedagogy for Sustainable Development

Participation is regarded as a prerequisite for achieving sustainable development [19], as noted in research studies on the participation in sustainability implementation at IHE and participatory pedagogy [20–22]. UNESCO's teacher education network has indicated that there is a need for a participatory approach in higher education to support interdisciplinary changes [23]. The participatory approach is seen as a positive move to integrate sustainable development into IHE programmes [24] but has been overlooked by lecturers because traditional lectures and pedagogical restrictions, among others, are still being used [25]. In a study, students in an IHE perceived cooperative work during activities as useful. They perceived cooperative work to be an effective technique for developing social skills and as an opportunity to improve academic performance [10].

ESD indicators that have emerged from a distinctive educational mandate are based on interdisciplinarity, multi-perspectivity and participation [26]. Scholars in ESD are calling for experiential, participatory, praxis-orientated, place-based, interdisciplinary and inquiry-based sustainability pedagogies to foster transformative competencies in sustainable development [27–30]. Pedagogies that are learner-centred and that foster reflective accounts, case studies and critical reading and writing activities [31,32] are more aligned to the shift in approach toward educating for sustainable development at IHE. A study in Europe by Lozano et al. [33] presented a framework connecting sustainable development pedagogical approaches to competences in IHE. Some competences were identified as potentially better covered by the pedagogical approaches. For example, systems thinking, interdisciplinary work, empathy and change of perspective, strategic action, justice, responsibility and ethics, personal involvement, interpersonal relations and collaboration, and anticipatory thinking. Some of the competences revealed that they have more pedagogical approaches with a high likelihood of coverage, despite fewer pedagogical approaches that may address them. For example, systems thinking, personal involvement, strategic action, critical thinking and analysis, and interdisciplinary work. Follow up research by Lozano et al. [34] on how European pedagogical approaches are being used to develop

sustainability competences put forward that to achieve sustainability it is necessary to cover all the competences through a combination of pedagogical approaches. A study by Evans [35] in the USA shares both competencies and pedagogies for sustainability education that implies the benefits of integrative, active, collaborative, and applied approaches to curriculum development and teaching. The pedagogical approaches that ranked the highest in confidence ratings were identified as project/problem-based learning (in an organization/community), 72%; integrative learning (inter- and transdisciplinary), 72%; project/problem-based learning (in class), 71%; active learning (in class), 68%; collaborative learning, 65%. Pedagogical approaches that fell outside the high confidence rankings are regarded as being worth applying in an IHE's sustainability module because they are often incorporated in other forms of learning that are ranked more highly in the research. The seven pedagogies relative to their current or potential roles in the module from that research are: discussion-based learning; writing-intensive learning; case studies; experiential learning; creative work/expression; learning communities; internships/apprenticeships as learning devices.

Regarding the state of education research in sub-Saharan Africa, South Africa is by far Africa's leader with too many African states showing signs of underdevelopment in educational scientific research [36] and specifically in teacher education [2]. More education research needs to be shared on the continent and it is for this reason that it has become necessary to share in more depth how a participatory approach in teaching and learning at a IHE influences social learning when educating for sustainable development.

This paper shares the lived experiences of pre-service teacher students, who took part in participatory learning experiences in an ESD module in a South African IHE. The lived experiences of pre-service teachers, especially the unconscious ones, help to understand the human experience [37]. New pedagogies need to be introduced in modules to cater for learner-centred teaching in the twenty-first century.

The research problem that arose from the outline above was as follows: What are the lived experiences of pre-service teacher students who take part in an ESD module using a participatory approach? The specific aim of the research reported in this paper was to analyse the experiences of pre-service teacher students in order to identify social learning indicators that emerged after pre-service teacher students participated in an ESD module. The research focused on the lived experiences using a participatory approach to teaching and learning, from which social learning indicators could be deduced.

3. A Theoretical Underpinning for a Participatory Approach

A participatory approach in teaching and learning gives students the opportunity to become actively engaged in a teaching-learning process that is a shared responsibility. Participatory approaches to learning can further guide students to commit to ESD principles to ensure sustainable living [11]. Participatory approaches are seen as a requirement that can contribute to a paradigm change towards the integration of sustainable development at a IHE [22]. Figure 1 represents a social learning process created from the literature and theoretical underpinning by the author. The theories that form part of the theoretical underpinning of this research are Bandura's social learning theory, situated learning theory, complexity theory and a participatory approach to learning.

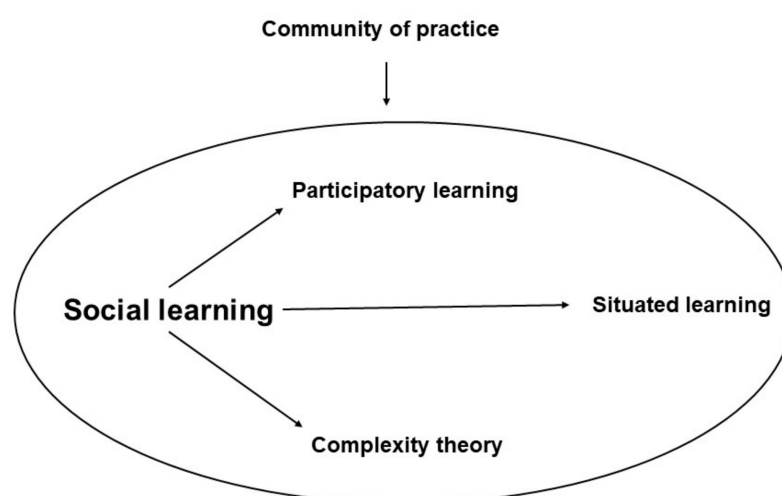


Figure 1. Social learning process theory developed by the researcher.

Social learning can lead to the development of social behaviour [38]. Social learning theory explains human behaviour in terms of the mutual interaction between cognitive, behavioural, and environmental influences. Bandura’s social learning theory puts forward that people learn through observing others’ behaviour, attitudes and the outcomes of those behaviours. By observing others (modelling) during learner-centred activities and experiential learning tasks, pre-service teacher students could form new behaviours that might later inform their actions [39]. Human behaviour is a continuous reciprocal interaction between cognitive personal factors, behavioural and environmental influences in Bandura’s social learning theory.

The situated learning theory (of Lave and Wenger) was also relevant to this research pertaining to adult education. In adult education, situated learning deals with how knowledge is developed over the course of an activity and how students create and interpret new knowledge [40]. This theory argues that learning is situated in a context where the participants are involved in a community of practice. The members of a group and those who join, immerse themselves in a new community and absorb the group’s modes of action and meaning and become a member of the community. This “learning legitimate peripheral participation” is an analytical viewpoint on learning to understand learning [41]. A focus of this theory is the relationship between learning and the social situation in which it occurs [41]. There are four major elements in the situated learning theory. Content refers to the facts and processes of a task within sustainable development. Context refers to the situations and activities that students are exposed to that shaped their value systems. The twenty-first century is calling for teaching and learning processes that promote the connection of context and content. It considers both as an interdependent whole [42]. Community refers to the group in which the student work, where they create new knowledge and negotiate solutions to problems. Participation refers to the students who work together with their group members to master the tasks and suggestion solutions to environmental problems [43]. A study by Schell and Black [44] placed students in situated learning contexts in an IHE. What emerged was an environment of mutual trust and respect where a culture for openness and exchange of ideas were nurtured. When the students’ expectations were met within a realistic learning community, and trust was achieved, active learning was realised. Altomonte et al. [45] found that interactive and situated learning can provide a relevant contribution to improve students’ academic results in sustainability education. It was also found that situated learning in an IHE context can enhance learner-centred pedagogies and can offer methods of communication that can enhance the educational experience. In a more recent study [46] students’ identity development took place when they participated in communities of practice and learned in social networks.

The conceptual-theoretical framework of this study was further based on the complexity theory. The theory offers a new way of thinking about social change in a participatory context in ESD. Complexity theory was developed in the fields of physics, biology, chemistry and economics [47–50] and concerns itself with the environments or systems that are complex. The complex systems, in this case students as human agents, are connected to and interact with one another in different ways. Complexity theory shares chaos theory's concern with larger systems and the relationships that exist among human agents [51,52]. ESD cannot stand alone to resolve complex problems due to a lack of conceptual tools [53]. Instead, a holistic, participatory and interdisciplinary approach, thinking and action are needed [54,55] to encourage a critical engagement with the concept of sustainable development. An interdisciplinary approach gives students a better ability to work in a problem-oriented way, employing transdisciplinary thinking with interconnections in a system within different contexts and at different levels [50,56]. Knowledge about sustainable development requires an understanding of complex systems, an interdisciplinary approach to its theory and a transdisciplinary approach to its practical implementation [53].

The participatory approach also formed part of the conceptual-theoretical framework since it is a pedagogical approach that involves students in the entire learning process from the initial problem to solving and evaluating a problem and defining its solution. Since ESD is process-oriented, participatory and an action-oriented learning approach [57–59], it is well suited. Holistic experiences stimulate reflection, critical thinking and a caring attitude towards the human-nature systems [20]. The latter makes that a participatory approach to learning within sustainable development can help recognise the interdependence of human nature systems [20]. The participatory approach promotes cognitive and affective learning outcomes and develops the professional skills that are needed to enhance sustainable development [60].

The following empirical investigation was launched based on a conceptual-theoretical framework regarding the lived experiences of students who were involved in a community of practice where complex problems were solved through social interaction in a context. A community of practice helps to develop the ability to deal with the complexity of sustainable development matters [61]. The integration of participatory approaches in sustainable development practices can help to promote a culture of participation [62], and where group work is done it can generally aid to promote social and personal skills, but is not an effective method for improving learning [10].

4. Research Design and Procedures

This qualitative survey research design relied on purposive sampling of all the third-year students who must complete a compulsory ESD module in the undergraduate programme. The students answered the research question in a group context about their lived experiences when learning using a participatory approach. The experiences obtained from the open-ended question pertaining to the lived experience yielded narratives that were completed by pre-service teacher students. Data were analysed using thematic analysis [63] of written responses to identify themes.

4.1. Methodology

A qualitative research approach used a compulsory ESD module's teaching and learning activities as an intervention. Throughout the semester, the pre-service teacher students completed eight group activities for assessment during contact sessions. The activities were completed in a group context, which consisted of a minimum of five and a maximum of eight members. Each group member was a subject specialist pre-service teacher student from the Intermediate Phase (Grades 4–6), Senior Phase (Grades 7–9) or Further Education and Training band (FET) (Grades 10–12).

The activities involved the use of group expertise to solve environmental matters using the knowledge gained from the module about environmental education. Each time the pre-service teacher students had to relate the new knowledge gained to their subject-

specific curriculum. All the groups provided feedback during the contact sessions where the outcome of their finalised task was discussed. Depending on the nature of the task, some tasks were assessed during the feedback session and others were submitted before the feedback for assessment by the lecturer. An environmental audit was a major group task that took six weeks to complete in the same group context and also formed part of the formative assessment of the module. The only difference with the audit task was that the groups met outside of the lecture hall and completed the task at their leisure.

A school ground environmental audit of a former private school on the grounds of the IHE had to be completed by the group. In a report, the group had to provide a general analysis of how the school curriculum incorporated the use of the school grounds in a school phase (Intermediate, Senior and FET) of their choice. The group had to analyse each of the following themes: garden education, water education, wildlife habitat, school grounds management, outdoor education, nutrition, school subjects and life skills, and explain how each theme could be developed into a practical aim at the school. The proposed practical aim was then discussed further as an educational aim for the phase of their choice. In the report, the pre-service teacher students had to explain how the learners would learn about each of the themes in a subject and grade of their choice through the curriculum. Together, the pre-service teacher students engaged in a unique opportunity that added value to the teaching and learning for sustainable living practices in a school, since the environmental audit task integrated the curriculum alongside ecological and environmental education.

Upon receiving the assessed environmental audit task, the groups of pre-service teacher students were required to reflect on the latter task and all their activities in the module. The group was requested to share their experiences with their group members and write a group narrative. Then, the entire cohort discussed their shared experiences verbally. The narratives helped to understand how the pre-service teacher students experienced a participatory approach to learning actively, questioning, thinking critically and using interdisciplinary thinking when working in groups over 10 weeks. Figure 2 represents the process followed during the participatory learning experience in the community of practice. The process reveals the theoretical underpinning of social learning theory, situated learning theory, complexity theory and a participatory approach to learning. The activities ensured that the module's learning objectives were mastered with a strong focus on curriculum development and ecological and environmental education. By working in groups as required by the module outcomes, teamwork, time management, communication skills and problem solving as a soft skill were further developed and nurtured in the learning process.



Figure 2. A representation of the process followed during the participatory learning experience developed by the researcher.

4.2. Paradigm

The research of this study is based on the interpretivist epistemology since it aimed to understand lived experiences of pre-service teacher students who took part in a participatory approach to learning in an ESD module. In trying to understand the lived experiences of the pre-service teacher students who took part in the participatory approach to learning in an ESD module, the idealist researcher was dependent on methodological principles of interpretation.

4.3. Sampling Strategy

The survey with an open-ended question was administered at the end of the semester, to all the third year contact pre-service teacher students who were registered ($n = 376$) for the compulsory module Introduction to Environmental Education in a Bachelor of Education programme. Since non-random purposive sampling of the population was followed, all the pre-service teacher students who had agreed to take part in the voluntary research had the opportunity to complete the survey question in group context.

The pre-service teacher students were made up of both male and female students who spoke English or Afrikaans as their first or second language. The pre-service teacher students represented the cultures of South Africa's rich cultural diversity. The narrative feedback was a reflection of the discussion that the group members were asked to have with each other. The groups were invited to share their lived experiences by writing a narrative in group context during the contact session. The narrative was used to understand the complexity of working in a group to complete tasks and how the group worked with the complexity. The pre-service teacher students worked in multidisciplinary subject specialist groups and used a participatory approach to analyse and solve the environmental matters in the modules' tasks. Interdisciplinary thinking and intercultural competencies were addressed, allowing the students to use their new knowledge in creative ways.

4.4. Method of Data Collection

The narrative in this research was an open-ended question to be discussed within a group context. The question posed to the students was "Share your experience of working on group tasks, discussing ideas and proposing solutions to environmental challenges, when learning about ESD in the semester module An Introduction to Environmental Education."

The researcher, who was also the lecturer of the module, collected 59 group narratives from the entire cohort after the contact sessions. The data sets were only handled by the researcher who collected, analysed and interpreted the data to capture a rich interpretation of what the pre-service teacher students had experienced through the completion of the activities in the module.

Thereafter, the data were only viewed by the second coder who worked with the datasets in the researcher's office, where the data were stored as a hard copy and in its analysed form on an external hard drive and kept safe by the researcher.

4.5. Method of Data Analysis

The 59-strong data set was analysed using manual coding [57] to answer the research question (What are the lived experiences of pre-service teacher students who take part in a participatory approach to learning in an ESD module?). For this small-scale study, the researcher used Microsoft Word's table function to directly code onto the data. Figure 3 presents the data analysis path. Firstly, the researcher sorted the data. All text that was associated with a related theme was pasted into the left-hand column owing to its similarity. The text that was added was quoted verbatim and copied from the data source. What began to emerge in the first column were rows with bold text highlighting words that associated it with a specific row. Bullets were used for multiple entries in a row. In the second column, the researcher used descriptive coding to summarise, in a word or phrase, what had emerged from the data in column one. Based on the amount of bullet entries (in column one) for each theme (in column two) the word cloud presentation of data

analysis was generated owing to its frequency. The researcher used focused coding for the second cycle of data analysis that produced major categories or themes from the data as the researcher searched for the significant codes and categorised the coded data based on the thematic similarity [64]. An independent colleague verified the codes and analysis of the data sets to ensure trustworthiness, rigour and quality. The researcher decided to use the independent coder for investigator triangulation [65] and to ensure content validity. The two coders then collaborated on the concept meaning where discrepancies in the interpretation of the data were found [64]. A code book was compiled to list and define the codes. As the process of code mapping evolved, the codes were reviewed [64]. The compilation of codes in the code book was done until saturation of the codes was reached. As part of the validation process, saturation was reached when the coding of the new data did not yield new themes, but reaffirmed existing codes [64,66]. The full sets of codes were then subjected to code mapping. This refers to the progress of the full set of codes, which were then reorganised into a selected list of categories and later condensed further into the central themes that emerged from the study and was added to a third column. The last stage of the analysis was the integration of primary codes, categories, themes, and concepts of the analysis into a narrative form, taken from the first, second and third column [64].

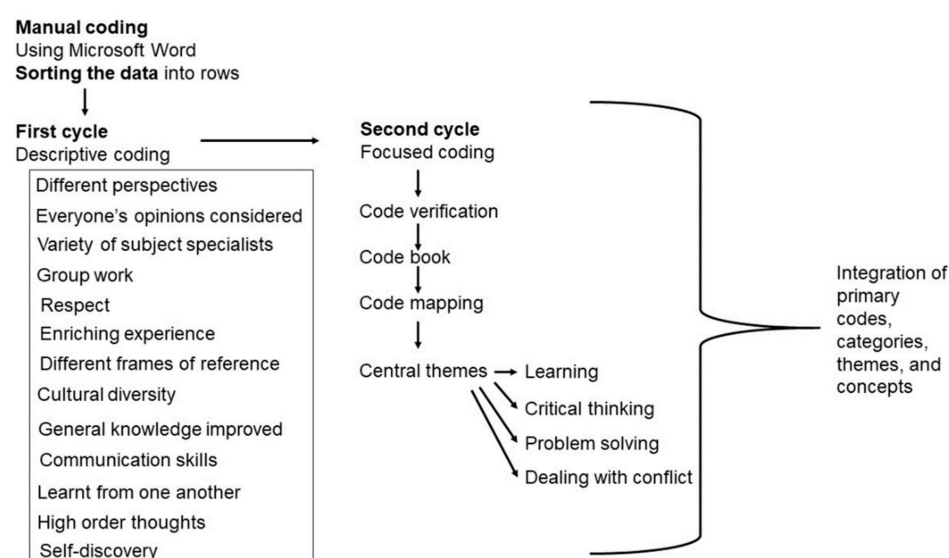


Figure 3. A visual presentation of the analysis process.

The analysis, through descriptive coding, of the qualitative data was undertaken and presented in a word cloud. A word cloud is a visual representation of word frequency when working with large data sets. It is a simple manner by which the data are visualised and is increasingly being used as a simple tool to identify the focus of the written material. Word clouds are generated through a computer programme that takes a text and counts the frequency of each word in the text. The more commonly the word or term appears in the text, which is analysed, the larger the word appears in the image generated. The caution associated with the use of a word cloud is that it falls short of grouping words that have the same or similar meaning and it tends to focus only on single word frequency and not on phrases [67,68].

4.6. Ethical Consideration

The application for ethical clearance for this study was received from the faculty's ethics committee after the project proposal was submitted to the various research committees for approval. The research was considered to be of minimal risk, since it is normal practice for pre-service teacher students to take part in the assessment tasks of the compulsory module and share their reflections. Pre-service teacher students who did not wish to

take part in the reflective narrative were free to do so. Everybody had to take part in the assessment task activities since they contributed to the participation mark. The anticipation was that the pre-service teacher students would realise the benefit of the participatory approach to ESD. The pre-service teacher students all received a letter outlining the aim and objectives of the research. The letter covered all the ethical matters and confidentiality, and all the pre-service teacher students who decided to take part, were required to complete the consent form. The pre-service teacher students' anonymity and option to withdraw from the study were addressed in the formal letter of invitation explaining the research. The pre-service teacher students had the freedom to decline or accept the invitation. In order to ensure confidentiality, the group participants' names were not required when they completed the survey question that is reported in this paper.

5. Results and Discussion

After completing a series of activities in group context throughout the module, the students took part in a detailed discussion of their participatory experiences to learning. The results of the analysis, as they pertain to the research question, are presented next.

An analysis through the descriptive coding of the qualitative data are presented as a word cloud in Figure 4. The analysis revealed that the pre-service teacher students experienced different perspectives held by the group members very highly during the group discussions [15]. The consideration of everyone's perspectives and opinions during the discussions is an indication that in this module the participatory approach brought culturally diverse students together who had an enriched learning experience. The students experienced good working relations as the group members worked collaboratively and developed their communication skills [33,34]. A nurtured collaboration and dialogue are characteristic of ESD [12]. Democratic values could have underpinned the culturally diverse group of subject specialists [7,69]. The groups reported an enriching experience working together where respect for one another was realised as well as experiences of self-discovery [35] and development of higher order cognitive thinking. The different frames of reference and varied opinions that were shared using the participatory approach confirm the groups experiencing having learnt a lot from one another through social learning [34,45]. Hence the general knowledge of the group members was enriched.

The analysis of the verbatim responses from the groups who reflected on their experiences as they pertain to the research question, are as follows:

"The fact that group members came from different subject areas helped that we looked at issues from different perspectives." (Group 46); "Because everybody in the group had a variety of different subjects we could learn from one another and share different ideas about teaching sustainable development." (Group 12); "...give your own opinion because everybody has different subjects and so individuals as a group decided on the best solution even though there were at times differences, everybody decided on better solutions." (Group 9)

The excerpts provide an insight into how the mixed groups of subject specialists experienced the different perspectives and the enriched discussions that took place in the groups. Discourse in groups as engagement for resolving problems is a complex and interconnected affair that yields meaningful outputs when a mix of participants is present to offer a new way of thinking [15,43] within ESD. When all the experiences were considered, a social learning environment, to which the students were exposed [38], allowed for the development of a new method in which groups learned. Groups decided collaboratively on the best solution for a communal representative answer. The students' experiences prove Bandura's social learning theory correct, as it emphasises that the students are not driven internally or by environmental influences. Students are motivated to learn socially because of a continuous reciprocal interaction between their own behaviour and its controlling conditions—their eagerness to work cooperatively participating and gaining skills [10] in ESD learning activities [15,45]. The students' learning experience is a result of the behavioural observation of others [70].

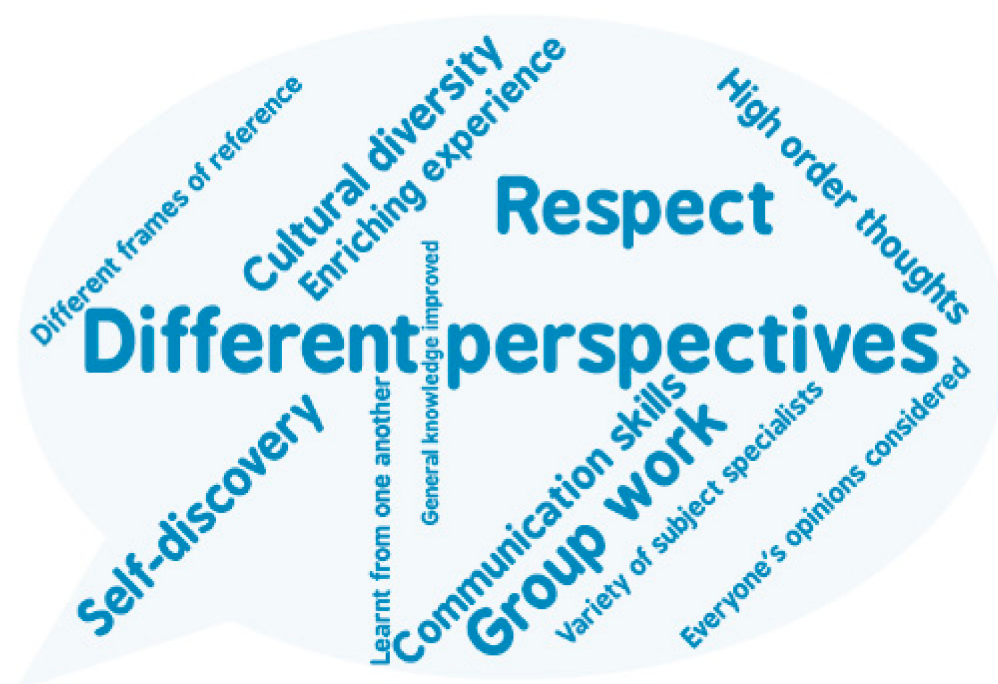


Figure 4. A word cloud of the descriptive coding of the data for participatory learning developed by the researcher.

When considering the following experiences of the groups, cooperative learning, together with the practical experience of learning, was experienced as a rich ESD learning experience.

“A lot was learnt in the environmental audit by experiencing everything together as a group.” (Group 5); “All subjects that are presented at school can become involved in the environment so that environmental learning can take place.” (Group 23); “We learnt how to integrate different subjects with the different environmental issues.” (Group 18); “We learnt to respect the environment as well as each other and to work effectively together.”. (Group 55)

The group members respected everybody’s inputs and opinions. The students immersed themselves in their new learning community and identified with it as their communal learning space. The example, of situated learning [40], illustrates that enriching learning experiences lead to positive experiences with regard to the input from individuals and their subject content, especially with respect to how to apply environmental learning when teaching a subject. The theory rightfully argues that learning is situated in a context where the participants are involved in a community of practice [43]. It also focuses on the relationship between learning and the social situation in which it occurs. However, the experiences of students working in groups in this research study shows that, as per situated learning theory, concepts learnt by the students during activities can be applied in other contexts. Environmental education is interdisciplinary by nature and concepts learnt by students, in general, are applied to their specific subject context and made relevant for their context. The students took part in participatory experiences to learn and understand how environmental matters are related to subjects in a curriculum [35]. Students also learnt how environmental matters are related to their group members’ subjects with regard to interdisciplinary knowledge, as well as how to apply systems thinking to their subjects [34]. The participatory approach experience promoted both the connection of context and content [38] as well as holistic and interdisciplinary thinking [54,55].

Experiences of the groups also relate to the social situation within which learning takes place.

“Group members also come from different backgrounds. It means we were able to draw upon different frames of reference and understanding when it came to developing solutions.” (Group 6); “We all came from different regions and have different cultures, yet we were able to interact [with] each other for the whole class semester.” (Group 10); “We were taught to think critically especially during the [environmental] audit task.”. (Group 32)

The students’ experiences speak to the cultural differences and different frames of reference that allowed for critical higher-order cognitive thinking to take place. The cohort was made up of a multicultural mix of students from all nine provinces of the country and is representative of the nine official languages spoken in the country. English or Afrikaans is either a first or second language spoken by students. Despite the students’ general knowledge that improved, their communication skills improved, they learnt from one another and were instrumental in facilitating one another to think critically during an intense environmental audit task activity following a participatory approach [44]. Professional skills, for example, communication and cognitive skills were developed through learning about ESD and through participation in a community of practice. Students working collaboratively make up complex systems and are connected to and interact with one another in different ways [35].

ESD highlights the complexity of environmental matters, the triple bottom line, and the interdependence of ecological systems aided by systems thinking. Transdisciplinary thinking, interconnections in systems and within different contexts, can facilitate multicultural groups to work in a problem-oriented manner [33,34,50,56]. The holistic learning experience that students were exposed to in their group context stimulated reflection, critical thinking and a caring attitude towards human-nature systems [20].

A total of four main clusters emerged from the second cycle [57] of focused coding in Figure 5. Learning, critical thinking, problem solving and dealing with conflict emerged from the analysed data as social learning indicators.

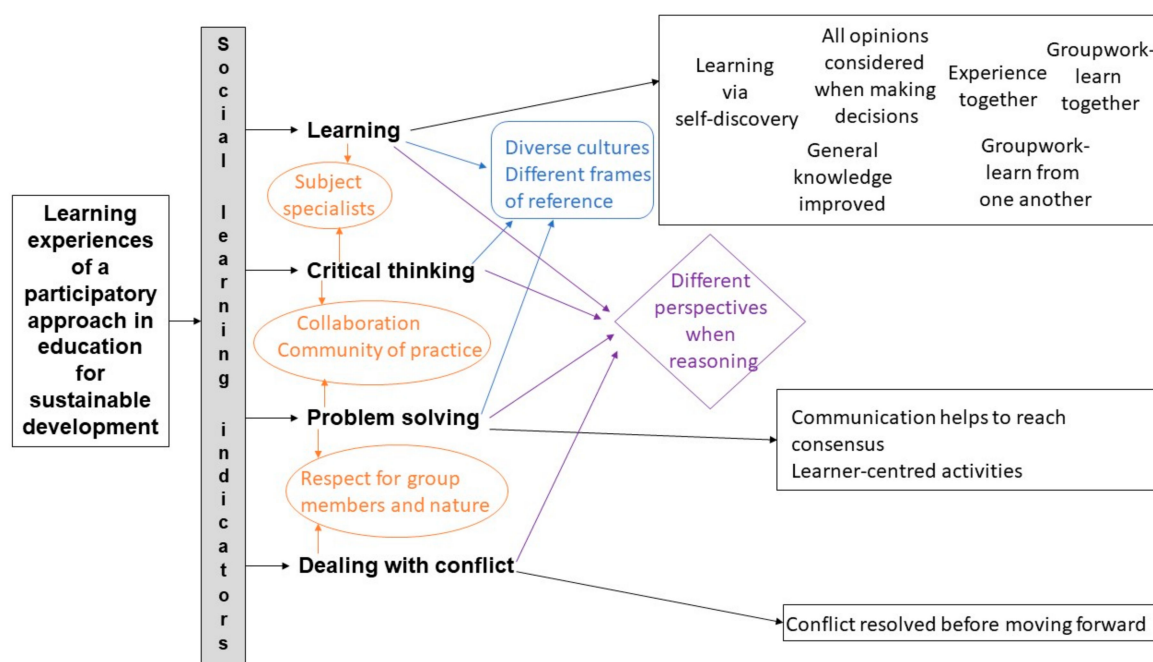


Figure 5. Social learning factors ensued after a participatory approach experience to ESD in a higher education institution developed by the researcher.

The social learning indicators that emerged from the experiences of groups after a participatory approach to ESD in higher education are discussed in the following section.

The groups that were made up of subject specialists experienced an enriching learning experience that improved the groups' general knowledge. The students learnt through self-discovery, from one another, and from sharing their knowledge with their group members. The groups completed the cycle of enriching and expanding their knowledge base through shared learning. Other studies have also pointed to reflective discourse that helped students to gain content knowledge in face-to-face collaborative learning settings [15,45]. Cultural frames of reference and subject-specific perspectives were used when analysing and discussing solutions to environmental issues in the complex world.

Critical thinking emerged as a social learning indicator. The students developed critical thinking skills through the activities that they completed in a participatory group context and it yielded solutions to the environmental issues in a social learning context [71]. The development of the critical thinking skills took place as the groups analysed the themes, reasoned together, evaluated the content of the activities to solve problems and make decisions [33]. Different perspectives that existed within each group gave rise to a variety of solutions that were discussed. Everybody's opinions were considered during the evaluation discussions by the subject specialist group members. The different frames of reference from the diverse cultural backgrounds within groups meant that solutions to problems and decisions that were made were inclusive of society. The participatory approach to teaching and learning guided groups to commit to ESD principles [11] and transform society.

Problem solving emerged as a social learning indicator when working collaboratively on an activity. The students experienced that problem solving skills were developed through open communication channels and respect for one another [44], and the natural environment that influenced their discussions. A study pointed to how interactive and situated learning enhanced learner-centred pedagogies and offered methods of communication that could enhance the learning experience [45]. In this study, the learner-centred activities gave students in a group the platform to discover together and solve problems using a variety of perspectives and frames of reference. Communication skills were also further developed, and the students mastered learning in their new community of practice.

Dealing with conflict emerged as a social learning indicator. The students' multiple perspectives led to more solutions on the table, greater discourse and disagreements. It was deemed important by the groups to deal with conflict immediately and resolve them before moving forward with the task's activity. Issues of conflict stalled progression and by resolving matters the students showed respect for one another.

Therefore, the analysis revealed social learning indicators that emerged from multi-faceted groups (culture, language, subject specialist) with varied frames of reference who used their different perspectives when reasoning in an ESD module using a participatory approach in higher education. This paper contributes to the literature on student social learning in education for sustainable development in an IHE. Social learning involves students in cooperative activities where they communicate, develop skills and are challenged to use critical thinking skills, among others. Critical thinking and problem solving are two sustainability competencies that emerged through a participatory learning approach in this study. For learning to take place in this ESD module and to achieve sustainability it is necessary to cover competences through a combination of pedagogical approaches as was pointed out in other studies [33,34].

6. Limitations of the Study

The study presented in this paper has several limitations. The results and the conclusions cannot be generalised because of the limitation of the sample and sample design. One cohort of pre-service teacher students from an ESD module in one South African IHE were sampled. Future research could include a longitudinal study design that also includes the students in the same module but from the other two sister campuses. The quantitative data and its results have not been included in this paper because it reports on pre-service teachers' sense of self-efficacy to teaching ESD. A data analysis management tool is a

limitation. A computer programme such as Atlas.ti could have been used. The small data set was manageable for the researcher using a Microsoft Word programme. The researcher and not the computer program assigns codes or names to categories, and it is the researcher who determines which units of data go with the codes [63]. A computer programme such as Atlas.ti could have presented the connections differently. The codes and analysis of the data in this study were verified to ensure trustworthiness and validity. Despite its limitations, the data collected and analysed in this study does add to scholarship. The identification of social learning indicators in the context of the participatory approach at IHE is a topic that needs to be considered in ESD teaching and learning in the 21st century.

7. Conclusions

The purpose of this research was to establish the lived experiences of pre-service teacher students who took part in an ESD module using a participatory approach. This research established that the participatory approach used in a ESD module at an IHE in South Africa resulted in social learning indicators. Learning took place amongst students, critical thinking and problem solving skills were experienced, and students deemed dealing with conflict as important when learning socially. This research established that when including a participatory approach in teaching and learning in the ESD module at the South African IHE students used their different perspectives when reasoning and participating collaboratively to work toward resolving environmental issues. Despite this research being based on the lived experiences of one cohort of pre-service teacher students where complex environmental issues were solved through social interaction, the findings are not representative of IHE that offer ESD modules. Future research could explore theory building. This research brings to the fore the need to focus on the development of innovative teaching and learning participatory approaches that promote interactive, learner-centred and transformative learning. By focusing on new teaching and learning experiences at IHE the rethinking of learning approaches may assist the transformation of learning and training environments through the integration of sustainability principles into education.

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Institutional Review Board Statement: The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Faculty of Education Sciences Ethics Committee of the North-West University (NWU-00203-16-A2 and 23 June 2016).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: Data available on request due to ethical restrictions. The data presented in this study are available on request from the corresponding author. The data are not publicly available due to the ethical restrictions.

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