

An Investigation and Intervention on Challenges Faced by Natural Science Teachers When Conducting Practical Work in Three Selected School of Zambezi Region in Namibia

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Abstract

Practical work in science is acknowledged and widely accepted as an important component in teaching and learning. However, in the Zambezi region, it has been discovered that some primary schools find it difficult to engage their learners in practical work. As a result, only a little or no practical work is conducted in some primary schools. The aim of this study is to investigate the challenges faced by teachers in conducting practical work in selected primary schools in the Zambezi region. Interviews were conducted with Natural Science teachers in three selected primary schools in the rural areas to identify the challenges that they experienced in doing practical work in their lessons. According to the data obtained from the participants, the results indicated that teachers faced challenges in conducting practical work in Natural science as there was: lack of apparatus and science laboratories, no time allocated for practical work on the school time-table and limited training on changes taking place in the education system. If the above challenges are to be taken care of, teachers will be able to do practical work effectively thus enhancing the performance of the learners and subsequently improving their results in Natural Science.

Keywords: Practical work; Natural science; Laboratory; Apparatus and Challenges.

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1. Introduction

This episode introduces my study, which is aimed at investigating the challenges that Natural science (NS) teachers face when conducting practical work (PW) in primary schools of Zambezi region. The first fragment of this article discussed the background of the study, followed by the research question as well as the significance of this study and ultimately the limitation and delimitation of my study.

1.1. Background

Practical work is one of the main forms of teaching used in science and it is a very important teaching style in any science subjects' curriculum. Reference [1] defines PW as "any teaching and learning activity that involves the learners in observing or manipulating real objects and materials". PW can take place in the laboratory, around or out of school setting such as in the field PW includes activities such as investigations, laboratory work, fieldwork and teacher demonstrations.

Reference [1] states that some knowledge cannot simply be transferred from teacher to learner by teaching. Learners must play an active role for them to understand the work being taught. Accordingly, learners should learn science by undertaking in hands-on research. PW is very important as it allows learners to demonstrate what a learner is capable of doing on a certain work and even in real life.

In Namibia, PW is considered important in science. According to the Ministry of Education (2010), the importance of studying science subject is to increase the learners' knowledge and understanding of the world they live in, critical thinking, investigating phenomena, interpreting data, and also applying knowledge to practical skills.

The Natural science curriculum (NSC) in Namibia lists practical activities that should be done with each curriculum item listed. It also recommends that the teaching of all topics listed in the syllabus should be practical based. According to [2] states that, "suggestions for practical activities or demonstrations that are considered essential and which all learners should have been exposed to, either through coursework or preparation for the practical examination, are included at the end of each topic" (p. 2).

PW is very important in the teaching and learning process of NS so it must be taken seriously by all NS teachers. [3] stated that the content of science is highly complex and abstract. Students need to participate in enquiry to appreciate the spirit and methods of teaching science. PW is naturally interesting to students. It is of great importance to make sure PW is conducted with learners for them to understand better.

Despite the fact that PW is very important in the learning process of science subjects, challenges are encountered by teachers. From the study carried out at Mpumalanga secondary schools, South Africa by [4], posits that practical work seems to be affected by various factors.

The most prominent factor is teachers' perceptions of their learners. He believes teachers who perceive their learners to be motivated and non-disruptive are more likely to engage learners in higher-level types of PW.

Another factor is the attitude of teachers towards innovation. Schools where innovation is highly supported have science teachers engaging in higher levels of PW.

The other most important factor is availability of physical resources (e.g. laboratories, science apparatus or portable laboratory stations) and teachers' motivation towards PW. Those teachers who are motivated to do PW will always find ways to do so even if they are in poorly resourced schools but those who are not motivated will not do PW even when they have access to the best of resources [4].

Reference [5] states that teachers encounter many obstacles when conducting practical inquiry teaching. These obstacles include "the teachers' lack of time, class size, students' motivation and ability, teachers' weak understanding on the nature of science, inappropriate curricula, lack of pedagogical skills, conflicts between the ideal standards and the realities of science classes and typical school culture".

Reference [6] regards PW as one of the most challenging tasks for science teachers, for that reason it is practiced rarely or incompetently in many science classrooms in the study area. The various reasons suggested for teachers' reluctance in adopting PW include the lack of external support such as limited time, large number of students, inavailability of resources, and the absence of trained laboratory assistants. This PW is crucial and the study is guided by the experimental learning theory.

1.1.1 Theoretical framework

The theoretical framework of this research is pinned on the experiential learning theory. Kolb (1984) came up with the learning theory. Kolb is cited by [7] where he posits learning as the process whereby knowledge is created through the transformation of experience. This experiential learning theory works on two levels, namely, four stages cycle of learning and four separate learning styles. Experiential learning theory is concerned with the internal cognitive process of the learner [7]. In this learning theory, effective learning is seen when a person passes through all four stages. The stages are; concrete experience, observation, reflection on that experience and formation of abstract concepts and generalizations (conclusions) which are then used to test hypothesis in future situations thus resulting in new experiences [7].

1.2 Statement of the problem

In NS, PW is the most suitable way of learning recommended in the syllabus so that learners might have a better understanding. Some schools face problems in carrying out PW in NS. This was experienced by the researchers during school based study when presenting practical work in NS. This problem prompted the researchers to investigate on challenges hindering NS teachers from conducting PW effectively. The research is guided by the research questions stated below.

1.3 Main research Question

What are the challenges and mediating strategies encountered by NS teachers when conducting practical works in three selected schools of Zambezi region?

Sub-research questions

The questions that will guide the study are:

1. What challenges do NS teachers experience in conducting PW?
2. What are the teacher's and learner's attitudes towards PW?
3. What are the teacher's qualifications and experience on PW?
4. In what ways can PW in NS be enhanced?

1.4 Significance of the Study

This study is of great benefit to all science practitioners and their novices. The results of this study benefit policy makers as it informs them of the challenges that prevent teachers from conducting PW in schools. This helps them to come up with suitable policies which can address these challenges. Moreover, it benefits teachers as they would be aware of the different ways to improve and mediate PW activities. When the suggested solutions are taken into consideration, learners might have benefited by receiving necessary skills and subsequently learner's performances in NS improved.

1.5 Limitations

There were limitations to this study including that not many researchers engage PW in Namibia at primary school level. This affected the literature review on PW. Another possible limitation was that some teachers were not giving information as expected.

1.6 Delimitations

Participants of this research were restricted to NS teachers in the three selected schools in Zambezi region, and it cannot be generalised.

2. Research Approach and Design

In this study a qualitative approach was used to generate the information from teachers on the challenges they face when conducting PW in NS. According to [8], a qualitative approach is best when exploring a problem and developing a detailed understanding of a central phenomenon. He theorizes saying a qualitative approach best suits when addressing a research problem in which you do not know the variables and need to explore. [8] defines a case study as a "qualitative design in which the researcher explores in depth a program, event, activity, process or one or more individuals" (p. 241). So qualitative was the best research design for this study. This research explores the challenges faced by NS teachers. It seeks an in-depth understanding on why PW are not conducted in selected Primary schools populace in Zambezi region.

3. Population

A population is the larger group with one or more characteristics in common from which a sample is obtained [9]. In this study the targeted population was 9 NS teachers in three selected primary schools in Zambezi region. These are the people in a better position to inform us on barriers they face when conducting practical works.

3.1 Sample and Sampling Procedure

Reference [9] states that a sample is a group of individuals, items or events that is drawn from the larger group of similar characteristics to provide information to the researcher. To save time and minimize the costs sampling was very important for this study as purposeful sampling was used. Purposeful sampling is another term that describes qualitative research. In this sampling approach, the researcher intentionally selects the individual and sites to learn, looking for participants rich in information [10]. For this reason the researchers purposefully selected schools by focusing on schools that lack resources/apparatus needed for conducting PW. Therefore, three primary schools were used in this study to investigate the challenges faced during PW.

This study used purposeful sampling known as homogeneous sampling that allows the researcher to select certain sites or people that possess a similar trait or characteristic [10]. For that reason, three schools in the rural areas were intentionally selected for this study and every NS teachers in those schools was asked to voluntarily participate.

3.2 Data generating techniques

In this study an interview was used as a research instrument to generate the required information. [9] defines an interview as a “purposeful interaction in which one person obtains information from another” (p. 370). A semi-structured interview was used during the process and both open-ended and closed-ended questions were asked in the interview. The interview results were recorded and transcribed.

The questions in the interview focused on the challenges and means of mediation that NS teachers practice in doing practical work. Questions also focused on how to enhance the conduction of PW. Data was obtained from NS teachers and was analysed.

3.6 Data Analysis

According to [10] there are six steps involved when analyzing and interpreting qualitative data. The first thing was to transcribe the audiotape to written information. The second was to read and re-read the data to have an impression and also make sure all information that answered the research questions was taken down. Then the data was summarized to narrow it down into smaller groups. Thereafter, the data was examined in depth. This helped in categorizing the data to identify themes and patterns. Lastly the data was interpreted to give meaning to the findings by looking on the themes and whether they reflect or differ from experience reported by other researchers in the literature.

4. Results and discussion

This section discusses data that was collected in three different PS of Zambezi region focusing on challenges faced when conducting practicals as they respond to questions below.

4.1 How long have you been teaching NS?

This question aimed to find out the experience of the teacher in teaching the subject. Teacher 1(T1) responded by saying he has been teaching NS for almost four years. Teacher 2 (T2) had been teaching the subject for 17 years, while Teacher 3 (T3) said to have been teaching it for a year.

This question was formed on the basis of comparing who conducts more PW, whether they were teachers who have been teaching NS for a long time or newly appointed teachers. Comparing the responses from all teachers researchers realized that the longer the teacher took teaching NS the better he engages in practical work. This is evidenced from the teacher with 17 years. He was far much better compared to the teacher with 4 years teaching experience when it comes to handling challenges of NS. Also, the teacher with 4 years' experience was better than the one with only a year.

4.2 What are your views on practical work as a viable method of teaching NS?

T1 said it was a very good method to use as it can help to produce good academic results because learners learn best by observing and by doing things on their own. T2 also emphasized on practical teaching (PT) as the most viable way of teaching giving reasons that learners learn best by activities, discovering facts on their own and solving emerging problems. It also encouraged peer coaching as learners share ideas and work in groups. T3 also believes in PT by positing that "when learners learn by doing things they will understand better and for that reason they will hardly forget and can have early recall".

All NS teachers that participated in the study have a positive attitude towards PW as a learning method. They believe that when learners are engaged in practical learning, they will understand better than being taught using any other teaching methods just like [3] articulated in his study that PW is naturally interesting to students. This demonstrates that teachers are willing to use PT in their school as they believe it can award them with good academic results.

4.3 How often do you carry out practical work for each grade?

On this question T1 said it just depended on the topics/works they are dealing with in that particular trimester but on average the teacher use to make sure he conducts at least 3 per class in a trimester. T2 responded by saying "it depends on a topic I am dealing with, but the Ministry of Education (MoE) require us to conduct two or three in a term". T3 was more specific to say it was only two PW conducted in each grade per trimester as prescribed by the syllabus.

Two out of three teachers who participated in this study said the number of practical work to be done was

determined by the type of topic they were teaching because some topics are more theoretical and some are more practical by nature. In most cases the teachers follow what the syllabus requires them to do, which is two or three PW per trimester. For that reason they only conducted the practical work when the syllabus says so and they never took it as a teaching strategy on its own. This articulates to us that, learners are learning through listening and observation instead of experiencing things on their own as there is a lack of practical works in schools.

4.4 How is learner's attitude towards Practical learning?

T1 said the attitude of learners towards PW is moderate. Some learners are serious and concentrate on the work given, while some take it as a free time or recreational time where they just want to play around and concentrate on the surroundings than the work, especially when the PW is done outside. T2 said the learners had a good attitude toward PW. Learners were very cooperative, followed instructions and concentrated on the work given in or out of the class. T3 said learners have a good attitude to this type of learning and even demonstrate best attitude of learning when using this approach as learners enjoy participating more than listening. According to [4] they believe teachers who perceive their learners to be motivated and non-disruptive are more likely to engage learners in higher-level types of PW. According to the information gathered, learners have a good attitude towards practical learning. They love learning by doing activities and they maintain a good behaviour when doing the practical activities but yet only few practical work is given to them. T1 said the attitude of the learners were moderate because not all learners are willing to carry out practical work for that reason they take it as play time and do not focus on the practical work. This can be a likely reason for that teacher to reduce the number of PW but still remain in question for others.

4.5 What challenges hinders teacher from carrying out PW?

T1 said availability of resources was the major factor on the school where he never had at least, a science kit. The second one highlighted a lack of a science laboratory. Since other chemicals are poisonous and explosive, conducting an experiment using these chemicals in class can harm the learners. T2 mentioned lack of materials and limited workshop and training as factors hindering from conducting PW. The teacher stressed that the school did not have material to be used in practical work and long-time serving teachers are not trained on modern ways to teach, such as practical teaching. T3 when asked answered by saying "unavailability of materials is the major factor that hinders me from conducting PW, I am willing to teach using practical learning but I cannot overcome that factor". According [4] availability of physical resources (e.g. laboratories, science apparatus or portable laboratory stations) is a challenge that stops teachers from conducting PW. From the information collected all teachers gave a common challenge of lack of materials in their respective schools, where by the schools did not have apparatus or instruments to be used during PW. This can cause a teacher to be demotivated. T1 also talked about the lack of a science laboratory as a serious blow since other activities cannot be conducted in class for the safety of the learners and for the safety of setup apparatus in case of PW that take time to show results. T2 added that, a teacher not knowing/understanding what to do is also a limitation to PW in school. T1 said the 40 minute time frame was also said not to be enough for PW. Furthermore, reduced security on setup apparatus/practical work is a challenge since there is no proper place to leave apparatus for

activity that gives results after hours/day. T2 encountered a challenge on time management as the time given does not accommodate every learner to participate especially in situations where materials are limited. T3 encountered time given as a factor saying the time given does not give a free pace to make sure every learner takes part and fully understand. The other factor was distraction from the environment, especially where the activity is conducted outside the classroom. To further add on to that, there were disturbances from the management as the management can call you on the mid of the activity to attend a management meeting. [5] said that limited time highly affect the practical work. When the teacher's time is over, another teacher has to come in which in most cases forces teachers to stop without attaining required results or learners understanding the topic. Also, for the reason of not having a science laboratory teachers are forced to place their setup apparatus in an uncontrolled environment like a classroom. By so doing the apparatus is highly disturbed by learners who want to explore what is going on, which leads to disturbed if not false results. When the practical where done outside a class another respondent faced a problem of keeping learners' attention as they were distracted by the environment which makes them lose concentration.

4.6 How do you mediate practical works after facing all these challenges?

When T1 was asked this question he responded by saying "I believe in trying my best despite the challenges that come my way. I used to borrow from other schools where possible. Where not, I always improvise to come up with something which can fit what is required for a practical work to take place. For example use a candle instead of a lighter or burner." T2 said no matter how challenging practical learning was he is still highly motivated to use the method, because the teacher wants the learners to learn using practicals. In cases where required resources were not obtained at all the teacher used to teach the work theoretically to at least give an idea to learners. T3 said lack of resources was too discouraging towards PT and in some topics where materials were not obtained at all, the work was left unattended. The example given was chemical reaction But teachers used to try by all means to borrow the resources from other schools. The teachers that were interviewed in this study have different ways of responding to this challenge despite not losing their interest to involve learners in high levels of practical work. One teacher believed in improvising, another in teaching theoretically and the last one in leaving the work unattended in cases where materials were not found at all. The teacher who believed in improvising will always get a way to make sure the action is done despite that resources are not available at school. This shows how highly motivated the teacher is towards practical work. Like [4] said those teachers who are motivated to do practical work will always find ways to do so even if they are in poorly resourced schools. Teaching the work theoretically can only be better in situations where improvising cannot work just to give the general idea to learners instead of leaving the works unattended.

4.7 With the education, training and experience acquired can you conduct/supervise any practical work at primary level?

T1 responded by saying, I can conduct any practical activity at primary level because instructions are very clear and all that I have done throughout my career have been positive. T2 also said he could conduct/supervise any practical work at primary level. T3 responded by saying, I believe provided with material needed I can conduct any practical work at primary level. All respondents that took part in the study never doubted their qualification,

training and experience acquired in NS so far saying the language of instruction at primary level is very clear to understand which makes the work easy to do. This informs me that teachers in schools have all required knowledge to involve their learners in high level of PW but it is the lack of materials that pull them down when it comes to engaging learners in PW.

4.8 What are your suggestions to the school and MoE on how to enhance PT in schools?

T1 responded by giving two suggestions. The first one being MoE must ensure every school have a science kit, since most basic apparatus are contained in the science kit. Secondly, the MoE must ensure that every primary school has a science lab where chemicals are kept, experiments are conducted and for safety of setup apparatus. T2 responded by saying schools must provide/buy some materials instead of just waiting for the MoE to do so. Schools must organise school tours for learners to explore reality in topic that can be observed and finally the MoE must provide practical material to all primary schools. T3 suggested to the schools that they must buy some materials on their own and not wait from MoE, and PW must have a slot on the time table. T3's suggestion to the ministry is to give more training to teachers in schools through workshops on how to use PT as a teaching strategy, to deliver the material on time that are ordered through the MoE and the MoE must build science laboratories for each primary school around the country. Two out of three suggested that the ministry must provide materials to all primary schools and that must be done on time to make sure every practical work is taught at the right time. To add-on the MoE should bring more training through workshops to impact more knowledge on teachers on how to use practical teaching as a strategy. By doing these the MoE will build a good foundation in science subjects and learners will have better understanding when they reach secondary and university level. They further suggested that the school must buy some materials on their own instead of waiting for materials from the MoE that take long to be delivered to school or not given at all in most cases. To add on, it is of great importance that schools include school tours on their yearly budget for learners to explore what they learn and have access to well-equipped science laboratories.

5. Summary, conclusion and recommendation

The study reported on the challenges faced by NS teachers in conducting PW in three selected primary schools of Zambezi region. This study was motivated by personal experiences as a student teacher at one primary school in the rural areas. For the reason that I could not overcome the challenges, I wanted to gain more insight on how other experienced teachers handled the situation. This study focused on challenges faced by NS teachers in conducting practical work and how they deal with these challenges. The study was a qualitative case study and interviews were used to generate data. The findings revealed that the NS teachers face challenges in conducting practical work in their respective schools. These challenges were categorized into two, those which hindered teachers to conduct and the challenges that they encountered when carrying out the practical work. The challenges that hindered the practical work was the unavailability of resources and science laboratories. The challenges that were encountered during PW were limited time, limited resources, limited workshops, management meeting and distraction of learners to the surrounding especially when done outside class and lack of security of set-up apparatus for PW that gives results after a long time. The teachers try to overcome these challenges by improvising as they look for a certain material to replace what they do not have. They try by all

means to borrow from other schools and teach theory where materials were not obtained at all just to make sure learners get something on the topics. All teachers that participated in this study feel if required materials are to be made available they can conduct any PW at primary level. They then suggested to the MoE to provide materials and on time, build laboratory for primary schools and train teachers on new ways of teaching like PT. They further suggested to the schools to include practical material and school tours on their school budget to ensure effective learning. In inference to this report it indicates that NS teachers in Zambezi region are interested in carrying out PW despite facing serious challenges. The finding clearly stipulated that NS teachers in some schools in Zambezi region use to improvise in order to carry out PW since they do not have required materials to use. The participant also elaborated by saying practical works must have their own slot on the school time table so that teachers and learners can work on their pace to ensure good results on PW and also ensure every learner has the opportunity to participate in the activity. According to the participants, learner's attitudes towards practical works showed more interested and they tend to be active when they learn by conducting practical work than when they learn using any other methods. Practical work forms an integral component of teaching and learning in NS. If NS teachers experience challenges in conducting PW and these challenges are not taken care of, they will lead to discouragement and laziness of NS teachers in conducting PW with learners. When this happens learners will not be able to acquire valuable skills that are required for further education, like in secondary school for example. Poor foundation in Natural science will lead to poor understanding of science concepts at secondary and tertiary level, which will lead to an increased failure rate in the fields of science. If PW is taken as an integral part of the teaching and learning process, scientific concepts, skills and values will surely be constructed by learners and this will enhance their performance in science. PW will also make learners to be innovative in life, which will improve their lifestyle. It is therefore important to address challenges that primary teachers face when conducting PW. The findings in this research cannot be taken to be conclusive without further analysis of some other variables that could influence challenges faced by teachers in conducting practical work. Factors such as lack of school laboratories and science equipment could provide further information on this study. This report has only investigated a couple of challenges that are contributing to failures of Natural science teachers in using PW when teaching NS and they might be a lot of them if further studies are carried out.

5.1 Recommendations

Considering the findings of this study and suggestions made by NS teachers, the following recommendations can be formulated.

- In-service courses in doing effective PW should be conducted by subject advisors and experienced science teachers, as Continue Professional Development (CPD) updating.
- Practical works must be allocated time on school time table with improved minutes to allow teachers work at their own pace and this might encourage teachers to be involved in PW effectively.
- The school management must see to it that they include necessary science equipment and resources when drafting the school budget to ensure effective learning takes place in their respective schools.
- The researcher also recommends that science laboratories be built in all primary schools in Zambezi region to ensure a strong foundation in science.

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