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IMPROVING ACADEMIC ACHIEVEMENT OF SCIENCE LEARNERS IN RURAL SCHOOLS THROUGH ASSESSMENT PRACTICES: A SOUTH AFRICAN CASE STUDY

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Abstract. *This research was embarked on to explore the underperformance of Physical Sciences learners and the subsequent increasing unpopularity of the subject in South African rural schools. As poor academic achievement in science is a concern in many countries and not only in South Africa, qualitative research was undertaken to determine whether assessment can contribute to the improvement of learners' academic achievement in this particular school subject. The research uses the Cultural and Historical Activity Theory as theoretical lens to analyse how assessment can improve the academic achievement of learners. Data were collected by means of face-to-face interviews with teachers, school principals and subject advisers, the "community" as advocated by the Activity Theory, while focus-group interviews were held with the learners who are the "subjects" in the Activity Theory. Verbatim findings highlight the views of participants and reveal that though efforts are made to incorporate a variety of informal assessment methods, key issues such as poor formulation of questions, weak comprehension skills and unsatisfactory interpretation of questions, remain a problem. Based on these findings, recommendations for improvement are proposed.*
Key words: *case study; improving science achievement; physical sciences assessment; rural schools*

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Introduction

The poor academic achievement of school children in the field of science is a world-wide problem and is evident in South Africa too. This is substantiated by Howe (2003), who refers to this situation as a cause for global concern. The high failure rates in Physical Sciences have made the subject unpopular, resulting in fewer learners selecting it in the Further Education Training (FET) phase of secondary schooling (Department of Basic Education, 2011). The South African National Department of Basic Education (2011) reiterates that the central feature emerging from rural secondary schools in particular, is poor academic achievement in science. The result is that fewer learners pursue scientific careers, which negatively affects the number of scientific professionals (Cameron, 2009). This has resulted in a shortage of engineers, skilled artisans, technicians, doctors and technologists. Assessment is probably the most important factor that educators can target to improve academic achievement of learners in Physical Sciences. The new Curriculum Assessment Statement (CAPS) has introduced changes to the assessment processes of all subjects, including Physical Sciences. Evidence has been obtained from Physical Sciences educators, school principals, curriculum advisers and learners on how assessment could be used to improve learner academic achievement in selected rural secondary schools.

Problem of Research

As pointed out the poor academic achievement of Physical Sciences learners is a cause for concern as is the declining number of learners choosing Physical Sciences as a school subject. Based on the discussion about the influence on assessment, this research focuses on how academic achievement of learners can be addressed through assessment practices. As the problem

is the underachievement of science learners, strategies need to be identified to effect an improvement of learner performance. One such strategy could be the use of assessment during teaching and learning. Consequently the following research question is asked: How can the assessment of learners improve the academic performance of Physical Sciences learners in selected rural secondary schools?

Theoretical Perspective

One theory that is appropriate to research this question is the Cultural-Historical Activity Theory (CHAT). According to Edwards (2010) CHAT offers a broad approach to analysing learning and the contexts of learning and can be used to analyse activities in schools, for example, to uncover how learners use both materials and conceptual tools and what aspects of tasks they prioritise. It is a useful framework to study how classrooms, schools or teacher teams operate as cultural systems that afford particular ways of, for example, being a learner. CHAT has an interest in the process of social transformation and includes the structure of the social world in analysis, taking into account the conflictual nature of social practice. Learning is seen as a social function. Engeström, Miettinen and Punamäki (1999) argue that the concept of "activity" opens up a new way to understand change. The key is "revolutionary practice," which is not to be understood in narrow terms but as joint "practical-critical practice." Accordingly Engeström considers subjects (in this case the learners), tools, the object (the improvement of learner achievement) and outcome, rules, the community (teachers, principals and subject advisers) and division of labour as a collective activity system. Engeström, Miettinen and Punamäki (1999) are of the opinion that the unit of activity includes the rules that regulate the learner actions towards a goal, and relations with other learners in the activity. In order for the system to have a positive teaching and learning environment, there is a need to establish behavioural rules in terms of assessment that give direction in the activity system. Norms and regulations within Physical Sciences are viewed as rules. Rules in Physical Sciences are important in that they facilitate teaching and learning of learners. A number of rules are set by the Department of Basic Education that facilitate the teaching and learning of Physical Sciences, including assessment guidelines. Engeström, Miettinen and Punamäki (1999) stipulate that rules refer to formal or informal regulations that can, in varying degrees, constrain or liberate the activity and provide the learner guidance on correct procedures and acceptable interactions with other community members. In this research, the object as outlined by Engeström, is the improvement of learner academic achievement in Physical Sciences in rural secondary schools.

CHAT's relevance to Physical Sciences teaching and learning is founded on the understanding that effective assessment takes place through collective activities (Gibbs, 1988). Assessment is viewed as a vehicle for driving Physical Sciences' teaching and learning since successful implementation of the curriculum mostly depends on it (Beets & Le Grange, 2005). The rules that direct how the assessment should be conducted are received from the Department of Basic Education in the form of the CAPS policy document for Physical Sciences. According to the CAPS document, assessment is a process that measures an individual learner's attainment of knowledge (content, concepts and skills) in Physical Sciences by collecting, analysing and interpreting the data and information obtained to enable the teacher to make reliable judgements about a learner's progress; to inform learners about their strengths, weaknesses and progress and to assist teachers, parents and other stakeholders in making decisions about the learning process and the progress of learners. The assessment guidelines stipulate the number of activities to be given to learners in Physical Sciences and form part of the rules of the Activity System.

Assessment of Learners

The Department of Basic Education of South Africa (2011) views assessment as a continuous planned process of identifying, gathering and interpreting information about the performance of learners using various forms of assessment. Lubisi (1999) states that assessment entails making sense of a learner's knowledge and skills. However, assessment should be both informal or formative (assessment for learning) and formal or summative (assessment of learning). Lockwood (1994) elaborates stating that assessment can be formative, enabling a learner or teacher to check the responses against criteria; it can be diagnostic enabling at least an initial identification of strengths and potential areas of learning difficulty; and it can be used to provide guidance and feedback. Assessment can also motivate learners through positive feedback from the educator that can help learners to develop self-esteem and confidence in their development (Dunphy & Dunphy, 2003). In both cases, regular feedback should be provided to learners to enhance the learning experience in Physical Sciences (Department of Basic Education, 2011).

Informal assessment entails the daily monitoring of learners' progress (Department of Basic Education, 2011). This is done through homework, classwork, tests and experiments. Informal assessment should be used to structure the acquisition of knowledge and skills and should be the precursor to formal tasks in the programme of assessment. The CAPS document emphasizes that informal assessment should be used to provide feedback to the learners and to inform teacher planning. Teachers and learners can mark these informal assessment tasks. Both self-assessment and peer assessment are important as they actively involve learners to learn from and reflect on their own performance. Self-assessment in itself is a crucial skill for learning and for future employment. It encourages learners to take responsibility for their own improvement, and is the route to excellence in Physical Sciences. Learners should be motivated by a desire to succeed, to explore, to develop and to improve, not through fear of failure.

Formal assessment tasks are marked and officially recorded by the teacher. All formal tasks are subject to moderation for the purpose of quality assurance and to ensure that appropriate standards are maintained. Formal assessment provides teachers with a systematic way of evaluating how well learners progress, but is dependent on covering all Physical Sciences' content and that a variety of different forms of assessment are used. Summative assessment provides a grade, which contributes to the final mark or is used for promotion purposes.

In order to address variety in the different forms of assessment, the Department of Basic Education (2011) stipulates that application exercises that include problem-solving activities should be done on all cognitive levels, in all knowledge areas and on all scientific concepts. If efficient organization of the teaching and learning process is to be maintained, an assessment taxonomy has to be applied that shows progression from unit to unit. Teachers should assess the full range of cognitive abilities of learners through exercises and formative assessment. In practice teachers should give learners at least two problem-solving activities on a frequent basis; at least one practical activity per term, and at least one informal test per term (Department of Basic Education, 2011).

The Norms and Standards for Teacher Education, which sets out the design and delivery of teacher education in South Africa, (Department of Education, 2000) emphasizes the need for teachers to effectively and efficiently perform the role of assessor. In terms of this role, competent teachers understand that assessment is an essential feature of the teaching and learning process and should demonstrate this understanding by integrating assessment into teaching and learning as a matter of course. By implication, teachers should know what the purposes, methods and effects of assessment are and should be able to explain these in the feedback given to learners. Informed by their knowledge and understanding of assessment, teachers should also be able to design and manage both informal and formal assessments in ways that are appropriate to the level and purpose of the learning. Teachers have a further responsibility in familiarizing learners with the terminology of science as the learners in the rural schools are taught in English, which is their second language. The language issue remains an obstacle to comprehension and expression, consequently rural learners need particular assistance with preparation for summative assessment. Research has provided a clear indication that using assessment properly does indeed improve learning and raises standards of learners' achievement (Harlen, 2000:3), but if that is the case and the teachers are familiar with the assessment requirements, why is the academic achievement of learners in rural areas so poor?

Methodology of Research

General Background of Research

This research used a qualitative approach and consequently is concerned with phenomena relating to or involving quality or kinds of results in the teaching and learning process. Qualitative research aims to discover the underlying motives and desires, using in-depth and focus-group interviews for this purpose. Through qualitative research, researchers can analyse various factors that motivate people to behave in a particular manner or why people like or dislike a particular thing. Tuckman and Harper (2012) state that qualitative research also requires skilful interpretation of the data and Miles and Huberman (1994, p. 6) elaborate: "...qualitative research is conducted through an intense and prolonged contact with a "field" or life situation. These situations are typical or normal ones, reflective of the everyday life of individuals, groups, societies and organizations." Morse (2001) explains by saying that qualitative research is concerned with the subjective assessment of attitudes, opinions and behaviour. Research in such a situation is a function of a researcher's insights and impressions. The data collected are accounts of interviews, including detailed descriptions of context and verbatim records of conversation. Consequently, the qualitative design keeps the researcher close to the data and markedly facilitates understanding of the phenomenon being studied (Schwandl, 2005). The design allows the researcher to view participants as collaborators from

whom to learn rather than as subjects to be studied. The qualitative approach is relevant to this research, which seeks to investigate the influence of assessment on learner academic achievement in Physical Sciences in selected rural secondary schools.

This approach was deemed appropriate to explore and interpret the perceptions of principals, teachers, curriculum advisers, and learners on assessment. In order to explore the social worldviews of these participants, an interpretevist paradigm is used, which according to Merriam (1998) attempts to understand and sense what people say of their experiences of their particular worlds. According to Cohen, Manion and Morrison (2000), there is a need to examine situations through the eyes of participants entailing reflection on the meaning that teachers, principals, curriculum advisers and learners assign to their own experiences regarding assessment. CHAT provides the lens through which the results will be interpreted, with analysis, categorization and interpretation of the perceptions of teachers, principals, curriculum advisers and learners in the framework.

Ethical Considerations

Permission to do the research was obtained from the relevant education authorities. Before the interviews were held, written consent was obtained from the participants to avail themselves for the interviews. The purpose of the research was explained in detail and all potential participants were assured of the confidentiality of their responses and of complete anonymity. Consequently no names of participating teachers, principals, learners and curriculum advisers are used in reporting the findings. All participation was voluntary and it was explained that anyone can withdraw from the interview without penalty. No one was coerced or rewarded for their participation in the interviews.

Selection of Participants

The purpose with the selection of participants in this research was to solicit information regarding assessment of Physical Sciences learners in selected rural secondary schools, consequently purposeful sampling was used. According to Patton (1990) purposeful sampling is done to increase the utility of information obtained from small samples. Creswell (2013) and Merriam (1998) both assert that purposeful sampling is based on the assumption that the researcher wants to discover, understand and gain insight and therefore must select a sample from which relevant data will be obtained. In other words, the sample was chosen because the participants would be knowledgeable and informative and could contribute to determining the role of assessment in academic achievement of learners.

The selection was first limited to a specific provincial education department and then to one of its education districts from which five schools that offer Physical Sciences were chosen. The selected schools differ in various ways from each another as one is well-resourced, whereas the others have limited to no resources.

The Physical Sciences teachers in the five schools automatically comprise members of the sample as well as the five principals responsible for managing and leading the schools. There are only two curriculum advisers and both were selected to participate in this research. A focus group was identified from each of the five schools and consisted of six Physical Sciences learners per group, with three boys and three girls in each group. The science academic achievement of the participants who were selected varied from low to high.

Instrument and Procedures

Data collection entailed in-depth face-to-face interviews with Physical Sciences teachers, principals and curriculum advisers and focus group interviews with Physical Sciences learners, which was decided upon as learners would feel less intimidated. All interviews were held in a setting familiar to the participants. According to Patton (1990) interviews usually yield the richest data, details, and new insights by enabling face-to-face contact with participants and provide an opportunity to explore topics in depth by allowing the interviewer to explain or help clarify questions, increasing the likelihood of valuable responses. During an interview one is able to discover information that may not have been pertinent in the beginning of the research and when responses are unclear, the respondents can be probed through further questioning to clarify issues. Scott and Morrison (2005) suggest that interviews provide a "more informed" way of claiming knowledge than a questionnaire, but interviews may distort perceptions, and the desire to please the interviewer may prevent honest responses. Researchers need to be aware of this for effective data collection.

Slavin and Davis (1997) stipulate that schedules with possible questions should be prepared for any interview. The schedules for this research were developed from an analysis of literature that explores the influence of assessment on academic achievement. Different schedules were used for the different participants, each with a list of questions or issues to be explored. Questions were semi-structured so that participants could express their own views on how assessment affects academic achievement of Physical Sciences learners.

Arrangements were made with the school principals to interview the participants in a vacant room. Teachers, principals, learners and curriculum advisers were informed in advance of the dates and time during which the interviews were to be conducted. All interviews were audio-recorded with permission from the participants Audio recordings reduce the tendency of the interviewer to make a subconscious selection of data favouring his or her biases. In addition recorded data can be played back more than once and can be studied much more thoroughly than would be the case if data were limited to notes taken during interviews (Kvale, 2007). However, handwritten notes were also made to report non-verbal cues and to supplement the recorded data. The recordings were transcribed to facilitate data analysis.

Data Analysis

According to Patton (1990), data analysis in qualitative work is to generate impressions based on initial digital recordings and to move quickly to written summaries that blur the distinction between what was heard (the raw data) and the patterns and themes that an investigator has discerned (which can often best be termed as an interpretation of the data). In order to achieve this, one needs explicit processes for tracking and managing raw qualitative data for coding (using phrases) in ways that permit data to be looked at both in its textual context; to check the dependability of coding by using multiple coders and to recognize and articulate emergent ideas about patterns, themes and explanations. Watling and James (2007) describe data analysis in the qualitative paradigm as a search for understanding, interpretation and meaning rather than conveying facts and measuring information. Data analysis in this research aimed at giving appropriate meaning to the views of the participants on the influence of assessment on academic performance in Physical Sciences.

Data of the various interviews were analysed separately at first to compare the responses of all the participants. After the coding process, the coded data were used to form a true analysis of the Activity System. The analysis was done by identifying the purpose of the activity for clarification. This included the context of Physical Sciences teaching and learning and learner academic performance. The "subject", the "community" and the "object" were defined. The "subject" included a description of how learners are motivated during teaching and learning in Physical Sciences. The "community" included the structure and social interactions within the teaching and learning of Physical Sciences. The expected "object" of the activity is the improvement of learner achievement. The analysis of the activity system included an identification of the activities in which the "community" (subject advisers, principals and teachers) and "subjects" (the learners) will participate and the rules within the particular Activity System. Finally, an analysis was made of the rules that guide the Activity System and the roles of the community members involved in the teaching and learning of Physical Sciences. This resulted in an analysis of the perceptions of participants on learner academic performance in Physical Sciences as well as problems they encounter with the teaching and learning of Physical Sciences.

Results of the Research

In an attempt to determine the effect of assessment on learner achievement face-to-face interviews were held with Physical Sciences teachers, curriculum advisers, principals and focus group interviews with Physical Sciences learners. In reporting the results, and to ensure anonymity of participants, numbers are used to distinguish between each individual participant. The findings are reported as narratives with verbatim substantiation from some "community members" and some of the "subjects" in the Activity Theory.

On the whole, the teachers responded in the same way to the questions in the interview schedule as they meet regularly to discuss planning and share their experiences resulting in similar points of view. Only selected eloquent quotes are given in reporting the results. Teacher 4 pointed out that assessment is very important because it helps to improve instructions given to learners during teaching and learning. The performance of learners will therefore improve if they are given the right kind of assessment continuously or more often. Teacher 1 pointed out that "... assessment helps teachers to determine if the method of teaching was effective or not and evaluating both the

teacher and the learners." The teachers unanimously mentioned that even though teaching approaches should be evaluated frequently for desirable results, assessment is the key as it apprises stakeholders of the current status. Teacher 3 stated "...assessment cannot be ignored because it informs learning methods and teaching methods. No doubt assessment informs and highlights topics which are difficult."

Teacher 2 argued that "...assessment should be part of learning because it assists the teacher, first of all to know where he or she is, what he or she has done, what needs to be done, how much has been learnt and how much has been achieved. Assessment is a way of measuring what is happening in the class and it helps not only the teacher or the learner, but the Department of Education to determine whether the targeted objectives have been achieved or not achieved." This was also raised by Teacher 5 who said: "If the teacher is teaching a topic such as vertical projectile motion, one wants to know if learners are able to substitute and apply the correct formulae and whether they grasp the content according to the objectives or guidelines. Therefore, assessment is vital." Consequently assessment should be used by teachers to determine not only how successful their teaching is, but also to identify what exactly learners do not comprehend. This can only be achieved by numerous and varied assessment methods. When asked to explain what this entails the general response referred to homework, classwork exercises, tests, assignments, investigations, projects and peer assessment. Homework is given to learners on at least a weekly basis to keep learners engaged and learners are encouraged to revise work at home. Only one teacher indicated that he can monitor the learners' progress by marking their work on a regular basis. The other teachers complained that they cannot do so because they have too many classes with too many learners in each class and consequently cannot mark learners' work every week. As there are too few qualified science teachers, those who are qualified tend to be overloaded and cannot cope with regular informal assessment. Teacher 3 stated: "Informally we give classwork, homework, tests, and experiments but we cannot always check the learners' work and the parents cannot help because they do not know science. Formally we have controlled tests and experiments set by the district. These we have to mark and it takes time."

Teacher 1 mentioned "...end-of-topic tests act as a diagnostic measure and can be used to determine retention capacity of learners after a period of time. Basically, assessment can be done daily, weekly, fortnightly or monthly." The key concern raised by all teachers is the fact that as learners are taught in their second language, they do not always understand what the action verbs in formal assessment questions mean. "We as teachers, also do not always know what is meant with words like extrapolate, analyse and so on. So we need assistance and examples to help us. Only then can we help learners" (Teacher 2). The issue was raised that a data base of possible questions with possible answers would greatly assist to prepare learners for their final examinations and that learner achievement should then improve.

Most of the Principals shared the same sentiments as the teachers concerning assessment. Principal 3 stated: "If you do not show them (learners) their mistakes in time and if you do not give them feedback, obviously it is going to affect their performance. Physical Sciences need thorough investigations and experiments. You must frequently check learners' books so that you can be able to identify slow learners, low achievers and high achievers." Principal 4 pointed out that "…assessment is one key that helps in improving academic achievement. If you assess your learners well you get them used to questions that will come up during the year and with regular assessment you can identify areas in which learners are not doing well and regular assessment helps in improving performance in Physical Sciences." Principal 5 also stressed that assessment in school plays a very prominent role in the sense that learners who are assessed regularly master examination techniques and are more comfortable with their summative assessment. Learners understand how questions are asked and from the feedback are able to correct errors: "If assessment is done and feedback is given then learners will be able to understand the subject." Principal 2 described the strategy used in his school: "Assessment is important so we make use of previous question papers to assess the learners throughout the year. By so doing the learners know how to answer questions." This principal also stressed the importance of comprehending what examination questions require learners to do and that the focus not only be on rote learning and memorization of content knowledge. Principal 1 indicated: "If the learners are assessed more often they will become assessment-ready. The pre-tests prepare them for the final task and the learners can improve their academic achievement and then even the final results will improve."

The curriculum advisers who were interviewed mentioned that educators should give quality questions during classwork and homework activities because they lead to high achievement in Physical Sciences. The question was raised whether the advisers should not take the lead and attend to this. Curriculum Adviser 1 responded by saying that he prepares questions for the schools in his circuit, but expects teachers to set special questions too. He complained that the teachers do not contribute but that he is prepared to offer workshops to assist in setting

assessment tasks and activities. Curriculum Adviser 2 pointed out that if learners are engaged in practical work they will understand and improve rather than being merely involved theoretically. In addition, Curriculum Adviser 1 mentioned that writing more informal tasks is essential to improve learner performance. Tests need to be standardized to enhance quality and teachers should provide learners with the necessary skills to answer question papers. In the long term this will motivate learners because they are given timely feedback.

The focus group interviews that were held with learners revealed that the learners in the different groups and from the different schools generally had the same concerns and experiences. The learners can identify their problems in Physical Sciences when they get tests and they then try to find ways to correct and improve, but they do not always understand the questions or what they should do to answer the questions. When the teacher goes over the test after it has been marked and they see what was expected it helps them clarify some issues and reinforces what they have learnt. Learners in two of the groups stated that assessment is just used to test their knowledge, but the general consensus in the other four groups was that they find out whether they understand the work or not. All the learners acknowledged that they do not enjoy writing tests, but they understand that it is a way to help them to study; to practice how to answer questions and enables them to gain confidence. In one group a learner made a case for assessment: "It is important to practice to understand the questions and what is wanted. We learn the correct way to answer a question and this makes it easier for big tests and exams. We can learn to understand the work better and to improve." A point that the learners from most of the groups agreed upon, was why their teachers assessed them namely to identify problem areas and then to get assistance from teachers where needed: "The reason why our teachers give us tests is to see whether we understand or not. If we do not understand they will explain it again because there will be possibility for that question to come up again and then I will be able to answer it correctly." "Our teachers ask questions to get information. They give us tests to get our standard in the subject and they want to know if we understand and if not then we re-do the section." "Teachers test us to see if we understand and if we don't he explains again and we get more homework." The learners therefore agreed that assessment helps the teachers to determine whether they have mastered the necessary content and whether revision is required. Many of the learners however, indicated that they are hesitant to approach their teachers individually for further tuition.

Besides helping the learners to identify their mistakes, assessment motivates them to work harder and to gain experience. Learners from every group suggested possible solutions on how assessment can improve their performance such as "...writing more tests and doing a lot of revision can help us pass." Consequently, more tests, more classwork and homework is required to improve their performance.

Discussion

The Department of Basic Education (2011) defines assessment as a continuous planned process of identifying, gathering and interpreting information about the performance of learners using various forms of assessment. The findings suggest that in Physical Sciences informal assessment provides teachers with an opportunity to understand the learning processes to improve learner achievement. Consequently, the frequency and standard of informal assessment has to be addressed. Lubisi (1999) also asserts that informal or formative assessment remains the most critical process because it allows teachers to observe learning before learners are exposed to summative assessment. Informal assessment allows teachers to gather information about learners and to use the information to improve learners' performance as learners do not always reflect on their own learning and do not realize that there is content they do not understand. Informal formative assessment is the foundation for summative assessments, therefore, is viewed as crucial. The findings indicate that informal formative assessment develops learners' reflection and increases learning opportunities in Physical Sciences. The CAPS document (2011) indicates that assessment should be both informal and formal, but it appears as though more should be done in this regard and that learners' progress should be monitored on a daily basis. The learners in the research accepted the importance of frequent assessment and that it is necessary to help them prepare for final examinations.

Dunphy and Dunphy (2003) indicate that assessment can motivate learners through feedback from the educator, helping learners to develop self-esteem and confidence in their development. The findings in this research re-affirm this, though the teachers themselves did not place much emphasis on this during the face-to-face interviews. It appears as though teachers should be encouraged to praise learners who perform well, but should also encourage those who do not. By assessing frequently, learners gain confidence and are encouraged to focus on learning and achievement. During assessment, teachers need to analyse evidence of learning in learners' work as

a basis for reflecting and improving teaching, but should also develop the reflection skills of learners on how to determine whether they have mastered the content or not. Assessment therefore encourages reviewing individual strengths and weaknesses and to identify problems that hamper achievement. Besides, helping learners show what they have learnt, assessment helps learners how to tackle questions through frequent assessment. Introducing assessment terminology appears to be of primary importance and this requires urgent attention. The findings suggest that assessment allows learners to practice how to answer questions and helps them to remember what they have learnt.

The findings further suggest that assessment helps to improve comprehension of instructions during teaching and learning. However, this is not evident in the schools involved in this research. The performance of learners should improve if they are given rigorous assessment more often. Moreover, assessment cannot be avoided because it informs the teacher about teaching methods. Assessment is a way to measure what is happening in the classroom and it helps not only the teacher or the learner, but also the Department of Education to determine whether the targeted objectives have been achieved or not. Therefore, assessment informs the stakeholders of the nature of the results. Assessment should therefore be viewed as a vehicle for improving Physical Sciences teaching and learning since successful implementation of the curriculum mostly depends on it (Beets & Le Grange, 2005). Regular assessment in Physical Sciences plays a prominent role in enabling learners to understand questions.

The importance of assessment is reiterated and learners need to be provided with the opportunity to revise previous question papers throughout the year to improve performance. Educators need to give quality questions during class-work and homework activities because they lead to high achievement in Physical Sciences. Homework is given to learners to keep them engaged and to revise work at home, but it is critical that teachers explain to learners what their mistakes are and to provide feedback soonest in order to improve learner performance. However, in the schools in this research, this is not always done due to large numbers of learners.

Research by Harlen (2000) has provided a clear indication that using assessment properly does indeed improve learning and raises standards of learners' achievement. Ideally, tests encourage learners to revise the difficult topics that have been taught to improve performance. Furthermore, end-of-topic tests act as a diagnostic measure and can be used to determine retention capacity of learners after a given period. It is important for learners to write pre-tests and post-tests in preparation for formal or common controlled tests to improve their achievement. Learners should do more informal tasks such as class-work, and weekly or monthly tests and a plan should be established to monitor learners' work, even if this is done on a rotational basis.

Conclusions

This research found that though informal assessment provides teachers with an opportunity to understand the learning processes and to improve learner achievement, there are shortcomings. Informal assessment allows teachers to gather information about learners that can be used to improve learners' performance, but the teachers do not do enough activities and exercises. Further it appears as though the type of assessment that is used does not test higher cognitive skills and tends to focus on rote learning with content mastering as main goal. Too few application and authentic assessment is done. As informal assessment is a foundation for formal summative assessment, it should be utilized properly. Ideally it should serve to identify problems to help learners improve and instil confidence in their abilities, but this research found that it has not been used effectually. Though teachers are aware of the importance of formative assessment, they are not equally confident in their abilities to set higher order thinking questions with adequate rigor. They often rely on previous examinations for setting formative assessments. Learners acknowledged that informal assessment helps them to practice how to answer questions especially when they receive detailed feedback with appropriate explanations. This helps them to remember what they have learnt and prepares them for similar questions that they may get in future. Ideally, tests encourage learners to revise the difficult topics that have been taught to improve performance. Furthermore, end-of-topic tests act as a diagnostic measure and can be used to determine the retention capacity of learners after a given period. The performance of learners could also improve if they are given appropriate classwork, homework and tests more frequently and that contributes to the development of process skills. It is, however, essential that this type of intervention is monitored, but some teachers cannot do so due to the large number of learners in their classes. The Department of Education needs to address the teacher-to-learner ratio to improve informal assessment and to ensure targeted objectives are achieved. These recommendations and suggestions can also contribute to improve the poor academic achievement of science learners in other countries where similar poor science achievement is encountered.

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