# Practices that help Grade 11 and 12 learners to improve their performance in Physics and Chemistry: A case of Omusati region, Namibia

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***Abstract***

*In Namibia, Omusati Region is one of the poorly performing regions in Physical Science Grade 12 national examinations. Despite the poor performance, there are few schools in this region which have been ranked among the top six performing schools in the country. These schools are located in the same geographic region with other schools with a poor performance record. Therefore, this study investigated practices that could help improve the academic performance of learners in the Physical Science subject. The sought answered to the following research questions: (1) What are the schools' administrative and classroom practices that assist learners to academically achieve higher in Physical Science Examinations in higher performing schools? (2) What are the schools' administrative and classroom practices that may contribute to low performance in underperforming schools? (3) How do administrative and classroom practices in high performing schools compare with those for low performing schools? (4) What mitigation strategies need to be put in place to help low performing schools improve their grade 12 physical science results?*

*The study employed a QUAL-quan research approach of a concurrent nested design by using a case study for an in-depth investigation. An extreme case sampling strategy was used to draw a sample of two schools from a population of seventeen secondary schools in the region. Six Physical Science teachers from both schools (three from each school) took part in the study and were observed over five different occasions. The four domains: (1) planning and preparation, (2) the classroom observation, (3) instruction, and (4) professional responsibilities were used in data collection. Interviews were used to collect data for domain four while domain one, two and three data were collected using a classroom observation. Field notes assisted the researcher to come up with mitigation strategies to be employed by School B. Results from this study showed that the classroom environment (Domain 2) was an important factor that helped learners improve their performance in Physical Science, with less efforts from the teachers towards other practices found in three domains including planning and preparations, instructions and professional responsibilities.*

*Mitigating strategies were suggested to strengthen the classroom environment for School B. These included creating an environment of respect and rapport, establish a culture for learning, manage classroom procedures, managing learner behaviour and organising the physical space. To improve on this domain, teachers were recommended to empower learners through career fairs, peer tutoring, group discussions while the education officers were inadequate to execute the Continuous Professional Development initiatives that focus on improving classroom environment.*

**Keywords**: *practices, improve performance, schools' administrative, underperformance, strategies*

## Introduction

Physical Science (Physics and Chemistry) form an integral part of the secondary school curriculum; they aim at increasing the learners' knowledge and understanding of the physical world of which they are part of, so that they can satisfy human needs and how the environment can be used in the sustainable way (National Institute for Educational Development (NIED), (2010)). Therefore, our personal lives are real world contexts for learning Physical science and understanding the impact of Physical science on our lives. Everyone can become engaged in science by way of linking daily personal experiences to Physical Science (NIED, 2010). It can thus be deduced that Physical Science is an important subject at secondary school level, but teachers are often faced with difficulties to understand and teach concepts related to this subject (Chavan, 2013). If these concepts which are difficult to understand for the teachers are taught to the learners, it will be transferred towards learners incorrectly and it will create many alternative conceptions. In order to teach today's Physical Science concepts, teachers need to understand the subject matter deeply and flexibly in order to help learners create useful cognitive maps, relate one idea to another, and address alternative conceptions (Chavan, 2013). Chavan further adds that teachers need to see how ideas connect across fields and to everyday life, how to present them to the learners for them to understand them effectively and improve their performance. This means, teachers are expected to demonstrate the knowledge of relevant content and a range of pedagogical approaches.

Teachers' roles and activities are seen as the major determinant of learners' performance in Physical Science in schools (Stephen, 2013). The positive and negative behaviours exhibited by teachers determine to a great extent their effectiveness in the classroom, ultimately, the impact they have on learners' achievement (Stronge, 2007). Learners are able to engage in sophisticated scientific practices and learn complex science concepts when provided with strategic scaffolding, where they are fully supported using different activities (Davis, 2013). On average, learners' performance on examinations and concept inventories is increased in active learning classroom (Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2013). Different schools have different classroom practices that contribute to different performance in Physical Science (Mji & Makgato, 2006).

Generally, Physical Science is one of the subjects in secondary schools in the Southern African Development Community (SADC) countries which learners do not perform well (Kibirige & Hodi, 2013). In SADC, there are, however, some schools where learners perform well in Physical Science mainly because of the different teaching standards (Mji & Makgato, 2006). This means, teachers should use different practises while presenting sophisticated scientific practices and complex science concepts to improve academic performance in Physical Science. In Namibia, for example, learners in the Omusati Region performed below average in 2017 with an average performance of 43.57% (A*-D symbols) in Physical Science (ORAS, 2018). Yet, a particular school (referred to herein as School A) came in top six best performing schools in Physical Science with 100% (A*-D symbols) in Namibia (Directorate of National Examination and Assessment (DNEA), 2018). Another school, referred to as School B, only attained 8.21% (A*-D symbols), which was ranked amongst the last ten schools out of 176 secondary schools in Namibia (DNEA, 2018). It is not known why some schools (e.g., School A) performed well in Physical science while others (e.g., School B) did poorly.

This study investigated why some schools perform well while others do not, in order to identify practices that will help Grade 11 and 12 learners to improve their performance in Physical Science.

## Theoretical framework and literature review

*Theoretical framework*

Investigating the best teachers' roles and classroom practices that contribute to higher performance is central to this study. Therefore, the conceptual framework of Danielson Theory of Best Practices for Teaching and Learning, which is grounded in a constructivist view, was adopted (Danielson, 2007). This theory of Best Practices of Danielson is a comprehensive and coherent framework that identifies aspects of a teacher's responsibilities that promote successful learning. Danielson's theory informs this study by using a validated instrument where teachers who receive higher ratings on their evaluation produce greater gains in learner test scores. Danielson (2007) divided the complex activity of teaching into four main domains of teaching responsibilities: planning and preparation, the classroom environment, instruction and professional responsibilities as shown in Table 1.

**Table 1: Four Domains and their components (adopted from Danielson, 2007)**

| Domain | Components |
|---|---|
| Planning and preparation | - Demonstrating knowledge of content and pedagogy<br>- Demonstrating knowledge of learners<br>- Selecting learning objectives<br>- Demonstrating knowledge of resources<br>- Designing coherent instruction<br>- Designing learner assessment |
| The classroom environment | - Creating an environment of respect and rapport<br>- Establishing a culture for learning<br>- Managing classroom procedures<br>- Managing learners' behaviour<br>- Organizing physical space |
| Instruction | - Communicating with learners<br>- Using questioning and discussion<br>- Engaging learners in learning<br>- Using assessment in instruction<br>- Demonstrating flexibility and responsiveness |
| Professional responsibilities | - Reflection on teaching and learning<br>- Maintaining accurate records<br>- Communicating with families<br>- Participating in a professional community<br>- Growing and developing professionally<br>- Showing professionalism |

*Literature review*

Miller and Cunningham (2011) argue that class composition (different learners' abilities), number of learners (class size) and classroom management are some of the best practices which improve the performance of the grade 12 learners in schools. Class composition includes the classroom grouping methods such as ability grouping of learners. Smaller classes are associated with learners who are less stressed and are more frequently on task with fewer reported behaviour problems than learners in large classes (Miller & Cunningham, 2011). This means, performance of learners in Physical Science could be affected by how the teachers compose their classes as per the learners' abilities, the number of learners in the class at a specific time and how effective the teachers manage their classrooms. Motivated and encouraged learners can inquire into complex science concepts, problems, and issues effectively with less effort from the teachers who are seen as powerful determinants of the classroom climate (Hassard & Dias, 2013). Teachers with motivated learners act as facilitators while learners direct their own learning. Teachers should have the interest in teaching and ability to teach science and hence to motivate and encourage learners. This is supported by Sahin and White (2015) who alluded to the fact that promising high-quality education in science for all learners depends on the teacher's interest in the subject and that promote and support understanding of scientific concepts. Teachers with the interest of teaching Physical Science promote confidence and love of the subject in the learners.

Furthermore, learners learn with understanding when the learning takes place in meaningful and familiar situations. As learners explore their familiar environments, they encounter experiences through which they actively construct knowledge and discover new relationships (Charlesworth, 2015). This means, learners master the taught content better when prior knowledge is addressed so that they could relate known to the unknown. Furthermore, Aguilar (2010) advocates for a classroom environment that can ignite learning and cultivate caring. Danielson (2007) contends that classroom composition, class size, physical environment and classroom management fall under the classroom environment domain. The reviewed literature does not explain why schools in the same or with similar classroom environment settings perform differently. Oladejo, Ojebisi, Olosunde, and Isola (2011) noted that teachers' usage of instructional materials complemented the theory of best teachers' practices. Academic performance in Physical Science is directly influenced by instructional resources; availability of textbooks and/or past papers as learners are well exposed to the content, type of examination questions and answering skills (Oladejo, Ojebisi, Olosunde, & Isola, 2011). This suggests that teachers develop their science by using carefully planned, fine-tuned lessons that reflect an understanding of many different teaching techniques. Teachers apply each technique skilfully to gain the desired intellectual, social, affective or kinaesthetic result (Orlich, Harder, Callahan, Trevisan, & Brown, 2012). This means, the teacher's knowledge of resources for classroom use and for extending the teacher's professional skill has to be extensive so that learning could be effective and contribute to the improvement of the learners' academic performance.

When the content that is being taught does not relate to the inherent goals of the learners, it will be forgotten (Schank, 2015). Thus, the teacher should be an informed and critical observer of science, concerned with developing scientific literacy that will assist learners to effectively grasp scientific knowledge and skills (Callaban, Cannon, Chesick, Mackin, Mandel, & Wenning, 2009). This is also indicated in the demonstrating knowledge component of the planning and preparation domain of Danielson (2007). This means, the effective teacher coordinates in-depth knowledge of content, learners and resources to design lessons that can improve learners' performance. It is a good practice for a teacher who is in complete charge of the class as discipline is concerned and paying attention to what learners do, what they say and how they say it. In this classroom, teachers may have the gift of instruction, and can inspire through their own knowledge and expertise by facilitating learning, questioning, sharing ideas, helping learners to formulate their ideas and develop their skills (Gunstone, 2012). The teacher encourages learners to participate and makes suggestions about how learners may proceed in an activity (Stronge, 2007). Engaging learners in learning and using questions and discussion techniques are part of Danielson's instructional domain as discussed in this study.

Archer, Childs, Covaciu, and De Young (2012) found that effective technology implementation in the classrooms has the potential for performance improvement. Archer et al. (2012) perceived technology as audio-visual materials that teachers take to classrooms in order to improve on the teaching-learning situations and by so doing bring about permanent and meaningful experience to their learners. For the learners to attain scientific knowledge and skills effectively, teachers are encouraged to advance teaching and learning agenda by using instruction that fully utilise the potential of mass media (Klosterman, Sadler, & Brown, 2012). Furthermore, using media in teaching Physical Science makes it more interesting for the learners and increases their ability to use science outside school (Ekborg, Ottander, Silfver, & Simon, 2013). Every educator should know that education and technology are inseparable. Thus, it's a rational response to interrogate every new technology for its potential to serve educational aims. Technology can shape what is learned by changing how it is learned (Laurillard, 2013). Therefore, teachers must demonstrate knowledge of 'resources and media' as stipulated by Danielson (2007) in both the planning and preparation domain, and instructional domain.

Finally, Poor performance in a science classroom may also be attributed to poor monitoring of academic progress of learners by teachers and inadequate communication from teachers to parents on learners' learning. Teachers should execute the tasks for which they are responsible (Lassibille, 2013). Monitoring of academic progress is part of professional responsibilities' domain (Danielson, 2007), where teachers are required to reflect on teaching, maintain accurate records, communicate with the families, participate in a professional community, grow and develop professionally, and show professionalism.

## Methodology

The study employed a mixed method research approach of QUAL-quan with a concurrent nested design. A mixed method was appropriate because it combined the strengths of, and to compensate for, the limitations of quantitative and qualitative methods (Pluye & Hong, 2014). The concurrent nested design was used on the basis of dominance of the study as a quantitative strand was embedded within a predominantly qualitative study (Castro, Kellison, Boyd, & Kopak, 2010). The quantitative method was used to get the teachers' mean score during the observation and tabulate the mean scores to summarise the data per teacher. The same method was used to gather systematic information about school practices and how these schools operate or experience their environments (Gay, Mills, & Airasian, 2011). A case study was appropriate for this research because it makes an in-depth investigation of a group of individuals whose behaviours cannot be manipulated (Gay et al., 2011). This case study used mixed method to integrate techniques for collecting and analysing qualitative and quantitative data concurrently.

The target population included 17 senior secondary schools that offer Physical Science at higher, ordinary or both levels in the Omusati Region. The sample was selected using an extreme case sampling strategy. Extreme case sampling is a type of purposive sampling that is used to focus or identify information-rich cases related to the phenomenon of interest which are either special or unusual by highlighting notable outcomes, failures or successes (Palinkas, Horwitz, Green, Wisdom, Duan, & Hoagwood, 2015). Extreme case sampling is suitable because the investigation focused at the best and the worst performance cases (Gay et al., 2011). Extreme case sampling was used to select participating schools, both schools. School A and School B by taking the top ranked school and bottom ranked school respectively. All Grade 11-12 Physical Science teachers of 2017 at School A and School B who taught at the same grade level in 2016 by default became part of the sample. There was a total of six teachers because each school provided three teachers teaching Physical Science at Grade 11-12 level.

The research instruments used were interviews, and classroom observations. Field notes were taken also. Individual in-depth face to face structured interviews with six teachers were used to collect qualitative data. The classroom observations used were overt non-participant observations. In non-participant observation, the observer simply observes the activities, but does not take part in them. Classroom observations looked at everything happening in the classroom during teaching and learning. Observations were recorded in the Classroom Observation Instrument (COI) which was based on the three first domains of Danielson (2007). This study used field notes to record the practices which were not covered by the COI and the interviews but were necessary to be recorded because they enhanced and aided the understanding of the practices used.

## Results and discussions

*Demographic information for teachers*

A group of six teachers from the two schools (School A and School B) in the Omusati Region were participants of the study. Tables 2 show the teachers' demographic information based on the number of years of teaching experience.

**Table 2: Demographic information for teachers of School A**

| Teacher's code | Years of teaching experience |
|---|---|
| SA1 | 11 |
| SA2 | 3 |
| SA3 | 7 |
| SB1 | 9 |
| SB2 | 8 |
| SB3 | 11 |

The table above shows that two of the three Physical Science teachers at School A have been teaching the subject for more than five years. It is also shown in Table 2 that all three Physical science teachers at School B have been teaching the subject for more than five years. The years of experience were not part of the research questions but it was only outlined to describe the study group in detail.

*Class sizes*

The class size at School A was 42 learners in one class while School B has class size of 40 learners. The results showed that School A and B had large class sizes as affirmed by the Namibian Teacher-Learner ratio of about 25 learners per teacher in secondary schools (Mundi, 2007). However, according to Miller and Cunningham (2011), smaller classes are associated with learners who are less stressed and are more frequently on task with fewer reported behaviour problems which at the end boost their academic performance than learners in large classes. Hence, the class size can affect the academic performance in Physical Science. But, the class sizes from school A and School B had a similar trend, which is regarded as large in the Namibian context. Therefore, the difference in academic performance between School A and School B might not be influenced by the size of learners in the class.

*(a) Classroom observation outcomes: Domain 1*

The total scores of all components in the domain were added together and the sum was divided by the total number of components to get the overall score of the domain. Furthermore, the total score of all Domain 1 for the five lessons was added together and the sum was divided by the number of lessons to get the overall attribute for teacher SA1 as shown in Table 3. The overall mean score for teacher SA1 in Domain 1 was rated at 2 which meant teacher SA1 was rated as basic in planning and preparation. The same procedures were followed to get the overall attributes of all other teachers (SA2, SA3, SB1, SB2 and SB3) (Table 3).

**Table 3: Domain 1 mean scores for teachers from School A and School B**

| Lesson Number | Teacher's Domain Score | | | | | |
|---|---|---|---|---|---|---|
| | SA1 Domain Score | SA2 Domain Score | SA3 Domain Score | SB1 Domain Score | SB2 Domain Score | SB3 Domain Score |
| L1 | 2 | 1 | 2 | 1 | 2 | 2 |
| L2 | 2 | 2 | 2 | 2 | 2 | 2 |
| L3 | 2 | 2 | 2 | 2 | 1 | 2 |
| L4 | 2 | 2 | 2 | 2 | 2 | 2 |
| L5 | 2 | 2 | 3 | 1 | 1 | 3 |
| Overall Domain Score | **2** | **2** | **2** | **2** | **2** | **2** |

Comparing teachers of School A and Teachers of School B, it was clear that they were all rated at 2 in Domain 1, which meant they were all not proficient when it came to planning and preparation. According to Orlich et al. (2012) teachers developed their science by using carefully planned, fine-tuned lessons that reflect an understanding of many different teaching techniques. Teachers apply each technique skilfully to gain the desired intellectual, social, affective, or kinaesthetic result. Orlich et al. are supported by Callaban et al. (2009) who alluded to the fact that teachers' preparation was very vital in teaching and learning as quality teaching depends on what was done by the teacher before stepping into the classroom.

Therefore, through planning and preparation, teachers will be encouraged to take part in scientific literacy development. Since science does not happen only inside the classroom, teachers were expected to plan in rendering they were charged with producing informed consumers of science who would be able to make decisions whenever science intersects with public policy (Callaban, Chapo, & Handricks, 2009).

Even though Callaban et al. (2009) have indicated the importance of planning and preparation in teaching and learning Physical Science, the study revealed that School A performed the same as School B, which fell short of proficiency. Despite the same performance in Domain 1, School A still out performed School B in Physical Science, this was revealed by the national performance rankings (Miller & Cunningham, 2011). This shows that there were other best practises, which were not determined yet and were not part of Domain 1, that assisted learners from School A to perform better than learners from School B in Physical Science.

*(b) Planning and preparation: Domain 2*

As the case in Domain 1, in Domain 2, Teacher SB2 was used to show how the teachers were rated and how the overall mean score of the domain was established from the mean scores of the components. The total scores of all components in Domain 2 were then added together and the sum was divided by the total number of components to get the overall attribute of the domain. Furthermore, the total score of all Domain 2 for the five lessons was added together and the sum was divided by the number of lessons to get the overall score for teacher SB2 as shown in Table 4. The overall attribute for teacher SB2 in Domain 2 was rated at 1 which means teacher SB2 was rated as unsatisfactory when it came to classroom environment. The same procedures were followed to get the overall attributes of all other teachers (SA1, SA2, SA3, SB1 and SB3) (Table 4).

**Table 4: Domain 2 mean scores for teachers from School A and School B**

| Lesson Code | Teacher's Domain Score | | | | | |
|---|---|---|---|---|---|---|
| | SA1 Domain Score | SA2 Domain Score | SA3 Domain Score | SB1 Domain Score | SB2 Domain Score | SB3 Domain Score |
| L1 | 4 | 3 | 3 | 2 | 1 | 2 |
| L2 | 4 | 4 | 4 | 2 | 1 | 2 |
| L3 | 4 | 4 | 4 | 1 | 1 | 2 |
| L4 | 4 | 4 | 4 | 2 | 1 | 2 |
| L5 | 4 | 4 | 4 | 2 | 2 | 2 |
| Overall Domain Score | **4** | **4** | **4** | **2** | **1** | **2** |

Table 4 showed that teachers at School A properly organized their classrooms that allowed all learners to learn effectively. They maximized instructional time and fostered respectful interactions among and between teachers and learners with sensitivity to learners' cultures and level of development. Learners themselves made a substantive contribution to the effective functioning of the class through self-management of their own learning and of others. Process and tools for learners' independent learning were visible to learners from School A. The findings of this study on the classroom environment concurs with Danielson (2007) and are also supported by Kstashuk (2007) who indicated that best structuring of the physical environment is when the teacher considers the best desk arrangement, best classroom decoration and adding videos to the classroom when necessary. The primary role of a teacher is to establish a learning environment where all learners are able to learn and are motivated to learn, an environment that is both challenging and supportive (Callaban et al., 2009).

Motivated and encouraged learners can inquire into complex science concepts, problems, and issues effectively with fewer efforts from the teachers who are seen as a powerful determinant of the classroom climate (Hassard & Dias, 2013). Results on Domain 2 concur with Sahin and White (2015) who alluded to the idea that promising high-quality education in science for all learners depends on the classroom's environment that promotes and supports understanding of scientific concepts. Additionally, learners learn with understanding when the learning takes place in meaningful and familiar situations. As learners explore their familiar environments, they encounter experiences through which they actively construct knowledge and discover new relationships (Charlesworth, 2015). Finally, Aguilar (2010) advocated for a classroom environment that could ignite learning and cultivate caring and this could be achieved through the practices that were incorporated in the classroom environment at School A. Therefore, strengthening Domain 2 (classroom environment) could assist learners to perform well academically in Physical Science.

*(c) Instruction: Domain 3*

The scores in Table 5 as previously explained were added together and divided by the number of components to get the overall score for the domain.

**Table 5: Domain 3 mean scores for teachers from School A and School B**

| Lesson Code | Teacher's Domain Score | | | | | |
|---|---|---|---|---|---|---|
| | SA1 Domain Score | SA2 Domain Score | SA3 Domain Score | SB1 Domain Score | SB2 Domain Score | SB3 Domain Score |
| L1 | 2 | 2 | 2 | 2 | 1 | 2 |
| L2 | 2 | 2 | 2 | 2 | 2 | 3 |
| L3 | 2 | 2 | 2 | 2 | 1 | 2 |
| L4 | 2 | 2 | 2 | 2 | 2 | 2 |
| L5 | 3 | 3 | 3 | 2 | 1 | 2 |
| Overall Domain Score | **2** | **2** | **2** | **2** | **1** | **2** |

Table 5 shows the teachers' scores in Domain 3. The components in Domain 3 are what constitute the core of teaching, which is the engagement of learners in learning content. Most of the teachers from School A and School B had an overall mean score of 2. This meant that, most of the teachers from both schools did not communicate clearly and accurately, used questioning and discussion techniques, engaged learners in learning, provided feedback to learners, and demonstrated flexibility and responsiveness proficiently (Danielson, 2007). Teacher SB2's level of performance was unsatisfactory in instruction domain. The poor performance in Domain 2 and 3 made Teacher SB2 to be rated as an unsatisfactory teacher as much of the components were not up to standard. Although most of the teachers from both schools were all rated at 2 (basic) except one teacher from School B who was rated unsatisfactory; they all did not perform well in instruction domain.

Because rates 1 and 2 were close to each other, it made not much difference from other results. According to Gunstone (2012), it is a good practice for a teacher who is in complete charge of the class and paying attention to what learners do, what they say and how they say it. Gunstone further emphasised that teachers may have the gift of instruction, and can inspire through their own knowledge and expertise by facilitating learning, questioning, sharing ideas, helping learners to formulate their ideas and develop their skills.

Gunstone's views are supported by Stronge (2007), who stated that the Physical Science teacher encourages learners to participate and makes suggestions about how learners may proceed in a classroom activity. As indicated by Gunstone (2012) and Stronge (2007), teachers who perform well in instruction help learners to perform academically well in Physical Science. However, teachers from School A, which performed outstandingly well than teachers from School B in Physical Science national examinations, were rated alike. The study has revealed that teachers from both schools put equal efforts as far as teaching and learning instruction were concerned.

*Interview outcomes*

The components and elements of professional responsibilities (Domain 4) were spread into questions of the interview. Teachers' responses were compared to the critical attributes from a rubric as designed by Danielson (2007) so that their responses could be rated.

*(d) Professional responsibilities: Domain 4*

An interview was conducted to collect data for Domain 4. These were the components were essential in the smooth functioning of the classroom that learners and parents rarely see (Danielson, 2007). Five components of Domain 4 were part of the interview. Each teacher was interviewed once during their free time. The rubric was used to determine the level of performance in each component. 1 is Unsatisfactory, 2 is Basic, 3 is Proficient and 4 is Distinguished.

**Table 6: Interview results for Teacher SA1**

| **Component 4** | **Element** | | | | **Mean score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 1 | 2 | | | 2 |
| **B** | Learner progress in learning | | | | |
| | 1 | | | | 1 |
| **C** | Engagement of families in the instructional program | | | | |
| | 2 | | | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 3 | 1 | 1 | 2 | 2 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 2 | 3 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 2 | 1 | 3 | 1 | 2 |
| **Total Mean Score** | | | | | **2** |

Table 6 shows the interview results for Teacher SA1 in Domain 4 (Professional Responsibilities). Six components (Components a-f) and some of their elements were covered in the interview questions. The components covered were: reflection on teaching and learning, maintaining accurate records, communicating with families, participating in a professional community, growing and developing professionally, and showing professionalism as shown in Table 1. The mean score for the components was used to determine the overall mean score for Teacher SA1 in Domain 4. The teacher's level of performance was rated as 2 (basic).

**Table 7: Interview results for Teacher SA2**

| **Component 4** | **Element** | | | | **Mean score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 2 | 3 | | | 3 |
| **B** | Learner progress in learning | | | | |
| | 1 | | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **C** | Engagement of families in the instructional program | | | | |
| | 2 | | | | 2 |
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 3 | 1 | 3 | 2 | 2 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 3 | 2 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 3 | 2 | 1 | 3 | 3 |
| **Total Mean Score** | | | | | **2** |

Table 7 shows the interview results for Teacher SA2 in Domain 4. The total mean score for Teacher SA2 was 2 which indicated that the teacher's level of performance in Domain 4 was basic.

**Table 8: Interview results for Teacher SA3**

| **Component 4** | **Element** | | | | **Mean score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 2 | 2 | | | 2 |
| **B** | Learner progress in learning | | | | |
| | 1 | | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **C** | Engagement of families in the instructional program | | | | |
| | 3 | | | | 3 |
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 3 | 1 | 4 | 2 | 3 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 2 | 2 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 3 | 2 | 2 | 1 | 2 |
| **Total Mean Score** | | | | | **2** |

Table 8 shows the interview results for Teacher SA3 in Domain 4. Teacher SA3 was rated as basic. Furthermore, teachers from School B were interviewed on Domain 4 (Professional Responsibilities) where six components were discussed. The discussed components were Component 4A (Reflecting on teaching), Component 4B (Maintaining Accurate Records), Component 4C (Communicating with Families), Component 4D (Participating in a Professional Community), Component 4E (Growing and Developing Professionally) and Component 4F (Showing Professionalism). Teachers' responses were rated as 1 (Unsatisfactory), 2 (Basic), 3 (Proficient) and 4 (Distinguished) by using critical attributes of Danielson's (2007) classification. The teachers' responses were summarised in the tables that follow. Table 9 shows the results for Teacher SB1.

**Table 9: Interview results for Teacher SB1**

| **Component 4** | **Element** | | | | **Mean score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 2 | 3 | | | 3 |
| **B** | Learner | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | progress in learning | | | | |
| | 3 | | | | 3 |
| **C** | Engagement of families in the instructional program | | | | |
| | 1 | | | | 1 |
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 1 | 1 | 2 | 1 | 1 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 1 | 3 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 3 | 2 | 1 | 3 | 2 |
| **Total Mean Score** | | | | | **2** |

Table 9 shows the interview results for Teacher SB1 in Domain 4. The total mean score for all six components was found to be 2, basic.

**Table 10: Interview results for Teacher SB2**

| **Component 4** | **Element** | | | | **Mean score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 1 | 2 | | | 2 |
| **B** | Learner progress in learning | | | | |
| | 1 | | | | 1 |
| **C** | Engagement of families in the instructional | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | program | | | | |
| | 2 | | | | 2 |
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 3 | 1 | 1 | 2 | 2 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 2 | 3 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 2 | 2 | 2 | 3 | 2 |
| **Total Mean Score** | | | | | **2** |

Table 10 shows the interview results for Teacher SB2 in Domain 4. The total mean score for all six components was found to be 2, basic.

**Table 11: Interview results for Teacher SB3**

| **Component 4** | **Element** | | | | **Average score** |
|---|---|---|---|---|---|
| **A** | Accuracy | Use in the future teaching | | | |
| | 3 | 2 | | | 3 |
| **B** | Learner progress in learning | | | | |
| | 2 | | | | 2 |
| **C** | Engagement of families in the instructional program | | | | |
| | 1 | | | | 1 |

| | | | | | |
|---|---|---|---|---|---|
| **D** | Relationship with colleagues | Involvement in a culture of professional inquiry | Service to the school | Participation in school and district project | |
| | 2 | 1 | 2 | 1 | 2 |
| **E** | Enhancement of content knowledge and pedagogical skill | Receptive to feedback from colleagues | Service to the profession | | |
| | 1 | 3 | 3 | | 2 |
| **F** | Integrity and ethical conduct | Service to learners | Decision-making | Compliance with school and district regulation | |
| | 2 | 1 | 3 | 3 | 2 |
| **Total Average Score** | | | | | **2** |

Table 11 shows the interview results for Teacher SB3 in Domain 4. The total mean score for all six components was found to be 2, basic. As in Domain 1 and 3, teachers from School A and School B had performed the same in Domain 4, which was ‘professional responsibilities.

The teachers’ professional responsibility components as they appear in Table 1 can boost the learners’ academic performance in Physical Science as supported by Cooper (2013) who reveals that teaching is basically a reflection process that can be improved by examining its components in an analytical manner. Shaw (2013) alludes to the fact that this could be achieved if the teacher demonstrated a capacity to assess, provide feedback and report on learning through record keeping of classroom data. Teachers are urged to be professional by integrating current global issues such as new technology, diverse cultures, religions, languages and lifestyles in a spirit of mutual respect, and open dialogue in personal, work, and community contexts. Poor performance in a science classroom may also be attributed to when learners' academic progress is poorly monitored and communication from teachers to parents on learners' learning is often perfunctory (Lassibille, 2013).

However, this study revealed that teachers from School A had the same level of performance with teachers from School B in Domain 4 components and elements. This has shown that there might be other teacher’s roles and responsibilities apart from professional responsibilities that are being implemented at School A but not at School B. Although, Teacher SB1, SB2 and SB3 performed similar to SA1, SA2 and SA3, the teachers of School B’s level of performance in Domain 2, as shown in Table 5, was different from the teachers’ level of performance from School A. Table 13 summarised the results of all the domains in the study to find out which of the domains (Danielson, 2007) was the best practice in Physical Science.

**Table 12: Comparison of School A and School B**

| Domain | School A (Scores for 3 teachers) | | | School B (Scores for 3 teachers) | | |
|---|---|---|---|---|---|---|
| | SA1 | SA2 | SA3 | SB1 | SB2 | SB3 |
| Planning and Preparation | 2 | 2 | 2 | 2 | 2 | 2 |
| Classroom Management | 4 | 4 | 4 | 2 | 1 | 2 |
| Instruction | 2 | 2 | 2 | 2 | 1 | 2 |
| Professional Responsibilities | 2 | 2 | 2 | 2 | 2 | 2 |

Table 12 shows the total mean scores of teachers from School A and School B in all four domains. Analysis of the attributes shows similar level of performance of all teachers except in Domain 2. The difference between Teacher SB1, SB3 and all teachers from School A is only the poor rating in classroom environment domain while teachers from School A had performed credibly well in that domain. Therefore, the study revealed (Figure 1), that effective classroom environment is the best practice and strengthening it might assist learners to perform well academically in Physical Science with less effort from the teachers towards other three domains. This is depicted in Figure 2, where classroom environment is indicated as a critical domain which needs planning and preparation, instruction and professional responsibilities as supportive domains to contribute towards learners' improvement in Physical Science performance.

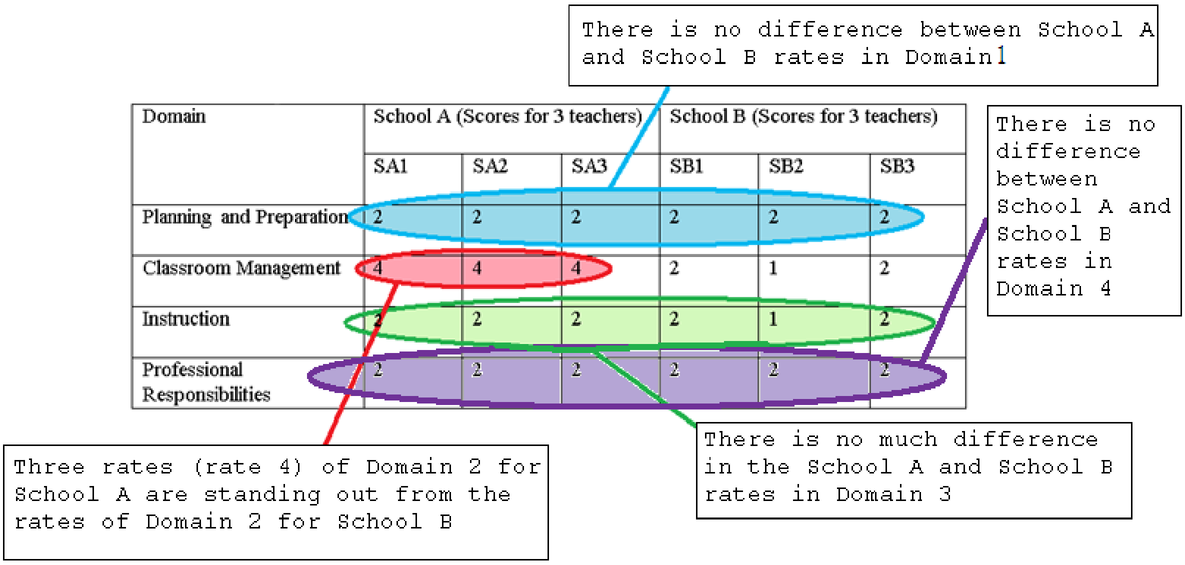


**Figure 1: Standing out analysis of the various domains Table 12**

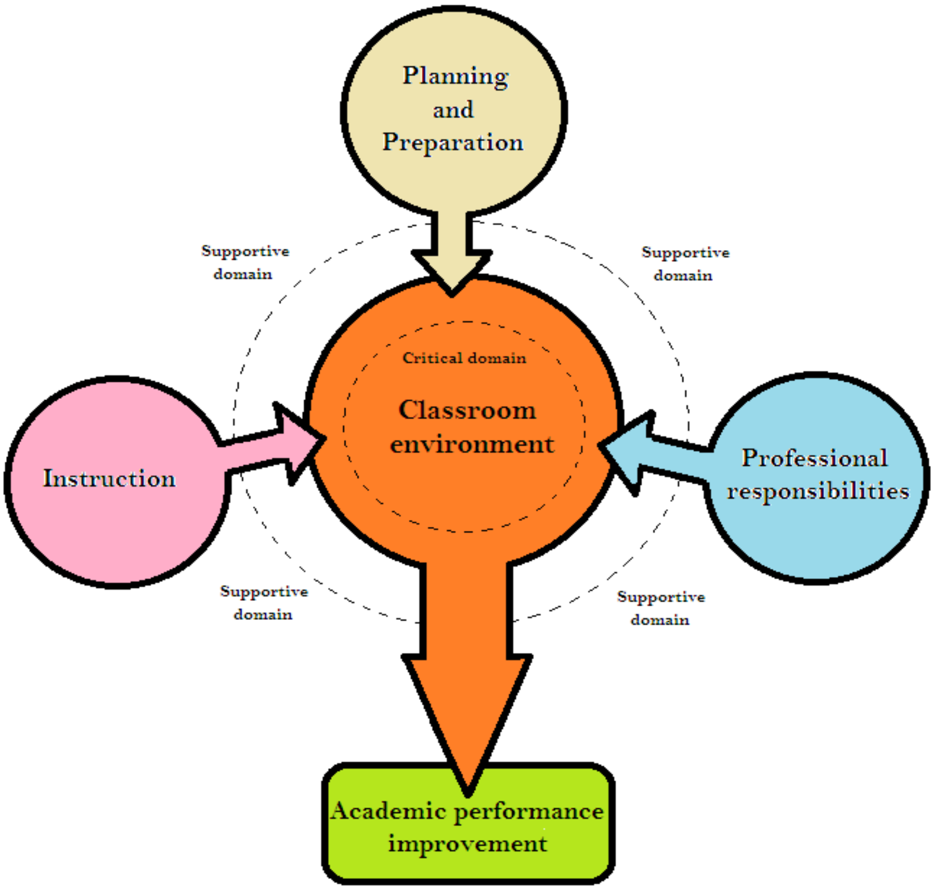


**Figure 2: Model of best practice for teaching and learning (adopted from Danielson, 2007)**

**Implications for improved performance**

The researcher spent a week each at School A and School B during the period of collecting data. The researcher took note of learners and teachers' behaviour outside the classroom and recorded all necessary information in the field notes. Field notes were also taken during lessons on the space of the 'comment' on the COI form. These notes were studied, together with all aspects attributed to classroom environment by Danielson (2007), to formulate the mitigation strategies that School B can put in place to improve its learners' performance in Physical Science as far as Domain 2 (classroom environment) is concerned.

***(a) Creating an environment of respect and rapport***

Statements taken from the field notes on creating an environment of respect and rapport show that classroom interactions among the teacher and individual learners should be based on respect, reflecting genuine warmth, caring and sensitivity to learners as individuals. Learners should exhibit respect for the teacher and contribute to maintaining high levels of civility among members of the class (Danielson, 2007). Respect is good when it starts with a learner. Learners should respect themselves by wearing tidy uniforms properly and making sure that classrooms are cleaned regularly. Learners respect teachers who respect them. Teachers who go to lessons late might make learners lose respect towards them and it demoralises learners to work hard.

***(b) Establishing a culture for learning***

With regard to establishing a culture for learning, the field notes showed that the classroom culture should be characterized by a shared belief in the importance of learning. Instructional outcomes, activities and assignments should convey high expectations for all learners. Classroom interactions should extend learning. Learners should assume responsibility for high quality work by initiating improvements, making revisions, adding detail and/or helping peers. High expectations in learning should be internalized by learners (Danielson, 2007). Learners should be motivated occasionally so that they can develop a culture of self-directing and self-reliance. Learners should have a good understanding of why they are at school and who they would want to be in the future because teaching learners with no hope will not yield any good results in Physical Science despite the efforts from the teachers.

***(c) Managing classroom procedures***

With regard to managing classroom procedures, the field notes showed that: Instructional time should be maximized by efficient classroom routines and procedures. Learners should contribute to management of instructional groups, transitions, and/or the handling of materials and supplies. Routines should be well understood and engaged in consistently by learners. Volunteers and paraprofessionals should work independently of the teacher and take initiative (Danielson, 2007). The school should come up with a functional timetable that would guide learners and teachers on what needs to be done, when and how. The time learners take to change classes during rotation should be limited and close attention should be made to make sure that positive actions are taken against those who will be found guilty.

***(d) Managing learner behaviour***

With regard to managing learner behaviour, the field notes showed that learners' behaviour should be entirely appropriate during school time. Learners should take an active role in monitoring their own behaviour and that of other learners against the school standards of conduct. Teachers' monitoring of learners' behaviour should be subtle and preventative. Teachers' response to learners' misbehaviours should be sensitive to individual learner needs and receives a positive reaction (Danielson, 2007). Learners should be treated with respect to avoid them being rebellious and rude towards teachers. Teachers should come up with a mechanism to control learners' behaviour where good work is rewarded and bad behaviour leads to demotion. For example, learners who are behaving as required should be awarded badges with points and points could be deducted from those who transgress.

***(e) Organising the physical space***

On the establishing of a culture for learning, the field notes showed that the classroom should be safe, and learning should be accessible to all learners including those with special needs. Teachers should make effective use of physical resources, including computer technology to show complex concepts in the subject. The teacher should ensure that the physical arrangement is appropriate to the learning activities. Learners should contribute to the use or adaptation of a better physical environment to advance learning (Danielson, 2007). The physical classroom environment should allow the teacher to reach every learner to maximise classroom control. The classroom setup should not be rigid because each teaching style works better when a suitable seating arrangement is used.

## Conclusion

This study found that the best practices that assisted learners from school A to perform well in Physical Science were from Domain 2 (Classroom environment). Further, the given mitigation strategies that School B and other schools with similar academic performance in Physical Science could employ to improve classroom environment include: creating an environment of respect and rapport, establishing a culture for learning, managing classroom procedures, managing learner behaviour and organizing the physical space.

Recommendations to the Professional Development (PD) Subdivision of the Ministry of Education, Arts and Culture and schools' management are discussed below so that they are practiced at School B and other schools with similar academic performance in Physical Science for teachers and learners to be assisted to enhance learners' understanding. Suggestions for further research are highlighted for readers.

## Recommendations

Professional Development Subdivision of the Ministry of Education is the department responsible for advising, training and ensuring teaching standards through Continuous Professional Development (CPD) in the Ministry of Education. Therefore, the study recommends to PD, that, the CPD programs should be mostly focused on the activities that are aimed at strengthening the classroom environment at all poor performing schools in Physical Science in Omusati Region. This will assist the learners who are hopeless to find the purpose of schooling and direct their own learning towards achieving their goals. A further study could be conducted to address domain 4 in more detail where a longer time will be spent to observe closely the level of performance of the teachers in this domain.

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