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Editorial

Welcome to the National Institute for Educational Development’s (NIED) 2020 Volume 28, Issue 1 of the journal Reform Forum. This volume includes seven most recent articles contributed by our readers which include titles like: Mediating sense making by science teachers of electrical current using an analogy of water flow in a narrow and wide pipe in under resources schools; Assessing students’ scientific epistemic beliefs; Lecturers’ perceptions about mentoring and challenges they face when mentoring students at an institution of higher learning in Namibia; and An investigation of the pedagogical orientations of Grade 8 Chemistry teachers in Orchestrating Practical Demonstrations at schools in Oshikoto Region, Namibia. This latest publication fulfils NIED’s mission of dissemination of educational information, experiences and the results of studies which is an essential part of the Institute’s mandate, closely linked with its (teacher) training, research activities and curriculum development. We invite you to it down while you read this edition with great interest and think about contributing an article towards the next publication. The reader should visit our website: www.nied.edu.na where you will find the latest titles in the Reform Forum (all downloadable), as well as additional information on the Institute and its programme of activities.

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Mediating sense making by science teachers of electrical current using an analogy of water flow in a narrow and wide pipe in under resources schools

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Abstract
Analogies are used in Science practices as mediating tools for teaching and learning. This study’s main goal was to explore teachers’ perceptions on the use of an analogy of water flow in a narrow and wide tube for sense making of electrical resistance. The study then strove to have an insight on what teachers consider as the strengths and weaknesses of the use of the water flow in a narrow and wide tube analogy for sense making of electrical current flow to mitigate a situation where mediating tools are lacking. In an effort to ensure that the goals of education are realized in schools which are under-resourced in the Zambezi Region, the study explored the effects of incorporating an analogy of water flow in a narrow and wide pipe to teach electrical current flow and factors affecting it to Grade 10 learners.

Sometimes schools in rural settings grapple to come up with teaching and learning apparatus as their science teachers fail to promote the use of different mediating tools as they strive to ensure that education is universal. Absence of varying mediating tools compromises the goals of education systems. To address this through use of analogy, participating science teachers ended up engaging cognitive activities to make sense of factors that could affect electrical resistance. Cognitive constructivism was embraced as the theoretical framework. Through use of interviews to the teachers and observation of teachers when they used water flow in a pipe as analogy for electrical current flow some of the key findings were; analogies can be used to ensure that almost all the goals of science education in the Zambezi Region are addressed in rural schools which are under-resourced if mathematical skills are employed to map the variable concepts in water flow in a pipe to electrical current flow. Also, scientific literacy can be improved in schools which initially could not have engaged in hands-on practical activities which well-resourced schools engage in. Finally, analogy usage can lead to meaningful learning and learners’ development based on their prior knowledge which serves as a key role in independent thinking.

Key words: analogy, mediating tool, scientific literacy, universal, goal

Background
African countries have introduced various goals to ensure universal primary and secondary education is achieved (McGee, 2000). In the Southern African Development Community (SADC) region, for example some countries’ goals are capacitating learners with equity, quality, democracy and access to education. This is evident since Namibia, a SADC country has these goals as stated in the (Namibia Ministry of Education and Culture, 1993) curriculum document. Proper explanation and understanding of these goals and their implication to the population has accelerated enrolment in schools. Shapwanale (2017) provide evidence as she reports that pupil enrolment shows improvement while survival rate of the learners is poor. Failure of the system to ensure that survival rate is high comes as challenges schools now face as they ensure that a large number of learners are in schools and have the necessary mediating tools needed to facilitate sense making of science concepts. Observations and analysis reveal that enrolment skyrocketed as these countries aim to make education universal. In the process, the supply of infrastructure, consumables and other daily needs required for sense making during learning science concepts in particular is constrained. Instead of the supply of educational consumables to be homogenous in all areas, the supply has become heterogeneous and is most noticeable in under-resourced schools. With the hope of lessening the situation, where learners’ survival rate at
schools is poor, analogies were embraced to level the terrain. This then justifies why we need this type of study which might assist teachers to come up with analogies as mediating artefacts in the teaching of electrical current flow to understand factors determining electrical current flow in conductors.

Also, another justification for this approach is literature on how analogies can be used, focuses only on schools that are well resourced. However, authors are aware of this scenario but no author has investigated the effects of using analogies for sense making in under-resourced schools to address equity, equality, quality and democracy. Analogies in use are only suitable to be done in schools which are well equipped as they use materials there as analogies to support the teaching of electrical current flow and understand factors determining electrical current flow in conductors.

For instance, Simayi (2014) recognizes that learners come with knowledge which can be incorporated in electrical current teaching as analogies. However, the analogies employed; the bicycle and rope are cultural artefacts found in schools which constantly receive teaching materials from the government but not seen in a disadvantaged school. Even though Hutchison and Padgett (2007) give an analogous relationship between the flow of a river down a hill and the flow of the electric current in circuits, they do not mention how this analogy can be employed in schools which suffer from heterogeneous supply of teaching materials so that factors determining electrical current flow can be understood. Also, they do not bring the mathematical relationship between variables in the base domain, the known knowledge or knowledge already in the schema of a learner as supported in cognitive constructivism (Piaget, & Inhelder, 1973) and those in the target domain, the knowledge to be assimilated.

Heterogeneous supply of mediating tools in schools sometimes perpetuates existence of inequity, inferior, unequal and undemocratic science teaching practices (Oakes, 2003). Thompson (2013) acknowledges that schools in SADC countries struggle to level the educational landscape for the goals to thrive since they are constrained materially. The heterogeneous supply phenomenon common in SADC regions creates challenges in particular in science subjects teaching which always requires hands-on practical activities for sense making. Ford (2012) understands sense making in science as to make meaning of science concepts in nature and this promotes scientific literacy to flourish. Failure to ensure that mediating tools, materials that affect or determine how science teachers interact with learners such as language, analogies, case studies and models, Engeström (1987) proposes should be used to promote deep learning. Once such type of mediating tools is embraced, this approach does not compromise the scientific literacy development of the citizens in those under-resourced schools. The study strove to address scientific literacy and educational goals mentioned in any SADC school lacking mediating tools. So, to respond to the research question; what do teachers consider as the strengths and weaknesses of the use of the water flow in a narrow and wide pipe analogy for sense making of electrical current to mitigate a situation where mediating tools are lacking. This study also sought to find out the elements teachers consider affect sense making in determining electrical current flow. This led to the use of an analogy of water flow in a narrow and wide pipe as base domain under-resourced schools in the Zambezi Region to understand factors affecting electrical current flow which is the target domain.

Problem statement
To mitigate the problem where science teachers encounter challenges with sourcing teaching and learning materials, science teachers sometimes resort to analogy use. The belief is that analogies serve as mediating artifacts and as analogical reasoning tools that trigger creativity and critical thinking (as Jonâne, (2015) supports. This has led this study to explore what teachers consider the strengths and weaknesses of the use of the water flow in a narrow and wide pipe as analogy in determining electrical current flow. This led to the use of an analogy of water flow in a narrow and wide pipe as base domain in under-resourced schools in the Zambezi Region to understand factors affecting electrical current flow which is the target domain.
making. This led to see the significance of this study and made us come up with research questions given in the section which follows.

**Significance of the study**
The significance of this study lies in the use of cultural artefacts and mathematical skills in the environment of the learner to mediate learning. This also allows learners who are in under-resourced schools to also discover on their own the factors which affect electrical resistance. The study focused at investigating how resistance and factors affecting electrical resistance can be understood using the perspective of an analogy.

**Research goals and question**
The goal of this study is to explore how an analogy of water flow in a narrow and wide pipe can be used by teachers to mediate sense making of electrical resistance and factors affecting electrical resistance. To achieve this, the following questions were asked.

**Research questions**
1. What do science teachers consider as the strengths and weaknesses of the use of the water flow in a narrow and wide pipe analogy for sense making of electrical flow and resistance?
2. What elements do teachers consider affect sense making of factors determining electrical current flow?

To answer the given research questions above, we found that knowledge of what literature say about an analogy is necessary. The literature about an analogy is discussed in the section.

**Literature review**

**Analogy in Science teaching**
Analogies may be taken as a comparison of a concept, an idea, an object, phenomenon or process to another that is quite at a higher level than it. Lakoff (1993) refers to knowledge used for comparison as the base domain whereas the intended conceptual knowledge is referred to as target domain. A familiar concept or situation acts as the base domain. This can be formulated by prior knowledge anchored on one’s experiences and everyday knowledge. Use of everyday knowledge sometimes reflects indigenous knowledge (IK), learners possess as prior knowledge necessary for new knowledge to germinate in it (Sfard, 1998). Also, subject content knowledge received in other encounters with knowledgeable peers scaffolding can act as a familiar situation. Wood and Middleton (1975) view scaffolding as support for cognitive activity used in cognitive constructivism when a member in a community of practice uses a familiar situation with a novice (Lave, 1996). A familiar situation is one Aikenhead (1997) refers to as science related situation. Sometimes, a familiar situation can be an analogy. A community member in practice such as a teacher uses similes, comparisons and metaphors to scaffold a learner’s understanding of a concept.

Lakoff (1993) uses the lens of a metaphor while Gentner (1983) uses the lens of an analogy to map concepts in base domain to those in target domain. Mapping of water flow in a pipe of narrow and wide diameter to electrical current flow in a conductor of narrow and wide diameter to understand factors affecting electrical resistance is represented in Table 1. Electrical resistance is not isolated from electrical current flows in a conductor. This explains why Table 1, representing the analogy of water flow and electrical current flow is used to gain insight on variables which will affect resistance. Electrical resistance exists in the presence of electrical current. This allows viewing electrical resistance by first gaining insight on water flow.

**Table 1: Structure mapping for water flow in a wide and narrow pipe and electrical current flow in an electric circuit to understand factors affecting resistance**

<table>
<thead>
<tr>
<th>Base domain [B]</th>
<th>Target domain [T]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of force $[SF_{H,O}]$  (Water at a certain pressure or with certain amount of potential energy in a dam.)</td>
<td>Source of force $[SF_{E, current}]$  (An electrical cell with a certain amount of potential difference.)</td>
</tr>
<tr>
<td>Energy $[E_{H,O}]$  (Potential energy used to facilitate the movement of water particles.)</td>
<td>Energy $[E_{E, current}]$  (Electrical energy used to facilitate movement of charged particles.)</td>
</tr>
<tr>
<td>Medium of transportation $[MT_{H,O}]$  (pipe of)</td>
<td>Medium of transportation $[MT_{E, current}]$</td>
</tr>
</tbody>
</table>


different length and constant area.

Volume of water \( V_{H,O} \) flow (water flow in a given cross section area through lengths which are constant.)

Volume of charge \( V_{E,current} \) flow (current flow per given cross section area through lengths which are constant).

Adapted from Gentner and Jeziorski (1993, p. 466)

It is of interest to have the comparison in Table 1. It shows the variables in the base domain, the water flow in a wide and narrow pipe and the target domain, the electrical current flow. The variables in the base domain are mapped into the target domain and then allow discussion of electrical resistance. These variables in the two domains are discussed and explained below.

In the target domain, voltage supplied from an electrical cell or battery can be compared to the constant pressure maintained through keeping same amount of water. The voltage provides electrical energy that pushes charges along a conductor. Whereas pressure in the water tank pushes water particles through the pipe and as they move they resist the flow. On the other hand, the electrical resistance of a conductor is an indicator of how challenging it is to drive the charges along. Using the water flow analogy, electrical resistance is similar to friction. For water flowing through a pipe, a long narrow pipe provides more resistance to the flow than does a short fat pipe.

Resistance in a pipe occurs at the water-pipe interface only, whereas the resistance in the wire occurs across the diameter. The (open) water level in a pipe varies for different amounts of water whereas the diameter of the wire is constant for different amounts of potential difference.

Hydraulic resistance to water flow may be understood as restriction in the water pipe. For example, if there is a throttle. Opening the throttle wide reduces resistance and partially closing it increases resistance. This explains why water flow in a narrow pipe encounters more resistance. In addition, most of the area inside the narrow pipe can be occupied by adhesion forces. Adhesion forces in water are found in the inside surface of the pipe and it consists of water molecules which are strongly attached to the pipe surface. It is not easy for such water to move. This contributes to a higher resistance to the water flow. The flow of water might be due to the water with weaker adhesion forces but stronger cohesion forces. Cohesion forces, between particles of the same type, make it possible for water to flow. So, the wider pipes might have more of the cohesion forces as compared to adhesion forces which imply that they might have less resistance to water flow. This also applies to the flowing charged particles which constitute electrical current: long thin wires provide more resistance than do short thick wires. This allows mapping variables in base domain to those in the target domain as (Gentner, 1983).

Gentner (1983) using the lens of an analogy uses a mathematical approach to relate parts in the base domain to parts in the target domain. If the acronyms in Table 1 are made use of to show the mapping, then the following relationship is noted.

\[
\text{Figure 1: Structure mapping for current flow in an electric circuit and water flow in a wide and/or narrow pipe} \quad \text{(Adapted from Gentner, 2012, p. 132)}
\]

From this, our view is that an analogy is a function in which each concept in the base domain is related to only one concept in the target domain. The mapping or function of such a type is a one to one relationship. It follows then that if an analogy is to be a
representative of the two domains it must be of the one to one type.

Jonāne (2016) posits that the analogies’ role is to provide scientific explanation. Analogies have been in use since the time science subjects emerged. In Physics in particular, Boyle compared gas particles with mobile coiled springs (Gingras, & Guay, 2011). Huygens on the other hand came with the perspective of water waves behaving as light waves, historically Carnot compared heat engines with waterfalls and Coulomb’s law is analogous with Newton’s law of gravitation as well as many others (Jonāne, 2016).

The spectrum of analogies given can be grouped based on increase on the level of abstraction, that is, from simple to abstract or concrete to abstract. Boyle’s and Carnot’s analogy are of the concrete-concrete type, Huygens’ and Podolefsky’s solar system and atom and water system electrical circuit are concrete-abstract analogy and Coulomb’s is an abstract-abstract analogy. Jonāne (2015) and Podolefsky (2016) propose grouping based on presentation. This type yields verbal to verbal, an example is an analogy in Table 1 and Coulomb’s analogy. Pictorial-verbal and pictorial-pictorial analogies also exist. Therefore, the level of increase in abstraction ensures that there is evidence of cognitive development in learners’ thinking. In the process, learning gradually becomes clouded with higher mental constructions which are offered in various presentations that signify sense making of concepts.

Presentational type of analogy can be taken to a hands-on practical activity level. This is manifested in Ramasike’s (2017) study. After comparing Ohm’s law with blowing air into a drinking straw which was inserted in water and engaging with some of the above types of analogy, she showed how Ohm’s law can be taught. Jonāne (2015) suggests that such an approach allows deep learning of science concepts. The focus of this study was to take an analogy representation to the level where it might support cognitive constructivism. In this study electrical resistance and factors affecting electrical resistance were conceptualized by using a verbal-verbal analogy, i.e. relating water flow to electrical current flow as in Table 1. This was used to develop and compare activities using cultural artefacts as mediating tools at the disposal of a learner (Mukwambo, 2017). The mathematical skills automatically evolve and gave a special type of variation and contribution into the study. Shaw (1999) argues that mapping of elements in the base domain which is cultural artefacts to those in the target domain can be expressed using a mathematical function.

Research methodology
To respond to the questions posed, this study was supported by the theoretical perspectives of an analogy which support cognitive constructivist teaching and learning philosophy. The study drew on conceptual framework of an analogy. As a qualitative and interpretive research, it acknowledges and embraces the “contextual nature of inquiry” (Glesne & Peshkin, 1992, p. 7). In this interpretive study ten Grade 10 Physical science teachers from ten different schools in the Zambezi Region of Namibia were observed in their natural environment teaching concepts of electrical current flow and factors affecting the flow of moving charged particles. Kirk and Miller (1986) refer to natural environment as “watching people in their own territory ... interacting with them in their own language, on their own terms” (p. 9). Ethical issues, such as concealing identity of participants and seeking permission from participants were considered throughout the research process.

The permission to conduct the research was requested from the following: subject advisor so as to know the research which was taking place in his region and the headmasters for the ten schools so as to understand the support that was to be offered for using the research site as well as the benefits to science teachers if any that the study would contribute. The ten Physical science teachers were requested in writing and verbally to grant permission to participate in the study. Furthermore, the use of a video-recorder to capture most of the data during observations and interviews was discussed before the research process started.

Interviews were aimed at finding out the perceptions of the teachers, the enablers and the constraints of using the water flow analogy in order to gain insight into factors teachers considered affected sense making of electrical resistance. To respond to research question 2, where we needed to know constraints and enablers of using an analogy, excerpts from the interviews were used. This was also related to analogical mapping illustrated in the literature review.
Mapping of variables in Table 1 was done with participants to generate data. The ten teachers only generated data using base domain elements at first. Variables in the base domain were used to infer how water flowed in three pipes of varying diameters but constant length and different length with constant diameter. This allowed the teachers to relate how the flow varied with cross section area and length.

Four components exist in each domain (base domain and target domain) shown in Table 1 and in Figure 1. They are presented as a one-to-one function basing on Gentner’s (1983) conception of an analogy. The last two in the base domain (Medium of transportation \([MT_{H,O}]\) and Volume of water \([V_{H,O}]\) flow) were selected for investigation in order to understand their behaviour. These were compared with components in the target domain and in the last two rows (Medium of transportation \([MT_{E.current}]\) and Volume of current \([V_{E.current}]\)), those were mapped within column 2.

To understand how the flow of water depends on length, three pipes of different lengths \(L_1\); \(L_2\) and \(L_3\) were used to estimate volume flow rate \(V_1\), \(V_2\) and \(V_3\), each pipe transported when time and area were kept constant. The pipes had the characteristics \(L_1=10\) cm \(< L_2= 20\) cm \(< L_3= 30\) cm. Similarly, to understand how flow of water depended on cross section area, pipes of different areas were considered; \(A_1= 0.8\) cm\(^2\) \(< A_2 = 3.1\) cm\(^2\) \(< A_3 = 4.5\) cm\(^2\) to estimate volume \(V_x\), \(V_y\) and \(V_z\). The aim of the activities was to understand opposition to flow rate and see how it depended on length and cross section area in the base domain set.

Two types of tables were obtained when work done by the teachers was finally rewritten by the researchers and the participating science teachers. The tables represented how volume water flow rate transported in relation to length of pipe and to cross section area. The same tables were used to detect the pattern of opposition to flow rate then map the pattern with corresponding components in the target domain, in particular the resistance. That is they were asked to do some inferences based on the tenets of analogy.

**Data presentation and analysis**

The data generated when water volume flow rate was compared with cross section area are indicated in Table 2. This data was generated when the two groups each with five members from the teacher component each came together and worked with the researchers to come up with the pattern which they thought was suitable to accommodate their observations which they presented using mathematical reasoning. The data on the observation schedule which each group yielded was then transcribed using medium of instruction, English to fit literature in analogy (Gentner & Jeziorski, 1993; Gentner, 1983). The volume flow rate of water was found to be high when the diameter was highest, \(r_1 = 0.5\) cm; \(r_2 = 1\) cm and \(r_3 = 1.2\) cm. A pipe, whose diameter was \(A_1\) and smallest had the highest volume flow rate opposition compared to \(A_3\).

<table>
<thead>
<tr>
<th>Volume flow rate (V) (cm(^3))</th>
<th>Cross section area (A) (cm(^2))</th>
<th>(cm^3/min^{-1}(VFRO))</th>
</tr>
</thead>
<tbody>
<tr>
<td>(V_x)</td>
<td>(A_1)</td>
<td>-</td>
</tr>
<tr>
<td>(V_y)</td>
<td>(A_2)</td>
<td>50</td>
</tr>
<tr>
<td>(V_z)</td>
<td>(A_3)</td>
<td>100</td>
</tr>
</tbody>
</table>

Where \(V_x= 50 < V_y= 100 < V_z= 150\) Where \(A_1 < A_2 < A_3\) \(VFRO \propto 1/A\)

Also, the data generated when volume flow rate was compared with length is indicated in Table 3. Similarly, this data was generated when the two groups each worked with the researchers to emerge the patterns that agree with their observations they presented using mathematical reasoning. Volume flow rate opposition increased as the length of the pipe was made longer, as shown in the table shows.
Table 3: Volume flow rate and length values used to compare

<table>
<thead>
<tr>
<th>Volume flow rate V (cm³ min⁻¹)</th>
<th>Cross section area A (cm²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>V₁ = 50</td>
<td>L₁</td>
</tr>
<tr>
<td>V₂ = 100</td>
<td>L₂</td>
</tr>
<tr>
<td>V₃ = 150</td>
<td>L₃</td>
</tr>
</tbody>
</table>

V₁ > V₂ > V₃

L₁ < L₁ < L₁

Data presented in Table 2 and 3 were generated aimed at understanding the variables in the last two rows of Table 1 showing the elements of base domain. To understand behaviour of elements in the last columns of the target domain, mapping was done. Tables 2 and 3 were mapped to the elements in the last two rows of the target domain to come up with data suitable for electrical current flow to respond to the stated research questions. Tables 2 and 3 data acted as baseline data for data which was obtained through mapping for target domain variables which could not be done using conventional tools on account of lack of materials in the mentioned schools. Table 4 presents the data which the participants emerged.

Table 4: Variable mapping for water flow in a wide and narrow pipe and current flow in an electric circuit

**Base domain**

- Medium of transportation \( [MT_{H₂O}] \) (pipes which are of different lengths and constant cross section area.)
  - \( VFRO \ MTH₂O \propto L \)
  - Volume of water \( [V_{H₂O}] \) flow (water flow per given cross section area in lengths of constant length.)
  - \( VFRO \ MT_{H₂O} \propto 1/A \)

**Target domain**

- Medium of transportation \( [MT_{E.current}] \) (electrical conductors e.g. copper of certain length and constant cross section area.)
  - \( VFRO \ MT_{E.current} \propto L \)
  - Volume of current \( [V_{E.current}] \) flow (current flow per given cross section area in lengths of constant length.)
  - \( VFRO \ MT_{E.current} \propto 1/A \)

Adapted from Gentner and Jeziorski (2012, p. 466)

The mapping in Table 4 is based on Lakoff’s (1993) view of a metaphor. In the base domain, \( VFRO \ MT_{H₂O} \) was found to be inversely proportional to the area and directly proportional to length. Most compelling evidence is that, \( VFRO \ MT_{E.current} \) is also inversely proportional to area and directly proportional to length. If Gentner’s (2012) lens is used, the mapping of variables in base domain to those in target domain can be illustrated as in Figure 2. According to Gentner (2012) the compared variables can be represent using mathematical symbolism. This is done in Figure 2.

![Figure 2: Structure mapping water opposition flow to current opposition flow](image-url)
To further include logical reasoning more familiar to mathematics used to explain physical phenomenon like the one under study, the participants together with the researchers related the variables under study through use of a constant $\rho$. $\rho$ was explained as the resistivity which depended on the characteristics of the material used for the study, water and charge flow respectively. This emerged two mathematical relations obtained through mapping with each illustrating how opposition depended on the length and cross section area. This is shown in Figure 3. The idea to show them as converging arrows was to convey the idea that a water system and a charge flow system are not in conflict but share some similarities.

**Data from interviews**

The theme that surfaced from the interviews on the extent which the use of an analogy was helpful or limiting sense making on investigating teachers’ perceptions on the use of an analogy of water flow in a narrow and wide tube for sense making of electrical resistance when an analogy is used to understand factors that determine electrical resistance is revealed in the following except.

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Work on understanding factors affecting electrical resistance in textbooks and that teachers reflect in their practices in most cases is based on rigorous mathematical approach which learners cannot understand on account of their weak mathematical background. Also, sometimes it is based on hands-on practical activities which cannot be done on account of lack of resources. However, the practical use of an analogy allows learners to gain insight on elements that affect electrical resistance easily.

$$R_{H,O} = \rho \frac{L}{A} \quad \longleftrightarrow \quad R_{Elect} = \rho \frac{L}{A}$$

*Figure 3: Factors determining resistance in a water system and electric system*

**Findings**

One of the research questions aimed at finding what teachers consider the strengths and weaknesses of the use of the water flow in a narrow and wide tube analogy for sense making of electrical resistance? This research question was responded when teachers used analogies embracing materials which are around the learners’ environment and their mathematical skills. Their observations generated Table 2 and 3. Teachers considered the mathematical strengths which come with water flow analogy. Transcribing the data yielded during observation required that participants possess the idea of mathematical functions that Gentner (1983) supports. Weaknesses might arise if participants fail to understanding the mapping presented in Table 1 which was adapted from (Gentner & Jeziorski, 1993) and used to familiarize participants with mapping skills. Understanding how components in the base domain operate and then relate how such a physical phenomenon operates if not understood can come as a challenge hampering the use of an analogy to make sense of factors affecting resistance. The skill to relate and compare water flow in pipes with electrical charge flow in a conductor removed weaknesses. Small pipes picked from around the community were used and teachers were tasked to observe the phenomenon under study using physical features.

Research question 2 aimed at finding the elements teachers consider affect sense making of factors determining electrical resistance. This was responded through mapping. It was found that factors affecting resistance are area and length. Through mapping with parameters which are known from learners’ environment with electrical current flow, these were found to be directly proportional to length and inversely proportional to cross section area. Also, teachers pointed out during discussion that lack of mathematical skills might lead one not to find the factors which affect electrical resistance.

Basing from the findings from the excerpt, the use of an analogy does not bring constraints. Instead, it is an enabler. This is evidenced from the excerpt where theme revealed is rigorous mathematical treatment of elements affecting electrical resistance can be substituted with the use of an analogy which embraces the idea of a function, Gentner (1983) proposes. The excerpt from the interviews affirms the goal of the study which
was to investigate teachers’ perceptions on the use of an analogy of water flow in a narrow and wide tube for sense making of electrical resistance.

Conclusion
Science textbooks sometimes use analogy of physical science phenomenon and others in learners’ environment. However, sometimes they offer a surface treatment of the physical phenomenon as they do not bring the mathematical relations existing in elements in base domain and those in target domain. As a result it hampers sense making of science concepts. From the view of the teachers science textbooks do not use analogies that engage the mathematical skills required to surface relation existing between variables to make the concepts that are difficult to be comprehensible, as this is one of the roles of an analogy. It is necessary to penetrate further. This can be done through mathematical analysis of how variables determining the phenomenon are related. In doing so, the use of an analogy level the terrain made rough by lack of resources so that equity, democracy, quality, access and sense making of science concepts are addressed to all learners and in all area of a country which has made its education system universal.

References


Assessing students’ scientific epistemic beliefs

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Abstract
This study aimed to adapt and validate a questionnaire for assessing Namibian senior secondary (Grades 11 and 12) students’ scientific epistemic beliefs (SEB) and explore their relation to achievement in science, gender, grade and socioeconomic status using paper and pencil. The study was correlational, with a sample of 944 (45% male; 55% female) Grades 11 and 12 students with the mean age M=17.9, SD= 1.4. The study adapted the scientific epistemic beliefs questionnaire developed by Conley, Pintrich, Vekiri and Harrison (2004). The adaptation entailed shortening the questionnaire to mitigate redundancy suspected in the original questionnaire. The self-reporting Likert scale questionnaire comprised of four dimensions of beliefs: source; certainty; development; and justification of scientific knowledge. The adapted questionnaire had good reliability with the Cronbach’s alpha of subscales ranging from .80 to .83 and the overall reliability of .70. Model fit analysis yielded good statistical fit with Chi-square ratio to degrees of freedom= 2.71, RMSEA= 0.043, CFI= 0.95, TLI= 0.94, SRMR=.032. The overall regression model was significant F (4, 939) =8.218, p <.001, R²=.034. Two dimensions, certainty (β=.154, p<.001) and justification (β=.100, p<.05) were statistically significantly predicted achievement in science. There was statistically significant difference in beliefs about source in terms of gender and grade and about certainty in terms of grade. The results show that the questionnaire works well with the Namibian sample used given the good model fit for the data and reliability. Results are further discussed in terms of 21st century skills development.

Keywords: scientific epistemic beliefs, cross-cultural validation, factor analysis

Introduction
The science curriculum in Namibia demands that students develop into scientific literate citizens (Ministry of Education, 2010). One of the components of scientific literacy is the understanding of the nature of scientific knowledge. However, the assessment of science knowledge in Namibian schools does not include this aspect of scientific literacy. All assessments mainly focus on subject content knowledge and omit the epistemic aspect of scientific inquiry needed to help students develop 21st century skills. Epistemic beliefs refer to individual’s beliefs about knowledge and knowing. Students need to develop sophisticated scientific epistemic beliefs in order to understand the nature of scientific knowledge and how such knowledge is constructed (Gu & Belland, 2015). Since this aspect of scientific literacy is not assessed in schools, there is hardly any means through which to ascertain the extent to which the goals of the science curriculum are being met. One way to ascertain students’ understanding of the nature of scientific knowledge and knowing is to assess their scientific epistemic beliefs. To achieve this, reliable and valid measures are required. Numerous epistemic beliefs measures have been developed and adapted in recent years (Buehl, Alexander, & Murphy, 2002; Conley, Pintrich, Vekiri, & Harrison, 2004; Murphy, Edwards, Buehl, & Zeruth, 2007; Schraw, Bendixen, & Dunkle, 2002; Tsai, Jessie Ho, Liang, & Lin, 2011). However, a review of relevant literature suggests that these measures were either developed or adapted in the western world and Asia. None of such measures were tested in the cultural context of Namibia.

The aim of this study was to adapt and validate the scientific epistemic beliefs (SEB) questionnaire developed by Conley, Pintrich, Vekiri, and Harrison (2004) using the Namibian senior secondary school (grade 11 and 12) students. The study attempted to answer three research questions:
1. How is the reliability of the adapted scientific epistemic beliefs questionnaire with the Namibian sample?
2. Does the data confirm the four-dimension hypothesised model?
3. Do students’ scientific epistemic beliefs predict their achievement in science?
4. Is there a difference in mean levels of SEBs in terms of gender, grade and socioeconomic status?

Terminology of epistemic beliefs

Epistemology is an aspect of philosophy that is concerned with the nature of human knowledge and reasoning (Muis, Bendixen, & Haerle, 2006). Educational researchers study epistemology in terms of individual’s perspective. They focus on beliefs individuals possess about how knowing occurs, how knowledge is justified and how these affect individuals’ cognitive processes (Gu & Belland, 2015). However, different terminologies referring to beliefs that people possess about nature of knowledge and knowing such as epistemic beliefs, epistemological beliefs, personal epistemology and epistemic cognition can be found in the literature. This suggests that there is no consensus regarding the terminology of this concept (Greene, Azevedo, & Torney-Purta, 2008; Hofer, 2004).

According to Kitchener (2002), epistemic beliefs are beliefs about knowledge and knowing, including the source or justification of knowledge, whereas epistemological beliefs are beliefs about the field of epistemology or beliefs about the study of knowledge. Though personal epistemology or epistemological beliefs are used by most researchers in some measures of beliefs, it could be construed that such measures were aimed at the type of beliefs that Kitchener referred to as epistemic beliefs (Murphy et al., 2007). For this reason, the term epistemic beliefs is adopted for this study to refer to students’ beliefs about scientific knowledge and knowing.

Greene et al. (2008) suggest that epistemic beliefs develop continuously from a naïve orientation to a more sophisticated position though in an unorganised way. Such beliefs begin with absolutism through multiplicity and evaluativism. Absolutism is concerned with beliefs that knowledge is absolute and certain. Multiplicity entails beliefs that knowledge is subjective and the evaluativist views knowledge as evolving, actively constructed and justified with evidence (Kienhues, Bromme, & Stahl, 2008).

Scientific epistemic beliefs

On the sidelines of the general characterisations epistemic beliefs is a suggestion that domain-specific epistemic beliefs are more pertinent and influential in academic learning (Muis, Bendixen & Haerle, 2006). For this reason, this study is located in the science domain.

Conley et al. (2004) proposed that scientific epistemic beliefs have four dimensions. The four dimensions are source (science knowledge comes from authority or experts); certainty (science knowledge has only one answer); development (science knowledge is evolving and changing); and justification (science knowledge should be based on evidence from different experiments and observations). Epistemic beliefs have been associated with learning and academic achievement in science (Cano, 2005; Stathopoulou & Vosniadou, 2007; Trautwein & Lüdtke, 2007). These studies highlighted the importance of exploring student’s views about the nature of scientific knowledge with a view to help them better understand science concepts. Studies that involved elementary students (e.g. Elder, 2002; Conley et al., 2004) provided conflicting results. Elder’s study revealed that students perceived science knowledge as changing (development) and derived from experiments (justification). The other one by Conley and other colleagues found no significant changes in beliefs regarding the changing nature (development) and justification of scientific knowledge, though they found that higher achievement in science was associated with more sophisticated beliefs. Moreover, similar studies done with upper secondary students showed more consistent results (Liang & Tsai, 2010; Stathopoulou & Vosniadou, 2007; Trautwein & Lüdtke, 2007).

This is perhaps not surprising because earlier work on epistemological thinking (Kuhn, 1988) asserted that it was not easy to identify epistemological thinking among younger students. However, this assertion was contradicted by Wellman’s (1992) work on children’s theory of mind, suggesting that epistemological thinking begins at an early age and hence it should continue developing (Chandler, Hallett, & Sokol, 2002). Against the
foregoing, this study chose senior secondary students (Grades 11 and 12) as the most appropriate sample to validate the adapted questionnaire in the Namibian context.

**Adaptation of the SEB questionnaire**

The original questionnaire was developed for a particular culture and in the present study it has been adapted for a different culture. This necessitates a cross-cultural validation. Cross-cultural validation entails ascertaining whether instruments that were originally developed in a particular culture are meaningfully applicable and thus equivalent for use in another culture (Huang & Wong, 2014). It has often been applied in psychological studies in which self-reporting measures are adapted for use in languages other than the original one. However, in the present study, both the original and the adapted version were in English. Cultural difference exists only in terms of geographical location: the original questionnaire was developed in the USA and the adapted version was used in Namibia (Africa).

Huang and Wong (2014) asserted that it might be challenging to adapt an instrument in a culturally relevant and comprehensible form while maintaining the meaning of the original items. In the context of the present study, the adaptation entailed the removal of items that were deemed repetitive in an effort to shorten the questionnaire. Shortening the questionnaire was deemed beneficial as it could reduce redundancy suspected in the original questionnaire as well as mitigating respondents’ fatigue. Wordy items were rephrased. Some words such as “stuff” were replaced with “things” for clarity. The development dimension showed lower reliability (α = .66) compare to other three dimensions in the original SEB questionnaire. For this reason, the item “Ideas in science sometimes change” was replaced with one that reads “Scientific ideas may change because technology may lead to new findings”.

The original version of the SEB questionnaire consisting of 26 items can be found in the Conley et al. (2004) article published in the *Contemporary Educational Psychology Journal*. The final adapted questionnaire had 22 items in total (Table 1).

<table>
<thead>
<tr>
<th>Dimensions of beliefs</th>
<th>Original SEB (no. of items)</th>
<th>Adapted SEB (no. of items)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Certainty</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Development</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Justification</td>
<td>9</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>22</td>
</tr>
</tbody>
</table>

Due to the adaptation of the questionnaire and the use of a sample different from the original one, it is recommended to examine the psychometric properties of the adapted instrument in order to assess its measurement precision and validity (Schraw, Bendixen, & Dunkle, 2002). Previous studies that used the same questionnaire (Liang & Tsai, 2010; Tsai, Jessie Ho, Liang & Lin, 2011) confirmed its factorial structure suggesting that we could formulate an a priori hypothesis to test the questionnaire’s factorial structure signifying that the four dimensions of beliefs proposed by Conley et al. (2004) should form distinct factors. Hence only confirmatory factor analyses were used to assess measurement model fit for the data in the present study.

**Methods**

**Participants and procedure**

After obtaining ethical approval from the university’s institutional review board as well as permission from the gate keepers at the Ministry of Education in Namibia, consent forms were signed by participating students in conjunction with their parents or guardians. A sample of 944 (45% male; 55% female) grade 11 and 12 students with the mean age M=17.9, SD= 1.4 from three senior secondary schools in two regions (Omusati and Khomas) of Namibia participated in the study. Sampling was inherently convenient because the aim of the study was not to generalize findings but rather to obtain sufficient sample suitable for advanced statistical analysis to examine psychometric properties of the questionnaire.
All participating students were in senior secondary level (Grades 11 and 12). With assistance of the teachers, students responded to the items using the paper-and-pencil method. Students in the senior secondary level were preferred considering their anticipated proficiency in the English language compare to younger students. On average, students spent approximately 10 minutes to complete the questionnaire. Students were assigned numbers corresponding to their position in their class list. This enabled the researcher to link their SEB questionnaire responses to their mid-year science (Biology and Physical Science) marks obtained from school records. Science marks were used to relate students’ SEBs to achievement in science. Provision was also made on the SEB questionnaire to collect some background data such as age, gender, grade and socioeconomic status (SES) by means of mother’s level of education.

**Instruments**

The 22-item questionnaire was adapted from the scientific epistemic beliefs’ questionnaire (Conley et al., 2004). Students were asked to indicate their level of agreement with the statements on beliefs about scientific knowledge. Items were unambiguously short, declarative statements without jargon. Each item was a five-point Likert scale of temporal frequency (Glynn, Taasoobshirazi, & Brickman, 2009), wherein 1 = strongly disagree; 2 = disagree; 3 = not sure; 4 = agree and 5 = strongly agree. The questionnaire comprised of four dimensions of beliefs and example of items are given in brackets: source (Whatever the teacher says in science class is true); certainty (All questions in science have one right answer); development (Existing ideas in science may change as scientists come up with new ones); and justification (Good answers are based on evidence from many different experiments).

Each item had to be answered by means of circling the number corresponding to the option that best described their beliefs. All items were worded in both and negative directions however, items were negatively worded, all from the two naïve dimensions e.g. source and certainty were reverse scored so that a high score on a particular dimension indicates more sophisticated beliefs. The adapted questionnaire was given to one university lecturer of English and Linguistics who proof read and approved the language usage. Students’ responses were captured manually and incomplete questionnaires were discarded, hence no missing data are found in the data set.

**Data analysis**

Ordinal data were analysed as if they were interval data (Glynn, Brickman, Armstrong, & Taasoobshirazi, 2011). The reliability of the scales was assessed using Cronbach’s alpha coefficient (Summers & Abd-El-Khalick, 2017), using the statistical package for social sciences (SPSS) version 25. Construct validity was assessed using two criteria: convergent and discriminant (Cristobal, Flavián, & Guinalíu, 2007).

Based on previous studies that used the same questionnaire (e.g. Liang & Tsai, 2010; Tsai, Jessie Ho, Liang & Lin, 2011), an assumption was made that the factorial structure confirmed by such studies through exploratory factor analysis should be sufficient for us to formulate an a priori hypothesis to test the adapted questionnaire's factorial structure suggesting that the four dimensions of beliefs proposed by Conley et al. (2004) should form distinct factors. Hence only confirmatory factor analyses in Mplus version 8 were used to assess measurement model fit using the ratio of chi-square to degrees of freedom ($\chi^2/df$), root-mean-square error of approximation (RMSEA), standardized root mean square residual (SRMR), Tucker-Lewis index (TLI) and comparative fit index (CFI) as fit indices (Glynn et al., 2011; Teo, 2013). Linear regression analysis was conducted to relate SEBs to achievement in science. Independent sample t-test was conducted to examine the difference in SEBs in terms of gender, grade and socioeconomic status. The reliability of the original SEB questionnaire ranged from .66 to .82. It also showed reasonable model fit for the data with the RMSEA of 0.038, the CFI was 0.90, the non-normed fit index (NNFI) was 0.89, and the root mean square residual (RMR) of 0.062 (Conley et al., 2004).

**Results and discussions**

The reliability of the adapted SEB questionnaire was estimated using Cronbach’s alpha coefficient. Reliability is a measure of internal consistency of respondents’ responses across the items on a multiple-item measure. Essentially, all the items on such measures should reflect the same underlying construct
thus respondents’ scores on those items should be correlated with each other (Wieland, Durach, Kembro, & Treiblmaier, 2017).

Streiner (2003) suggested that the alpha coefficients of .70 and higher are ideal for research tools.

Table 2: Reliability comparisons of original and adapted SEB questionnaires (N=944)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>No. of items</th>
<th>Alpha (α)</th>
<th>Original</th>
<th>Adapted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>5</td>
<td>.82</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>Certainty</td>
<td>6</td>
<td>.79</td>
<td>.81</td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>6</td>
<td>.66</td>
<td>.83</td>
<td></td>
</tr>
<tr>
<td>Justification</td>
<td>9</td>
<td>.76</td>
<td>.80</td>
<td></td>
</tr>
<tr>
<td>Overall reliability (α)</td>
<td>26</td>
<td>.70</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The reliabilities of the scores from the five factors in the questionnaire for this study were assessed using Cronbach’s alpha coefficient. The reliability of scores from individual dimensions ranged from .80 to .83 (Table 2). The overall reliability of the scores on the adapted SEB questionnaire was .70. This suggests that the questionnaire had good overall reliability for the sample used although as all dimensions showed reliability values well above the recommended minimum threshold of .70 (Streiner, 2003). The overall reliability of the original SEB questionnaire was not reported, however, based on what was reported dimensions wise, the adapted SEB showed better reliability. It should be noted that the original SEB questionnaire was administered to elementary school students while the adapted one in the present study was administered to senior secondary students. The mode of administration was also different. In the original questionnaire, items were orally read out to students while in the present study, students responded by reading the questionnaires themselves.

Conley et al. (2004) reported that there was considerable redundancy in the original SEB questionnaire due to very high correlation between the source and certainty dimensions (r = .92) which made it difficult to differentiate between the two concepts logically. However, our correlation analysis of the four dimensions (Table 3) showed that they were distinctly different from each other thus eliminated any possible redundancy of items.

Table 3: Correlation of adapted SEB dimensions (N=944)

<table>
<thead>
<tr>
<th>Source</th>
<th>3.4</th>
<th>.10</th>
<th>-</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certainty</td>
<td>3.9</td>
<td>.79</td>
<td>-.041</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>4.1</td>
<td>.62</td>
<td>.025</td>
<td>.014</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Justification</td>
<td>4.3</td>
<td>.56</td>
<td>.015</td>
<td>-.014</td>
<td>.007</td>
<td>-</td>
</tr>
</tbody>
</table>

M= mean SD= Standard deviation

The overall level of beliefs was fairly low for the two naïve dimensions namely source (M = 3.4, SD = .10) and certainty (M = 3.9, SD = .79) but were higher for the sophisticated dimensions namely development (M =4.1, SD = .62) and justification (M= 4.3, SD = .56).

Though these results are similar to the findings in the original questionnaire, it is difficult to interpret students’ beliefs accurately due to the cross-sectional nature of the present study. Source and certainty were reverse scored so that high scores on them indicate sophisticated beliefs. Another assessment after an intervention could perhaps clarify this as one would be able to ascertain whether there were any changes in their beliefs. It should be noted that as such was not the aim of the present study. It is rather an opportunity for future research.

Confirmatory factor analysis of the SEBs dimensions

Confirmatory factor analysis was performed to verify the construct validity of the SEBs hypothesized four-dimension model. The values of item loadings, composite reliability (CR) and average variance extracted (AVE) are advised to evaluate convergent validity of the constructs (Hair, Black, Babin, Anderson & Tatham, 2006). Convergent validity
measures the level of correlation of multiple variables of the same construct that are in agreement (Ab Hamid, Sami, & Sidek, 2017). As shown in Table 4, almost all loading values of the items were significant and higher than 0.5 (except for one item under justification that had a loading value of 0.35), indicating that in most cases more than 50% of the variance is explained by the dimensions. The CR values all exceeded the recommended cutoff value of .70 (Fornell & Larcker, 1981). The AVE values for three of the dimensions (source, certainty, and development) met the minimum cutoff point of .50 while the AVE value for the justification dimension was .40. The AVE values for the four dimensions ranged from .40 to .50. The CR values ranged from .80 to .83 (Table 4). Although one dimension had the AVE value below the preferred minimum cut-off point of .50, convergent validity may still be adequate because the other three dimensions had AVE values of .50 and all dimensions had CR values above .70 (Fornell & Larcker, 1981). Malhotra and Dash (2011) argued that the AVE is often too strict and validity can be established through CR alone.

Regarding goodness of fit of the measurement model, the ratio of chi-square to degrees of freedom ($\chi^2/df$) was 2.71, RMSEA = 0.043, CFI = 0.95, TLI = 0.94, SRMR = 0.032, indicating that the measurement model fits the data very well. (Garson, 2015) The recommended resultant value for $\chi^2/df$ should be in a recommended range of 1.0-3.0 (Glynn et al., 2011, Garson, 2015). The RMSEA and the SRMR are independent of the sample size but are sensitive to model misspecification and adequate fit values should be 0.06 and 0.08 or less respectively (Teo, 2013). The TLI and CFI are incremental indices with a recommended cutoff value of 0.95, indicating goodness of fit, however, values above 0.90 are acceptable (Hooper, Coughlan, & Mullen, 2008). Maximum likelihood (ML) estimation was used to estimate the model’s parameters and fit indices.

Table 4: Confirmatory factor analysis of the SEB four dimensions model (N= 944)

<table>
<thead>
<tr>
<th>Source (S)</th>
<th>Factor loadings</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>0.675**</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>S2</td>
<td>0.816**</td>
<td>0.80</td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>0.625**</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>S4</td>
<td>0.709**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certainty (C)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>0.653**</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>C6</td>
<td>0.820**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>0.559**</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>C8</td>
<td>0.772**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C9</td>
<td>0.606**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development (D)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D10</td>
<td>0.744**</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>D11</td>
<td>0.506**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D12</td>
<td>0.714**</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>D13</td>
<td>0.583**</td>
<td></td>
<td>0.50</td>
</tr>
<tr>
<td>D14</td>
<td>0.722**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D15</td>
<td>0.733**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification (J)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J16</td>
<td>0.633**</td>
<td></td>
<td>0.40</td>
</tr>
<tr>
<td>J17</td>
<td>0.632**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J18</td>
<td>0.718**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J19</td>
<td>0.672**</td>
<td>0.81</td>
<td></td>
</tr>
<tr>
<td>J20</td>
<td>0.547**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J21</td>
<td>0.753**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J22</td>
<td>0.354**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

** significant t-value, $p < .001$

Discriminant validity was assessed by comparing the square root of the AVE with the correlation of latent factors (dimensions) in the model (Hair et al., 2016) and was tenable as
shown in Table 5. The extent to which latent factors (dimensions) differ from each other empirically defines discriminant validity (Hair, Hult, Ringle, & Sarstedt, 2016). This means that a latent factor should explain the variance of its own indicators better than the variance of other latent factors (Ab Hamid et al., 2017).

Table 5: Correlation matrix for SEB

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Development</td>
<td>4.1</td>
<td>.62</td>
<td>0.67</td>
<td></td>
</tr>
<tr>
<td>2. Source</td>
<td>3.4</td>
<td>.10</td>
<td>0.03</td>
<td>0.71</td>
</tr>
<tr>
<td>3. Certainty</td>
<td>3.9</td>
<td>.79</td>
<td>0.02</td>
<td>-0.06</td>
</tr>
<tr>
<td>4. Justification</td>
<td>4.3</td>
<td>.56</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Note:** The diagonal numbers in italic are the square root of the AVE values

Prediction of achievement in science

Previous studies (Cano, 2005; Trautwein & Lüdtke, 2007; Stathopoulou & Vosniadou, 2007) have suggested that epistemic beliefs may have an influence on students’ academic achievement. SEBs were used as predictors of achievement in science when regression analysis was conducted. Achievement in science was the outcome variable. Overall, the model fit proved to be good, $\chi^2$ (df = 4) = 32.481, TLI = .954, CFI = .957, RMSEA = .012, SRMR = .024. The resulting standardized beta coefficients are shown in Fig. 1. The regression model was significant $F$ (4, 939) = 8.218, $p < .001$, $R^2 = .034$. However, only two dimensions namely certainty ($\beta = .154$, $p<.001$) and justification ($\beta = .100$, $p<.05$) statistically significantly predicted achievement in science. Source ($\beta = -.005$, $p = .886$) and development ($\beta = -.021$, $p = .503$) negatively predicted achievement in science but the regression weights were not statistically significant.

Figure 1: Linear regression of SEBs and achievement in science

With regard to certainty dimension, the findings in this study are contrary to what Trautwein and Lüdtke (2007) reported in their study involving upper secondary students. They found that certainty beliefs were significantly negative predictor of
achievement. However, their achievement factor was broader than the present study which focused on science only.

**Differences in SEBs in terms of gender, grade and socioeconomic status**

In response to the fourth research question which asked whether there were differences in mean levels of SEBs in terms of gender, grade and socioeconomic status (SES), independent sample t-test was conducted for each dimension, separately for each group. The SES was determined by grouping students into two. One group for those whose mothers had a degree or diploma considered as ‘high SES’ and the other group was for those whose mothers had matric or below matric considered as ‘low SES’. Those who didn’t know about the level of their mothers’ education were excluded from these analyses. The study found that there was statistically significant difference in beliefs about source of scientific knowledge in terms of gender (Table 6). Female students (M = 3.44, SD = .892) showed slightly more sophisticated beliefs about source of scientific knowledge than male students (M = 3.26, SD = .890), t(942) = -3.086, p < .05, however, the effect size was very small, Cohen’s d = 0.16, probably owing to the large sample size. Nonetheless, this was a positive finding considering that this is a validation study. The results were congruent with Cano (2005), although using different instruments, it was found that girls’ epistemological beliefs about knowledge and learning, at all school levels, were more realistic than for the boys. There was no statistically significant difference in beliefs about other three dimensions in terms of gender. This is in line with Pintrich (2002) who asserted that there were no important differences in epistemological thinking in terms of gender. The original study (Conley et al., 2004) also reported that boys and girls in the fifth grade appeared to have similar scientific epistemic thinking as they didn’t find evidence suggesting the effects of gender nor any moderating effects of gender over time.

**Table 6: Mean difference in terms of gender**

<table>
<thead>
<tr>
<th>SEBs</th>
<th>Gender</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
<th>95% CI of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>Male</td>
<td>421</td>
<td>3.26</td>
<td>.890</td>
<td>3.086</td>
<td>942</td>
<td>.002</td>
<td>-.180</td>
<td>.058</td>
<td>-.295 to -.066</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>523</td>
<td>3.44</td>
<td>.892</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certainty</td>
<td>Male</td>
<td>421</td>
<td>3.92</td>
<td>.804</td>
<td>.301</td>
<td>942</td>
<td>.763</td>
<td>.016</td>
<td>.052</td>
<td>-.086 to .117</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>523</td>
<td>3.90</td>
<td>.773</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>Male</td>
<td>421</td>
<td>4.13</td>
<td>.619</td>
<td>-.218</td>
<td>942</td>
<td>.827</td>
<td>-.009</td>
<td>.040</td>
<td>-.088 to .070</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>523</td>
<td>4.14</td>
<td>.613</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification</td>
<td>Male</td>
<td>421</td>
<td>4.24</td>
<td>.571</td>
<td>-.851</td>
<td>942</td>
<td>.395</td>
<td>-.031</td>
<td>.037</td>
<td>-.104 to .041</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>523</td>
<td>4.27</td>
<td>.555</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

With regard to grades, there was a statistically significant difference in beliefs about source and certainty between grades (Table 7). Grade 11 students (M= 3.43, SD=.879) showed more sophisticated beliefs about source than Grade 12 students (M= 3.29, SD=.908), t(942) = 2.389, p < .05, with Cohen’s d = 0.22, suggesting a small but significant difference. Alternately, Grade 12 students (M= 4.00, SD= 763) showed more sophisticated beliefs about certainty than Grade 11 students (M= 3.83, SD= .800), t(940.69) = -3.423, p <.05, which is also a small but significant difference (Cohen’s d= 0.20). These results are in conflict with the hypothesis that Grade 12 students would have more sophisticated beliefs than Grade 11 students, because they have been studying science longer. However, this can only be adequately tested with a pre-test post-test kind of assessment. As such was not possible for the present study. Although in the original study (Conley et al., 2004) students were assessed at two points in time, mimicking a pre-test post-test scenario, it did not compare different grades as it used fifth graders only.
The results showed that there was no statistically significant difference in the means of high and low SES across all four dimensions of beliefs. Both groups showed overall lower scores on source and certainty and higher scores on development and justification (Table 8). The results suggest that regardless of the SES, students possessed less sophisticated beliefs about source (high SES: M= 3.30, SD= .904; low SES: M= 3.41, SD= .824) and certainty (high SES: M= 3.90, SD= .827; low SES: M= 3.92, SD= .771) but possessed more sophisticated beliefs about development (high SES: M= 4.16, SD= .561; low SES: M= 4.06, SD= .693) and justification (high SES: M= 4.24, SD= .653; low SES: M= 4.30, SD= .513).

### Table 7: Mean difference in terms of grade

<table>
<thead>
<tr>
<th>SEBs</th>
<th>Grade</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>Df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
<th>95% CI of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>11</td>
<td>492</td>
<td>3.4</td>
<td>.87</td>
<td></td>
<td>3</td>
<td>2.389</td>
<td>.017</td>
<td>.058</td>
<td>.025 .253</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>452</td>
<td>3.2</td>
<td>.90</td>
<td></td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certainty</td>
<td>11</td>
<td>492</td>
<td>3.8</td>
<td>.80</td>
<td></td>
<td>3</td>
<td>-3.423</td>
<td>-.174</td>
<td>.051</td>
<td>-.274 .074</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>452</td>
<td>4.0</td>
<td>.76</td>
<td></td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Development</td>
<td>11</td>
<td>492</td>
<td>4.1</td>
<td>.58</td>
<td></td>
<td>4</td>
<td>.075</td>
<td>.003</td>
<td>.040</td>
<td>-.076 .082</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>452</td>
<td>4.1</td>
<td>.64</td>
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<td></td>
<td>6</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification</td>
<td>11</td>
<td>492</td>
<td>4.2</td>
<td>.55</td>
<td></td>
<td>5</td>
<td>-.696</td>
<td>-.025</td>
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<td>-.097 .046</td>
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<td>12</td>
<td>452</td>
<td>4.2</td>
<td>.57</td>
<td></td>
<td>7</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Table 8: Mean difference in terms of socioeconomic status

<table>
<thead>
<tr>
<th>SEBs</th>
<th>SES</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
<th>Mean Difference</th>
<th>Std. Error Difference</th>
<th>95% CI of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source</td>
<td>High SES</td>
<td>215</td>
<td>3.30</td>
<td>.90</td>
<td>-1.427</td>
<td>503</td>
<td>.154</td>
<td>-.110</td>
<td>.077</td>
<td>.262 .042</td>
</tr>
<tr>
<td></td>
<td>Low SES</td>
<td>290</td>
<td>3.41</td>
<td>.82</td>
<td></td>
<td>4</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Certainty</td>
<td>High SES</td>
<td>215</td>
<td>3.90</td>
<td>.82</td>
<td>-2.37</td>
<td>503</td>
<td>.813</td>
<td>-.017</td>
<td>.072</td>
<td>-.158 .124</td>
</tr>
<tr>
<td></td>
<td>Low SES</td>
<td>290</td>
<td>3.92</td>
<td>.77</td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
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<td>7</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Development</td>
<td>High SES</td>
<td>215</td>
<td>4.16</td>
<td>.56</td>
<td>1.787</td>
<td>503</td>
<td>.075</td>
<td>.103</td>
<td>.058</td>
<td>.010 .216</td>
</tr>
<tr>
<td></td>
<td>Low SES</td>
<td>290</td>
<td>4.06</td>
<td>.69</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Justification</td>
<td>High SES</td>
<td>215</td>
<td>4.24</td>
<td>.65</td>
<td>-1.228</td>
<td>393.5</td>
<td>.220</td>
<td>-.066</td>
<td>.054</td>
<td>.172 .040</td>
</tr>
<tr>
<td></td>
<td>Low SES</td>
<td>290</td>
<td>4.30</td>
<td>.51</td>
<td></td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

22
This implies that students’ mothers’ level of education did not have an influence on their beliefs about scientific knowledge and knowing. These findings are contrary to what was reported about SES in the original study (Conley et al., 2004). It was reported that low SES students scored lower in all four dimensions of beliefs than average SES students. Suggesting that low SES students appeared to possess less sophisticated epistemic beliefs. It should be noted that the criteria for classifying students into low and high SES were different. In the original study, the SES was determined in terms of eligibility for free lunch at school while in the present study it was based on mothers’ level of education.

**Conclusion**

This study set out to adapt and validate the scientific epistemic beliefs questionnaire using the Namibian sample of Grades 11 and 12 students. The overall level of beliefs was fairly low for the two naïve dimensions namely source and certainty but was higher for the sophisticated dimensions namely development and justification. These results were similar to the findings of the original questionnaire but it is difficult to interpret students’ beliefs accurately due to the cross-sectional nature of the present study. Source and certainty were reverse scored because their items were reverse-coded, so that high scores on them indicate more sophisticated beliefs. Although reverse-coded items may help mitigate response bias, it can also lead to confusion among respondents. Respondents, especially second language speakers, who are not careful may miss the reversing or the negative form and may incorrectly respond to the reverse-coded items (Weijters, Baumgartner, & Schillewaert, 2013).

Another assessment after an intervention could perhaps clarify the current state of students’ beliefs as one would be able to ascertain whether there were any changes in beliefs. It should be noted that as such was not the aim of the present study. It is rather an opportunity for future research.

The results indicate that the adapted questionnaire had adequate construct validity owing to good convergent and discriminant validity estimates. Similarly, the reliability of responses in terms of both alpha coefficient and composite reliability estimates were good as the estimates for all four dimensions of beliefs were above the preferred cut-off point of .70. The measurement model shows good fit for the data with good fit statistics such as $\chi^2/df$, RMSEA, SRMR, TLI and CFI. In comparison with the original questionnaire, the present study showed better model fit indices. This study also found that two dimensions of beliefs namely certainty and justification statistically significantly predicted achievement in science in this sample.

Further analyses revealed that there was a statistically significant difference in beliefs about source in terms of gender and grade as well as about certainty in terms of grade. No difference was found in other two dimensions of beliefs (development and justification) in terms of gender, grade and socioeconomic status. The results showed that the adapted questionnaire works well with the Namibian sample used given the good model fit for the data and reliability. This study focused on the exit phase of the Namibian basic education (Grades 11 and 12). At the moment, there are no formal assessments for students’ scientific epistemic beliefs within the Namibian education system. Elsewhere especially in the developed world, there has been a shift of learning goals in recent years, from content knowledge to emphasising the epistemic aspect of scientific inquiry needed to help students develop 21st century skills (Gu & Belland, 2015).

As such, Namibia as a developing nation needs to keep abreast with the developments in science education in order to achieve the aims of its science curriculum. The main aim of the science curriculum is to provide students with the basic scientific background and develop them into scientifically literate citizens who are capable of dealing with 21st century challenges (Ministry of Education, 2010). Thus, developing sophisticated scientific epistemic beliefs is a prerequisite for developing 21st century skills. However, the fact that epistemic beliefs are not explicitly emphasised during science instructions and subsequently not assessed, also given the dearth of instruments for assessing scientific epistemic beliefs in the Namibian cultural context, this study intended to provide a valid instrument for use by researchers of science education. Copyrights for the original questionnaire is with the Contemporary Educational Psychology Journal.
References


Lecturers’ perceptions about mentoring and challenges they face when mentoring students at an institution of higher learning in Namibia

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Abstract
This paper examined lecturers’ perceptions about mentoring, as well as the challenges they faced in their endeavours to mentor students at the University of Namibia (UNAM), Katima Mulilo Campus. It used a mixed methods approach, and took the form of a survey. The study was descriptive in nature. Data collection was done by using a questionnaire. The researcher distributed the questionnaire to 12 lecturers who participated in the study at the UNAM, Katima Mulilo Campus. Data were analysed quantitatively using descriptive statistics, with thematic analysis of qualitative data. The findings were that the frequency of mentoring meetings was too limited; that is, there wasn’t enough mentoring time accorded to the mentorship programme; mentees saw no need to be mentored, and thus did not turn up for mentorship meetings. In addition, some lecturers or mentors were overwhelmed with more mentees than others. The study recommended that mentorship meetings should be done regularly; mentors should educate and encourage their mentees to turn up for mentorship meetings as per the mentorship schedules; and there should be equitable distribution of mentees among mentors for the sustenance of the programme.

Keywords: mentoring, lecturers, students, mentor, challenges, qualitative, mentee, perceptions, quantitative, descriptive design, positivist

Introduction and literature review
The purpose of this paper was to solicit the University of Namibia (UNAM), Katima Mulilo Campus lecturers’ perceptions about mentorship; the challenges they faced when mentoring their students; and the measures they took to mitigate these challenges. It is important to state that mentorship stands out as an old concept in academia, and because of its significance and worth, the practice continues to be maintained in academic circles across the world (Okurame, 2008). It is a “one-to-one relationship between an older person and a younger one to pass on knowledge, experience and judgment or to provide guidance and friendship” (Powell, 1999, p. 3). Similarly, UNAM’s mentorship policy (2012, p. 3) defines mentoring as “a personal development relationship in which a more experienced or more knowledgeable person helps to guide a less experienced or less knowledgeable person”. This translates into the understanding that the process of mentorship is sustained by experts or the more knowledgeable others (MKOs) (Vygotsky, 1978). The UNAM policy indicates mentorship as having two important legs, a mentor and a mentee. The mentorship policy of the UNAM (2012) spells out the roles of the two legs of the mentoring process as follows: a mentee is a person who is being mentored, a person who is being advised, coached, and taught, and a mentor is a guide and teacher. George and Mampilly (2012, p. 2) perceive a mentor as a “highly resourceful person who is organized, rich in skills and experience, knowledge, attitude, and willingness to impart his qualities to the younger generation”.

While the main aim of mentorship is to transform students and teachers into responsible and accountable colleagues, it is also incumbent upon mentees to support the initiative for the benefit of the mentor and mentee (Besar, 2018). It should be mentioned that mentors are important in the sense that they offer advice and guidance not only on academic matters but also on labour related matters. Nonetheless, this phenomenon is not only particular to education, but applies to various organizations and/or agencies. An apprentice in any workplace will have to have someone (a mentor) to guide them until they internalize the expectations of the job and are
now able to do the job successfully on their own. In other words, this practice helps to expose mentees to the real world of work (Bukaliya, 2012), and this is exactly what this paper attempted to associate mentorship with. To give a practical example, it is virtually impossible in the academic world to study towards a doctoral degree or any postgraduate qualification (for that matter) without a mentor, and that is why normally in an academic society, mentors are attached to such candidates so as to facilitate learning. Therefore, mentorship is an “intervention that aims at decreasing risk factors and increasing the likelihood of success” (Stumbo, Blegen, & Lindal-Lewis, 2008, p. 45) for students. According to George and Mampilly (2012), mentoring changes and transforms mentees into professionals. George and Mampilly (2012, p. 1) furthermore contend that mentoring “supports professional growth and renewal, which in turn empowers faculty as individuals and colleagues”. Furthermore, mentoring informs professional as well as personal development of a mentee. Research also indicates that “mentoring increases job satisfaction, career attainment and organizational commitment” (Pinho, Coetzee, & Schreuder, 2005, p. 20). According to Pincho, Coetzee, and Schreuder (2005, p. 20), “mentoring involves vocational or career development, psychosocial support, and role modelling”.

While mentoring is seen to have a lot of benefits for mentees, it is also worth to state that mentors are faced with a range of challenges in their quest to help their mentees. One of such challenges is the availability of time. Research indicates that because mentoring is a heavy responsibility, more time needs to be accorded to it so that the exercise can be effective and achieve its goals (Kilburg, 2007). Kilburg (2007, p. 294) further acknowledges that “if mentoring is seen as an important practice in an academic setup, then adequate time must be provided for observations and meetings”. Similarly, Cunningham (2012) cites time as an important variable which should be worth mentioning in this regard. He says that it is difficult for mentors to find enough time to engage in the activity. This researcher also acknowledges the fact that if mentoring time is not availed and clearly defined, students’ concerns will not be fully addressed. Another challenge, which I believe takes time to address relates to student numbers versus available mentors. This is a challenge, and is likely to reduce the quality of intervention the mentor renders (Martinez, 2004). Furthermore, Martinez (2004) acknowledges that if one mentor is allocated many mentees, quality in terms of assistance rendered will be compromised.

**Mentor attributes**

To do something in a more professional manner, one has to conform to set standards or norms. In the same way, mentors should have attributes that inform effective mentoring of their subjects. George and Mampilly (2012, p.137) contend that “a mentor must embody values, aspirations, wisdom and strength that the student respects and perhaps wishes to attain”. George and Mampilly (2012) further say that a mentor should be a person of great rank, experience and/or expertise who has the ability to teach and inspire another person so as to develop him or her not only personally but also professionally. A mentor should show willingness and commitment to the mentorship process to realise its goals. Research claims that “both the mentor and the mentee should strive to achieve open communication and rely upon each other to indicate their needs and preferences” (Barrett, Mazerolle, & Nottingham, 2017, p. 157).

**Models of mentorship**

There are different models of mentorship, and in this study I focus on the following:

**One on one mentoring:** This is an individualized and very personal mentoring model. The mentor sees and holds discussions with one mentee at a time. The model is strong at developing a strong relationship between the parties involved in the exercise (Caroll, n.d.). According to Tolan (2013, p.1), “most people prefer this model because it allows both the mentor and protégé or understudy to develop a personal relationship, and communicate regularly while the mentor provides individual guidance and support”.

**Team mentoring:** Here the mentee and mentors meet jointly as a team. This is of great benefit to the mentee because s/he will have different points of view on areas of interest under discussion, and will thus have other colleagues with whom to share views and/or collaborate (Tolan, 2013).

**Multiple mentors:** This model suggests mentees to have more than one mentor and
these mentors meet the mentee individually (Carol, n.d.).

**Peer mentoring:** This is a situation where senior students, and generally all the workers, are used to mentor junior students and junior workers. This model is more informal as compared to other models of mentoring like one on one mentoring, team mentoring, multiple mentoring, and distance mentoring. According to Caroll (n.d., p. 1), “peers can provide important advice and guidance about negotiating in the academic world and about mentoring relationships”.

**Distance mentoring:** This is when mentoring is done via email and by telephone, as well as through occasional visits. This is important if mentors are at different institutions and it is difficult to meet one-on-one or face to face for intended discussions. It so happens if a certain area of expertise is needed and there is no one in the institution that can do it. Cunningham (2012, p. 60) suggests that “there appears to be a fundamental connection between the stage of professional development a trainee is at and the nature of the mentoring which will be most appropriate”.

**Statement of the problem**
Learning takes place effectively and efficiently if lecturers don’t only understand how their students learn, but also have familiarity with challenges that impinge their learning. As much as individual attention applies to school learners, there is also a need for this attention to be extended to students in institutions of higher learning by way of mentorship. Though the mentorship policy is in place at the UNAM, Katima Mulilo Campus, lecturers do not consider or perceive it as a mandatory exercise; they relax to mentor students, as if it were not a normal academic practice. There are no frequent mentoring activities or meetings taking place in departments, and this prompts undesirable students’ behaviour, as well as students’ poor academic performance. This is due to the fact that students seem to be left on their own, which is a cause for great worry and concern.

**Research questions**
This study sought to answer the following questions:

1. What are lecturers’ perceptions about mentoring at Katima Mulilo Campus of the University of Namibia?
2. What challenges do the lecturers encounter when mentoring students?
3. How do the lecturers overcome the identified challenges?

**The purpose of the study**
This paper sought to first investigate lecturers’ perceptions about mentoring. Second to establish different challenges lecturers face when mentoring students at the University of Namibia, Katima Mulilo Campus. Third, to establish strategies lecturers used to mitigate the challenges faced, as a way to strengthen their mentorship meetings with students. This is significant because students who are effectively mentored always lead a successful academic career. The study benefits both the mentors and the mentees as it exposes them to the mentorship protocol.

**Theoretical framework**
This study is based on Lave and Wenger’s situated learning theory of the apprenticeship model. The theory claims that learning is best realized through interaction in a community of practice (Mentor teacher, 2013). In this paper a ‘community of practice’ refers to a group of “people who engage in a process of collective learning in a shared domain of human endeavor” (Mentor teacher, 2013).

The theory further argues that during interaction between mentor and mentee, the mentee’s level of growth is elevated to the next level of academic knowledge or excellence. Lave and Wenger (cited in King, 2017, p. 101) refer to such collaborations as social nature of learning, and maintain that it is this type of learning that benefits “newcomers from old timers” in the workplace. This also has a positive bearing on the mentee’s Zone of Proximal Development (ZPD) (Vygotsky, 1978) due to the fact that through the apprenticeship model, the mentee “assumes the role of an expert” (David, 2007, p. 3), the result of directly benefiting from the mentor. Supporters of the apprenticeship model like Sfard and Mills contend that the model gives rise to teamwork, solidarity and collaboration with well mentored students assisting the weaker ones (David, 2007). This implies that “learning through participation as apprenticeship might also encourage the
students’ collaboration in the classroom” (Besar, 2018, p. 52)

Methodology

Research design
The study was both qualitative and quantitative in nature and was informed by a positivist epistemology. Springer (2010, p. 19) admits that quantitative research tends “to reflect positivism, the assumption that reality consists of facts and causal processes that are independent of observers and thus can be revealed through scientific observation”. According to Springer (2010, p. 249), “the purpose of a descriptive design is to describe phenomenon in quantitative terms”. The answers to the questionnaire gave a picture of the perceptions lecturers had on mentoring, challenges they faced when mentoring their students, as well as how they mitigated such challenges.

Sampling
The sample of twelve (12) lecturers was drawn from lecturers of the UNAM, Katima Mulilo Campus only. This was done in order to get a representative sample, as well as making generalizations easier. I used purposive sampling to draw the sample. “Purposive sampling is a procedure in which the researcher samples whoever he or she believes to be representative of a given population” (Springer, 2010, p. 107).

Data collection
Data were collected by using a questionnaire. The questionnaire was distributed to 12 lecturers who participated in the study to express their perceptions on mentoring. Lecturers were asked to give their opinions about mentoring, the challenges or problems they faced with mentoring, as well as how they addressed these challenges. Some items required respondents to substantiate their views so as to get the full depth of their perceptions regarding the practice.

Data Analysis
Data were analysed quantitatively using descriptive statistics, with thematic analysis of qualitative data.

Findings
This section of the paper presents data on the UNAM, Katima Mulilo Campus’ lecturers’ perceptions on mentoring. Data is presented in accordance with how lecturers responded to the questionnaire, and was done question by question (See Figure 1). Each item reflects the extent to which it was either supported or not supported by respondents in percentage form as in Figure 1.

Figure 1: Lecturers’ perceptions on student mentoring

Figure 1 clearly indicates how lecturers responded to questions in the questionnaire. It indicates the extent to which respondents expressed their perceptions to the contents of
the questionnaire by either indicating ‘Yes’ or ‘No’. Prior to analysing the findings of this research, the researcher formulated a statistical null hypothesis (H₀) as shown below:

- H₀ = Lecturers show no interest in the mentorship programme.
- H₁ = Lecturers show interest in the mentorship programme.

Findings from the questionnaire (Figure 1) revealed that all the 12 respondents indicated their preference for mentoring and that it was really helpful to mentor students in institutions of higher learning. Since the response was positive and overwhelming with all 12 respondents who supported mentoring, we reject the null hypothesis (H₀) that lecturers showed no interest in the mentorship programme, and conclude that lecturers showed interest in the mentoring programme (H₁). This seems to confirm that mentoring is seen as a significant tool if students are to perform to their maximum at the UNAM, Katima Mulilo Campus. Lecturers’ approval of mentorship (as good practice) seemed to have influenced their responses to other questions in the questionnaire. As a way to further demonstrate their approval of mentorship, 8 of the 12 lecturers indicated that the programme came at the right time. However, the lecturers indicated the frequency of meetings as being insufficient and that this needed consideration as a matter of priority. For example, “We don’t conduct meetings regularly with students” (Lecturer 3); “Our mentorship meetings are rare, sometimes only once in a week” (Lecturer 8). Lecturers further suggested that meetings be made more regular in order to establish a good relationship with mentees. About 5 of the 12 respondents supported the current frequency of meetings as stipulated in the mentorship policy of the UNAM as being good practice. For example: twice per year for each mentorship group, and once per semester for individual mentees.

Lecturers expressed concern about the availability of mentees for meetings. While 3 of the 12 lecturers indicated that mentees were readily available for meetings, 9 of the 12 lecturers indicated that mentees were not turning up for such meetings. One respondent expressed this by saying, “they never come” for meetings. Another one said, “They are reluctant to come to meetings and they apparently view such meetings with suspicion”. Mentees not showing up for meetings could be attributed to heavy academic workload as one lecturer pointed out: “Mentees often complained of being occupied with many tasks at a time which affected their availability for meetings”.

About 5 of the 12 lecturers expressed satisfaction that mentees were willing to share their experiences and problems during mentorship meetings. Conversely, 7 of the 12 lecturers saw it differently, and expressed their opinions as follows:

Lecturer 1: “They are reserved about their experiences and they do not come out in the open about themselves”.
Lecturer 2: “They have not yet opened up probably because they have not yet established trust in the mentor because of just meeting them once in a semester”.
Lecturer 7: “They are too shy to speak out their experiences”.
Lecturer 8: “They don’t seem used to mentorship”.
Lecturer 10: “They don’t get to the bottom of their concerns and need training on the concept of mentorship”.
Lecturer 11: “The concept is new to students”.
Lecturer 12: “They don’t know what it is to be mentored and the benefits thereof”.

While 2 of the 12 lecturers expressed discontent and/or unhappiness about time set for mentoring sessions, 10 of them expressed satisfaction and indicated that the time was enough. All 12 lecturers shared their support for the mentorship policy saying the areas of focus were very clear. Regarding the challenges they faced, the respondents, as shown in Table 1 below, expressed their views as follows:

<table>
<thead>
<tr>
<th>Table 1: Mentorship challenges faced by lecturers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Respondent</strong></td>
</tr>
<tr>
<td>Lecturer 1</td>
</tr>
</tbody>
</table>
The programme has not kicked off yet at our campus

The programme adds on to the lecturing workload

Other students do not see the importance of attending the mentorship sessions

Students do not show up for meetings due to lectures and assignments

The programme adds on to the lecturing workload

Students do not show up for meetings due to lectures and assignments

There should be one time slot for mentorship meetings that accommodates both mentors and mentees during working hours

The programme adds on to the lecturing workload

Students do not show up for mentorship meetings due to lectures and assignments

Students do not show up for mentorship meetings due to lectures and assignments

There should be one time slot for mentorship meetings that accommodates both mentors and mentees during working hours

The programme adds on to the lecturing workload

Students do not show up for mentorship meetings due to lectures and assignments

Students do not show up for mentorship meetings due to lectures and assignments

Lecturers also expressed what they did to overcome the challenges they faced and their responses are shown in Table 2 below:

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecturer 1</td>
<td>I encouraged students to attend meetings</td>
</tr>
<tr>
<td>Lecturer 2</td>
<td>I shared with students the benefits of mentorship</td>
</tr>
<tr>
<td>Lecturer 3</td>
<td>I conduct mentorship meetings after hours so that classes are not disturbed</td>
</tr>
<tr>
<td>Lecturer 4</td>
<td>I always tell them they cannot be forced to attend the meetings stressing the importance of the mentorship meetings to them</td>
</tr>
<tr>
<td>Lecturer 5</td>
<td>I advised students to come for meetings</td>
</tr>
<tr>
<td>Lecturer 6</td>
<td>I normally talk to students about how valuable mentorship meetings are.</td>
</tr>
<tr>
<td>Lecturer 7</td>
<td>I ask students to identify timeslots they are free in order to hold mentorship meetings.</td>
</tr>
<tr>
<td>Lecturer 8</td>
<td>I always encourage students to value the meetings</td>
</tr>
<tr>
<td>Lecturer 9</td>
<td>I always talk to students about mentorship meetings.</td>
</tr>
<tr>
<td>Lecturer 10</td>
<td>I work meeting schedules with them</td>
</tr>
<tr>
<td>Lecturer 11</td>
<td>I advise them why such meetings are good.</td>
</tr>
<tr>
<td>Lecturer 12</td>
<td>I conducted a special lecture on mentorship to my students and this made them understand the value of mentorship.</td>
</tr>
</tbody>
</table>

**Discussions**

This investigation gave rise to themes such as extension of frequency of mentoring meetings; time for mentoring sessions; mentees saw no need for mentorship meetings as well as student numbers (mentees) versus available mentors.

**Extending the frequency of meetings with mentees:** Frequency of meetings refers to how regular the mentor engages the mentees. This paper revealed that the area of ‘frequency of meetings’ needed consideration. It revealed that the frequency of mentoring meetings was not adequate and should be revisited despite the UNAM’s mentorship policy stating that “mentorship shall take place on a regular basis” (UNAM Draft Mentorship Policy, n. d., p.6).

**Time:** The study established that time for meetings with mentees was not enough. The study suggests that mentoring should have a time slot on the timetable so as to accord it enough time like any other academic module. According to Kilburg (2007), mentoring is a heavy responsibility and thus deserves to be accorded enough time. It is furthermore believed that “if mentoring is seen as an important practice in an academic setup, then adequate time must be provided for observations and meetings” (Kilburg, 2007, p. 294). Cunningham (2012) also cites time as [being] an important variable and that mentors are not able to effectively carry out their mentoring function due to lack of time.

**Mentees see no need to be mentored, and thus do not show up for mentorship**
meetings: From what this paper has gathered, it comes out clearly that mentees do not attach any significance to mentoring. This is so because they do not show up for mentoring meetings. Research states that the aim of mentoring is to transform students into responsible and accountable colleagues (David, 2007). According to Bukaliya (2012), mentoring helps to expose mentees to the real world of work. In the same vein, “mentoring involves vocational or career development, psychosocial support, and role modelling” (Pinho, Coetzee, & Schreuder, 2005, p. 20). It is during mentoring meetings that relationships are established, and students (mentees) are guided by their mentors (Powell, 1999; King, 2017).

Student numbers versus available mentors: This is perceived as a problem, and if students (mentees) outnumber mentors, the practice becomes ineffective and difficult to manage. According to Martinez (2004), this situation is likely to reduce the quality of intervention the mentor renders. Furthermore, if a mentor has many mentees, quality in terms of assistance rendered can be compromised (Martinez, 2004).

Recommendations
Based on the findings of this study, the following recommendations were made:

- The section in the mentorship policy of the UNAM on the frequency of meetings should be revisited and made very clear;
- Regular monitoring activities across the UNAM Campuses should be strengthened to regulate meetings between mentors and mentees;
- Institutions of higher learning should encourage student mentorship;
- Mentees should be equitably distributed among mentors to avoid certain mentors overcrowded with mentees and to maintain efficiency and effectiveness during mentorship meetings;
- Mentoring sessions should have a time slot on the time table so as to maintain the desired frequency of meetings with mentees.

Conclusion
Mentoring is the way to go in any workplace, especially in institutions of higher learning. Mentorship strengthens institutional capacity; elevates work ethics and if an institution of higher learning, the UNAM for example, is to operate effectively, mentorship should be the norm. Students should understand the benefits that come with it (mentoring) and that without it they are likely not to do well in their studies. Furthermore, mentorship is an important tool used to rededicate students to their studies, ultimately attaining their goals and objectives.

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Environmental science practices integrated with IK: The case of soot

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Abstract
The integration of IK in science practices, in which various cultural practices, artefacts and science language reflecting western science indigenous communities (IC) use, is sometimes not well-explained to learners. Consequently science teachers grapple to incorporate IK with science concepts in the curriculum. In this study, global warming due to soot ranking second only to carbon dioxide is investigated, to see how ideas IC use can be incorporated into environmental science classrooms.

Activities in which IC interact with soot are there in the community but not documented. For instance, indigenous communities discourage one another to fetch water from a water source using a soot-contaminated container. To understand more of this cultural practice in order to successfully incorporate knowledge advanced and used; this study used brainstorming, practical work, interviews and reflections to generate data. Activities IC engage in were incorporated as case studies and practical activities in in Grade 11 science practices, first by teachers and then by learners. In doing so, a culturally responsive pedagogical style emerged.

Investigation emerged ideas indigenous communities use and how their incorporation into environmental science/teaching practices were achieved and possibly assisted in reducing global warming. Findings were IC cultural practices related to soot can be incorporated in teaching concepts of global warming and also, such approach brings about culturally responsive pedagogical styles.

Key words: soot, truth theories, global warming, practices, indigenous communities

Background
Studies done on global warming suggest soot as a major contributor and point how it can be curbed (Gronewold, 2009; Jacobson, 2002; Wijaya, 2014). The studies that were conducted in the developed countries argued that under-developed countries were the major contributors to global warming. Jacobson (2002) posits that global warming due to soot ranks second only to carbon dioxide. Developing countries are said to contribute more in global warming as if in all their activities they engage with do not take cognizance of the effect of practices which might endanger the environment through soot. In support is Bond and Roden (2006) in a study conducted in Honduras where they posit that developing countries are at the forefront in producing soot as 2 billion people in developing countries use wood stoves that emit soot particles.

It might be that developing countries contribute more to global warming as more wood stoves are found in these areas since that is the only alternative source of heat energy. Gronewold (2009) supports the idea that developing countries are major contributors of global warming as he suggests that vast swaths of the world population rely on wood or charcoal as principal sources of energy. Even though such a scenario exists, some communities in developing countries are aware of the adverse effects of soot coming from wood stoves. However, they cannot act to stop engaging cultural practices which emit soot, they are economically weak to opt for other sources of energy generation friendly to the environment (Wijaya, 2014), but if they reason logically about other cultural practices friendly to the environment and relate them they should win bringing about a clean environment. This is evidenced from certain cultural activities which they practice. For instance, in some indigenous communities (ICs) located in Southern African Development Community (SADC) Zimbabwe, South Africa Botswana and even in Namibia, where this phenomenon was observed, some ICs discourage one another from using soot contaminated utensils to fetch water from pools or any other source(s) of water. Even though science teachers are aware of this practice some still grapple to incorporate this IC practice in their
science teaching. In a study Mukwambo (2016) conducted in the Zambezi Region of Namibia, revealed that the IC understood that the soot dust darkens the substrate and fosters increased heating and evaporation in water bodies.

Accepting that soot absorbs more heat as the Pacific Northwest National Laboratories (PNNL) (2011) suggests that this causes ice to melt faster. This scenario deprives those farmers of water to irrigate their crops since they depend on melted ice to irrigate crops. Ramanathan and Carmichael (2008), Pravetton (2009), and Chen (2012) have also revealed how soot contributes to global warming. Indigenous communities, however, have been aware of these effects for some time since other communities discourage community members to use soot contaminated utensil. This is a cultural and historical practice in many SADC countries. Such knowledge has been and is still used, in particular, by indigenous communities to curb the effects of global warming. Mukwambo and Ngcoza (2015) suggest that indigenous communities use cultural practices based on understanding of how soot contaminates water bodies and how it can be avoided in order to reduce excess evaporation of water, as well as preventing the accumulation of large amounts of energy from the sun. Western modern science (WMS) refers to this phenomenon as the Albedo Effect (Akbari, Matthews & Seto, 2012). The Albedo Effect forms one of the cultural practices that this study investigated for use in science teaching. The objective of the study focused on how IC practices related to soot can be used in science practices. Also, when learners know the benefits of the Albedo Effect as practiced by IC, this will raise the level at which community members keep practising this and as a result reduce global warming since it will be practiced at a larger scale. Furthermore, it aimed at finding how the Albedo Effect, based on the views of IC can be brought into science practice through the use of practical activity which Conole (2008) advocates as one of the mediating artefact useful in mediating learning.

Indigenous knowledge
Even though indigenous knowledge (IK) and prior everyday knowledge are indicated as more or less the same, IK is more specific. IK comes into a community as the community members intend to use it to better their welfare just as western science. After community members have scrutinized their prior knowledge and experiences, they will then convert it into IK. Kibirige and Van Rooyen (2006) consider IK as “a legacy of knowledge and skills unique to a particular indigenous culture and involving wisdom that has been developed and passed on over generations” (p. 2).

Since the focus of this study is on how indigenous knowledge related to how communities protect the environment to prevent global warming, we view IK as
cultural knowledge that a given community widely adopts and is used as a source of knowledge to sustain a community. Cultural practices explored in this study are a component of indigenous knowledge that indigenous communities use. The emphasis of IK falls on different issues from community to community, sometimes with a greater focus on the conservation of ecology (which is referred to as Traditional Ecological Knowledge or TEK (Kibirige & Van Rooyen, 2006). Depending on how indigenous knowledge is used, this might bring another focus of what IK is. For instance, those who view that IK is silenced by WS can define IK as an epistemological therapy device (Mukwambo, Ngcoza, & Chikunda, 2019).

To support the argument that IC practices reflect science and are true and can be used to minimize a problem where some science teachers grapple to incorporate IK into WS, the truth theories were used. These were used as conceptual framework to support the data that emerged.

Theories of truth as conceptual framework
Consensus on what truth is has not yet been reached, but, however, certain theories exist which can be used to say what is true. In order to support the findings which emerged in the study of how cultural practices were used as the focus of a practical work in order to show how IK views can be incorporated in WS, the correspondence, pragmatic and coherence theories were used. Bealle (2000) and Tape (2009) view the correspondence theory as speculating that knowledge, cultural practice or a belief is true if there exist facts corresponding to reality. Verification is achievable through observation and physical measurements in the correspondence theory. Coherence theory according to Schmitt (2004) posits that certain cultural practices may have no connection with reality, but are internally consistent (coherent) between statements in a closed system. There is a need in this theory to ensure that cultural practices and the cultural artefacts which are the products of the activity fit in with other accepted beliefs. On the other hand the pragmatic theory from the view of Hammond and Stewart (2001) posits that a belief, cultural practice or a product of cultural activity (cultural artefact) is true if it works for whatever purpose you need it. That is cultural practices that ICs engage in help to reduce or prevent the effects of global warming.

Significance of the study
There is much to learn from IK, cultural artefacts and cultural practices-based approaches to global warming prevention. Indigenous communities are confronted with changing environments for years, for instance, the 2004 tsunami among the Moken and UrokLawai peoples of Thailand’s coasts as mentioned before. ICs have developed a wide array of coping cultural practice strategies, and their traditional knowledge and practices deliver an important basis for facing the even greater challenges of climate variation. Although their strategies may not be successfully and completely done, they are effective to some degree and that is why the people continue to use them. So when these are brought into a classroom they might be reinforced or the community members see the need to keep on using them. In doing so, the learner applies knowledge gained into practical use.

Limitation of the study
Although the cultural practices under investigation adhere to the truth theories mentioned above, that is they manifest coherence and correspondence with knowledge in WS and are applied to curb global warming, science teachers might still harbour negative feelings about their use. This makes it impossible to apply them in science teaching and learning as an alternative. This brings some limitation to their use even though they might be a solution as seen through practical activities in the methodology section used in this study to verify them. To mitigate the situation where science teachers harbour negative feelings and grapple to use cultural practice reflecting science, we came with research questions.

The research questions to achieve the mentioned objective were as follows:
1. How can science teachers in the Zambezi Region incorporate indigenous practices related to global warming in science practices?
2. How can science teachers incorporate IC practices related to soot in science practical work practices?

Methodology
This qualitative study consisted of two phases: the first phase centred on the researchers and the six participating science teachers.
brainstorming cultural practices in which ICs take cognizance of the effect of soot on the environment. Also, representatives of ICs participated when they came to explain to the science teachers their beliefs about soot practices. This led the science teachers to look the IK concepts related to soot were looked for in the practices of indigenous communities. These were investigated to find out how they corresponded, cohered with concepts in WS and also whether the cultural practices helped the community to prevent global warming. Verification using practical work based on ICs’ practices with soot followed.

The second phase entailed assigning the six willing participating teachers to conduct the practical work related to cultural practices in soot and present it among themselves and thereafter to their science learners so that the learners understood what global warming was. Thereafter interviews were conducted with science teachers and finally, the teachers were assigned to do reflections. The data generated from the activities of the teachers and learners were practical in nature. Instead of experimenting on phenomena reflecting global warming outside the learners’ environment, the teachers decided to conduct a practical activity in which a cultural practice seen in learners’ communities which act as accessible prior knowledge. Also, the tasking of the six science teachers to conduct a practical work aimed at ensuring that reliability is addressed.

Each teacher was asked to average the value of each variable measured and record. These values obtained by each teacher were then compared for sameness and finally concluded if there was consistent results time after time.

Data presentation
The activities which the teachers conducted with their learners incorporated the use of two recycled 2 litre plastic soft drink containers shown in Figure 1. Equal amounts of water were poured into the containers labelled as A and B. In container A, a teaspoonful of soot obtained from a container normally used for warming water over an open wood fire was scratched from underneath and poured into it. In both containers a thermometer was inserted to measure the temperature changes. The two were then placed in an open space. This was aimed at verifying whether the soot the IC believed enters into water when a soot contaminated container is used to fetch water has an effect on increasing the temperature which then according to WS increases the internal energy of water particles and evaporates faster.

Another set of apparatus was aimed at verifying the ICs observation which they had stated during a visit with the science teachers that water contaminated with soot becomes less in quantity compared with one which is soot free as stated in the methodology section.

![Figure 1: Application of the Albedo Effect in Indigenous community cultural practices](image)

In Figure 1, container B acted as the control. The one litre of water poured in each of the two containers A and B came from the same source. This was aimed at ensuring that if impurities existed in the water, the rate of evaporation would not be interfered with if A did not have soot in it. The set of apparatus was placed at the same place so that the factors which affect evaporation were the same for the four containers.

The factors affecting evaporation of water are wind, heat, surface area of water in
the container, nature of liquid, humidity and vapour pressure. When science teachers were verifying the science concepts in the practices of ICs and when they presented to the learners, the containers were placed at the same spot allowed them to absorb the same amount of heat energy, receive the same amount of air and experience the same amount of humidity and pressure. The use of the same type of recycled 2 litre plastic soft drink containers ensured that the surface area was a constant and finally using water from the same source guaranteed that the nature of the liquid used was the same.

The thermometers inserted in each container measured the temperature. The recordings of temperature change in containers A and B (Figure 1) were done for recycled 2 litre plastic soft drink containers hourly. The continuous data generated from A and B is presented in Table 1.

Table 1: Temperature and time variation of a sample of water with soot in Beaker A and without soot in Beaker B (control)

<table>
<thead>
<tr>
<th>Time (Hrs.)</th>
<th>Beaker A (temperature °C)</th>
<th>Beaker B (temperature °C) [control]</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>09:00</td>
<td>36</td>
<td>31</td>
</tr>
<tr>
<td>10:00</td>
<td>37</td>
<td>35</td>
</tr>
<tr>
<td>11:00</td>
<td>40</td>
<td>37</td>
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<tr>
<td>12:00</td>
<td>41</td>
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<td>13:00</td>
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<td>14:00</td>
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<td>15:00</td>
<td>38</td>
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<td>18:00</td>
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<td>25</td>
</tr>
<tr>
<td>19:00</td>
<td>27</td>
<td>23</td>
</tr>
<tr>
<td>20:00</td>
<td>26</td>
<td>19</td>
</tr>
</tbody>
</table>

The recordings in Table 1 facilitated the construction of a graph of temperature and time (see Figure 2).

![Figure 2: Graphical presentation of effect of soot on temperature changes](image-url)
The information from the graph became useful to check whether the data generated supported the correspondence, coherence and pragmatic truth theories discussed in the previous section. Also, data generated from measuring the volume of water left in A and B (Figure 3 was analysed together with data generated from interviews and reflections.

**Data analysis from interviews and reflections**

The science teachers were tasked to answer four questions which were posed during the interviews. The interview questions like the practical work were aimed at giving response to the research questions highlighted before. Can IC practices related to soot be incorporated in science practices? Can IC practices related to global warming concepts attributed to soot incorporated with WS using practical work? How can science teachers incorporate IC practices related to soot in science practical work practices?

In the interview the teachers were asked whether use of case studies or practical work related to soot and global warming could be used as a way to incorporate IK with WS. The science teachers responded that from the experience they gained from the activity, a case study could be used to explain to the learners what was taking place. In doing so, the teacher or learner who explains, is in a position to describe the phenomena of global warming using concepts from both knowledge systems. The practical work acted as a way to consolidate concepts which were discussed.

In relation to whether IC practices related to global warming concepts attributed to soot could be incorporated with WS using practical work, the practicing teachers pointed out that it had a benefit. The benefit mentioned became that of contextualizing the teaching of global warming. Furthermore, they went on to say to respond that use of IC practices related to global warming from learners’ culture perpetuates the use of the practice. In doing so they said will allow the young generation to desist from engaging in activities which might be responsible for global warming through producing soot. Examples given by the teachers included discouraging learners from burning forests, preventing burning of garden refuse at home and instead making a composite where the organic material decomposes naturally. Their arguments were further supported by what they pointed out in the reflections which showed learning through and from experience.

For instance, a theme which kept reoccurring in the reflections indicated that there was a need to have an IK café where cultural practices and artefacts would be showcased. This will help teachers in knowing case studies related to WS concepts they teach and how to contextualize them as practical activities for learners. Some of the teachers in their reflections pointed out that the cause of failure to understand global warming concepts could be attributed to examples of case studies and practical activities related to global warming which focus only on activities done in other foreign cultures. Activities related to curbing global warming in their community allows learners to understand and apply what they are taught and in so doing reduces activities associated with global warming. The
data generated from other instruments is analysed below.

Analysis of data from brainstorming and practical work done
Data generated from brainstorming with the six science teachers reveals that there were some correspondence between concepts advanced in WS and those in IK related to global warming. Cultural practices where an IC understands effect to cause water sources to evaporate faster when soot contaminated, is a belief which corresponds to concepts in global warming as viewed from the lens of WS. For example each of the knowledge systems considers soot as an absorbent of heat energy from the sun. Soot contaminated water ends up at a higher temperature than soot free water as seen in Figure 2 and 3. The curve for soot contaminated water remained at a higher temperature than water in the control B. This evidence is also seen in Figure 3, where the amount of water in B is more than the amount of water in A. Considering the colours illustrated in the curves, we can say the blue curve shows the behaviour of soot contaminated water when it absorbs heat and time changes, it is at a higher temperature than the red curve. It lags behind during cooling and rises faster before it reaches the maximum value of 40°C. On the other hand, the red curve shows the behaviour of water not contaminated with soot when it absorbs heat and time changes it lags behind, attains a lower value of 39°C at its peak and cools faster.

A similar trend is also observed when volumes in container A and B were examined. Container “A” contaminated with soot had less water. However, in container “B” with soot free water, more water remained in it after the same period. This coheres with the concepts of global warming reflecting WS. WS posits that a black body absorbs more heat. Absorbed heat raises the internal energy of particles and as this happens they escape from the surface ending up as vapour. This raises the vapour pressure thus breaking the equilibrium which had existed before. Before, the two pressure systems were in equilibrium, the atmospheric and the vapour pressure were all contributing the same number of particles but the disequilibrium brought more particles escaping from the soot contaminated water.

Comments from the teachers as they were interviewed and other information coming from their reflections of IC practices are practical activities. Science teachers viewed IC practices as tools that could be used to prevent global warming due to soot which IC use to reduce global warming. In their view the IC practices when used in science teaching will prove useful in instilling an attitude of responsibility in the young generation currently studying science.

Discussions
From the teachers’ views, IC practices related to soot can be incorporated in science practices as evidenced from what the teachers said in the interviews and reflections.

The IK concepts related to global warming when soot is under consideration correspond, cohere and help prevent excessive water loses in communities. It also helps to prevent heat to be retained on the earth surface as water bodies releases the heat absorbed during the day normally. A global warming activity from the view of IC practices is an example of where indigenous communities are applying their traditional knowledge about the environment to sustain it.

On whether IC practices related to global warming concepts attributed to soot can be incorporated into WS using practical work, the teachers agreed that explanation of science ideas in IK needed to be explained using a case study, thereafter; a practical activity can be conducted. According to our view this allows removing the disconnection which normally exists when practices from other cultures are used and this supports the view by (Duschl, Schweingruber, & Shouse, 2007). This enabled the participants to come up with the conclusion, which was drawn from the practical activity, which allowed the participants to consolidate the concepts taught.

The fact that the science teachers mentioned that engaging a practical work which focus on IC activities allows a teacher to come up with a culturally responsive pedagogical style is evidence, supporting the use of practical work to teach environmental science concepts on global warming.

On how can the use of IC practices related to soot be used to reduce global warming? Science teachers suggested that the incorporation prevents young generation from shunning the practices as has been happening. The young generations who are the learners see how IC practices contribute in preventing global warming so this urges them to perpetually practice them and even avoid other
activities contributing soot in the atmosphere. Science teachers also pointed out that activities which they engaged in can also be very suitable for starting teaching the Green House Effect. Their opinion of the Green House Effect in most cases is discussed as attributed to carbon dioxide without talking too much on how soot perpetuates global warming.

The activities engaged in are culturally related situations which Aikenhead (1997) advocates as suitable for teaching science concepts. Also, the use of cultural practices related to the Albedo Effect as viewed from the lens of IC, served as a mediating artefact (Conole, 2008).

The correspondence, coherence and practical applicability of the cultural practices involving soot echoes with the truth theories put forward. Observations and hands-on practical activities the teachers carried out verified the reality surrounding cultural practices as Bealle (2000) and Tape (2009) propose. The congruency manifested between cultural practices and WS is what Schmitt (2004) believes should exist. The congruency lies in that the views IC have, echoes with Ramanathan and Carmichael (2008), Pravetton (2009), and Chen (2012) of the effects of soot. Finally, the observation that water with soot remained at a higher temperature is in support of the idea that IC take advantage of this to sustain the environment. This comes as a way of showing the usefulness of cultural practices explored and this is supportive of Hammond and Stewart (2001) view about truth in a particular activity.

Conclusion
Incorporating indigenous community practices when one knows whether the concepts observed correspond, cohere with WS can be achieved through use of a case study, thereafter, conducting a practical activity based on the same activities which the community engage in. The fact that the IC practices offer a solution to global warming threat is evidence enough that there is science which science teachers need to incorporate through a practical activity to consolidate concepts discussed in a class.

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An investigation of the pedagogical orientations of Grade 8 Chemistry teachers in Orchestrating Practical Demonstrations at schools in Oshikoto Region, Namibia

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Abstract
The use of practical work is ubiquitous in almost every science classroom globally. It is advocated for by the Namibian National Curriculum for Basic Education [NCBE] for a country to become a knowledge-based society which should be achieved through engaging learners in hands-on practical activities. Regardless of the calls from the NCBE for learner-centred practical work, teachers in the Oshikoto Region resort to enacting practical demonstrations. This mixed methods study investigated the pedagogical orientations of teachers in Oshikoto Region when orchestrating grade 8 chemistry demonstrations. The study involved two phases. During Phase I, quantitative data were collected through a questionnaire survey that was administered to 87 Grade 8 Physical Science teachers. Phase II involved the collection of qualitative data by means of class observations and semi-structured interviews of 10 teachers purposefully selected from a pool of 87 teachers who completed the questionnaire.

The findings revealed that 56.3% (49 out of 87 teachers studied) in the Oshikoto Region exhibited a preference for teacher-orchestrated demonstrations rather than entrusting practical activities to learners. Contextual factors such as a lack of resources to conduct practical work, insufficient curriculum time allocated for practical lessons and large class sizes were considered to influence this preference. The results further showed that through teacher-orchestrated demonstrations, teachers regularly applied certain pedagogical actions. These included inviting learners to make a prediction, asking learners to explain their observations, and facilitating a class discussion after the demonstration. This suggests that although demonstrations were teacher-orchestrated, teachers interacted with learners through these actions to ensure that they were cognitively engaged. Therefore, the study recommended that the NCBE should allocate more timetable time for practical work in science classrooms, science teachers should be engaged in continuous professional development on practical work and they should also be encouraged to make use of readily available materials to do practical work in the absence of the traditional, practical work equipment.

Keywords: practical work; teacher-orchestrated demonstrations; pedagogical orientations, Chemistry

Introduction and background
In almost all countries globally, science scholars acknowledge the role of practical work in teaching and learning science. Like other countries, the importance given to practical work is recognised in Namibia. According to the Ministry of Education, Arts and Culture, in the Physical Science curriculum for junior secondary phase (JSP), 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 (Namibia, MoEAC, Syllabus, 2015). The natural sciences area as one of the key learning areas in the NCBE “contributes to the foundation of a knowledge-based society by empowering learners with the scientific knowledge, skills and attitudes to formulate hypotheses and to investigate, observe, make deductions and understand the physical world in a rational, scientific way” (Namibia,
MoEAC. NCBE, 2018, p. 13). For this knowledge-based society to be achieved, the said curriculum document further emphasised that the approach to teaching and learning science should be based on the paradigm of learner-centred teaching approach which is meant to recognise the vast knowledge learners bring to class. Moreover, the knowledge-based society could also be achieved through exposing learners to as many practical work in science from the early grades as possible. The curriculum document further specifies and makes suggestions of possible practical activities and/or demonstrations that teachers should enact at the end of each topic (Namibia. MoEAC, Syllabus, 2015).

Practical work varies in form and intention. According to Millar, Le Marechal, and Tiberghien (1999) if researchers are to explore the effectiveness of practical work in achieving educational goals, then there is need to provide clarity about the different types of practical work, their different purposes, and pedagogical approaches for each type. Despite calls for learners to do independent scientific inquiry where they have an autonomy in formulating their own investigation and planning an inquiry, factors such as lack of resources, large classes, and the lack of class time have resulted in teacher-orchestrated practical demonstrations being the prevalent form of practical work in sub-Saharan countries (Ramnarain, Nampota, & Schuster, 2016).

This study investigated the pedagogical orientations of Physical Science teachers when orchestrating chemistry practical demonstrations at schools in Oshikoto Region, Namibia. The first author is a High school Physical Science teacher in this Region and has particular interest in understanding how other teachers enact chemistry demonstrations in their classrooms. Most schools in Oshikoto Region, especially in Omuthiya Circuit, where the first researcher teaches, are under-resourced in terms of science facilities, such as laboratories. The Education Management Information Systems (EMIS, 2017) report shows that out of 94 schools where Physical Science is offered as a subject, only 47 are equipped with science laboratories. The benefit of teachers using demonstrations in such a context has been recognized. Treagust (2007) points out that demonstrations can increase learners’ cognitive involvement.

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The value of demonstrations is also advocated by the Namibian Ministry of Education, Art and Culture and, it is prescribed in the Physical Science curriculum for JSP, (Grade 8 and 9), that learners should be exposed to practical activities, approaches and demonstrations during instruction (Ministry of Education, Arts and Culture [MoEAC], 2010, 2015). The Physical Science JSP curriculum consequently outlined that, relative to the general and specific objectives to be achieved at the end of each topic or area of content, teachers should decide when “it is best to convey content directly; it is best to let learners discover or explore information for themselves or when they need directed learning” (Namibia. MoEAC, Syllabus, 2015, p. 4).

Literature review on practical work in science teaching and learning
The literature abounds with numerous characterizations of the construct “practical work”. To this end, science scholars seem to gear their understanding towards the inclusion of hands-on activities in their descriptions of what practical work encapsulates. This is reflected in the definition by Lunetta, Hofstein, and Clough (2007) who described practical work as “learning experiences in which students interact with materials or with secondary sources of data to observe and understand the natural world” (p. 2). Woodley (2009) concurs with their definition as she defined practical work in science as “a hands-on learning experience which prompts thinking about the world in which we live” (p. 49). According to Roth et al. (2006), practical work may be broadly classified into whole-class practical activities and independent practical activities. Whole-class practical activities involve mainly teacher-orchestrated demonstrations of phenomena and objects, whereas independent practical activities involve activities “carried out by the students themselves, usually working in small groups” (Millar et al., 1999, p. 33). Whole-class teacher-orchestrated demonstrations range from simple displays of objects such as the model of the heart to display objects related phenomena or showing how substances react with oxygen. This study focused on the enactment of teacher-orchestrated demonstrations, and the pedagogical orientations that teachers display during these demonstrations.
Hattingh, Aldous, and Rogan (2007) identified four levels into which science practical work may be classified. The four levels are positioned in terms of decreasing learners’ autonomy in carrying out practical work. Level 1 involves mainly teacher-directed demonstrations, whereas level 4 involves learner-directed activities. Table 1 shows the four levels of practical work defined by Hattingh et al. (2007). It is evident that levels 1 and 2 refer to practical work in the form of demonstrations. For level 1 practical work, a teacher uses demonstrations to help learners develop an understanding of science concepts by using materials or specimens that are easy to obtain within a given environment. For level 2 practical work, a teacher still leads demonstrations, but learners are partly involved as they assist teachers in planning and carrying out demonstrations. Levels 3 and 4 reflect an inquiry-based approach where more autonomy is entrusted to learners in investigating phenomena through practical activity.

<table>
<thead>
<tr>
<th>Level</th>
<th>Types of science practical work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teacher uses classroom demonstrations to help develop concepts. Teacher uses specimens found in the local environment to illustrate lessons.</td>
</tr>
<tr>
<td>2</td>
<td>Teacher uses demonstrations to promote some form of learner inquiry. Some learners assist in planning and performing the demonstrations. Learners participate in closed (cook-book) practical work. Learners communicate data using graphs and tables.</td>
</tr>
<tr>
<td>3</td>
<td>Teacher designs practical work in such a way as to encourage learner discovery of information. Learners perform guided discovery type practical work in small groups engaging in hands-on activities. Learners can write a scientific report in which they can justify their conclusions based on the data collected.</td>
</tr>
<tr>
<td>4</td>
<td>Learners design and do their own 'open-ended' investigations. Learners reflect on the quality of the design and data collected and make improvements when and where necessary. Learners can interpret data in support of competing theories or explanations.</td>
</tr>
</tbody>
</table>

Adapted from Hattingh, Aldous and Rogan (2007)

Despite reformed school science curricula that underlie inquiry-based science education, practical work in the form of teacher demonstrations remain ubiquitous in the science classes in Namibia (Namibia. MoEAC. NCBE, 2018) and globally (Basheer, Hugerat, Kortam, & Hofstein, 2017; Daluba, 2013). Ramnarain (2010) suggests that a demonstration “involves learners watching the teacher generating and collecting data” (p.3). In a demonstration, learners are expected to link the data collected by the teacher or the phenomena they observed to the predictions they made prior to the activity. Similarly, Odom and Bell (2015) described a demonstration or lecture demonstration (as they are synonymously referred to in literature) as referring to learners “watching the teacher do experiments, lecture demonstrations are teacher-led with students passively observing the results, the teacher may pose questions or ask for predictions, but students are not physically engaged with science materials or socially engaged with peers” (p. 88). Odom and Bell (2015) further stated that “although laboratory science became more common in the twentieth century, demonstrations have continued to be a mainstay in science classrooms” (p. 87). The reason that demonstrations are not yet completely phased out of teaching science, are the constraints hindering the effective implementation of practical work in science such as lack of resources and larger classrooms (Odom & Bell, 2015).

Ramnarain (2010) postulated that teachers use demonstrations to familiarize learners with procedures of inquiry. During this type of demonstrations, a teacher places learners’ focus on the event or phenomenon being demonstrated. During a practical demonstration, the Predict–Observe–Explain (POE) method and discrepant events are the most useful aspects of a demonstration. According to White and Gunstone (1992), within a POE method, learners are expected to...
predict what will happen, then observe what is happening and only then will they be able to explain their inferences. Shivolo (2018) gives an example of a demonstration where the POE method is applied. He refers to the expansion of solids, using a ball and ring apparatus where “learners are expected to predict what would happen to the metallic ball before it is heated, with respect to moving through the metallic ring once it is heated, and then through observation, they are able to explain their initial prediction” (p. 29). The POE and discrepant events can therefore help learners develop skills such as hypothesising, experimentation and drawing conclusions (Ramnarain, 2010).

Demonstrations can also be used to illustrate discrepant events “where learners observe unexpected results that are contradictory to their normal experience or expectations” (Ramnarain, 2010, p. 41). According to Shivolo (2018) discrepant events may be better described in terms of a demonstration on the unusual behaviour of water between 0 °C and 4 °C. Learners are believed to think that if water is cooled below 4 °C, it would contract like any other substance, but through observation, they would expect unexpected results.

Conceptual framework
This study was informed by the two conceptual frameworks: the pedagogical content knowledge (PCK) and the teachers’ pedagogical orientations.

Pedagogical content knowledge
In 1986, Lee Shulman identified “PCK as a central element in the knowledge base of teaching” (Friedrichsen, Van Driel, & Abell, 2011, p. 359). PCK is the capacity of a teacher to transform the content knowledge he or she possesses into forms that are pedagogically powerful, yet adaptive to the variation in ability and background presented by students (Shulman, 1987). Shulman (1987) further described PCK as representing the “blending of content and pedagogy into an understanding of how particular topics, problems or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and presented for instruction” (p. 8). Moreover, “PCK includes an understanding of what makes the learning of specific topics easy or difficult: the conceptions and preconceptions that students of different ages and backgrounds bring with them to the learning of those most frequently taught topics and lessons” (Shulman, 1987, p. 9). PCK is therefore an important element in teaching science in that it is of special interest because it identifies the distinctive bodies of knowledge for teaching science (Shulman, 1987). Shulman’s original emphasis was on the following knowledge elements: content knowledge and/or subject matter knowledge (SMK), general PCK, the knowledge of the curriculum, knowledge of learners, knowledge of the educational contexts and knowledge of the educational ends, purposes and values (Magnusson, Krajcik and Borko 1999). The Shulman PCK model, however, lacked the element of orientation to teaching science of which Magnusson et al. included as a crucial aspect of PCK. As one of the significant constructs of this study, orientations, also pedagogical orientations to teaching science will be discussed in the next section.

De Jong, Veal and Van Driel (2002), indicated that PCK can be designated at three levels: general PCK, domain-specific PCK and topic-specific PCK. It is for this reason that Magnusson et al. (1999) described PCK as a “teacher’s understanding of how to help students understand specific subject matter including knowledge of how specific subject topics, problems and issues can be organised, represented, and adapted to the diverse interests and abilities of learners, and then presented for instruction” (p. 96). Wei and Liu (2018) revealed that although there seems to be no commonly accepted conceptualisation of PCK, agreement has been reached on two essential elements of Shulman’s (1986) PCK model which focused on the knowledge of the representations of specific subject matter and understanding of students’ learning difficulties and wrong conceptions (Van Driel et al., 1998). Wei and Liu (2018) further described subject matter as being “somewhat elusive, however, and some insights can be obtained from the discussion of subject matter knowledge in the literature” (p. 2).

According to Grossman, Wilson and Shulman (1989) SMK comprises four broad categories: (1) content knowledge – the “stuff” of a discipline; (2) substantive knowledge – knowledge of the explanatory framework or paradigms of a discipline; (3) syntactic knowledge – knowledge of the ways in which new knowledge is generated in a discipline; and (4) beliefs about the subject matter –
feelings and orientations towards the subject matter. Based on the four categories of SMK as espoused by Grossman et al. (1989), Wei and Liu (2018) believe “practical work, or experimentation, is an integral part of Natural Sciences subject matter across the four categories” (p. 2). While practical activities in the science classroom have been projected as playing a vital role, traditional teaching of teacher “talk and chalk” are dominant strategies. Friedrichsen et al. (2011) specified that science teachers’ practices are influenced by many factors such as the social and policy context in which science is taught, SMK, PCK as well as their attitudes and beliefs about teaching science.

Teacher pedagogical orientation when orchestration practical demonstrations
According to Magnusson et al., (1999) an orientation is defined as “a general way of viewing or conceptualizing science teaching” (p. 97). Anderson and Smith (1987) also used the term ‘orientations’ to describe teachers’ “general patterns of thought and behaviour related to science teaching and learning” (p. 99). Hewson and Hewson (1987) conceptualise a pedagogical orientation similarly as they refer to it as a “set of ideas, understandings, and interpretations of experience concerning the teacher and teaching, the nature of content of science and students and the learning which the teacher uses in making decisions about teaching, both in planning and execution” (p.194).

In this study, pedagogical orientations were therefore viewed as science teaching orientations and described as the knowledge and beliefs teachers have about teaching science at a particular grade level (Magnusson et al., 1999). Figure 1 depicts the simplified version of teaching science according to Magnusson et al. (1999).

![Figure 1: The Simplified Version of Teaching Science](Adapted from Magnusson, Krajcik, & Borko, 1999)

In Figure 1, orientation (circled in red) towards science teaching is projected as a construct of PCK. Orientation towards science teaching is also presented as being influenced by knowledge of science curriculum, knowledge of students’ science understanding, knowledge of assessment and knowledge of instructional strategies. Magnusson et al. (1999) further outlined that the orientations are generally organised according to the emphasis of the instruction. In the Grossman et al. (1989) PCK model, one of the four broad categories of SMK revolve around teachers’ beliefs about the subject matter – feelings and orientations towards the subject matter. Tables 2 and 3 outline the “goals of teaching science that a teacher with a particular orientation would have and the typical characteristics of the
instruction that would be conducted by a teacher with a particular orientation” respectively (Magnusson et al., 1999, p. 97).

Table 2: The goals of different orientations to teaching Science

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Goal of teaching science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Help students develop the “science process skills.” (e.g., Science-A Process Approach [SAPA])</td>
</tr>
<tr>
<td>Academic rigour</td>
<td>Represent a particular body of knowledge (e.g., Chemistry).</td>
</tr>
<tr>
<td>Didactic</td>
<td>Transmit the facts of science.</td>
</tr>
<tr>
<td>Conceptual change</td>
<td>Facilitate the development of scientific knowledge by confronting students with contexts to explain that challenge their naive conceptions.</td>
</tr>
<tr>
<td>Activity driven</td>
<td>Have students be active with materials; “hands-on” experiences.</td>
</tr>
<tr>
<td>Discovery</td>
<td>Provide opportunities for students on their own to discover targeted science concepts</td>
</tr>
<tr>
<td>Project-based science</td>
<td>Involve students in investigating solutions to authentic problems.</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Represent science as inquiry</td>
</tr>
<tr>
<td>Guided inquiry</td>
<td>Constitute a community of learners whose members share responsibility for understanding the physical world, particularly with respect to using the tools of science.</td>
</tr>
</tbody>
</table>

Adapted from Magnusson et al. (1999, p. 100)

Table 3: Nature of instruction associated with different orientations to teaching Science

<table>
<thead>
<tr>
<th>Orientation</th>
<th>Characteristics of instruction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process</td>
<td>Teacher introduces students to the thinking processes employed by scientists to acquire new knowledge. Students engage in activities to develop thinking process and integrated thinking skills.</td>
</tr>
<tr>
<td>Academic rigour</td>
<td>Students are challenged with difficult problems and activities. Laboratory work and demonstrations are used to verify science concepts by demonstrating the relationship between particular concepts and phenomena.</td>
</tr>
<tr>
<td>Didactic</td>
<td>The teacher presents information, generally through lecture or discussion, and questions directed to students are to hold them accountable for knowing the facts produced by science.</td>
</tr>
<tr>
<td>Conceptual change</td>
<td>Students are pressed for their views about the world and consider the adequacy of alternative explanations. The teacher facilitates discussion and debate necessary to establish valid knowledge claims.</td>
</tr>
<tr>
<td>Activity driven</td>
<td>Students participate in “hands-on” activities used for verification or discovery. The chosen activities may not be conceptually coherent if teachers do not understand the purpose of particular activities and as a consequence omit or inappropriately modify critical aspects of them.</td>
</tr>
<tr>
<td>Discovery</td>
<td>Student-centred. Students explore the natural world following their own interests and discover patterns of how the world works during their explorations.</td>
</tr>
<tr>
<td>Project-based science</td>
<td>Project-centred. Teacher and student activity centres around a “driving” question that organises concepts and principles and drives activities within a topic of study. Through investigation, students develop a series of artefacts (products) that reflect their emerging understandings.</td>
</tr>
<tr>
<td>Inquiry</td>
<td>Investigation-centred. The teacher supports students in defining and investigating problems, drawing conclusions and assessing the validity of knowledge from their conclusions.</td>
</tr>
<tr>
<td>Guided inquiry</td>
<td>Learning community centred. The teacher and students participate in defining and investigating problems, determining patterns, inventing and testing explanations and evaluating the utility and validity of their data and...</td>
</tr>
</tbody>
</table>
Magnusson et al. (1999) identified several types of orientations as indicated in the tables above, but for the purposes of this study only the didactic and academic rigour orientations (circled in red) are considered because they are both a typical example of teacher-orchestrated orientations. Magnusson et al. (1999) noted that within a didactic orientation, a teacher has the “goal to transmit the facts of science” (p. 100). Magnusson et al. (1999) further claimed that it is through this approach that a teacher is believed to present scientific phenomena to learners through the discussion and/or lecture approach. By this means, questions are used as the teaching style for which learners are expected to reproduce facts established through science. On the contrary, academic rigour requires that a teacher has the goal of representing a particular body of knowledge to learners, where learners are challenged with difficult problems and activities to solve (Magnusson et al., 1999). Moreover, Magnusson et al., (1999) outlined that academic rigour involves laboratory work and demonstrations which are used to verify science concepts by demonstrating the relationship between particular concepts and phenomena.

Pedagogical orientations manifest in pedagogical actions which may include types of questions asked, the use of prompts, and facilitating collaboration and reflection (Gervasoni, Hunter, Bicknell, & Sexton, 2012). In accordance with this conceptualization of pedagogical orientation, this research investigated the pedagogical orientations of Namibian Physical Science teachers when enacting teacher-orchestrated chemistry demonstrations in Grade 8. In terms of this conceptualisation of pedagogical orientation, the following aspects in Namibian teachers’ pedagogical orientations with regards to practical demonstrations are investigated: teachers’ pedagogical preferences; pedagogical actions; and views on the learning outcomes. Accordingly, the research was guided by the following question:

1. What pedagogical orientations do Grade 8 teachers display when orchestrating chemistry demonstrations?

Methodology
This study adopted a “sequential explanatory mixed methods” design (Creswell, 2002). A mixed method is described by Creswell and Plano Clark (2011) as an approach which conglomerate both quantitative and qualitative data in a single study. They further showed that the centrality of this amalgam is to enable the researcher to have a thorough understanding of the research problem at hand rather than using either approach alone. For a sequential explanatory mixed-method approach, qualitative data are used to explain and elaborate quantitative findings (McMillan & Schumacher, 2010). McMillan and Schumacher further explained that quantitative and qualitative data collection is implemented in two phases, this study primarily put an emphasis on the quantitative methods over the qualitative methods. First quantitative data are collected, and this is followed by qualitative data.

The process of collecting data during this study therefore comprised two phases. Phase I involved collecting quantitative data by means of a questionnaire survey, with 87 Physical Science teachers from Oshikoto Region in Namibia completing the questionnaire. The questionnaire used in this study was adapted from an online survey in the United Kingdom administered by Durham University called ‘Practical Work in Science-Science Teachers survey.’ The permission to use this questionnaire was granted by my supervisor (Prof. Umesh Ramnarain) as he formed part of the initial survey. The questionnaire is structured into sections that comprise items relating to learning outcomes of chemistry demonstrations, the type of demonstrations teachers use, the impact of contextual factors on the types of demonstrations, and teachers’ pedagogical actions during demonstrations. The questionnaire was validated for the above constructs by a panel of three science education researchers at the University of Johannesburg. The adapted questionnaire was piloted with 3 Namibian Grade 8 Physical Science teachers to establish the readability of items before it was adopted for this study. The piloting revealed that the questionnaire was
well designed and asked all that was required and hence no changes were made to the questionnaire Phase II involved the collection of qualitative data by means of classroom observations and thereafter semi-structured interviews. This process involved 10 teachers, purposefully selected from a pool of 87 surveyed teachers, who had indicated a preference for teacher-orchestrated demonstrations.

Questionnaire data (quantitative) were analysed using IBM’s Statistical Package for Social Sciences (SPSS) software which involved the calculations of percentages and generations of graphs. The analysis of classroom observation and interview data were facilitated by using ATLAS.ti 7 software and were subsequently coded deductively, and classified, to determine patterns in explanations for teachers’ chosen options in the questionnaire survey. Such patterns and trends were later interpreted by means of Thematic Analysis (TA) and translated as assertions which were corroborated by excerpts from classroom and interview data. According to Clarke and Braun (2013) TA is described as “a method for identifying and analysing patterns in qualitative data” (p. 3).

Discussion of the Findings
The findings from the analysis of the questionnaire survey were integrated with the findings from the interviews, and classroom observations into a coherent whole. The interview and classroom observation explained some of the findings which emerged from the questionnaire analysis. This integration of quantitative and qualitative data supported the production of assertions (Gallagher & Tobin, 1991) on the pedagogical orientations of grade 8 teachers when orchestrating chemistry demonstrations. These assertions are presented next.

Assertion 1: Pedagogical preference for teacher orchestrated demonstration
In the questionnaire, teachers were asked to indicate their preference for either doing a teacher-orchestrated demonstration or for entrusting practical work onto learners. Responses to the questionnaire showed that 56.3% of teachers expressed the preference to orchestrate demonstrations, whereas 43.7% indicated that they would entrust learners to carry out practical work. In the investigation of the role of contextual factors informing this choice, there was a section in the questionnaire where teachers were asked to rate the degree of the impact of certain contextual factors on a scale of 1 to 5, where 1 indicated “no impact” and 5 indicated a “high impact”. The analysis of data revealed that teachers considered the availability of equipment and resources, the amount of lesson timetabled time for practical activities, and the number of learners per class (class size) as key factors in their decision to do teacher-orchestrated demonstrations rather than having learners do practical activities. These finding are presented in Table 4.

Table 4: Rating of contextual factors in decision to do teacher-orchestrated demonstrations

<table>
<thead>
<tr>
<th>Contextual factors</th>
<th>Degree of Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No impact</td>
</tr>
<tr>
<td>Availability of equipment and resources N (%)</td>
<td>2(2.3%)</td>
</tr>
<tr>
<td>Lesson timetabled time N (%)</td>
<td>3(3.4%)</td>
</tr>
<tr>
<td>Class size N (%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

Note. N = number of teachers who made this choice.

From this table, it is evident that 76 teachers (87.4%) rated either 4 or 5 the impact of the availability of resources in their decision to do teacher-orchestrated demonstrations. A similar result was noted for the impact of class size where 79.3% of teachers rated the importance of this factor as either 4 or 5. For lesson timetabled time, 75.9% of surveyed teachers rated the impact level of this factor as either 4 or 5. In the interviews the teachers elaborated upon the influence of these contextual factors on their preference for doing demonstrations compared to learner-centred practical work. The following excerpt from a teacher interview highlights the problem of a lack of resources.
teachers experienced and how this impacted on their decision to do demonstrations:

**Due to the fact that the provision of resources when it comes to science, that’s not so good and we don’t have enough resources, at the same time we are trying to save so that we can do other practicals, I could not give learners to do individual or group works, rather I demonstrate and [it is] for them to observe (T16).**

The excerpt below elaborates upon how the lack of teaching time left the teacher with little option other than to do a whole class demonstration:

**The purpose of, to demonstrate to the whole class was just to save time, because demonstrating group or going from group to group, is very time consuming and a lesson is just 40 minutes, so that was just to save time and to finish with the demonstration at once (T83).**

**Assertion 2: Teachers perceive that teacher-orchestrated demonstrations lead to a variety of learning outcomes**

In the questionnaire, teachers were asked to respond to a list of six envisaged learning outcomes for teacher-orchestrated demonstrations by rating them on a 5-point scale, where 1 indicated that the learning outcome was “unimportant”, 2 indicated that the learning outcome was “of little importance”, 3 indicated that the learning outcome was “moderately important”, 4 indicated that the learning outcome was “important” and 5 indicated that the learning outcome was “highly important”. Teachers considered the following learning outcomes as either “important” or “highly important” during teacher-orchestrated demonstrations: helping learners to understand science concepts (97.7% teachers); developing learners’ science skills such as handling apparatus (93.1% teachers); stimulating learner interest in science (95.4% teachers); helping learners to observe physical changes in science phenomena (95.4% teachers); and developing social skills in learners (96.6% teachers). Figure 2 exemplifies these responses.

**Figure 2: The learning outcomes for Orchestrating Chemistry Demonstrations**

With regards to the learning outcome of supporting learners to understand a concept, the teachers expatiated on this benefit during the interviews. The following responses were elicited:

**Learners were able to explain expansion in solids, that’s why I demonstrate to them how expansion take place in solids, by using a ball and ring (T3).**
Yeah, the learning outcome is for the learners to understand that once matter is heated, they can expand, especially solids can expand just like gas and liquid particles (T9).

Well, the learning outcomes or basic competencies so to say, I want to see that learners should be able to describe the test and the results of various gases as per the syllabus stipulation (T83).

It would appear from the above responses that the demonstrations provided an opportunity for learners to visualise phenomena, and this visualisation led to conceptual understanding. This benefit was also revealed in their assessment of ‘helping learners to observe physical changes in science phenomena’ where a great majority of teachers recognised its importance. This is evident in the excerpt below:

The learners were observing as I, the teacher was busy with a demonstration, but they were also active at some points because they have to answer questions that I have asked them, and they also have to feel the test tube when we were doing the demonstration to see if the test tube has become hot or colder (T2).

Teacher maintained that demonstrations enabled the development of science process skills in learners. Although the demonstrations were teacher-orchestrated, teachers maintained that during the demonstrations they often invited learners to assist them by setting up the apparatus or reading measurements from devices. This is revealed in the following passages from the interviews:

The role of the learners was to observe when the teacher is doing the demonstration, it was also to participate, for example they were asking questions and also to help, to assist the teacher for example in holding some of the materials during the experiment (T25).

The role of the learners in the lesson was to observe the experiment, they have to observe, and they have to answer questions, and also, they have to handle the apparatus since I called one learner to come and help in the demonstration (T76).

The development of social skills was also considered a strong outcome of demonstrations. Teachers held the view that during demonstrations sufficient opportunity needed to be provided for learners to interact with each other. This interaction appeared to be at the stage where learners were asked to explain their observations. Here teachers saw the exchange of ideas within a social setting as potentially contributing to the development of social skills.

Assertion 3: The pedagogical actions of teachers are supportive of an interactive approach in teaching Science

In a section of the questionnaire, teachers were asked to indicate an option on the frequency within which they displayed certain pedagogical action: no demonstrations; a few demonstrations; about half the demonstrations; most demonstrations or all demonstrations. The data analysis revealed that teachers either did “most demonstrations” or “all demonstrations” and they displayed the following pedagogical actions: ask learners to predict the results (89.7%); talk and show the experiment while learners listened (67.5%); ask learners to explain their observations (95.4%) and ask learners to compare their observations to their predictions (78.5%). Figure 3 depicts the results obtained in this regard.
During classroom observations of teacher-orchestrated practical demonstrations, it was evident that the teachers employed various pedagogical actions. These observations resonated with their responses to the quantitative questionnaire where teachers responded that they frequently employed several pedagogical actions when conducting practical demonstrations. It emerged from these observations that teachers employed both interactive and non-interactive approaches when leading teacher-orchestrated demonstrations. This enabled the researcher to classify their pedagogical actions as being interactive or non-interactive. The observed pedagogical actions are reflected in Table 5.

**Table 5: Interactive and non-interactive approaches to teaching Science**

<table>
<thead>
<tr>
<th>Interactive approach to teaching science</th>
<th>Non-interactive approach to teaching science</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>There is a teacher-learner and learner-learner interaction in new knowledge construction</strong> After the demonstration, teacher facilitates and engages learners in a class discussion, where learners explain their observations and are scaffolded in constructing new knowledge</td>
<td>The teacher talked and carried out the demonstration while learners listened quietly. There is no teacher-learner and learner-learner interactions.</td>
</tr>
<tr>
<td>This approach does not resemble the predict-observe-explain (POE) approach, as learners are not asked to make predictions prior the demonstration, however teacher starts demonstration, and only ask learners to make observations and he/she ask them to explain their observations and later concludes by consolidating learners’ responses</td>
<td>The teacher was in control of the demonstration, learners were not engaged in the demonstration apart from observing. Learners were asked to explain their observations; however, the teacher also, at some point tried to explain learners’ observations and then consolidated the learners’ answers.</td>
</tr>
<tr>
<td><strong>There is less teacher-learner interaction, learners assist the teacher during the demonstration by handling apparatus</strong> Although learners are asked to make observations during the demonstration, they</td>
<td>In this approach, the teacher demonstrated to the whole class either to confirm a law/science principle and/or to affirm the science concepts which he/she taught theoretically.</td>
</tr>
<tr>
<td><strong>No demos</strong></td>
<td><strong>No new knowledge was constructed by the learners as they passively watched the</strong></td>
</tr>
</tbody>
</table>

**Figure 3: Teachers’ pedagogical actions in Orchestrating Chemistry Practical Demonstrations.**

[Graph showing percentages of teachers' actions during demonstrations]
Figure 4 shows a framework/typology that’s had been developed from this study which categorised the teachers’ pedagogical approaches in orchestrating chemistry demonstrations as being interactive and non-interactive as also presented in Table 5.

![Figure 4: Typology for Teacher-Orchestrated Chemistry Demonstrations](image-url)

Figure 4

Although in large measure there was resonance between the pedagogical actions claimed by teachers in the questionnaire and the actions observed in the lessons, there was also some discrepancy between these two datasets. For example, 89.7% of teachers indicated in their questionnaire responses that they asked learners to predict the results in either “most demonstrations” or “all demonstrations”. However, in none of the observed lessons did teachers enact this action. So, in large measure the teacher invoked the learners to “observe” the phenomena and “explain” their observations of the POE strategy that was developed by White and Gunstone (1992) but did not provide an opportunity for them to make a prediction on the result.

This finding is illustrated in a lesson taught on the expansion of solids. After showing the metal ball passing through the ring, the teacher failed to ask the class to make a prediction on what would happen to the ball when it was heated. This was an opportunity lost for the teacher to get learners to articulate their ideas. The teacher proceeded to heat the ball, and then showed the class that it no longer passed through the ring. The learners were asked to describe what they had observed, and thereafter to advance an explanation for this observation. They were prompted here by the teachers referring the learners to the particle model of matter.

Conclusion

Although a larger study is necessary to provide a broader overview of the practical work in Namibian science classes, the findings for the Oshikoto Region given it being typical of other regions in the country may have significance for the entire country. The findings revealed that, given the existence and influence of contextual factors that teachers in Namibia experience, such as lack of resources to conduct practical work, insufficient time allocated for practical lessons and the issue of large class sizes, it would appear from the results of this study that in Oshikoto Region teacher-orchestrated demonstrations are regarded as being the most effective forms of practical work by which learners can derive learning benefits, such as acquiring an understanding of science concepts, developing practical skills and developing an interest in science.

In terms of the levels of practical work presented by Hatting, Aldous, and Rogan (2007), it is evidently clear that the practical work is predominantly levels 1 and 2, where level 1 is strongly teacher-centred demonstrated, and level 2 albeit still a demonstration reflecting more effort at learner engagement. From the findings it can also be seen that although the demonstrations are teacher orchestrated, the pedagogical actions of the teacher suggested that the learners were
cognitively engaged. During the demonstration learners were requested to make observations and they were prompted to explain their observations. After the demonstration, learners were engaged in class discussions. From this, an inference could be made that the chemistry demonstrations conducted by teachers in the Oshikoto Region of Namibia took on a form of a whole class demonstration.

Although this state of affairs in the science classroom did not adhere to the prescripts of the school science curriculum, the findings reflected that teachers acknowledged the important role that practical work played in science learning. This is a significant baseline from which teachers can innovate their practice by exploring opportunities by which inquiry-based learning maybe gradually infused into their practice. Rogan (2003) maintains that, the implementation of an innovation should occur in manageable steps. He introduces the notion of a Zone of Feasible Innovation (ZFI), by analogy with Vygotsky’s zone of proximal development to suggest that the implementation of a reformed curriculum needs to be gradually progressed in stages. This implies that if the existing practice of a teacher in practical work is dominated by teacher-centred demonstration, it is unreasonable to demand a quick transition to guided or open inquiry.

A gradual transition for Namibian teachers would be that they introduce a new teaching strategy like the Predict-Observe-Explain (POE) that could be used in association with demonstrations. Further research might thus explore the feasibility of implementing a POE strategy in Namibian science classrooms where contextual factors identified by this study have significance.

**Recommendations**

The successful implementation of practical activities in Physical Science largely relies on the preparedness of teachers who are the primary agents of change. The Namibian government has embarked upon the development, formulation and reformulation of several policies in terms of the provision of the educational curriculum.

However, there seems to be less effort on the continuous professional developing of teachers in teaching practical science. In an attempt to significantly improve the quality of science education in Namibia, there is a need to strengthen the issue of continuous professional development of teachers in terms of teacher training in teaching with practical work as early as primary schools. It is therefore recommended that:

- The Ministry of Education, Arts and Culture should budget enough money for the construction of functional and adequately resourced science laboratories especially at schools in rural areas, as from primary level so that teachers begin involving learners in practical work as early as primary school to do away with teacher-orchestrated demonstrations which are found to be the predominant and effective forms of practical work at schools in Oshikoto Region.

- Laboratories that are already existing at some schools must be renovated to provide conducive learning environments to conducting practical activities.

- MoEAC should design and develop compulsory practical science examination as a form of formal assessment from Grade 8, which is the inception grade of the secondary phase. This is to enable these learners to become competent in higher grades where they are expected to write an alternative to practical work paper.

- The NCBE should be revised to allocate more time for practical work to allow teachers to encourage effective involvement of teachers and learners in doing practical work as compared to the current 9% of the total teaching time per week (56 periods per cycle) equating to five 40-minute lessons on a seven-day cycle allocated to the natural sciences learning area.

- Teacher training institutions should incorporate in their curriculum, modules on facilitating practical work for novice and pre-service teachers. For practicing teachers, in-service continuous professional development (CPD) training on teaching through practical work is recommended.

- Teachers are also encouraged to teach practical work using locally available, low-cost materials in the place of lack of traditional laboratory equipment.
References


The role of language ideologies in the development of indigenous languages in Namibia

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Abstract
This paper examines discursive language practices, more particularly among the youth, in the Kavango Region. The initial motivation for this study was data from the Kavango Region that suggests that traditional linguistic boundaries between indigenous African languages (IALs) have been re-negotiated to express expanded views of the self. The study shows that expansion of linguistic codes is enhanced by common substrate systems in the three major Kavango languages, using lexical borrowings, semantic shifts and morphological derivations from Afrikaans, English and German as source languages.

Using a translanguaging framework, hybrid language practices challenge traditional conceptualizations of language. That is to say, hybrid language practices reflect heteroglossic speech where rules and norms overlap traditional language boundaries. Likewise, the current study explores how the multilingual youth in the Kavango Region challenge the monolingual discourse practices in pursuit of voice and agency when they engage in their everyday way of speaking. The paper reports on data predominantly collected from the ‘Rukavango Service’ (radio) call-in programme commonly known as ‘Mudukuli’ or ‘Mutuyuri’, and general discussions and conversations on Wàto FM.

The initial data for the current study were collected as part of my PhD data collection. Additionally, data for the study were also collected through discussions with some laypersons, educators in the Kavango Region, fellow post-graduate students at the University of the Western Cape (UWC), and colleagues at the National Institute for Educational Development (NIED).

Furthermore, the study calls for more studies on this language development from translanguaging, migration and settlement angles in order to draw comprehensive accounts of hybrid language use in Namibia’s towns and cities, and comparable situations. Moreover, the study highlights the implications for language planning and policy in Namibia. Last but not least, implications for future research based on the study’s findings are also highlighted.

Keywords: language ideology, standard language, non-standard language, standardization, hybrid language, codeswitching, translanguaging

Introduction
The aim of this paper is to evaluate some of the work that has been done on translanguaging and the emergence of other new and hybrid forms of language and communication in Africa, with a focus on Bantu languages spoken in the Kavango Region. The initial motivation for this study was data from that region that suggests that traditional linguistic boundaries between IALs have been re-negotiated to express expanded views of the self (Makalela, 2013).

As Makalela (2013) observes, it is almost axiomatic that traditional language boundaries in highly multilingual and hybrid communities are growingly blurred as new discursive linguistic resources emerge (Blommaert, 2010; Garcia, 2011b; Creese & Blackledge, 2010). Makalela (2013, p. 11) further observes that migration patterns towards developed countries and translocal movements that are facilitated by rapid urbanisation have created new sites of linguistic and identity negotiation in the 21st century, which characterize what Blommaert (2010) refers to as a “critical sociolinguistics of globalisation”.

According to Makalela (2013, p. 111), a plethora of studies that are framed within translanguaging has revealed that mobile linguistic resources are exerting pressure on
monolingual practices and ideologies worldwide (Baker, 2011; Blommaert, 2010; Creese & Blackledge, 2010; Shohamy, 2006). In the current study, therefore, there was an interesting phenomenon about attitudes structuring adults’ and the youth’s use of the standard language in the Kavango Region. In our informal talks both adults and the youth overwhelmingly maintained that the standard language(s) should be used at all times, rather than the hybrid language(s). Nevertheless, the adults’ position on this matter was in conflict with not only their perceived discomfort towards employing the hybrid language(s), but also their own linguistic practices (Mohamed & Banda, 2008).

It is particularly striking that the adults’ linguistic practices were also paradoxical in two ways: first, they accused the youth of codemixing (CM) and codeswitching (CS) in their discourse practices (Mohamed & Banda, 2008). However, CM and CS phenomena were also noted among adults, especially during the radio call-in programmes, and general conversations and discussions. The adults were thus performing exactly that for which they blamed the youth of doing, i.e. the adults failed to see the point that the youth’s language behaviour is indeed a reflection of the adults own discursive practices (Mohamed & Banda, 2008). As the adults believe that using CM and CS is against the established cultural practice, which privileges the standard language, adults allow neither themselves nor the youth to exercise their full potential in using both the traditional linguistic codes and discursive linguistic resources in functionally integrated ways (Makoni & Mashiri, 2007). In other words, it is not that CM and CS are considered as a hindrance to the youth’s discursive language practices, but more critically, the hybrid language itself is prevented from being used in bilingual symbiosis with the standard language (Mohamed & Banda, 2008).

As Da Costa, Dyers, and Mheta (2013) observe, we live in a world where we accept as ‘commonsense’ and ‘natural’ the power of certain languages, and the prestige attached to being highly proficient in these languages. For Da Costa et al. (2013), one of the ways in which a language variety attains power is by being chosen as the standard variety for a particular language. However, as Da Costa et al. (2013, p. 12) put it, “… a standard language is just another variety of a language which differs from others in terms of its elevated functions, high prestige and elaborate codification”.

**Definition of terms**

It sounds imperative that some terms and concepts have to be defined, especially those on the basis of which the rest of this paper will be developed. That is to say, as terms and concepts such as language ideologies, language attitudes, standard language, non-standard language, and so forth, are seminal to our discussion, in this paper, they need to be defined. Nevertheless, these terms and concepts need to be defined the way they are interpreted, and used in this paper.

To begin with, Myers-Scotton (2006, p. 135) defines ideologies as “the patterns of beliefs and practice, which make some existing arrangements, almost always appear ‘natural’ because they … are the ones who put these arrangements in place”. By ‘they’ Myers-Scotton clearly means the dominant groups in society who have over lengthy periods of time established the existing arrangements in that society so that everyone, even the dominated groups, comes to view such arrangements as normal and natural (Da Costa et al., 2013). For example, the current study tries to show that both adults’ and the youth’s attitudes and thinking towards hybrid language use in the Kavango Region are explicable within the framework of ideological formation and hegemony. In this regard, hegemony entails influence of the dominated to an extent of accepting the status quo as legitimate (Mohamed and Banda, 2008). In Myers-Scotton’s (2006) definition, therefore, one sees how ideologies are part and parcel of the maintenance of relations of power in societies. As Da Costa et al. (2013) argue:

Languages can be powerful tools of domination in the hands of those in power, and can be used to control and exploit the rest of the country’s population. Even in courts of law, speakers of varieties other than the official standard variety may often find themselves at a disadvantage and unfairly discriminated against, leading to miscarriages of justice (Da Costa et al., 2013, p. 315).

Further, Da Costa et al. (2013, p. 312) point out that:
Language ideologies are the beliefs about language shaped over time in societies, in the interests of the powerful in such societies. An example, of a language ideology would be the belief that only certain languages are appropriate for use in particular domains like education and the courts.

Da Costa et al. (2013, p. 312) note that “… More personal beliefs about languages are called language attitudes”. Therefore, our personal attitudes are often a reflection of the more powerful language ideologies held in our societies.

Da Costa et al. (2013) state that the notion of standard language has a long history. As Crowley (1989, p. 125) notes, for instance, the term was used in the mid-19th century to indicate “the uniform and commonly accepted national literary language upon which linguistic historians and lexicographers worked”. Yule (2006, p. 194-195) argues that the standard variety of a language is usually “the variety used for writing, for example, in newspapers and books”. Holmes (1992, p. 83) observes that the standard variety is “generally one which is written, and which has undergone some degree of regulation or codification …; it is recognised as a prestigious variety or code by a community, and it is used for high (H) functions alongside a diversity of low (L) varieties”. Garvin (1993, p. 41) defines a standard language as “a codified variety of a language that serves the multiple and complex communicative needs of a speech community that has either achieved modernisation or has the desire of achieving it”.

The standard language is often used for writing books, newspapers, and in official government documents and high functions, such as formal meetings, and is often used alongside what are considered low varieties (Banda, 2016). Weber and Horner (2012) are critical of what they call the standard language ideology which is based on the assumption that languages are internally homogenous entities with strict borders between them, a belief which completely ignores the constant blending and borrowing between various languages by ordinary people, as is the norm in multilingual societies.

Contrasted with standard language, a non-standard language\(^2\) is defined by Swann, Deumert, Lillis and Meshtrie (2004) as a variety which is used often by particular geographical, ethnic or social groups, and which is different from the dominant standard variety. This differentiation (between standard and no-standard varieties) is indicative of another powerful language ideology, namely that of a language hierarchy (Weber & Horner, 2012). According to Da Costa et al. (2013), this particular ideology allows for language varieties to be divided, labelled and ranked.

**The study**

This is an exploratory study which heavily relied on data from the local radio conversations and call-in programme. The current study was largely part of my PhD data collection which I carried out in 2011 (mostly) in the Kavango Region. In its preliminary stage, the data for the study were mainly collected from the radio call-in programmes during my field research using convenience sampling. During that period, I dedicated myself to listen to as many callers as possible, specifically during the ‘Rukavango Service’ call-in programme commonly known as *Mudakuli or Mutuyuri* among the locals of the Kavango Region.

Nevertheless, it is particularly worth mentioning that the current study continued after completing my PhD studies. The study forms part of an ongoing research project that seeks to explain and interpret translanguaging practices in urbanized multilingual contexts of Africa, more particularly among multilingual speakers in Namibia generally, the Kavango Region in particular. To supplement the current study’s data I often hold casual (corridor) talks with laypersons in and around Okahandja (where I currently dwell), Namibian educators, more specifically those who usually come to NIED for workshops.

This paper draws on the notion of multilingualism as social practice (Heller, 2007) in attempting to explore the following research questions:

1. Who communicates with whom, in what setting, for what purpose and in agreement with which norms and conventions?

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\(^2\) The notion of multilingualism as social practice has been developed by scholars such as Heller (2007) and has been influential in the study of multilingualism.

\(^3\) Convenience sampling is a method of sampling where the researcher selects the sample according to their convenience. This method is often used in exploratory studies due to its ease of implementation and flexibility.
2. Which attitudes and ideologies underlie the communication, and which languages or language varieties and styles are selected by speakers as appropriate for the messages they want to communicate?

3. What and how are social actions and activities of people manifested linguistically in people’s everyday life?

In addressing these questions, the paper shows how people use language in social contexts for real communication (Bock, 2013). Equally, the paper shows how language ideologies and language attitudes enhance or hinder language development in Africa. As Mohamed and Banda (2008, p. 106) put it, “… people’s ways of doing things … are shaped by socially valued ideologies and beliefs. These ideologies not only influence people’s attitudes towards particular practices, but they also configure their thinking about such practices”.

**Theoretical considerations**

This study operates within a post-structuralist paradigm that involves “a philosophical questioning of many of the foundationalist concepts of received canons of knowledge” (Pennycook, 2001) to emphasize the fact that they are “products of particular cultural and historical ways of thinking” (Pennycook, 2001). Even the key taken-for-granted concept of language will be unpacked. Equally, other notions, built around the structuralist and nation-state ideologies of language, are problematized (Mambwe, 2014). This entails a different theorization of language and other notions built around the structuralist and nation-state ideologies of language that account for the translocations and diasporic nature of late modern African identities and lifestyles (Banda, 2016).

**What is language?**

It is important to note that there are two competing models of what a language is, one of which could be referred to as the ‘popular’ model and the other as a more ‘expert’ model. According to Weber and Horner (2012, p. 27), “The ‘popular model’ differentiates between ‘languages’ and ‘dialects’, and postulates a hierarchical relation between them”. An evaluative dimension is tagged on to this hierarchy, with languages being perceived as better than or superior to dialects. Weber and Horner (2012) observe that ‘language’ tends to be automatically identified with the standard language, as described in grammars and dictionaries. However, as Weber and Horner (2012, p. 27) further observe:

Most of these beliefs and assumptions are rejected in the expert model, which is shaped by many linguists and especially sociolinguists. According to this model, there is no purely linguistic difference between languages and dialects, and hence it would be preferable to refer to them all as ‘linguistic resources’ or ‘varieties’. Furthermore, in linguistic terms no variety is ‘better’ than any other variety.

According to Musk (2010), therefore, our taken-for-granted conceptions of what constitutes a language are historically, culturally and socially contingent. As Musk (2010) so aptly puts it, the concept of a language as a discrete unit is historically and culturally part and parcel of the European nation-building project, founded on nationalist ideologies, which “established an innovative link between ethnicity and language” (Lewis, 1977, p. 24).

Increasingly, however, researchers recognize that languages are not always easily treated as discrete isolatable units with clear boundaries between them. Rather, languages are more often continua of features that extend across both geographic and social space. The Ethnologue approach to listing and counting languages as though they were discrete, countable units, does not preclude a more dynamic understanding of the linguistic makeup of the countries and regions in which clearly distinct varieties can be distinguished while, at the same time, recognizing that those languages and their dialects exist in a complex set of relationships to each other (Aronin & Hufeisen, 2009; Mambwe, 2014).

It is important to note that this paper’s conceptualization of language is informed by recent post-structuralist thinking in which speakers’ spaces of interaction and use of linguistic resources are not bound by rigid boundaries or inflexible hegemonic systems (Pennycook, 2010; Heller, 2007). In this conceptualization, the notion of multilingualism and the relationship between language and identity is different from the traditional one built around the notion of linguistic distinctness (Heller, 2007), in which
the world is seen as “a neat patchwork of separate [ethnic], monolingual, geographical areas almost exclusively populated by monolingual speakers” (De Schutter, 2007, p. 3).

According to Banda (2016), therefore, language is seen as social practice operating across ethnic, cultural, geographical, etc. boundaries, and across semiotic artifacts (spoken modes of semiosis, books, media, music, internet, etc.) as well as spaces (classrooms, homes, church/mosque, playgrounds, etc.) in different ways (Heller, 2007; Stroud, 2007). As Banda (2009b, p. 8) points out, “… The problem is that in multilingual contexts, defining a person’s linguistic repertoire based on ethnic or home language is rather inadequate because of the translocations and diasporic nature of late modern African lifestyles”.

In urbanized multilingual contexts of Africa, people draw their identities not only from mother tongue ownership or pandering to rural ‘ethnic’ identities, but more from their repertoires as diasporic multilingual urbanites (Makoni, Brutt-Griffler & Mashiri, 2007). As a consequence, Banda (2009b) argues that:

 [...] the relationship between language use and ethnicity is not always straightforward one, contrary to how it is depicted in literature on language policy and education. The argument is as follows: To take advantage of the large pool of first, second, third, etc. language speakers of these African tongues, language planning and policy needs to cross ethnic, regional and national borders (Banda, 2009b, pp. 8-9).

According to Banda (2009b), it is necessary to recognize that geographic, linguistic, ethnic, etc. borders are social constructs and not impermeable structures. As Banda (2009b, p. 9) puts it more succinctly when he argues that:

There is … a need for the democratization of multilingual community spaces so as to enable hybridity and temporal and spatial identities to be exhibited through multiple languages/dialects. This entails weaning African multilingualism from distortions resulting from the colonial legacy and the pervasive monolingual descriptions that underlie models of language education.

Consequently, García (2009, p. 40) questions the usefulness of the concept of language per se in the bilingual context, and suggests focusing on children’s “multiple discursive practices” that constitute “languaging”. More often than not, individuals and communities engage in bi-/multilingual discourse practices, that is to say, they “translanguaging” (Garcia, 2009). Bock and Mheta (2013, p. x) put it more succinctly when they point out that:

We live in a multilingual, transforming society in which languages play a dynamic and central role. Not only do we live in a region that has an immensely rich and complex linguistic inheritance, but the developments associated with globalisation and the increased mobility of people and information across borders, have added to the emergence of new and hybrid forms of language and communication.

Translanguaging practices
Translanguaging started in Wales in the early 1980s as a pedagogic practice to reinforce skills in both English and Welsh (Makalela, 2013). This practice has caught the imagination of educational linguists about the prospects of using two or more languages in the same lesson and, in this way, moving away from the negative 20th century notion that learning or using more than one language causes mental confusion (Baker, 2011; Lindholm-Leary, 2001).

Makalela (2013) observes that classroom translanguaging has been studied in different parts of the world as a new framework that shifts the focus from cross-linguistic influence to how multilinguals intermingle linguistic features that are assigned to a particular language (Hornberger & Link, 2012). Beyond the classroom, which is the focus of this paper, translanguaging has been extended to include all discursive resources that apply among multilingual speakers in their everyday way of communicating (Garcia, 2009).

The question is: Isn’t translanguaging what others call “code-switching”? Absolutely not! Translanguaging is not simply going from
one language code to another (García, 2011a). As García (2011a, p. 1) so aptly puts it:

The notion of code-switching assumes that the two languages of bilinguals are two separate monolingual codes that could be used without reference to each other. Instead, translanguaging posits that bilinguals have one linguistic repertoire from which they select features strategically to communicate effectively.

Accordingly, Makalela (2013) captures the distinction between translanguaging and code-switching thus: While translanguaging encompasses instances of code-switching in language contact situations, it differs from traditional conceptions of code-switching in that the starting point is not language as an autonomous skill. Rather, the starting point is what the speakers do and perform with their mobile and flexible discourse practices (Garcia, 2009). Surprisingly, according to Makalela (2013), there is a paucity of research on hybrid language forms as well as on the points of view of the speakers in complex multilingual contexts.

**Sociolinguistics of mobility**

It is remarkable to note that increased movements of people between and within nation states in the 21st century have correspondingly resulted in movements of languages and shifting of traditional boundaries (Makoni & Pennycook, 2007; Makoni & Mashiri, 2007; Creese & Blackledge, 2010). According to Makalela (2013), this new development has spurred interest among sociolinguists who started shifting their attention to language and mobility in superdiverse communities. As Makalela (2013) puts it, in this new context of superdiversity, the intermeshing and interweaving of numerous factors create a post-migration experience that sets aside regional, ethnic, cultural and linguistic characteristics of particular groups in favour of a more hybrid habitus (Heller, 2007).

According to Makalela (2013), to describe multilingual practices in the post-migration communities, some sociolinguists discredit treatment of languages as hermetically-sealed units in favour of weakening boundaries between traditional linguistic codes and the use of discursive linguistic resources in functionally integrated ways (Makoni & Mashiri, 2007). To this end, Makalela (2013) argues, a large body of scholarship has identified globalized communication practices as those involving a constant merger of translocal, transcultural and transnational use of languages when multilinguals engage in their everyday ways of meaning-making and identifying in their new settlement spaces (Blommaert, 2010; Heller, 2007; Hornberger & Link, 2012), which includes new language inventions. Makalela (2013) argues that this new type of communication is best explained as spatio-temporally complex as one language can no longer be tied to space and time. Here, multilingual speakers are engaged in a negotiation of multiple identities which cut across traditional language boundaries, and keep making choices in defining who they want to become (Garcia, 2009, 2011b). Consequently, this global language trend calls for detailed research on linguistic complexity in local situations under the notion that can best be described as “the sociolinguistics of mobility” (Makalela, 2013).

**The role of ideologies in language development**

The key ideology in the development of languages is the consideration that some languages are better or more powerful than others. As García (2011a) points out, in most bilingual situations, one language group is more powerful than the other. García (2011a, p. 3) further points out that “keeping the two languages separate at all times creates a linguistic hierarchy with one language considered the powerful majority language, and the other minoritized”.

Unsurprisingly, this situation also prevails in Namibia, with English considered the majority language,\(^4\) and the other Namibian languages minoritized. In my view, this is one of the ideologies that informed the choice of English as the sole official language of a highly multilingual country like Namibia. However, there were various reasons, too. For Da Costa et al. (2013, p. 312), it was “… an attempt by the post-colonial leadership not only to build a nation, but also to reduce the influence of a former language of power, Afrikaans”. In line with the slogan from the struggle days, ‘one Namibia one nation’, the

\(^4\)
post-apartheid leadership in post-independent Namibia wanted to form a nation defined by only one single language, as the use of many languages in the country was (and still is) considered a problem rather than an asset.

Weber and Horner (2012) refer to this notion, that is to say, the belief in one language, one identity and nation, as the one nation-one language ideology. As Ferris, Peck and Banda (2013) put it, the notion presupposes that a nation has only one language and, therefore, one identity. As Weber and Horner (2012, p. 18) point out, “According to this ideology, language can be equated with territory, and the link between language and national identity is essential”.

Nevertheless, just like the one nation-one language ideology is difficult to apply to Namibia, so is the ideology, which Weber and Horner (2012) refer to as the mother tongue ideology. In combination with the one nation-one language ideology, the mother tongue ideology is based on the belief that every speaker has only one single mother tongue (MT) (Weber & Horner, 2012), which is not necessarily the case throughout Africa. In my view, having so many languages within Namibia, it would be impossible to expect that, in such a complex multilingual country, every citizen would have only one ‘MT’. Consequently, it would make no sense to strictly enforce MTE in Namibia (Banda, 2000).

In view of that, Weber and Horner (2012) suggest that it is important for teachers to respect the whole of their learners’ linguistic repertoires if they want to provide them with the best possible chances of educational success. They opine that teachers need to build upon all the children’s linguistic resources in a positive and constructive way. As Weber and Horner (2012, p. 78) aptly put it, “Indeed, it is important to take into account all the children’s resources and to build the best possible education system upon these foundations”.

According to Banda (2009a, p. 109), “In this conceptualisation, there are problems with the applicability of the mother tongue based bilingualism model in multilingual contexts as it appears conceptualized and described in monolingual terms”. As Banda (2009b, p. 6) observes:

Based on the monolingual perception of a direct relationship between language and identity, the failure of imported models of education is crystallised in the language planning and policies in African education, which are pursuing a monolingual agenda. The language policies and the models that they spawn are designed for a monolingual child and his vernacular/mother tongue, or a child and his second language English. The models take an ‘either/or’ approach when, in fact, the two languages are both important, and thus both need to be developed as part of the child’s linguistic repertoire.

As Banda (2009b) so aptly puts it, this means that there is a place for IALs and English in the repertoires of late modern globalized societies throughout Africa.

**Distortions in official, regional and national language designations**

After independence, the emergent African countries followed the ‘Western’ tradition of labelling certain languages as ‘official’ and others as ‘regional’ or ‘national’. Thus, the distinction between official and national languages is not always clear, as these are described differently by various countries. In practice, some of the languages designated as national languages are best described as ‘regional’ languages, because they are restricted to regional use (Banda, 2009b).

As I argued elsewhere, this appears to be the case with Namibia’s ‘national languages’ which are predominantly region-based and mostly used for cultural functions and occasionally in local governance, while English is used nationally in all official functions (Haingura, 2017). In view of the above, Banda (2009b) criticizes the labelling and division of languages in a hierarchical structure, which currently prevail throughout Africa. As Banda (2009b, p. 7) aptly puts it:

In almost all cases, the colonial languages became the official languages and, ironically, what should be regional indigenous languages are proclaimed national languages. The proclamation of languages as official, national and non-official imposes a power and status hierarchy not only
among the languages, but also among the speakers of these languages. Material resources for the development and use of the languages depend on official designations, meaning that the colonial languages retain the monopoly in terms of national exposure in the media (...) as well as in government communication. This has led to distortions in the multilingual landscapes of Africa as it becomes desirable, and even fashionable, for individuals to acquire colonial languages at the expense of local ones.

Following Banda’s (2009b) observation, Rumanyo would fall within the ambit of a ‘regional’ language, since it is solely used as MoI, and taught as a subject in the Kavango Region (Haingura, 2017). I therefore fully concur with Banda (2009b, p. 2) when he points out that “The linguistic influence of … African languages is mostly confined to the same regions to which the colonial governments had assigned them, for administrative convenience”. In Namibia therefore there is a big difference between the official language (viz. English), which receives a lot of support from the Namibian Government (as well as from other donor-funded projects, more particularly from the British and US Governments), and the country’s IALs (‘national languages’), which receive very little support.

This labelling of languages mainly occurs owing to the influence of the ideology of language hierarchy. As Weber and Horner (2012, p. 16) point out:

This is the belief that linguistic practices can be labelled and divided into ‘language’ or ‘dialects’, ‘patois’, etc. which are then subsumed into a ‘hierarchy’, with ‘languages’ being looked upon as ‘superior’ to ‘dialects’ and, additionally, certain languages being given a higher status as the ‘national’ or ‘official language’ of the state or community.

For Kosonen and Young (2009, p. 12), the distinction of language and dialect is treated from the linguistic perspective, which emphasizes intelligibility. They argue that only when people speaking different language varieties understand each other sufficiently and can communicate without difficulty can they be said to speak dialects of the same language. If intelligibility between speakers of different linguistic varieties is insufficient, they speak different languages (Kosonen & Young, 2009). Nevertheless, as Weber and Horner (2012) put it:

[I]t is not possible to distinguish between language and dialect in purely linguistic terms. The most common argument put forward in support of such a distinction is the criterion of mutual intelligibility: ‘if two varieties are mutually intelligible, they are dialects, and if not they are languages. However, some ‘languages’, such as Danish, Swedish and Norwegian are largely mutually intelligible, and some ‘dialects’, e.g. of Chinese, are not (Weber & Horner, 2012, pp. 16-17).

Banda (2009b, p. 7) therefore notes that:

[I]f we ignore the designations of the languages and dialects above, we see the range of linguistic repertoires available to Africans. The fact that very few languages are listed as extinct, despite policies that appear designed for monolingualism, suggests that speakers use the official, national or regional languages but have also not abandoned indigenous languages which do not fall into these three categories. In other words, the multilingual repertoires of speakers contain codes of both officially recognised and unrecognised languages.

Furthermore, in Africa, the hierarchy of languages is informed by both standard and purist ideologies. That is to say, both standard language and purist ideologies underlie teachers’ concern with language correctness. Unfortunately, the purist ideology has also, in a subtle manner, found its way into the Namibian educational system where teachers insist on teaching learners what they consider to be the ‘pure’ form of the language, and look down upon varieties spoken by the learners and their families. Little wonder that standardization and linguistic purism are
frequently regarded as two sides of the same coin (Horner, 2005).

Moreover, according to Da Costa et al. (2013), the very use of the term standard points to the standard language ideology (Weber & Horner, 2012; Milroy & Milroy, 1999). As Da Costa et al. (2013, p. 313) note, “This ideology is based on the belief that languages are internally homogenous entities with strict boundaries between them, a belief which totally ignores the constant blending and borrowing between different languages by ordinary people, as is the norm in multilingual societies”. They further note that this ideology allows for certain language varieties to be chosen for standardization simply owing to the socio-political power of their users, not due to any inherent superiority of these varieties over others. Thus, a standard language is just another variety, although it is often considered the most important one from a social and cultural point of view. That is, the standard language is a ‘dialect’, but for socio-political reasons, it is frequently valued more highly than the other ‘dialects’ and even (mistakenly) identified with the language as a whole (Weber & Horner, 2012).

Da Costa et al. (2013) point out that the standard language is the norm according to which people occasionally judge what others write or say as ‘right’ or ‘wrong’, ‘good’ or ‘bad’. As Da Costa et al. (2013) further point out, it also becomes clear that a person who uses that standard variety is often seen as having more social power than the one who uses a non-standard dialect. As Weber and Horner (2012, p. 20) so aptly put it, “Such judgements are indicative of a third language ideology, namely an ideology of language purism, which stipulates what constitutes ‘good’ or ‘bad’ language usage, and associates values of ‘purity’ with the standard variety”. As Weber and Horner (2012) point out:

Closely intertwined with the one nation-one language and mother tongue ideologies, this ideology has a powerful evaluative component, which stipulates what constitutes ‘good’ or ‘proper’ language. It is based on a denial of the linguistic ‘fact of life’ that language always changes … (Weber & Horner, 2012, p. 20).

As Weber and Horner (2012, p. 143) further point out:

Hence, there is an urgent need for both policy-makers and teachers to break through the standard language ideology and to valorize all the different linguistic and cultural resources of all the children, including not only standard indigenous … languages, but also non-standard … varieties.

Following the purist ideology, in the current study, the word, that many of my informants seemed to have stigmatized, was pire, used mostly by the youth in and around the town of Rundu. They labelled the word pire as bad, non-standard, illogical and alien to the speakers of the major Kavango languages, namely Rukwangali, Rumanyo and Thimbukushu. For example, when one asks someone, particularly the youth: Do you have a book? If he/she does not have it, he/she would answer pire, instead of using the word kwato, considered by most speakers of the main Kavango languages, specifically speakers of Rukwangali and Rumanyo, to be correct and ‘good’, and compatible with the ‘standard’ versions of their languages.

Most ‘Rumanyo-speakers’ perceived the word pire to have originated from Rukwangali, and therefore needs to be rejected. In contrast, however, Rukwangali-speakers also reject(ed) this assumption, as the word pire appears to be illogical and non-standard in their own language as well. It is notable that its variant pira is also often used in the same way. Sometimes, if one asks a child in Rumanyo, Vana ya tiki kare vakondi voye kumundi ndi? (“Have your parents arrived home already?” He or she would answer, pira! (“no”!). In a full sentence this will read as follows: Pira shimpe vana ya tiki (“No, they haven’t arrived yet”). [Cf. one of the Rukwangali advertisements presently being aired on Wato FM “Wa kwara ndi pira wa kwara”? (“Are you married or not yet married‘?)].

One of the things you may have noticed (above) is the ‘ungrammatical’ nature of the participants’ language. You might have wondered whether this is due to their educational levels or linguistic competence (Bock, 2013). As Bock (2013) so aptly puts it:
However, false starts, hesitations, ungrammaticalities, repetitions and, in multilingual settings, the mixing of languages, is normal in informal spoken language, even among the ‘educated’ speakers, so we should not judge people’s level of education on the basis of these features (Bock, 2013, pp. 10-11).

There are some of the interesting points of analysis that can be made about the above phenomenon. As Bock (2013, p. 17) observes:

[Researchers] of language and communication should focus on discovering and analysing the range of communicative situations, and acts which have meaning for participants within any given speech community. They should explore the ways in which participants use the range of language resources that they have at their disposal to signal things about their identities or feelings, or compliance or resistance to the unspoken rules of the context.

Consequently, both (words) *pire* and *pira* qualify to be called hybrid language, with no particular owner. Makalela (2013) refers to this phenomenon as “internal translanguaging”, which takes advantage of the similarities in the substrate systems of mutually intelligible IALs.

As I have argued elsewhere, the hybrid language should not be stigmatized, but need to be embraced by all late modern Africans (Haingura, 2017). Certainly, nonetheless, we are likely to encounter a lot of resistance, as those who examine bilingualism from a monoglossic angle stigmatize hybrid language use as code-mixing or an example of semi-lingualism. As Banda (2017, p. 7) so aptly puts it, “The very notion that ‘mixing’ languages helps learners with learning and acquiring new knowledge might not sit well with traditional pedagogical practices which are premised on using a singular language at a time and space for teaching and learning”. Similarly, Weber and Horner (2012) remind us that those who try to preserve one (traditional) form of linguistic diversity may not be ready to acknowledge other, newly emerging forms of linguistic diversity, for example, the new mixed urban youth languages. Further, in line with the ideology of linguistic purism, most ‘Rumanyo-speakers’, seem to question the use of the word *mitiri* (“teacher”), which was in use for many years, as it is perceived to have originated from Otjiherero. However, following etymology the word *mitiri* actually derives from the word *meester* (an Afrikaans word used when referring to teachers, especially during the apartheid era). If one phonologizes the Afrikaans word *meester* to fit the writing system of the major Kavango languages, it would, indeed, read as *mitiri*.

Furthermore, instead of the word *mitiri*, previous Rugciriku teachers and authors opted to use the word *murongi* (teacher) as evident in a number of Rumanyo textbooks currently used in schools. Surprisingly, nonetheless, this word is also rejected by current Rumanyo teachers and authors who prefer to use the word *mushongi*, as the former, according to them, originated from Rukwangali, while the latter is considered to be a ‘pure’ Rumanyo word which had been used in the past, even in the Holy Bible (Haingura, 2017).

It is noteworthy that, during my fieldwork, it was not uncommon to come across statements expressing concern about Rumanyo being a marginalized language. In these ideological debates, Rumanyo was even presented as an endangered language that is in need not only of standardization, but also of preservation and promotion. Even these days, most ‘Rumanyo-speakers’ point to Rukwangali as the main culprit for this, referring to it as a ‘killer language’. That is, Rukwangali is ‘killing’ Rumanyo. The intention of this purist discourse is to establish a clear boundary between Rumanyo and Rukwangali, because, as a language in its own right, rather than a dialect, Rumanyo can be positioned as a valid competitor with Rukwangali (Haingura, 2017). In other words, Rumanyo is perceived here as being in opposition to Rukwangali, and all other languages spoken in the region or even the nation, which is counterproductive and dangerous for language development in Africa. As Banda (2009b, p. 2) aptly puts it, “The danger here is that African languages which have existed side by side for significant periods of time, complementing and supplementing
each other in multilingual symbiosis, are suddenly cast as competing for spaces”.

Notably, the linguistic purism debate has been (and is still) popular on the Rukavango Service phone-in programmes, and general discussions on Wato FM. Sometimes, there are heated debates, i.e. people from all walks of life (would) make calls and lament, especially the youth, for ‘bad’ language usage. They (would) use metaphors such as “the youth is ‘killing’ our languages”. If we are not careful, we are about to ‘lose’ our heritage”, viz. our languages. Some of the statements often uttered in the three major Kavango languages are:

Rukwangali: Vanona ava kuna kudipaga eraka lyetu, (“these kids are killing our language”). Oru ngesi kapisi Rukwangali rwene-rwene, (“this is not ‘pure’ Rukwangali”).

Rumanyo: Vanantjoka kuna kudipagha liraka lyetu, (“the youth are killing our language”). Runo kapishi Rumanyo rwene-rwene, (“this is not ‘pure’ Rumanyo”).

Thimbukushu: Otho ne mbadi Thimbukshu thene keho tho, (“that is not ‘pure’ Thimbukushu”). Hamurereya kuna kupagha ndimi dhetu, (“the youth are killing our language”).

Nevertheless, if one listens more carefully, they themselves (i.e. the defenders of the standard language ideology, and/or apostles of linguistic purism) end(ed) up “translanguaging”.

Presentation of real communication data
The texts below (what I will refer to as data) are extracts that one often hears in everyday conversation, especially among the youth in the Kavango Region. The results of the present study show that hybrid language speakers have an extended repertoire of languages that they pool together to fit their communication needs. That is, they display linguistic flexibility, which suggests a case of versatile intermingling of linguistic resources rather than static and separated codes (Makalela, 2013). The Extract underneath shows this flexibility:

A: Una duna kare unsuku kuposa ndi? (‘Have you already applied for the post/vacancy?’)
B: Mukuranti munke yina kara? ([‘In which newspaper is it] advertised?’)

Here, Speaker A begins the conversation in Rumanyo with Una, a marker for the pronoun (“you” – singular), and then uses a phonologized Afrikaans phrase ansoek doen for “apply”. Speaker B does the same. Participants use a mix of local language, Afrikaans and English (which include words such as posa – a Rumanyo word for ‘post/vacancy’, kuranti derived from koerant – the Afrikaans word for ‘newspaper’) which signal their identity. Below follows another extract of a conversation by two Rukwangali-speakers:

C: Nkera kani resere mbudi zondona. (‘I read bad news yesterday’)
D: Mosaitunga musinke? (‘[In which newspaper?]’)

Speaker C uses the word resere derived from kuresa from the Afrikaans word lees, meaning “to read”. Note that Speaker D’s question “In which newspaper?” is preceded by a Rukwangali prefix, Mo, a marker for the English preposition in, followed by a phonologized Rukwangali word saitunga, derived from the German word Zeitung, for “newspaper”.

You probably noticed from the language mixing that these participants are multilingual individuals, using Rumanyo/Rukwangali, and Afrikaans/English/German in one conversation. Their mixing of languages is evidence that the group is probably close knit in social and cultural terms and that they are comfortable and relaxed in this setting as language mixing is typically found in informal settings. These conversations show a typical case where multilingual speakers choose discursive resources from various languages to communicate and carry out social functions – something that typifies a translanguaging practice. Above all, these conversations show that hybrid language speakers have a language repertoire that breaks boundaries in ways that render them versatile speakers and listeners (Makalela, 2013). Besides, the mixing of languages is characteristic of informal spoken
interactions (Bock, 2013). What is interesting about these interactions is the way in which the norms and values of what is considered to be ‘decent’ and ‘appropriate’ way of speaking shape the participants’ interactions. I pick up this point later on.

As will become clearer underneath, the notion of ‘imagined communities’ is used in language and identity studies to refer to desired membership of groups of people to which we connect through the power of imagination (cf. Kanno & Norton, 2003). This membership includes using identity markers and approximating the behaviour of the imagined community. Most notably, the current study shows that hybrid language speakers do not only use vocabulary from local contexts, they equally draw from transnational cultural expressions with which they identify. Let us consider the following extract:

Wami topi\textsuperscript{11} na yi tjeka mu tau kuna kupita mushitavura opo na yi veisa ndi yi mpeko zak topi kuna ka baleka (‘My friend I saw my father walking in town when I asked him to give me money he started to run’).

First, the Speaker uses a slang term, topi, which, in this case, refers to father. In the same utterance, he brings in phonologized English words, tjeka (‘check’), tau (‘town’) as well as phonologized Afrikaans word veisa (derived from the word wys) followed by Rumanyo words within the same stream of thought. He also uses the word baleka originating from IALs across our (Namibian) borders. The word baleka in isiXhosa means ‘run’. It is remarkable to notice that the word topi is re-appropriated by the speaker here to mean father in a pledge of solidarity (Smitherman, 2000) to their own speech community.

This imported usage shows that hybrid language speakers often have imagined communities owing to international exposure to various cultures and behaviours. While they localized their linguistic repertoires, they also develop transcultural repertoires that cut across national boundaries as part of their expanded ways of seeing themselves with respect to others in the 21\textsuperscript{st} century. It is in this context that Blommaert’s (2010) concept of a ‘critical sociolinguistics of globalisation’ becomes relevant. That is, hybrid language speakers are not only preoccupied with local ways of identifying, but they also assume transcultural identities that are mediated through globalization (Makalela, 2013).

For that reason, the ideology of linguistic purism has been found, by post-structuralist (socio)linguistic scholars, to be dangerous and counterproductive for language development, specifically in our globalized late modern African societies. Particularly, in this regard, one needs not look further than the metaphors that the language purists rely upon (Haingura, 2017). In the domain of education, for example, the discourse of endangerment tends to be connected with the discourses of standardization and purism (Weber & Horner, 2012).\textsuperscript{13}

Implications for language planning and policy

Language planning and policy in Africa has not moved along with the current language practices (Makoni et al., 2010). That is to say, it has not accounted for massive migrations and urbanization all over Africa, and the constant crossing of the rural-urban spaces by both rural and urban people due to improvements in air and road networks. For that reason, there is a need for multilingual models of education and language policies which are based on natural linguistic repertoires of the speakers concerned and for the cross-border configuration of such models and policies that account for border-crossing multilingual landscapes (Banda, 2008, 2009a, 2010). Africa is constituted of multilingual landscapes that cross national, ethnic, etc. borders. Multilingualism and multiculturalism being the norm means that Africans do not shy away from ‘crossing’ ethnic, cultural and linguistic borders in their quest for voice and agency (Banda, 2009b).

Language planning in Africa needs to take into account that languages spoken in a specific country are also spoken outside its borders, and that ethnic, cultural, linguistic, and so forth, borders are social constructs. This would build and extend multilingual democratic spaces for speakers as a way of enhancing and taking advantage of multilingualism as a voice for experience and identity performance, and hence as a linguistic resource. This would enable material

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production through local agency and voices across borders, be they ethnic, community-based or national. In this way, multiple languages would become tools for the socio-political, cultural and economic transformation of Africa, as multilingualism becomes the means for increased socio-economic, political, and so forth, participation across broad African populations (Banda, 2009b).

**Discussions**

The current study sought to explain how hybrid language speakers perform their multilingual practices in the towns and cities throughout Namibia. The key finding from these dialogues is that communication among these speakers is spatio-temporally complex and it embodies the transcultural and linguistic movements of people. Their linguistic moves cut across traditional linguistic boundaries in ways that reflect their multiple identities and hybrid habitus.

The first instance of translanguaging practices was found in the speakers’ ability to mesh codes within single thought units. For instance, there were opportunities to use more than three languages in one utterance. This linguistic flexibility suggests that multilingual speakers have an extended linguistic repertoire from which they extract a range of language forms in order to express meanings. As this process of relating meaning in enmeshed codes has been automatized, one is able to affirm a common understanding in translanguaging studies that the languages used are not differentiated, but rather form an amorphous continuum in which speakers “soft-assemble” (Garcia, 2009) and use available discursive resources as and when the social environment dictates. In other words, from the point of view of the speakers, multilinguals do not necessarily switch from one code to the next as studies on code-switching tend to suggest (Gumperz, 1982; Slabbert & Myers-Scotton, 1996).

The study has shown that mixed ways of using language is very creative. Instead of using traditional forms that characterize a specific language group, the speakers prefer more neutral forms. We have seen that *pire* and/or *pira*, as discussed above, have become common hybrid language distinguishing properties, which have no ethnic lineage to any of the IALs spoken in the Kavango region. Instead of using complete words, the speakers creatively use semantic shifts as in *pire* and *pira* for *kwato* and *kapi*. In doing so, the speakers resist mother-tongue labels of their so-called heritage languages.

It is particularly striking that, even though hybrid language speakers are enmeshed in their environment where they bridge linguistic gaps, the study has shown that they are constantly involved in transcultural imagination of the globalized world. For example, the word *baleka* has found its way into the streets of Rundu, which may reflect transcultural identification with South Africans. While this lexical item has no history in Rundu, it seems that transcultural imagination takes precedence due to exposure to popular culture from South Africa. That is to say, owing to globalization and the fast exchange of information in the 21st century, language expressions are no longer attached to particular spaces and times. This is a typical example of linguistic mobility that is indexical of the permeability of boundaries between languages and cultures (Blommaert, 2010; Creese & Blackledge, 2010; Makoni, 2003).

Another significant finding of the study is with regard to experiential harmonization of discretely defined Kavango languages. Mixed neighbourhoods of traditional users of the three major Kavango languages in the town of Rundu have brought these languages so close together that the hybrid language speakers use them interchangeably when they communicate with one another. The study has shown that translanguaging between speakers of mutually intelligible languages is a natural process where these languages become indistinguishable in everyday use. While the translanguaging frequently refers to a mixture of non-cognate languages, here we saw an opportunity for using the Kavango language varieties without boundaries.

It is remarkable to note that most Bantu languages in Namibia are mutually intelligible to the extent that their orthographies could be harmonized and/or restandardized into a common form (Holmarsdottir, 2001; Haingura, 2017). It is argued that, orally, most of the ‘Bantu languages’ in Namibia are, to some extent, similar and mutually intelligible, which may be ascribed to the syntactic and morphophonological similarities of Bantu languages (Holmarsdottir, 2001).

Finally, the languaging experience has shown practical opportunities for harmonized use in hybrid communities such as our towns and cities (Makalela, 2013). The notion of
indistinguishable forms and traditional boundaries in IALs was shown further through lexicalization processes when hybrid language borrows words from African languages, German, English and Afrikaans.

**Conclusion**

This study has shown that the youth and adults in the Kavango Region practice multilingualism in fluid, mobile and flexible ways that transcend traditional language boundaries. Designations such as ‘MT’ seem increasingly irrelevant to individuals from these areas who favour a hybrid form, which involves a confluence of Afrikaans, English, German and IALs. From a translanguaging perspective, their linguistic repertoires have expanded to give them the flexibility to ‘soft-assemble’ and make choices in their everyday encounters, such as when they are in monolingual situations. This languaging practice goes far beyond what has traditionally been referred to as ‘codeswitching’, which routinely focuses on language interference. What we see instead is the way in which multilingual speakers tend to become socially versatile by actively making choices about who they want to become in fluid language context situations. In Garcia’s (2011b) terms, they identify through languaging.

While at the surface this phenomenon reflects how hybrid language speakers see themselves as a new generation of speakers who cannot be tied to a single linguistic and cultural code, the transcultural and linguistic mobility of people in the 21st century provide new opportunities to redefine languages. The study calls for more studies on this language development from translanguaging, migration and settlement angles in order to draw comprehensive accounts of hybrid language use in our towns, cities and comparable situations throughout Africa. It forms a basis for future studies that need to take into account these hybrid forms of language and identity negotiation (Makalela, 2013).

**Endnotes**

1. While the major study was underway the Kavango Region was split in two distinctive regions, namely Kavango East Region and Kavango West Region. In the current study, nonetheless, I will continue to refer to the ‘Kavango Region’, the region that existed during the initial conceptualization of the main study from which the current study originates.
2. According to Weber and Horner (2012), a term such as ‘non-standard’ has a negative connotation. ‘Non-Standard’ varieties might be looked upon as inferior to the standard varieties. In my view, the Namibian education system is a prime example, of a system that puts greater value on the standard varieties, even at the risk of losing quite a lot of linguistic varieties spoken by the majority of the population. In the Namibian context, this has mainly led to impractical policies and models being adopted in the country (Banda, 2009a).
3. Convenience sampling (also known as grab or opportunity sampling) is a type of non-probability sampling which involves the sample being drawn from that part of the population which is close to hand. As I was undertaking a doctoral research in the Kavango Region, it was easy for me to hold informal talks with various stakeholders, and listen to the local radio call-in programmes to gauge the caller’s propensity towards hybrid language practices, such as CS, CM, translanguaging, and so forth.
4. The concept ‘majority’ language is used here not following the number of its speakers in the country, but due to its global power as a ‘world’ language. Following the number of its speakers, in Namibia, English will definitely be termed a ‘minority’ language, the term ‘minority’ here referring to the number of its speakers as opposed to its global economic power.
5. Essentializing assumptions and ideologies dominate the discourse about multilingual education, which in turn hampers language development and promotion throughout Africa (Haingura, 2017).
6. (Cf. the Thimbukushu word mbadiko as its equivalent).
7. Personal communication with SM Ndjunga, Senior Education Officer for Thimbukushu, in the Sub-division, African Languages at NIED in Okahandja, 7 May 2019.
8. My argument is that the fact that a word like pire or pira is only an urban variety was found to be untenable in the major study (Haingura, 2017) carried out by this writer. The study found that, although the word pire or pira would qualify to be
called an urban variety, it is not necessarily restricted to the urban settings. To some extent, it is equally spoken in rural settings, that is, in far flung villages of the Kavango Region. In addition, as Musk (2010) notes, the operative forces determining how we perceive of language have had an impact on bilingualism and multilingualism too. Since the findings of numerous (socio)linguistic studies suggest the blurring of borders between languages (cf. Auer, 2007), it becomes understandable that notions that conceive language to be an autonomous system become untenable in accounting for language practices in late modern societies.

9. These were (and still are) primarily adults who used to call in, and complain that the youth in the Kavango Region were busy ‘killing’ their languages (referring to Rukwangali, Rumanyo and/or Thimbukushu).

10. This extract is an informal, spoken spontaneous discussion which has been recorded and transcribed into a written form by this writer.

11. The opposite word for topi in the common youth parlance is zali a word which has also originated from across our (Namibian) border. Interestingly, the words topi and and zali are currently commonly used (as part of the new mixed urban youth language) throughout Namibia.

12. The translation of this Extract has been perfected with the assistance of Kletus Likuwa who was by then a fellow post-graduate student at the University of the Western Cape, in Bellville (Cape Town). Kletus Muhena Likuwa, PhD, currently works as a Deputy Director at UNAM’s Multidisciplinary Research Centre (MRC).

13. Notice the use of a metaphor from the domain of health (that is to say, the strengthening of ‘endangered’ or ‘dying’ languages), which evokes the image of endangered languages as ailing patients who need to be given drugs to restore his/her bodily strength. Similarly, the topics of language shift as opposed to language maintenance have become highly emotional ones, with languages being anthropomorphically referred to as dying or being killed by other languages (Weber & Horner, 2012). These metaphors suppose the existence of distinct languages – which is not the case. So, if it is true that “languages are not fixed, ‘static systems’ but ‘open systems’ which are continuously shifting and changing, then language death needs to be relativized” (Pennycook, 2004, p. 231). As Weber and Horner (2012, p. 53) point out, “language death is a metaphor that needs to be relativized in the light of the fact that all (...) languages are involved in a continuous process of change”.

References


Learning through play and its influence on basic literacy skills development in the Pre-primary grades in Zambezi region, Namibia

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Abstract
Learning through play is key to developing various skills in a pre-primary grade. This is due to the fact that through play a child engages in activities that are beyond his or her average age. This paper therefore investigated how play promotes the development of basic literacy skills in pre-primary classrooms in Zambezi region of Namibia. The study was guided by Vygotsky’s sociocultural theory of how children learn. It is a multiple case study and took a qualitative approach. Six (6) pre-primary classes participated in the study. A sample of the schools and a sample of teachers were drawn purposively. Data were gathered by using interviews, observation, and document analysis like lesson plans. Data analysis was done qualitatively through themes. The study established that teachers did not practice learning through play during lessons, and that there was a high level of schoolification of the pre-primary (Grade 0) curriculum. This study thus recommended that teachers should be trained to understand the speciality of pre-primary; support should be given to current teachers to adopt a child-centred, play-based approach to pedagogy; teachers should adopt collaborative teaching and learning, and that they (teachers) should attach learning themes to contextual games.

Key words: pre-primary; literacy skills; schoolification, and play based approach.

Introduction and literature review
Play engages learners in hands-on activities and is thus fundamental to basic literacy learning in pre-primary grades. Teachers should thus plan lessons that are play related and should implement them accordingly. According to Kennedy et al. (2012, p. 42), through play and hands-on experience, “children see and interact with print as they build an awareness of its functions and conventions”. Research claims that children “investigate the world through play thus making play an important part of the child’s pre-school activities” (Namibia Ministry of Education [Namibia MoE], 2015, p. 10). This, by implication, means that pre-primary children learn effectively when learning is play-based. For example, “when children are afforded the opportunity to physically demonstrate action words like jump, run, sit, and laugh, word comprehension is immediate and long lasting, and when children materially move over, under, beside, and near objects, the child better grasps the meaning of these prepositions” (Johnson et al., 2010, p. 4). Through such games and even songs, children develop vocabulary in context and also learn to work together as a group (Orenberg, 2016), thus developing their physical, social, cognitive and emotional skills which is the purpose for the pre-primary education curriculum in the schools. Despite Namibia’s pre-primary curriculum emphasis on learning through play (MoE, 2015), the same curriculum, as per the pre-primary ‘Daily Program’ denigrates play by holding children in class listening to the teacher for 1.5 hours without exposure to the outside classroom for involvement in play based activities. This also points at how Namibian pre-primary teachers promote ‘schoolification’ of the pre-primary curriculum. In this study schoolification is a “practice by teachers who, due to a lack of professional training teach pre-primary learners in a more formal and structured manner thus putting them at risk to miss out on the much needed exposure to early childhood education in terms of good health, psychosocial stimulation, and play environment” (Polanki, 2013, p. 1).

When children are exposed to the outside classroom, they learn by doing which “creates more neural networks in the brain, and throughout the body, making the entire body a tool for learning” (Johnson, Christie, &
Wardle, 2010, p. 4). Neuroscience further reveals that the child’s early years are crucial and that “once these critical periods have passed, the brain’s potential is difficult to realize” (Namibia MoGECW, 2007, p. 10). Therefore, pre-primary teachers should plan lessons by aligning prescribed curriculum topics to contextual games, and use such games to help learners attain lesson targets. Teachers could introduce learners to such activities as “threading beads, buttons and reels, playing with puzzles, zipping clothes and tying shoe laces, because it is through these activities that learners’ small motor muscles responsible for drawing and writing are developed” (DBE, 2015, p. 26).

According to Namibia MoE (2015, p. 10), “play provides the basis for literacy learning and through play, children develop the ability to communicate an understanding of how things work”. Nieuwoudt (1998, cited by van Rensburg, 2015) observed that pre-primary content should not necessarily be academic, but anything that prepares the child to learn when s/he gets to Grade One the following year. A UNESCO study on the state of literacy in Pre- and Lower Primary classrooms in Namibia reported that “schools do not engage children in activity based learning and there are no play structures in the schools” (Weiss & Steukers, 2015, p. 22). Waite (2011, p. 24) believes that “movement underpins all other areas of early development, whether physical, intellectual or social, and is essential for young children”. Children develop literacy skills in an emergent way through retelling parts of stories in their own words, doing role plays and by asking questions. Grove and Hauptfleisch (1986, p. 6) observed that “until a child can enunciate clearly, has something to say, and can express his or her ideas or ask questions intelligibly, it is a waste of time to prepare him or her to read”. This means that a child should be able to hold some dialogue with the teacher and friends as a sign of readiness to read in Grade One. During oral deliberations, children’s level of vocabulary improves, and they learn to understand and interpret conversations in context. Snow, Burns and Griffin (1998) stress that:

Preschool instruction should be designed to stimulate verbal interaction, to enrich children’s vocabularies, to encourage talk about books, to provide practice with the sound structure of words, to develop knowledge about print, including the production and recognition of letters, and to generate familiarity with the basic purposes and mechanisms of reading (p. 9).

These are basic skills that inform and strengthen children’s basic literacy knowledge which translate into ways that demonstrate the acquired behaviour. This transition from the basics to implementation of basic literacy knowledge should be mediated by the teacher in order to be achieved by children.

Theoretical framework

This study is underpinned by Lev Vygotsky’s sociocultural theory (SCT) of how children learn. SCT theory has its roots in the child’s social, historical, and cultural experiences. Therefore, play as one of the ways children learn in the early years explores the child’s social, historical and cultural backgrounds to effectively learn basic literacy skills. In other words, children’s cultural experiences are demonstrated, to a larger extent, through play-based activities as children use cultural knowledge to meaningfully do an activity, thus facilitating learning in the Zone of Proximal Development (ZPD). This is due to the fact that play embraces imaginative and collaborative modes used by children to construct new knowledge through shared learning, thus promoting the development of higher mental processes (HMPs) (Nicolopoulou, 1993). The development of HMPs is critical for the reason that reliance on lower mental functions (LMFs) has serious implications for learning as children will be inhibited from developing abstract thinking due to dependence on their environment (Vygotsky, 1978; Bodrova, 1997). Research found that:

As long as humans possess the LMFs only, they remain ‘slaves to the environment’ completely dependent on the stimulation that comes from the outside and that lower mental functions are culture-free and have not changed significantly over the course of human history (Bodrova, 1997, p. 17).

LMFs are thus the basis for higher mental functions (HMFs) which can be promoted when children do activities through play. According to Vygotsky (1978, p. 93), play is
the “imaginary illusory world in which the unrealizable desires can be realized”. This implies that play immerses children in an imaginary world; a world in which they (children) engage in a variety of play activities with rules of behaviour to be obeyed to satisfy the objectives of a particular play activity (Vygotsky, 1978). Instead of waiting to be introduced to rules later when they are responsible enough, this is done through play. According to Bodrova (2008),

Whenever there is an imaginary situation in play, there are rules – not rules that are formulated in advance and change during the course of the game, but rules stemming from the imaginary situation. Therefore, to imagine that a child can behave in an imaginary situation without rules, i.e. as he behaves in a real situation, is impossible. If the child is playing the role of a mother, then she has rules of maternal behaviour. The role the child plays, and her relationship to the object if the object has changed its meaning, will always stem from the rules. In play, the child is free but this is an illusory freedom (p. 359).

Vygotsky (1978, p. 98) further claimed that the theories of play are significant to concept formation, though he still believed that “real concept formation and abstract reasoning appear only in adolescents”. Such concepts emerge when children interact during play activities. Vygotsky (1978, p. 103) saw play as the ‘leading activity’ of childhood learning in which the ‘leading activity’ is the action that “provides optimal conditions for the mental functions that develop at the current stage as well as preparing the foundation for the mental functions that will develop during the stage that will follow”.

**Play and the Zone of Proximal Development:** Pre-primary is traditionally the first formal year of schooling, but owing to its uniqueness it can still accommodate play which is a necessary form of learning in this age group and stage of schooling. For this reason it is necessary to examine play in relation to the ZPD. It is thus worth stating that “play is the work of children and through a variety of activities and routines, children are being prepared for more than just the next grade; they are being prepared for life-long success” (DoE, 2008, p. 23). Through play, the child’s basic literacy competencies which are unique to preschool are promoted, affirming play as the beginning of a child’s learning (Bodrova, 2008). According to research, play is a “source of development and creates the zone of proximal development” (Bodrova & Leong, 2015, p. 376; Vygotsky, 1978, p. 102). This is affirmed by the fact that during play, children think fast; which signals that ‘play’ is a successful and fulfilling mode of learning in early childhood. Play is collaborative and as children engage in collaborative activities; their ZPDs are enhanced and accelerated as they develop new levels of thinking. It has been established that, for play to be of benefit to a pre-primary child, it should be well planned by the pre-primary teacher with the objective of developing the entire child (Excell & Linington, 2011).

In the Zambezi region for example, and in the whole of Africa, there are common traditional games in which children engage. Some of these games are ‘hide and seek’ (maipato), draughts (mulabalaba), and pretend play (mandiwani). These traditional games can be played using any language as determined by the context/s of learners. They (the games) are played because children find them pleasurable to play. Furthermore, through play the child’s language, gross and fine motor skills, which are critical in development of a child’s basic literacy skills, are unconsciously developed. Children engage their critical reasoning skills during play thus reflecting reality in what they do, and migrating from LMFs to HMFs which are critical to literacy learning in Grade One.

In his acknowledgement of this thinking, Vygotsky (1978, p. 102) wrote that “in play the child is always above his average age, above his daily behaviour; in play it was as though he were a head taller than himself”. This denotes that through play the child engages in activities that promote abstract reasoning. Learning which results in the promotion of abstract reasoning occurs in no other region but the ZPD. The fact that the child engages in activities that are beyond his or her average age, “as if the child tries to jump above his usual level” (Bodrova, 2008, p. 360), suggests the advancement and accomplishment of his or her developmental goals in the ZPD. Kennedy et al. (2012, p. 42), reason that, through play and hands-on experiences, “children see and interact with print as they build an awareness of its functions and conventions”.

Symbolic play: Pellegrini and Galda (1993) report that early work on symbolic play was conducted by Jean Piaget who coined the term symbolic play. Piaget defined symbolic play as “egocentric thought in its pure state” (Cemore, 2005, p. 9). In his investigations on symbolic play, Piaget revealed that “children can use objects as part of the symbolization process, for example, a doll could be made to represent a baby” (Pellegrini & Galda, 1993, p. 163). As children represent events symbolically in their minds, their critical and abstract thinking develop. “Assigning new names to the play props as these are used in a new function helps children master the symbolic nature of words as the child first “unconsciously and spontaneously makes use of the fact that he can separate meaning from an object” (Bodrova, 2008, p. 362). Children also come to realize that there is a relationship between words and a variety of objects they signify (Bodrova, 2008).

However, children do not randomly substitute objects’ real names with new names, but do so under guidance of relevant procedure (Vialle, Lysaght, & Verenikina, 2005; Karpov, 2005). Karpov (2005, p. 135) points out that “the new name that the child is imposing on an object substitute has to be supported by the child’s knowledge of the relevant procedure. For example, the word ‘iron’ given to a ‘block’ will lead to the child’s use of the block as if it were an iron only if the child is familiar with the procedure of ironing”. This is not spontaneous; it is a gradual process which happens when a child observes an adult ironing. Therefore, modelling behaviour is key to assisting children to develop symbolic play, which also involves children in play games of counting and drawing. According to Vygotsky (1986), children’s early drawing is linked to marks made by young children as drawing remains “the earliest evolving type of symbolic representation, and continues to be a significant aspect of young children’s symbolic play” (Whitebread, 2012, p. 22). Whitebread (2012, p. 23) further states that “through drawing, children gradually increase their graphic vocabularies”. In the same vein, Karpov (2014) reasons that, when children apply different symbols in their play activities, their symbolic thought is promoted. As pre-primary children fantasize events during symbolic play, they develop concepts and abstract thinking which support literacy learning (Mielonen, 2009). Therefore, teachers should have a fantasy corner in class where children can use scrap paper and other drawing materials to make shopping lists. Though the actual words may not be structurally correct, such activities support the emergence of learner basic literacies (Barnes, 2015).

Constructive play: “Constructive play starts in infancy and becomes more complex as the child grows” (Anderson-McNamee & Bailey, 2010, p. 2). Children enjoy playing in sand, and while playing in smaller groups (which is social) outside, they prefer manipulating (physical) various objects like tins, bottles, sticks, wires and many other play related objects. They use some objects to construct houses or any structure related to the object of their play activity. Constructive play is essential as it encourages creativity, critical thinking and imagination. In pre-primary, constructive play can be encouraged by ensuring that there are materials such as wooden blocks and others which children can manipulate and use during play time (South African Department of Basic Education [DBE], 2015).

Make-believe play: Vygotsky’s approach suggests that young children imitate adult activities through make-believe play: a step toward understanding the adult world and optimizing their potential (Bodrova, 2008). During make-believe play, children master use of symbols and, later, communication with their peers with words, which is, of course, a breakthrough for learners in terms of literacy learning (Vygotsky, 1978). Vygotsky observed that through make-believe play, “one can actually watch the child of tomorrow” (Bodrova, 2008, p. 360), as children engage in fantasizing the adult world through taking up adult roles, allowing children to understand and internalize concepts through concerted practice, which is key to strengthening the foundations of literacy.

Research questions
The key research questions explored by this research were:

1. How does learning through play influence learners’ acquisition of basic literacy skills in pre-primary classrooms in Zambezi region, Namibia?
2. What type of play activities did teachers use during their literacy development lessons?
Methodology

Research design
This was a qualitative case study. The aim of approaching this study from a qualitative perspective was to understand the influence of play on the acquisition of basic literacy skills in pre-primary classrooms, and for the researcher to express his experiences in a narrative way. According to Johnson and Christensen (2012), data collected by qualitative research is qualitative data, and does not deal with numbers. In the same vein, Okeke and Van Wyk (2015) posit that:

Qualitative research is concerned with the understanding of how a particular individual or group of individuals think and the meanings they attach to their actions and in the quest to understand these meanings, qualitative researchers are encouraged to adopt ways that enable them to represent the voices or actual words of the participants in their research reports thus making the qualitative approach thick and descriptive (p. 209).

Therefore, for this study, qualitative data enabled the researcher to get a thick description of how learning through play influenced pre-primary learners’ acquisition of basic literacy skills. In other words, qualitative analysis of both interview and observation data provided the researcher with a rich description and understanding of how teachers used play to develop learners’ basic literacy skills in pre-primary classrooms, as well as the types of play activities teachers used during literacy development lessons.

Sampling
Six (6) pre-primary schools and 6 pre-primary teachers participated in this research. The 6 schools and 6 teachers were sampled using a purposive sampling technique. “Purposive sampling is a non-random sampling technique in which the researcher solicits persons with specific characteristics to participate in the study” (Johnson & Christensen, 2012, p. 215). Though purposive sampling “helps in achieving representativeness of individuals, the ability to generalize from a sample to a population on the basis of a single study is severely limited” (Nzwala, 2007, p. 38). The 6 schools were drawn from three different contexts, for example, 2 from urban, 2 from peri-urban, and 2 from rural contexts. The purpose for drawing participants from these contexts was to establish the influence of context on learner acquisition of basic literacy skills.

Data Collection
Data were collected by interviewing all 6 pre-primary teachers at the 6 schools, observing their literacy lessons, and document analysis of teachers’ lesson plans.

Data Analysis
Data generated by different data sets of teacher interview, teacher lesson observation, and teacher lesson plans were analysed (by way of cross cutting themes) thematically and in a narrative way.

Findings and discussions
The findings of this research are based on interviews, lesson observation, and teacher lesson plans data.

Teacher interview data
Data from interviews revealed that some teachers knew that play was critical in developing learners’ basic literacy skills in the pre-primary phase. This was demonstrated during interviews as shown in Dialogue Box 1 below: Note that teachers’ names are expressed as pseudonyms. For example, Urban School Teacher 1 (UST1); Urban School Teacher 2 (UST2), Peri-urban School Teacher 1 (PuST1), Peri-urban School Teacher 2 (PuST2), Rural School Teacher 1 (RST1), and Rural School Teacher 2 (RST2) respectively.

Dialogue Box 1: What is the role of play in developing pre-primary learners’ literacy skills?

| UST1: | Yes, learners they must play with toys. |
| UST2: | The pre-primary curriculum must make provision for play related activities. |
| PuST1: | The curriculum is teaching me a lot of things which I have to do with my learners like outdoor play and indoor play. |
| RST1: | The financial position of the school is stable even though we pre-primary teachers we don’t have other resources like playfield for training. |
| RST2: | They must learn how to match things. |
Although UST\textsuperscript{1}, PuST\textsuperscript{1}, and RST\textsuperscript{1} expressed the importance of play in pre-primary when interviewed, their lessons were not play based. According to research, play is critical as it is a “source of development and creates the zone of proximal development” (Bodrova & Leong, 2015, p. 37). Similarly, Vygotsky (1978) claims that play is the basis of concepts for children.

**Lesson observation data**

Lesson observation data revealed that though the above teachers acknowledged the use of play to help with pre-primary learners’ acquisition of basic literacy skills, none of them demonstrated the use of play in their language development lessons. Instead all the 6 teachers taught formally while their pre-primary learners passively listened to them. This confirmed teachers’ failure to demonstrate what they expressed during interviews, which could be attributed to their lack of the concept of ‘play’ as they were not trained as pre-primary teachers. RST\textsuperscript{1}’s mention of resources like ‘playfield’ suggests that learning through play can only be realized if there is a sports field. Instead of engaging learners in play based activities, learners were subjects of a teacher centred approach with no materials for manipulation by learners.

According to South African Department of Basic Education [DBE] (2015), play can be encouraged in pre-primary by ensuring that there are materials such as wooden blocks and others, which children can manipulate and use during play time. The study established that though all the 6 pre-primary classes which were observed had objects such as tins and blocks with which learners could play and manipulate, learners were not afforded time to play as teachers strictly observed the timetable, keeping all learners indoors, and there was no reflection of play-based activities in lessons and lesson plans. It was observed that teachers discouraged learner talk during lessons even if learners made noise in the context of lessons taught. For example: During a lesson on picture reading PuST\textsuperscript{2} said, “Muezalilata-zwelapili Ronaldo” (You are making noise-continue Ronaldo) - “Hanilati banana baba ezalilatakoo” (I don’t want learners making noise there. In her second lesson (Lesson 2) on phonics, UST\textsuperscript{2} warned learners against making noise and said, “Ni utwalilatakamulaho” (I hear some noise at the back); “Kwalamulomo” (Shut your mouth); “Ukuze” (Keep quiet). RST\textsuperscript{1} in her preparatory reading lesson (Lesson 1) demonstrated her dislike for noise in her class when she said: “Musikemwaezalilata” (Please don’t make noise).

The fact that teachers discouraged noise making in their respective classes revealed the extent of their disregard for a play-based environment; as well as their unwillingness to engage learners in active learning due to the fact that learning in pre-primary should be fun and entertaining. Teachers’ displeasure about learner talk (herein referred to as noise-making) also demonstrated their expectation of pre-primary learners to keep listening to them for the entire lesson duration despite their short concentration span. It also showed their lack of understanding that pre-primary learners develop literacy skills in a collaborative manner.

Research argues that collaborative teaching and learning in pre-primary classrooms accelerate learners’ ZPDs thereby promoting abstract reasoning among learners (Vygotsky, 1978; Bodrova, 2008) thus preventing learners from staying at lower mental functions’ stage. This implies that without critical thinking, learner ZPD will not grow to the next level, as learner cognition will be stagnant with no promotion of lower mental processes to higher mental processes. This situation dictates learners’ reliance on LMFs. According to research, “as long as humans possess the LMFs only, they remain ‘slaves to the environment’ completely dependent on the stimulation that comes from the outside and that lower mental functions are culture-free and have not changed significantly over the course of human history” (Bodrova, 1997, p. 17). LMFs are thus the basis of HMFs.

**Teachers’ lesson plans**

Teachers did not plan lessons that involved play; lessons that were collaborative and interactive, but rather planned lessons that were too formal, and teacher centred. These lesson plans ushered into situations where teachers discouraged noise making during lessons, even if learners made noise in the context of lesson topics. Such lesson plans suggested that teachers lacked expertise in the pre-primary phase and that the curriculum had a formal structure as it was drawn on the basis of Grade One.
Conclusion
Pre-primary is traditionally the first formal year of schooling, but owing to its uniqueness it can still accommodate play which is a necessary form of learning in this age group and stage of schooling. For this reason this study explored play in relation to the ZPD. The study further explored the significance of play in a pre-primary class and how it facilitates the acquisition of basic literacy skills in pre-primary phase. The study also recommended options that pre-primary teachers can adopt in order to stimulate literacy learning in a pre-primary class. For example, teachers should be trained to understand the speciality of pre-primary, and support should be given to current teachers to adopt a child-centred, play-based approach to pedagogy. Teachers should also adopt collaborative teaching and learning with play at the centre of their pre-primary classroom activities.

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