Insights into the interaction and discourse in the senior phase natural sciences classroom

Awelani V. Mudau(a)∗ Ndivhuwo P. Netshivhumbe(b)

(a) Full Professor, College of Education, Department of Science and Technology education, University of South Africa, Pretoria, South Africa.
(b) PhD student, College of Education, Department of Science and Technology education, University of South Africa, Pretoria, South Africa.

Abstract

This paper investigated interaction and discourse during teacher classroom practices in the Senior Phase Natural Sciences in some rural schools positioned in the Vhembe District of the Limpopo Province, South Africa. The research method employed was a qualitative interpretative multiple case study design. Two schools were selected, and one Natural Science teacher from each school participated in this study. Classroom observations and interviews were used to collect data from Senior phase Natural Sciences teachers. Natural sciences teachers were interviewed in their schools and observed during classroom practice. The findings of the study show that the type of discourse observed from Natural Sciences teachers was authoritative discourse and the pattern of discourse employed was Initiation Response Evaluation. Teacher questioning was used to develop the lesson and evaluate learner understanding. Teachers used an interactive-authoritative communicative approach during their lesson presentations. The consequences of the approaches the teachers use limit the opportunities for learners to interact amongst themselves and the subject content. It is recommended that besides focusing on subject matter knowledge during continuous development programs, there is a need to focus on interactions and discourse. Furthermore, there is a need to conduct further studies on a large scale so that a suitable intervention program can be designed for in-service teachers.

Introduction

South Africa’s national research and development strategies are intended to heal human capital development in the field of sciences (Department of Science and Technology, 2002). Even though the strategy was developed and published in 2002 there are still glaring challenges in its implementation for the production of human capital, in this case learners who take science-related subjects (Parmin, Saregar et al. 2020). It is therefore important that as many learners as possible who have interest in the subject take Natural Science in the further education and training phase (FET). This is crucial if they are to contribute meaningfully to the Millennium Development goals. Furthermore with the numbers of learners enrolled in science-related subjects in the FET phase decreasing, it has become more critical that learners are taught meaningfully and in an attention-grabbing manner in the senior phase (El Islami, Nuangchalerm, & Sjaifuddin, 2018). Obviously, teachers play an important role in the teaching of Natural Science.

In South Africa the government has made enormous efforts in producing qualified science teachers in rural areas such as in the Limpopo Province. However, there are still schools in rural areas that are lacking teachers who specialise in Natural Science. Obviously, such teachers experience challenges when teaching the subject (Nkanyani, 2018). This paper focused on the nature of classroom interactions and discourse of Natural Science teachers. The researchers hope that the findings of the study will assist practicing teachers in moulding their classroom practices as well as provide a foundation for in-service support programmes by researchers and stake-holders who are interested in the continuous professional development of Natural Science teachers.

© 2022 by the authors. Licensee SSBFNET, Istanbul, Turkey. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/).
In the teaching and learning of Natural Science, knowledge and understanding of the subject matter is very important (El Islami, 2018). McDermott (2006) indicates that Natural Science teachers must have knowledge and full understanding on the subject topics they teach so that they can lay a good foundation of science to the learners to study science at higher level and pursue it as a career. However, it needs to be noted that even if teachers have the best subject matter knowledge, the ultimate goal is what they do in the classroom when they facilitate teaching and learning. How they teach usually determines how learners learn. If they choose inappropriate instructional strategies the aim of assisting learners in acquiring knowledge in the subject meaningfully is compromised. It follows then that the focus should not only be on producing teachers who are highly competent in the subject matter knowledge but also who are able to choose appropriate instructional strategies and discourse in the classroom when facilitating meaningful learning (Naqiyah, Rosana, Sukardiyono, & Ernasari., 2019). The following question guided the study: what is the nature of the classroom practices of senior phase Natural Science teachers with a focus on interaction and discourse?

This paper is structured as follows: first part is introduction which describe the problem of the study; second part discussed reviewed literature in order to gain an understanding on the theories of the research including the discussions of the findings of other researchers that had an interest on the topic under exploration. Additionally, conceptual framework which guide this study presented in the literature review part. Third part discussed research and methodology. Fourth part presented results and discussion. Firth part presented conclusion. In addition, recommendations and limitation of the study presented within the conclusion part followed by acknowledgement.

Literature Review

Classroom Interaction and Discourse

Foy (2013) defined classroom discourse as the language which students and teachers use to communicate in the classroom. Markee (2015) reported that a classroom discourse is usually associated with analysing the language and interaction of teaching and learning. Therefore, classroom discourse is commonly associated with the way in which the teacher communicates with the learners and cause teacher-learner interaction to happen in the classroom. It unpacks how everyday language use shapes practices, processes and content demands of the curriculum (Green and Rex, 2018). On the other hand, researchers use classroom interactions to investigate which behaviours and teaching and learning strategies can be correlated with the learner learning indices (Green and Rex, 2018). Rezaie and Lashkarian (2015) reported classroom discourse being mostly comprises of explanations, instructions, descriptions, and arguments. Teaching and learning of science on its own involves introducing learners to the social language of school science (Chin, 2006). Chin (2006) further states that teachers use scientific ideas available in the classroom to assist learners in making sense of and internalising those ideas, and support learners in the application thereof. By doing this the teacher can draw upon the prior knowledge of learners and everyday views of the topic, convince learners of the scientific views, and monitor and respond to learners’ understandings (Mortimer & Scott, 2003).

Moreover, according to Chin (2006), in a science classroom teaching and learning is based on teacher talk and teacher-learners talk. The talk between a teacher and learners in a classroom is vital as it can improve understanding and achievement (Mercer and Howe, 2012). Furthermore, the structure, quality and flow of discourse can affect what learners learn as well as how well they learn in the classroom (Chung, Yoo,Kim, Lee, and zeidler, 2016). This is because learners consider their teacher as a more capable peer with whom meaning is constructed through shared discourse (Rezaie and Lashkarian, 2015). Therefore, interaction and discourse are key factors that have a significant impact on the teaching and learning of science. Bosser and Lindahl (2021) indicates that a teacher uses language to orient or guide the students’ conceptual activity in a desired direction to achieve the desired outcomes.

A Natural Science classroom involves doing for learners to have knowledge and understand the ideas of science. From a learning point of view, process skills are an important and necessary means by which the learner engages with the world and gains intellectual control of it through the formation of concepts (Department of Education, 2002c). Therefore, through classroom talks a teacher can guide learners into scientific discourse where learners can use their thinking skills to be able to talk and write using the required scientific language. According to Tang (2017), interactions and discourse in the science classroom between the teacher and students results in the production of development of knowledge and thematic content of science education.

Theoretical and Conceptual Background

The Classroom Practice Diagnostic Framework (CPDF) was used as the theoretical framework for this study. The CPDF mainly focus on how interaction and discourse is constructed from teacher knowledge and instructional strategies in the classroom. Vygotsky (1978) suggests that theoretical knowledge first appears between people on an inter-psycho-somatic plane and thereafter inside the learner on an intra-psycho-somatic plane. Therefore, classroom practice diagnostic framework (Figure 1) has been utilised to assist with the information of knowing and understanding interaction and discourses in Natural Science classroom.
As seen in Figure 1 above, the teacher knowledge frame is the most vital zone for understanding the teachers’ practice. In this study, teachers’ knowledge involves content, context, and learners’ understanding. This knowledge influences every action in the teaching environment. An instructional strategy frame is the outcome of teachers’ knowledge. Teachers use their knowledge when determining the instructional strategies to be used. Therefore, teachers’ knowledge influences the way in which the teacher teaches. Teaching strategies include epistemological perspective, teaching methods, activities, and explanatory framework. The instructional strategies that the teacher decides on will then lead to the interaction and discourse frame.

The interaction and discourse frame emphasises the types of discourse, pattern of discourse, teacher questioning and communicative approach. Therefore, it is vital for teachers to re-examine the ways in which they use discourse in the classroom. It is not uncommon for a science classroom to consist primarily of teacher talk and not enough learner interaction. For example, if a teacher speaks 90% of the time in a classroom and is using complex scientific terms that learners are not aware of, some of the learners can develop a view that science is like a foreign language. This kind of situation will not only limit learner participation but also complicate the meanings of scientific vocabulary. Therefore, frame A and frame B result and shape the interaction and discourse frame. Furthermore, there is a relationship amongst all the frames, with such relation displayed by small letters a, b, c, d, e, f, as shown in Figure 1. Natural Science teaching should be learner-centred for learners to develop knowledge and skills such as demonstrating, investigating, and interpreting data as well as communication skills. The two types of discourse, namely authoritative and dialogic discourse, are illustrated in Figure 2.

**Figure 1: Classroom practice diagnostic framework (CPDF); Source: Mudau, 2013.**

**Figure 2: Discourse in science classroom**

Tytler and Aranda (2015) indicates that classroom discourse can be analysed in terms of its authoritative and dialogic functions. In authoritative discourse a teacher directs discussions or conveys information and the utterances are often made up of instructional questions and factual statements to promote learning (Demiral and Kartal, 2017). On the other hand, in dialogic discourse the teacher encourages debates and challenges (Chin, 2006). This type of discourse gives learners an opportunity to be actively involved and participate collaboratively by means of talking about their ideas based on the lesson topic in the classroom. Moreover Alexander (2008) stated that dialogic discourse requires teachers to be aware of the function of talking in education and how it guides and supports children’s knowledge acquisition.

In a teaching environment, classroom talks mostly arise with a teacher questioning the learners (Boyd, 2015). Rezaie and Lashkarian (2015) indicates that teacher questioning is a key component of classroom discourse and they have potential in mediating the construction of knowledge in learners. Some studies on teacher questioning focus on the recitation or initiation, response, evaluation (IRE) pattern of discourse (Mehan, 1979) and the importance of wait time in increasing students’ thoughtfulness (Rowe, 1986). Teacher questioning is used in the classroom in the form of Initiation Response Evaluation (IRE) which is a pattern of discourse
In initiation a teacher asks learners a question; in response, a learner or group of learners respond to the question asked; in evaluation, a teacher evaluates the learners’ response (Rezaie and Lashkarian, 2015). This means that during lesson presentation the teacher must initiate dialogue by means of questioning learners and learners must answer, thereafter said teacher shall provide feedback based on learners’ responses.

In the classroom communicative approach focuses on how a teacher works together with learners to address the ideas of a lesson. Scott & Ametller (2007) indicated that a communicative approach is defined by characterising the talk between teacher and pupils along each of two dimensions interactive-non-interactive and dialogic-authoritative. Moreover, Chin (2006) advocates that the dialogic approach invites different views whereas the authoritative approach focuses on the school science point of view. In an interactive approach, participation of other people is considered while in a non-interactive approach they are excluded (Chin, 2006). Chin (2006) advocates communicative approach, which focuses on whether the teacher considers students’ ideas, how the teacher interacts with students. In addition, Chin (2006) discusses various communicative approaches as follows:

i. In an interactive/authoritative approach the teacher invites responses from learners but discounts their ideas since the focus is on a specific scientific idea. This means that the teacher leads learners with questions, and they give responses, but the teacher will only focus on correct answers.

ii. In an interactive/dialogic approach students’ views are considered even though they may be alternative to the accepted scientific meaning.

iii. A non-interactive/authoritative approach is best represented by the formal lecture, where ideas are presented in a monologue.

iv. In a non-interactive/dialogic approach, the teacher does not invite other points of view from the students but makes statements that also address other points of view in addition to the formal ones.

Mudau (2013) used CPDF to diagnose teaching difficulties of projectile motion on teacher classroom practices. However, for the purposes of this study, the focus was only on the interactions and discourse between teachers and learners.

Research and Methodology

Research design

The research methodology employed in the study was interpretative qualitative case study. The researcher employed qualitative case study approach to seek and develop a full understanding on classroom interactions and discourse from those involved in the teaching and learning of Natural Science. The study was conducted at schools of Vhuronga 2 circuit under Vuwani cluster in the Vhembe District. Qualitative case study approach was imperative for this study as it enable a researcher to examine interaction and discourse in Natural Science classroom.

Participants

For this study determination, a purposeful sampling of two senior phase Natural Science teachers in each of the two selected schools from Vhuronga 2, Vuwani cluster participated in the study. The name of participants used in this paper are pseudonyms and this was done to protect the identity of the participants. Then two teachers from each school became the cases of the study. Both teachers had a minimum of more than five years of teaching experience in Natural sciences. The rationale for this was to minimize the lack of pedagogical content knowledge as well as content related matters.

Data Collection Tools

Interviews and observations were used to collect data from teachers. Two teachers (Cases) were interviewed and observed. Furthermore, audio recording was used during interviews and video recording was used during lesson observation and assisted a researcher when analysing data.

Data Analysis

The data obtained from two cases were analysed and interpreted separately. Video recorded lessons and audio-taped interviews were transcribed verbatim from the recording devices to a word document. Furthermore, after transcribing data from recording devices to word document, the researcher replayed the video to check if the words transcribed corresponded with what was on the video. The same process was done for the audio-taped to verify the interview information, and to check if the event did answer the research questions. Hence, the data that the researcher transcribed was presented to relevant participants before being considered as final product. The data collected were presented in the form of case studies i.e. case 1 and case 2. The names of the participants that the researcher presented in the study were pseudonyms and that was done to protect participants’ identity. Interaction and discourse was utilised to analyse data collected for the study. The first row in the table contains the proposed theme that was used to guide and organise the data of the study and the themes’ categories and characteristics make up the next two rows. The data related to theme interaction and discourse obtained from two cases during interview and observation was included in the table of each case. The interpretation of data for the study focused on classroom interaction and discourse for the purpose of clarity into interaction and discourse from teacher practices.
Results and Discussions

Results

The results of this study were obtained from the classroom practices of the two cases (Ms J and Mr C). The data presented in this section only focuses on categories and characteristics of the theme of classroom interaction and discourse which was investigated to gain insight and clarity on the interaction and discourse used in a senior phase Natural Science classroom. Moreover, focus was on the types and patterns of discourse, teacher questioning as well as communicative approach employed during Natural Science classroom practices in regard to the two cases.

Classroom interactions and discourse identified from Ms J classroom practice

Authoritative discourse and initiation response evaluation pattern of discourse. Ms J pose questions at the beginning of the lesson and by so doing she draw learners close to her as they participated by giving answers to the questions asked. Furthermore, the type of discourse and pattern of discourse was shaped by means of instructing learners to look at the keywords from their Natural science textbook and read the meaning of the keywords and that grasp learners total participation during the lesson. Examples of few questions that Ms J asked, and responses learners gave in support of the interaction and discourse diagnosed during the lesson are as follows:

i. Ms J: What is a mixture? I know that you have done this in grade 6 (initiation, prior knowledge)
ii. Learner: Is objects that are mixed together (response)
iii. Ms J: can you give me the examples, what is it that you can mix together? (instructional question, evaluation)
iv. Learner: sugar and water (response)
v. Ms J: when you mix sugar and water, when they are together, we say they are a mixture (response, authoritative)
vi. Ms J: when we say two or more substance is put together, we find these substances are put together in a physical way, the way that you can see. You see someone taking an instrument and the books putting inside the school bag that is a mixture. said in the class we have a mixture, there are boys and girls (conveys information, Authoritative)
vii. Ms J: we can classify the materials of substances that we want to put together to form a mixture. Some substances are pure, if something is pure it means that it is not mix with anything it is alone. The examples of pure substances yes that one, what is that? (initiation, convey information, instructional question)
viii. Learner: water (response)
ix. Ms J: water itself it is pure (response, authoritative)

Teacher questioning. Ms J used questioning technique to engage learners in the learning process and by so doing dialogue was initiated as learners gave their responses and evaluated thereafter. Ms J asked straight forward questions and learners were actively involved as they were able to give the answers to the questions. However, the questions did not require much of learners to exercise their cognitive skills among themselves. Examples of questions that the teacher asked in order to engage and evaluate learners in the lesson topic are as follows:

i. Ms J: what is a mixture? (develop lesson, instructional question)
ii. Ms J: what is it that you can mix together (instructional question, evaluation)
iii. Ms J: can you give me the example of a substance that is made of one particle? (develop lesson, instructional question)
iv. Ms J: I have water here can’t you see that this water is pure? (improve learning, demonstrate, motivate)
v. Ms J: Substances that you used to make tea, what are they? (initiation, instructional question)
vi. Ms J: what is to separate class? (initiation, develop lesson, instructional question)
vii. Ms J: what are the methods of separations? (initiation, instructional)

Communicative approach. This approach is crucial in the teaching and learning process as it enables one to know how both teacher and learners work together to address the ideas of the lesson topic. Moreover, in this approach unity in the learning process between teacher and learners can be easily evaluated. During Ms J classroom practice interactive/authoritative approach was identified as she leads learners with questions and learners gave answers, but she only focuses on the right answers’ learners gave. Few examples that reveal that Ms J employed interactive/authoritative approach during the lesson are as follows:

i. Ms J: my mother has boys and girls we were using one rondavel being 5 at home, we were using the same rondavel being 5 children at home then my father build a 12 rooms house then my mother try to separate us, how can she do that? (initiation, convey information, interactive/authoritative)
ii. Learner: my mother will take three boys to their room and 2 girls and share their room (response)
iii. Ms J: very good that is separation, other ways that the mother can separate the children don’t forget we are five at home (interactive/authoritative)
iv. Learner: each one of us get his or her own room (response)
v. Ms J: each one of us gets his or her own room, and that is separation (response, interactive/authoritative)
vi. Ms J: (she moves towards the learners so that they can see the chalks inside the plate) what are the methods of separations? I am having different colours chalks here, which colours are these? (initiation, interactive/authoritative)
vii. Learners: blue, pink, green, orange and white (responses)
viii. Ms J: I want the two here, may you please separate these mixture (Ms J left the plate with chalks on the desk for the two learners seated on that particular desk to do the separation and the class looked at what they were doing. (Interactive/authoritative)
ix. Ms J: what are they using to separate the mixture? (instructional question, interactive/authoritative) Learners: hands (response)
x. Ms J: then that method we call it hand sorting (response, interactive/authoritative)

Classroom interactions and discourse identified from Mr C classroom practice

Authoritative discourse and initiation response evaluation pattern of discourse. Mr C gets learners’ attention by means of starting his teaching by asking question that the learners were expected to give an answer to it. Furthermore, the type of discourse and pattern of discourse was shaped by means of conveying information and initiating straight forward questions that doesn’t require much of learners thinking skills but required their prior knowledge. Examples of questions that Mr C initiated and answers from learners’ in support of the interaction and discourse diagnosed during the lesson are as follows:

i. Mr C: What is matter? (initiation)
ii. Learner 1: Model that helps us understand that matter is made from particles and how they affect the behaviour of matter (Misconception, response)
iii. Learner 2: Matter is that occupies space and has mass (response)
iv. Mr C: Matter is anything that occupies space and has mass (response, authoritative)
v. Mr C: We have three states of matter, mention three state of matter (initiation, instructional question)
vi. Learner 1: Solid (response)
vii. Learner 2: Liquid (response)
viii. Learner 3: Gas (response)
ix. Mr C: Name of water in the solid state (instructional question)

Teacher questioning. Mr C questioning gave learners opportunity to engage themselves in lesson as many learners were able to raise their hands to give responses. Mr C teaching mostly focuses on questioning technique. However, Mr C questioning was employed in a form of initiation (teacher), response (learner), evaluation (teacher). However, the questions did not require much of learners reasoning skills among themselves. Examples of questions that Mr C initiated in order to engage and evaluate learners during the lesson are as follows:

i. Mr C: What is matter? (Develop lesson)
ii. Mr C: Mention three state of matter (instructional question)
iii. Mr C: Name of water in the solid, liquid and gaseous state (evaluation)
iv. Mr C: What happen when we heat ice? (initiation, develop lesson)
v. Mr C: When we heat water it turns to….. (evaluation)
vi. Mr C: The process when we cool water vapour to form water is called what? (develop lesson, instructional question)

Communicative approach. During Mr C classroom practice interactive/authoritative approach was employed because only Mr C initiated questions and learners only gave answers, but the teacher only focus on the correct answers. The following are examples that indicate that Mr C use interactive/authoritative approach during the lesson:

i. Mr C: The arrangement of particles solid or ice are arranged in specific pattern. Liquid are loosely arranged and are not in a fixed shape. Gas or steam they are not arranged in a specific pattern (initiation, convey information, non-interactive/authoritative)
ii. Mr C: Movement of particles, under ice they vibrate in a fixed position drink. Water they move more freely than in solid and slide pass each other. steam move randomly in all the direction and fill the whole container (convey information, non-interactive/authoritative)
iii. Mr C: The space between the particles of ice, water and steam. The space between the particles of ice they are very small. The space between water is large. The space between steam they are very large (initiation, convey information, non-interactive/authoritative)
iv. Mr C: What happen when we heat ice? (instructional question, interactive/authoritative)
v. Learners: It will melt (response)
vi. Mr C: It will melt this process is called melting (response, interactive/authoritative)
vii. Mr C: When we heat water it turns to? (interactive/authoritative).
viii. Learner: Water vapour (response)
ix. Mr C: The process when water turn to vapour (interactive/authoritative)
x. Learner: Evaporation (response)
xi. Mr C: We have a reverse reaction, when we cool water vapour it forms water, and when we cool water it forms ice. The process when we cool water vapour to form water is called what? (initiation, convey information, interactive/authoritative)
xii. Learner: Condensation (response)
xiii. Mr C: When we cool water to form ice process is called (interactive/authoritative)
xiv. Learner: Freezing (response)
xv. Mr C: When ice turns to gas which is vapour it is called what? (interactive/authoritative)
xvi. Learner: Melting (response)
xvii. Mr C: When ice turns to gas which is vapour it is called what? (interactive/authoritative)
xviii. Learners: No reply (difficult)
ix. Teacher: Sublimation (response, authoritative)

Discussion

Case one (Ms J)

Ms J began her lesson by asking questions based on learner’s prior knowledge and learners responded. Questioning technique was used to check learners understanding on concepts learnt from previous grade and that encouraged learners to participate in the lesson. Ms J employed authoritative type of discourse because she mostly conveys information to the learners by means of explanations and questioning. Consequently, learners were not given an opportunity to add to the lesson ideas or at least form groups in order to discuss the lesson ideas and present their thoughts. According to Chin (2006) dialogic discourse encourages debates and challenges. Ms J did not make use of dialogic discourse because she did a lot of questioning and explanation in the classroom while not considering that learners might have their own ideas, they might wish to share with the class concerning the content being taught. It could have been a good opportunity for learners to exercise their communicative and thinking skills by debating amongst themselves.

The pattern of discourse used was initiation, response, and evaluation (IRE). Ms J’s classroom practice did not encourage much cognitive activity among the learners. Ms J gave instructions and asked instructional questions to check for learners’ understanding and the learners gave responses. This type of discourse was appropriate for checking learners’ understanding of the content taught. According to Mortimer & Scott (2003), Interaction and discourse in the science classroom between the teacher and students is fundamental to learning because it is central to the meaning making process. This discourse is favoured since it enables the teacher to evaluate the learners in order to check learner understanding and know where the learners still need to be assisted in terms of understanding the content (Saefuddin et al., 2019). However, Ms J did use IRE to convey information together with sequencing ideas.

Communication is part of the Natural Science classroom since it is used to build a relationship among learners, between learners and teachers, as well as between learners and their environment. However, Ms J’s practice did not facilitate much of the use of communicative and thinking skills by students. The communicative approach that Ms J used was interactive-authoritative. According to Chin (2006), in an interactive-authoritative communicative approach the teacher invites responses but discounts them if they are incorrect as the teacher focuses only on correct answers. Ms J sometimes used demonstration when explaining lesson ideas to the learners. Besides the textbook she was provided at school she also prepared other teaching aids to assist her during the lesson. Ms J was aware of other resources that she could use that could be helpful to the learners in learning the concept she was teaching. However, the interaction was mostly from the teachers’ side to learners. The teacher did a lot of questioning and demonstration of lesson ideas. Learners responded to questions and they were given a chance to demonstrate other ideas of the lesson but it was limited. Moreover, learners did not raise questions and there was no discussion between the teacher and learners as well as between the learners themselves. What Ms J said in the lesson was considered as final even though learners were invited to give responses.

According to Chin (2006), in the interactive-dialogic approach students’ views should be taken into account even though they may be alternative to the accepted scientific meaning. In this case the time for learners to interact among themselves was limited. Ms J should have given learners the chance to interact among themselves by means of posing questions or giving learners an idea based on the content. Furthermore, learners should be given the opportunity to discuss among them, and for Ms J to act as a facilitator/mentor so that they can be able to develop process skills like communicating or raising questions. From a learning point of view, process skills are an important and necessary means by which the learner engages with the world around them and gains intellectual control of it through the formation of concepts (DoE, 2002c). Such skills may be used in everyday life, in the community.
and in the workplace. According to grade 7-9 NS CAPS (DBE, 2011c), cognitive and process skills that the learners develop and gain during Natural Science lessons include accessing and recalling information, observing, sorting and classifying.

Case two (Mr C)

In the case of Mr C i.e. Case 2, the lesson started with topic introduction and thereafter Mr C asked learners’ questions which required learners’ prior knowledge. It was noted at the beginning of the lesson that Mr C asked learners to define matter and also requested learners to mention three states of matter. Mr C used questioning technique to check if the learners still remember what they had learnt in previous classes concerning the particular concept. According to Chin (2006), in a science classroom the acquisition of knowledge by learners is based on teacher talk and teacher-learners talk. Mr C employed an authoritative discourse because he mostly conveyed information to the learners by means of the lecture method and most of lesson ideas were written on the board. Consequently, the learners accepted the information the teacher provided for them by copying notes. The learners were not given an opportunity to form groups to discuss the ideas of the lesson among themselves and as such Mr C did not make use of dialogic discourse.

Mr C makes use of the questioning technique at the beginning of the lesson in the form of Initiation Response Evaluation, which is a pattern of discourse suggested by Mehan (1979). Molinari, Mameli, & Gnisci (2013) state that IRE can be used to convey information together with initiating sequences, encouraging a variety of explanations or motivating learners’ cognitive skills. Mr C used IRE in the transmission of information about the ideas of the lesson. Mr C explained ideas of the lesson and asked instructional questions whereby learners responded and were evaluated. This type of discourse was appropriate for Mr C to assess learners’ understanding of the content taught. The chosen discourse enabled Mr C to know where the learners still need to be assisted on their understanding of the content.

The communicative approach that Mr C used was interactive-authoritative. Mr C did not give the learners time to discuss the concepts taught in order for them to be able to exercise their reasoning skills. In addition, the students should at least have an opportunity to raise questions as well as discuss the ideas of the lesson among themselves. In this case the teacher raised questions and explained the ideas of the lesson whereas learners only responded to the questions, and learners always did what the teacher expected from them. Thus, interaction was mostly from the teacher to the learners and not among the learners themselves. Additionally, What Mr C said in the lesson was considered as final even though learners were invited to give responses.

Mr C used textbook during classroom practice and did not prepare any other teaching aids to assist him during the lesson. Mr C was therefore not able to do experiments or demonstrate some of the ideas of the lesson e.g. heating ice for learners to see it change to liquid form. According to Saeufudin et al., (2019), for effective science teaching textbooks, revision books, laboratory chemicals and equipment must be readily available. Mr C’s lesson presentation did not enable learners to develop process skills like doing investigation, observation, communication or raising questions as time was limited for learners to interact among themselves and the content. Mr C did not develop and improve learners’ skills such as demonstrating, investigating and interpreting data because of limited resources, e.g. the lack of laboratory equipment. The cognitive and process skills of the learners were not developed.

Conclusions

The purpose of this study was to examine interaction and discourse in the teaching and learning of senior phase natural science. Even though this is not a comparative study, one can infer from the findings and discussions herein that the teachers under study for this paper mainly use authoritative discourse. They focus mostly on conveying information to the learners as opposed to discussion. They create limited opportunities for learners to interact among themselves and the subject matter. Therefore, the learners’ opportunity to discuss or share their own ideas related to the topic is insufficient. The teachers use IRE as pattern of discourse. This pattern of discourse is seen as a successful pattern to use as the teachers can evaluate the learners by means of questioning and class activities. As far as learners’ success it concerned, the teachers assist learners to attain their full potential by involving them in class activities. The teachers mainly focus on teaching by means of questioning, explaining lesson ideas and giving learners’ activities, and as such findings in an interactive-authoritative approach. As learners’ understanding is one of the teachers’ main concerns, Ms J provides some teaching aids in order to demonstrate other aspects of the lesson. Ms J interacts with her learners and learners also interact with the material provided. Though Ms J did most of demonstrations, she also gave learners the opportunity to demonstrate the ideas of the lesson. Ms J’s demonstration teaching method makes a huge difference to the learners as they are exposed to ideas of science in a tangible manner. This findings in increasing learners’ interest and participation in the lesson.

Mr C depended on the textbooks provided by the school and did not improvise any other teaching aids to assist learners to learn science through doing. This resulted in Mr C failing to develop and improve skills like experimenting and observing in the learners. The fact that the school does not have a laboratory or other teaching aids required in the teaching of Natural Science does not mean the activities need to be omitted. As a teachers’ priority is to see that all learners learn and understand the subject concerned, they must find a way to assist them to have the required knowledge. Additionally, the teacher can improvise related materials for particular concepts and practice several methods for Natural Science teaching. Because of the lack of additional teaching aids, the chance for learners to exercise their communicative and reasoning skills was limited.
The teachers need to be assisted on the proper interaction and discourse methods to be used so that all learners can benefit from the lesson. As far as interaction and discourse is concerned, teachers should vary their instruction in order to cater to all learners in their classroom and to provide learners with greater opportunities to learn the ideas of science without the difficulties they encounter as they differ in terms of strength and weaknesses. The findings of the study provide evidence that there are areas in teacher classroom practices that need to be developed and improved such as interactions and discourse if they are to achieve meaningful learning and increase the number of learners taking science subjects in the FET phase. This study should also raise concerns to subject advisors that more workshops need to be conducted, specifically those that focus on classroom practices. It should be noted that this is a small scale study, the findings of which can be related to other teachers, however it is suggested that a larger scale study be undertaken that should give a comprehensive understanding of the nature of the classroom practices of Natural Science teachers with a specific focus on interactions and discourse.

As limitation of this paper, only two schools and two senior phase Natural Sciences teachers of vhuronga 2 circuit in the Vhembe District of Limpopo Province were involved. The findings of this study can therefore not be generalised to other schools’ teachers in the district. However, through the rich description provided during analysis of data the finding may be applicable to other districts with similar contexts.

Acknowledgements

We would like to acknowledge the teachers from the Vhembe District who participated in this study.

All authors have read and agreed to the published version of the manuscript.

Author Contributions: Conceptualization, A.V.M. and N.P.N; methodology, N.P.N. validation, A.V.M; formal analysis, A.V.M. and N.P.N.; investigation, N.P.N.; resources, A.V.M.; writing—original draft preparation, N.P.N.; writing—review and editing, A.V.M and N.P.N.

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

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

Conflicts of Interest: The authors declare no conflict of interest.

References


466


**Publisher’s Note:** SSBFNET stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

© 2022 by the authors. Licensee SSBFNET, Istanbul, Turkey. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (http://creativecommons.org/licenses/by/4.0/). International Journal of Research in Business and Social Science (2147-4478) by SSBFNET is licensed under a Creative Commons Attribution 4.0 International License.