IN SEARCH OF A WORKING STRATEGY: THE *AHA*… MOMENT OF LIFE AND PHYSICAL SCIENCES TEACHERS OF TWO BEST PERFORMING HIGH SCHOOLS IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

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ABSTRACT

The purpose of this study is to examine a 'working' strategy established to improve and sustain learner performance by two Life Sciences and two Physical Sciences teachers of two best performing high schools in the North West province of South Africa. The schools in this study have been producing a pass rate of over 90% for a number of consecutive years in Physical and Life Sciences. Ausubel's (1963) constructs of Meaningful Reception Learning theory provided the conceptual framework for this study. The study was purely qualitative, thus employed an exploratory case study approach. In this case study, four teachers were identified from two best performing schools. Purposive sampling was adopted to identify participants and research sites for the study. Data was generated through interviews, classroom observations and document analysis. Data gathered were thematically analysed using open coding, axial coding and selective coding. Results of the study demonstrate that the *aha! moment* for the teachers came through trial and error. The efforts that these four teachers put in establishing a 'working' strategy of teaching might work in improving and sustaining learner performance in Life and Physical Sciences. Recommendations for policy and further research are suggested.

Keywords: National Strategy for Learner Attainment (NSLA) framework, role play, Meaningful Reception Learning theory.

1. Introduction

Physical Sciences as a school subject in South Africa is characterised by poor performance amongst high school learners (Mavhungu, 2016). Outdated instructional teaching practices and lack of basic content knowledge amongst the teachers have resulted in poor teaching standards in the South African education system (Makgato & Mji, 2006). However, this is not the case in every public school. Mavhungu (2004), shows that generally the failure rate in Physical Sciences in most South African schools varies from region to region. The same can be said about Life Sciences. There has been a consistently poor record of performance in Life Sciences as a school subject in the past (Ferreira, 2011), with some miniscule improvement reported in some schools lately. The impediments to success and reasons for the poor performance are complex and only vaguely understood. According to Kriek and Grayson (2009), some of the reasons include poverty, lack of resources, entrenched learning cultures, poor infrastructure of schools and low teacher qualifications as well as insensitive regional distribution of Mathematics and Science teachers. Ramnarain (2013) indirectly puts the blame on teachers who lack specialist content knowledge and are reluctant to implement successful teaching strategies in their classrooms. This paper reports on the aha! moment (a point in time when the teachers had sudden insight into a 'working' teaching and learning strategy amongst other strategies), to improve and sustain learner performance in the two subjects perceived difficult by learners who perform below average in a majority of schools in the North West province.

1.1 Background to the study

In order to fully understand the background in which this study was undertaken, it is necessary to describe the context in which this research took place. The Physical Sciences and Life Sciences results of 2012-2016 Grade 12 final examinations are phlegmatic and depressing. A close look at the Physical Sciences results paints a gloomy picture. Table 1 shows the Physical results since 2013 for the North West province.

Table 1: Physical Sciences results since 2013 for the North West province

		Physical Sciences	
Year		No. of candidates	% of candidates
Nov. 2014	Wrote	8 191	
	Pass at 30%	5 243	64.01%
	Pass at 40%	3 012	36.77%
Difference Nov. 2013 & Nov. 2014	Wrote	-787	
	Pass at 30%	-1 443	-10.46%
	Pass at 40%	-1 170	-9.81%
Nov. 2015	Wrote	9 090	
	Pass at 30%	5 639	62.04%
	Pass at 40%	3 265	35.92%
Difference Nov. 2014 & Nov. 2015	Wrote	+898	
	Pass at 30%	+396	-1.97%
	Pass at 40%	+253	-0.58%
Nov. 2016	Wrote	8 593	
	Pass at 30%	5 984	69.64%
	Pass at 40%	3 699	43.05%
Difference Nov. 2015 & Nov. 2016	Wrote	-497	
	Pass at 30%	+345	+7.60%
	Pass at 40%	+434	+7.16%

From Table 1, the quantity passes is determined by the number of candidates who made the 30%+ pass percentage and the quality passes are determined by the candidates who achieved 40%+ pass percentage. As can be seen from Table 1, in 2016, in Physical Sciences 497 less candidates wrote the subject examination. According to Lehari (2017), the Physical Sciences showed an excellent performance as 345 (7.60%) **more** candidates managed to reach the 30% pass criteria and 434 (7.13%) **more** candidates managed to achieve at 40%. From a political standpoint, this trend suggests an excellent improvement focusing on the 2016 class, but from an academic viewpoint, the quality of passes raises serious concerns. Life Sciences generally has a similar profile despite the figures being modest.

This paper reports on how role playing was identified as the 'working' teaching and learning strategy when it was deployed by four teachers of two best performing schools in the two subjects perceived difficult by learners who perform averagely in the North West province.

1.2 Role-playing as a teaching strategy

Role-play is a pedagogical practice that been used in a wide variety of contexts and content areas (Rao & Stupans, 2012). Derived from psychodrama, Craciun (2010) explains that role playing may be used to help learners understand the more subtle aspects of literature, social studies, and even some aspects of science or mathematics. Role playing is a basic engagement and should not be considered just as fun but as part of the learning process (de Medeiros-Silva, de Oliveira & de Oliveira, 2017). Westrup and Planander (2013:7) summarize the benefits: "to get students to apply their knowledge to solve a given problem, to reflect on issues and the views of others, to illustrate the relevance of theoretical ideas by placing them in a real-world context, and to illustrate the complexity of decision-making." Besides acting as an active teaching strategy that promotes skill-based learning, Knowles, Holton, & Swanson (2012) showed that role-playing as experiential learning offers the greatest degree of flexibility, creativity, and direct hands-on opportunity in the learning environment. Beyond learning the mere facts of the subject, role-play helps learners to be prepared in dealing with the challenges of the twenty-first century.

Although it is not a new strategy, role playing has found a place in only a few classrooms in which planning is a priority for the teacher (Rao & Stupans, 2012). Slowly, role-playing teaching as a holistic teaching method that inculcates the process of critical thinking, instigates emotions and moral values, and informs about factual data has found its way into the teaching of science subjects (de Medeiros-Silva et al., 2017). Khiri and Mohammadi (2016) found role playing as a method of problem-based learning which increases decision-making, interpretation of situation and critical thinking. Bhattacharjee (2014) sums it all by saying; role-playing increases the efficacy of the learning experience, increases reliability of learners, thus enabling learners to think freely and deeply and makes it more grounded in reality. The purpose of this study is to examine a 'working' strategy established by the Life and Physical Sciences teachers of two best performing high schools in the North West province of South Africa.

2. Research Questions

The central research question is: how was role-playing identified as the "working" teaching and learning strategy amongst other strategies, to improve and sustain learner performance? The focus of this question is delimited to four teachers of the best performing schools in the two subjects perceived difficult by learners. These learners perform average to low in majority of schools in the North West province. Two sub-questions which the study focuses on are: (i) what is the relevance of role-play in practice? (ii) How does role-play in practice relate to teachers' pedagogic practices?

3. Conceptual Framework

Ausubel's (1963) constructs of Meaningful Reception Learning theory provided the conceptual framework for this study. For this study, meaningful learning refers to instances when learners actively process the information they are asked to learn. Reception learning essentially means that learners receive information, think about it, make deductions and then apply this information. Within a classroom setting, this cognitivist theory brings a holistic and collaborative learning and teaching approach. According to Haas & Parkay (1993:144), information is said to be meaningful if it can be related in some way to the learners' present, past or future experiences. Ausubel contends that learning occurs because of the relatedness of what learners know and what they learn. In other words, learning proceeds in a deductive manner. For this study, Ausubel's learning model was coupled with role-play as a learner-centred pedagogy. Ausubel's theory consists of three phases and the main elements of Ausubel's teaching method are shown in Table 2.

Table 2: Ausubel's Model of Meaningful Learning

Phase One Advance Organiser	Phase Two Presentation of Learning task or Material	Phase Three Strengthening Cognitive Organisation
Clarify aim of the Lesson	Make the organisation of the new material explicit	Relate new information to advance organiser
Present the lesson	Make logical order of learning material explicit	Promote active reception learning
Relate organiser to students' prior Knowledge	Present material in terms of basic similarities and differences by using examples and engage students in meaningful learning activities	

Ausubel advocates the use of advance organisers to help link new learning material with existing related ideas. An advance organiser is information presented by an instructor (in this case a teacher) that helps the learner organise new incoming information (Mayer, 2003). This is achieved by directing attention to what is important in the coming material, highlighting relationships and providing a reminder about relevant prior knowledge (Woolfolk, Winne, Perry & Shapka, 2010). Advance organisers make it easier to learn new material of a complex and difficult nature, provided the learner processes and understands the information presented in the organiser (Kumagai, 2013; Woolfolk et al., 2010), as this increases the effectiveness of the organiser itself. Furthermore, the organiser must indicate the relations among the basic concepts and terms that shall be used. Ausubel distinguishes between two kinds of advance organisers - *comparative* and *expository*. Comparative organisers act as reminders to bring into the working memory of what one may not realise as relevant. In contrast, "expository organisers provide new knowledge that students will need to understand the upcoming information" (Woolfolk et al., 2010, p. 289). Essentially, expository organisers furnish an anchor in terms of that already familiar to the learner. As mentioned earlier, coupled with role play, as the practice of having learners take on specific roles - usually roles they are not familiar with - and act them out in a case-based scenario for the purposes of learning course content and understanding "complex or ambiguous concepts" (Sogunro, 2004: 367.

4. Methodology

The study was purely qualitative, thus employed exploratory case study approach. An exploratory case study was adopted, which according to Basit (2010), supports the production of detailed accounts and deeper consideration of actions, experiences and perceptions.

4.1 Sample

Participants. The sample consisted of four Further Education and Training (FET) teachers of two best performing public high schools and one of their Grade 12 classes. Each school had one Grade 12 class specialising in Physical Sciences and one class specialising in Life Sciences. One of the best performing school was situated on the outskirts of a small town some 60km from the provincial capital of the North West province. In this study, this school is referred to as school A. The Physical Sciences teacher at School A was a lady who in this study was named Natalie. All teachers' names in this study are pseudonyms-not their real names. The Life Sciences teacher in this study was named Lizanne. School

B is a suburban school situated in the provincial capital of the North West province, Mafikeng. The Physical Sciences teacher was named Modise. The Life Sciences teacher was a lady who in this study was named Kelebogile. The two sampled schools had moderate class sizes, a trend still existing in most well performing schools. The sample was purposively selected from one district of the North-West province of South Africa which was deemed to be performing well and contributing significantly to the overall performance of the province in matriculation examinations. Purposive sampling is a non-probability sampling method whereby only those schools consistently producing a pass rate of over 90% were selected.

4.2 Research Methods

In order to capture the lived experiences, perspectives and knowledge generated by the four teachers - Natalie, Lizanne, Kelebogile and Modise - classroom observations and semi-structured interviews as 'extended conversations' (Holland & Ramazanoglu, 1995) were organised on a regular basis (one interview per three weeks) over a school term period (3-months) resulting in sixteen interviews (4 with each teacher) in all. The learners for each class were interviewed twice, immediately after the first and last classroom observation sessions. Focus was on how learners viewed the role playing teaching strategy and its relevance in their learning process.

4.3 Data Analysis

Data gathered were thematically analysed using open coding, axial coding and selective coding (Neuman, 2011). This helped organise data into conceptual categories and themes whilst also assisting in the development of several core generalisations. To strengthen and enhance the quality of the findings, Lincoln and Guba's (1985) concept of trustworthiness (credibility and confirmability) was used. Results of the study demonstrate the effort these four teachers put in to establish a 'working' strategy of teaching that resulted in improvement and sustained learner performance in Life Sciences and Physical Sciences.

5. Results and Discussion

In this section we introduce the cases for the two best performing schools (and their four teachers) by presenting data based on themes around the three phases and main elements of Ausubel's teaching method. Phase one relates to the advance organisers and phase two relates to presentation of learning task or material whilst phase three relates to strengthening cognitive organisation. The generated resonances were linked to DoE's 2015 NSLA framework objectives of sustained improvement in learner performance, role of teachers, and increased efforts on time on task making high learner attainment.

The themes based on the first phase are: clarifying the aims of the lesson, presenting the lesson, and relating the organiser to learners' prior knowledge. After a long journey in their teaching profession, the four teachers had their common human experience of suddenly understanding a previously incomprehensible problem [the aha! moment] through trial and error. This was in a bid to improve learner performance and ensure that they sustain their effort. This study identified what they called a 'working' teaching strategy which is role-playing. During interviews, the teachers had this to say: "*…I like trying new teaching methods…and I used to do a lot for my learners. More-or-less like spoon feeding them, you understand? I just decided someday to try role-playing as a teaching method... My aha! moment was when I put on the method to test and it worked when revising the topic electricity (Natalie, School A).*

Kelebogile's narration was almost similar to that of Natalie. She says she has a lot of work on her table. This is her story: *"I attended a PSF meeting, had a chat with a colleague teaching a similar grade who suggested this teaching method to me. I told her it was possibly going to work with lower grades, for example, kindergarten but she proposed I try it …* One of Kelebogile's learners had this to say during focus group interviews: *Playing "Pancreas" helped me to actually understand how this organ contributes in regulating blood sugar level…* As can be inferred from the learner's description of events in the role-play lesson, the presentation of the lessons is solely the responsibility of the learners. Interestingly, the organiser was just clarifying aims of the lesson by the teacher and giving direction to the lesson (Kumagai, 2013).

The second phase- presentation of learning task or material had three themes. These are (1) making the organisation of the new material explicit, (2) making logical order of learning material explicit, and (3) presenting material in terms of basic similarities and differences by using examples, and engaging students in meaningful learning activities. All four teachers planned for the lessons very well, making sure that the new material to be taught was made explicit. This is what one learner from Modise's class said during focus group interviews: "*Our teacher prepares ahead for us to play a game based on a certain topic she has to teach. One time she came to class with soccer balls pasted with instructions to follow… for example in electricity if you are a conductor, you will have to behave like a messenger…"* (Learner 1, Modise's class, School B). Logical order of learning material was made explicit. As witnessed during classroom observations of Modise's lessons on electricity, the learners used simulations first to demonstrate similarities and differences between parallel and series circuits before a group presenting this topic offered it through role playing. However, it was evident that the groups of learners had consulted with their teacher during preparation time. In a way the learning process was significantly dependent on the teachers (Kumagai, 2013).

Two themes were formulated from the third phase dealing with strengthening cognitive organisation. The themes are relating new information to an advance organiser and promoting active reception learning. The first theme can be illustrated by what was observed in Lizanne's class. Lizanne could be seen following sessions where learners had role played with keen interest. She was also seen clarifying certain concepts after group presentations. Asked why she was doing that during interviews, she had this to say: *I was ensuring new knowledge was linked to what the learners already knew and preparing for the learners for the new content which was yet to be presented in future.*" This finding confirms de Medeiros-Silva, et al. (2017) findings which showed role playing is a basic engagement and should not be considered just as fun but as part of the serious learning process.

Having sat in all four teachers' classrooms during teaching and learning sessions, a question asked to all four teachers towards the end of the study was "what is the relevance of role-play in practice?" Two teachers had this to say: Natalie responded: "*By simulating a scenario during acting [and] role-playing, it allows my learners to practise newly-developed skills… which is close to the real experience of the learners. Learners' second language learning is enhanced and it motivates them to research for specific topics*." Kelebogile responded to the question by saying, "*All I can say is that through use of this method, learner interest in the topic is raised… If one takes time to prepare, indeed the benefits far outweigh the effort*." This also accords with Khiri and Mohammadi's (2016) observations, which showed that role playing is a method of problem-based learning which increases the ability of learners in decision-making, interpretation of situation and critical thinking.

An inference can be made from the teachers' responses to questions posed and recollecting some events which took place during the teaching and learning process, in answering a question such as, how does role-play in practice relate to your teachers' practices? What is clear is that the teachers do know the pros and cons of such a teaching strategy.

6. Conclusions and Recommendations

From the results presented and discussed, the eureka effect (aha! moment) was that moment when all four teachers who took part in this study identified role-playing as a teaching and learning strategy amongst other strategies chosen to bring about a desired future, such as achievement of a goal or solution to a problem. In this study, the desired future was to improve and sustain learner performance in both Life and Physical Sciences. Another finding was that teachers were well-informed regarding the relevance of role-play in practice. Learner interest in the topic was evidently raised as was observed in the case study. There was also increased contribution on the part of the learners in role-playing lessons and learners' use of their background knowledge in addition to acquiring new information. Phases of the conceptual framework were evoked in describing the findings. Play in practice was related to teachers' pedagogic practices by emphasising the fact that planning is important, just like the introduction where the aims of the lesson are clarified. This study demonstrated that constructs of Ausubel's Meaningful Reception Learning theory were coupled with role playing to describe the experiences of teachers in narrating their teaching practices. The study recommends that teachers who are passionate for having established uncommon teaching practices can share them with their colleagues who are in schools which are not doing as well as them. Further research could be done when teachers such as the ones described in this study are paired with their colleagues from poor performing schools for improved results in the latter.

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