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Do Teachers' Learning Styles Influence Their Classroom Practices? A Case of Primary School Natural Science Teachers from South Africa

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ABSTRACT This paper examines the influence of teachers' learning styles on their classroom teaching and learning practices. The reported mixed method study was conducted in various school districts in a large province in South Africa. The data was collected with the use of questionnaires administered to primary school natural science teachers and classroom observations made during a science lesson. The study examined the preferred learning styles of primary school science teachers. It then investigated how they taught natural science and attempted to establish if their learning styles influenced teaching and learning in their classrooms. Findings from the questionnaires showed that most teachers preferred or learned better partly through visual, active, sequential and intuitive learning styles. However, analyses of classroom observations revealed a contradiction as the teachers' proclaimed learning styles were not emulated, translated into or visible in their classroom teaching practices. The researcher argues and concludes that the teachers' learning styles do not necessary shape or influence their classroom teaching practices.

INTRODUCTION

In their systematic and critical review of learning styles and pedagogy in the post-16 learning, Coffield et al. (2004) poses a fundamental question that how can the teachers enhance learner performance if they do not know how they themselves learn? They call this a charade whose time has expired, and question the seriousness behind developing a learning society when there is no adequate answer to the question regarding learning models teachers employ and how they utilize them to improve their own practice and that of their learners. Since the 1970s there has been a continuous discussion on issues concerning an individual's learning styles (Dunn 1984; Pashler et al. 2008; Zhou 2011; Zhang et al. 2013). According to Pashler et al. (2008), the term learning styles refers to the view that individuals learn information in different ways. The literature indicates that an individual processes information by hearing and seeing, acting and reflecting, intuitively and logically reasoning, visualizing and analyzing, and both steadily and in fits and starts (Felder and Henrigues 1995; Zhou 2011). Felder and Henrigues (1995) state that the manner in which an individual characteristically acquires, retains and retrieves information, are collectively termed the individual's learning style. Dunn (1984) concurs saying that a learning style is the way an individual absorbs and retains information and/or skills, irrespective of how that process is described. He also notes that this can differ dramatically from one person to another. Ellis (1985) delineates a learning style as being the way in which a person perceives, conceptualizes, organizes and recalls information. Passrelli and Kolb (2012), on the other hand, theorize that learning styles are influenced by an individual's genetic make-up, prior learning experiences, cultural allegiance, and the society in which they reside.

Sims and Sims (1995) indicate that research among various populations into 'learning styles' or 'learning preferences' has received considerable attention in many developed countries, including North America, Australia and a number of European countries. To highlight the progress and development in this area, Felder and Henrigues noted in 1995 that over 30 learning style assessment instruments had already been developed, while in their review, Coffield et al. (2004) identify 71 learning style models. James and Gardner (1995) say that the focal point of any discussion on learning styles is the different ways in which individuals learn, and the in-

struments intended to ascertain or measure the preferred learning style. In these studies, the research focus has mainly been on student learning outcomes (McGrath 2009) with little exploration being directed at adults (Sims and Sims 1995). Opdenakker and Damme (2006) state that much research still needs to be conducted to further explore the links between teacher beliefs, thoughts, theories, knowledge and attitudes on one hand, and teacher behavior, classroom practices and student outcomes on the other. This is required to deepen the understanding of the creation of classroom practice. These researchers argue that although research indicates that classroom practices, teacher behavior and teaching styles are important with respect to student outcomes, hitherto little research has been conducted regarding the degree to which effective classroom practices are class, teacher, and school dependent and are related to student composition, teacher characteristics, and teaching styles.

Most research already conducted in this area has been in developed countries, leaving room for investigations in underdeveloped ones such as South Africa (SA). The issue of how primary school natural science teachers' learning styles[1] influence their classroom teaching and student learning has hardly received adequate research attention in SA. In a study investigating teaching styles and cognitive processes in language learning conducted in Cape Town, Makoni (1998) states that there is a need to examine the teachers' learning styles and concedes that because all the teachers involved in his study were women, a gender factor could be relevant. Undeniably, teachers are a key element in any school, and effective teaching is one of the crucial propellers for school improvement (Ko et al. 2013). Literature highlights that the learning styles of a teacher not only influence how they learn, but also how they teach their students (Krueger and Sutton, 2001). Furthermore, it argues that when (some) teachers begin to teach, they adopt the practices of their former teachers and teach the way they have been taught (Kennedy 1999; Oleson and Hora 2013; Owens 2013). By contrast, Felder and Henrigue's research (1995) highlights that how much a given learner learns in a class is governed in part by that learner's native ability and prior preparation, but also by the compatibility of his or her characteristic approach to learning and the instructor's teaching method. McChlery and Visser (2009) also state that the learning context and a person's nationality play a critical role. However, is this the case in the South African context?

Objective of the Study

This study examines the influence of the learning style of natural science teachers on their teaching practice and the learning of learners. Damrongpanit and Reungtragul (2013) argue that a teacher's teaching style has an effect/influence on a learner's outcome, and therefore a teacher should explore his/her teaching and learning style. Through classroom observation and questionnaire data analysis, this study discusses the following questions:

1. What are the primary school natural science teachers' preferred learning styles?
2. How do teachers teach natural science in their classrooms?
3. Do teachers' learning styles influence the teaching and learning of natural science in their classrooms?

The focus on natural science is considered imperative, as this is one of the critical learning areas in SA. It is clouded by severe challenges, which range from a shortage of qualified science teachers (Centre for Development Enterprise 2015; DBE 2013; Human Sciences Research Council 2012) to significant content knowledge gaps in the science teachers (National Education Evaluation and Development Unit 2013; Bosman 2006; DBE 2013), to poor learner performance and achievement in science education (Human Sciences Research Council 2012; DBE 2014), and declining numbers of learners studying science at high school and eventually pursuing it at a tertiary level (Holtman and Rollnick 2010; Schultze and Nukeri 2002; Taylor et al. 2008). A lack of or inadequate science teaching and learning resources (Bantwini 2012; DBE 2013) are also significant problems.

What follows is a discussion of the research methodology and findings and discussion of the reported study, as well as its conclusion and implications for the teaching and learning of natural science in primary schools.

RESEARCH METHODOLOGY

The reported study used a mixed method research approach intended to provide a better comprehension of the research problem and

yield rich and informative data that would respond to the major research question: Do teachers' learning styles influence their classroom teaching practice? The mixing of both quantitative and qualitative research was intended to enable the researcher to obtain breadth and depth of understanding and enhance its corroboration, whilst offsetting the weaknesses inherent in using each approach by itself. Furthermore, the use of mixed methods allows for data and methodological triangulation (Denzin 1970), which necessitates cautious analysis of the type of information provided by each method, including its strengths and weaknesses.

Research Context and Participants

The study was conducted in the Eastern Cape Province, one of the largest provinces in South Africa. The province comprises 23 districts grouped into three clusters: A, B and C. Each cluster is led by a chief director and includes various districts led by district directors. Each district is made up of a varying number of primary and secondary schools and is further divided into circuits led by circuit managers. Data for this paper was collected from eight school districts spread among the three clusters and it was purposively sampled. The sampling criteria focused on the districts' geographic positioning in order to ensure that all three clusters were well represented. Furthermore, the permission and support of the district director was significant. Permission to conduct the study was requested from and granted by the Provincial Department of Education Superintendent, and the application complied with their research policy requirements or procedures.

The participants of the study were all natural science teachers from various public schools. The schools included rural, urban, township and farm schools spread across the eight school districts in the province. The primary data was collected using a questionnaire and classroom observation tools applied during the teaching of a science lesson.

Questionnaire

The questionnaire sought to determine how teachers learn and perceive their learning, and how their beliefs about their learning process influence their classroom teaching process. It was divided into four parts: the *first part* collected demographic information, the *second part* focused on their educational qualifications and experience, the *third part* on how they learn, and the *fourth* on perceptions about how they teach in their classrooms. Questions exploring how teachers learn were drawn from the *Barbara Soloman and Richard Felder Index of Learning Style Questionnaire* (1999). This *Index of Learning Styles* is used to assess preferences on the four dimensions or descriptors of a learning style model. They are active/reflective, sensing/intuitive, visual/verbal, and sequential/global (see Table 1). These are used to present findings and discussions. The instrument itself comprises 44 questions with 11 questions relating to each of the four groupings. However, for the purpose of this study, 24 questions were selected to administer to the teachers. These were chosen based on their relevance and potential to provide the rich data required for the study. Each question had two responses, which corresponded to one of the categories. Felder and Henriques (1995) argue that these categories are by no means comprehensive since no finite number of dimensions could ever encompass the totality of individual student differences. In addition, they add that the dimensions have not been shown to be fully independent and validated instruments of assessing individual preferences.

One hundred and eight primary school natural sciences teachers were asked to complete the questionnaire. These teachers were from four schools from each of the eight districts. With the assistance of district officials who are more familiar with the context than the researcher, a total of 32 were sampled. About fifty-four percent of the teachers were from rural schools, twenty-nine percent from townships, fifteen percent from urban public and two percent from farms schools, and the schools were spread out across the districts. The teacher sampling focused on natural science teachers in Grades 4-6 and ensured that each grade level was represented. Of the 108 questionnaires distributed, 55 (51%) were returned completed. Of these, twenty-six percent were by males and seventy-four percent by females. All were South African nationals and the majority of the teachers were Blacks (89%) with a few Whites (6%) and Coloreds (6%). About two percent of the participant's age range was between 20-24 years, fif-

Table 1: Summary of learning styles and a description of each

Learning Style	*Description*
Active Style	o Learners tend to retain and understand best by doing something active with it, discussing or applying it or explaining it to others. o They tend to like group work more than reflective activities.
Reflective	o Learners prefer to think about it quietly first. o They do not enjoy group work and prefer to work alone.
Sensing	o These learners like solving problems by well-established methods and dislike complications and surprise. o Sensors tend to be good at memorizing facts and doing hands-on (laboratory) work. o Sensors don't like courses that have no apparent connection to the real world
Intuitive	o Learners often prefer discovering possibilities and relationships. o Intuitors like innovation and dislike repetition. o Intuitors don't like "plug-and-chug" courses that involve a lot of memorization and routine calculations.
Visual	o Visual learners remember best what they see, for example, pictures, diagrams, flow charts, time lines, films and demonstrations.
Verbal	o Verbal learners take more out of words and value written and spoken explanations.
Sequential	o Sequential learners tend to gain understanding in linear steps where each one follows logically from the previous one. o Sequential learners tend to follow logical, stepwise paths in finding solutions
Global	o Global learners tend to learn in large jumps, absorbing material almost randomly without seeing connections, and then suddenly "getting it." o Global learners may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, but they may have difficulty explaining how they did it.

teen percent was 30-34 years, twenty-eight percent were 35-39 years, nineteen percent were 40-44 years, thirteen were 44-49 years, eleven percent were 50-54 years, nine percent were 55-59 years and four percent were 60 years and above. The majority of these teachers had taught for more than 10 years.

Classroom and Lesson Observations

The classroom observations intended to observe if teachers were be able to apply their preferred learning styles in the classroom discourse. Thus, a classroom observation tool was developed to allow for uniformity in the observation process. The observation tool focused on classroom management, instructional learning (including lesson delivery, conceptual focus of the lesson and assessment during the lesson), and teacher pedagogical content knowledge and planning. A total of 22 primary school science teachers from each district were observed during their teaching of a science lesson. Of these, six were 4th Grade classes, seven were 5th Grade and nine were from the 6th Grade. In 4th Grade the number of learners varied from 27 to 57 in one classroom, in 5th Grade from 26 to 99 learners and in 6th Grade from 4 to 82 learners. From the 22 observed teachers, 20 were females and 2 were male. Evidently, most primary schools are fully staffed by female teachers (Table 2).

Data Coding and Analysis

The completed questionnaires were imported into the *Statistical Package for the Social Sciences* (SPSS). A frequency distribution analysis was then applied to yield the statistical re-

Table 2: A demographic summary of the classroom and lesson observation

Grade	*Number of observed teachers*	*Male*	*Female*	*School types*			
				Rural	*Township*	*Farm*	*Urban*
4	6	0	6 (100%)	2 (33%)	1 (17%)	1 (17%)	2 (33%)
5	7	1 (14%)	6 (86%)	1 (14%)	4 (57%)	1 (14%)	1 (14%)
6	9	1 (11%)	8 (89%)	5 (56%)	1 (11%)	1 (11%)	2 (22%)
Total	22	2	20	8	6	3	4

sults. From each dimension category, a percentage of response rates were calculated to determine which of the learning styles were most preferred by the respondents. For example, in active and reflective dimensions, all the percentages for active learning styles were added and then divided by the number of questions and similarly with other reflective learning styles.

The qualitative data coding and analysis followed an iterative process as recommended by Miles and Huberman (1994). These researchers describe various steps that include reading and affixing codes to the transcript notes whilst noting reflections or other remarks in the margins, and sorting and sifting through the materials to identify similar phrases and relationships between variables, patterns, and themes. (Miles and Huberman 1994:9). Throughout the process of analysis, the research questions were used to inform the emerging issues from the data. The following is a discussion of the themes that emerged from the study.

FINDINGS AND DISCUSSION

Teachers' Learning Style and How they Teach Natural Science in their Classrooms

The findings presented focus on 24 survey questions administered to the primary school natural science teachers. Their responses are grouped based on the four dimensions outlined above (active/reflective, sensing/intuitive, visual/verbal and sequential/global) and are discussed together with the findings from the classroom and lesson observations.

Active and Reflective Learning Style

In the administered questionnaire, teachers were asked what helps them understand better when they learn. Of the surveyed teachers, eighty-five percent said that they understand better after they try something out, whereas fifteen percent stated that they understand it better after they think it through (see Table 3). Regarding learning something new, sixty-eight percent of the teachers said it helps them to talk about it, whereas thirty-two percent believe that when they are learning something new it helps them to think about it. About seventy-eight percent mentioned that they prefer to study in a group whilst twenty-two percent indicated that they prefer to study alone. When questioned further, eighty-seven percent mentioned that when studying in a group and working on difficult material they are likely to jump in and contribute ideas, while thirteen percent said they just sit back and listen. Furthermore, about sixty percent said they prefer to first have a group brainstorming where everyone contributes ideas, whereas forty percent wanted to brainstorm individually before coming together as a group to compare ideas. From these responses it is clear that most of the surveyed teachers (76%) are active oriented and a small group (24%) is reflective and believe in mental exercise before progressing to active and practical activities. It was very interesting to note that when juxtaposing these findings with the classroom observations, incongruences emerged.

Table 3: Summary of the active and reflective learning styles

Question	*Learning style*	*Percentage (%)*
I understand better after I		
o try it out	Active	85
o think it through	Reflective	14.8
When I am learning something new, it helps me to		
o talk about it	Active	68
o think about it	Reflective	32
I prefer to study		
o in a study group	Active	78
o alone	Reflective	22
In a study group working on a difficult material, I am more likely to		
o jump in and contribute ideas	Active	87
o sit back and listen	Reflective	13
When I have to work on a group project, I first want to		
o Have a group brainstorming where everyone contributes ideas.	Active	60
o Brainstorm individually and then come together as a group to compare ideas	Reflective	40

Analysis of classroom observation data revealed that teachers theorized throughout their natural science lessons without giving their learners an opportunity to try out whatever they were learning. It was only at the end of the lesson that learners were given two or three questions developed by the teacher to discuss. Learners would be asked to work in groups of 4-7 mixed gender members. This seemed problematic because although most of the learners were in groups, they did not collaborate with each other. In addition, it was unclear in most of the classrooms whether each student had been assigned a role to play in the group, for example, that of a group leader, scribe or reporter. From the observations, it was also evident that most of the teachers possessed inadequate knowledge regarding the effective use of learner group work, and they hardly even noticed that some learners were dominating the groups or that the learners were not effectively collaborating. The issue of the inadequate use of group work in this province has previously been reported on (Bantwini 2010; Foncha and Abongdia 2014). The lack of a full utilization of group work can be attributed to deficiency in understanding how to use this pedagogical practice in the classroom (Gillies and Boyle 2010). The use of group work during science teaching and learning is considered to be a best teaching strategy that can benefit both learners and teachers (Baines et al. 2015; Webb 2009). Frykedal and Chiriac (2014) indicate that by engaging in group work, learners learn to inquire, share ideas, clarify differences and construct new understandings. Moreover, in order to develop and promote scientific thinking skills, Krueger and Sutton (2001) argue that learners must go beyond learning disconnected facts and should rather master scientific knowledge and processes whilst using logic and reasoning skills. The *National Science Teachers Association* (NSTA 2002) has observed that young learners learn science best when they engage in first-hand exploration and investigation, which nurtures inquiry and process skills. This was lacking in all the classes observed.

The majority of teachers (68%) hold the belief that when learning something new, it helps them to talk about it, but this was *not* evident in their classrooms. This idea is supported by NSTA (2002) who argue that young learners learn science best when communication skills are an integral part of science instruction. However, in most classrooms the teachers would be the ones dominating the talking and they hardly gave the learners a chance to discuss anything. During the lesson, some teachers did ask learners to discuss questions that they themselves identified, but they did not ask learners to develop and investigate their own questions. Constructivism theory advocates that knowledge is not passively received but is actively built up by the cognizing subject (von Glaserfeld 1989). Thus learning is undertaken by the learner and is not something that can be imposed on the learner. Frykedal and Chiriac (2014) argue that it is not until the teachers relinquish some measure of control and handover the responsibility of engaging in the task to learners that learners will take charge of their own learning processes. The inquiry approach to teaching advocates that teachers allow learners to develop their own questions for investigation in order to ensure effective learning.

When questioned on group work, seventy-eight percent of the teachers mentioned that they preferred to study in groups and only twenty-two percent preferred to study alone. This idea is related to constructivism theory, which argues that learners learn from each other. They do this through discussion, communication and the sharing of ideas, by actively comparing different ideas, reflecting on their own thinking and trying to understand other people's thinking by negotiating a shared meaning (Shuard et al. 1986). However, the researcher noticed that the group discussion was dominated by few learners who were considered 'gifted' in science education. Also, in many of these cases, the teachers would not move from group to group to monitor and ensure that all learners were benefiting from this learning approach. This was also contrary to their view as sixty percent of the teachers indicated that when they have to work in a group, they first want to have a group brainstorming where everyone contributes ideas. In the observed classrooms learners were not monitored nor were they encouraged to brainstorm within their group. They were not even given an opportunity to engage the teacher on the question(s) under discussion. The gifted learners drove most of the groups, as they dominated the discussion and were the ones who ended up answering all the questions on behalf of their group. From Frykedal and Chiriac's (2014) perspective, group work enhances academic

achievement and socialization. Furthermore, by interacting with other learners they learn to inquire, share ideas, clarify differences and construct new understandings. In this process they also learn to use language to explain issues and construct new ways of thinking. Thus, as Foncha and Abongdia (2014) argue, the teacher must emphasize the importance of participating in a group task and further motivate learners to take part in the group work. Felder and Soloman (1999) warn that a balance of the active and reflective learning styles is desirable if learners always prematurely act before reflecting, it could lead to trouble, if they take a long time to reflect, they will never accomplish anything.

Visual and Verbal Learning Style

When asked about their preference for getting information, sixty-four percent of the teachers mentioned that they prefer to get new information in the form of pictures, diagrams, graphs or maps whereas thirty-six percent declared that they prefer to get new information in the form of written directions or verbal information (see Table 4). Teachers were also asked about getting directions to a new place. About seventy-four percent noted that when they get directions to a new place they prefer a map, while twenty-six percent said they prefer written instructions. About forty-three percent believe that when they see a diagram or sketch in class they are most likely to remember the picture, while fifty-seven percent believe that they are more likely to remember what the instructor said about it. In a book with lots of pictures and charts, seventy percent mentioned that they are likely to look over the pictures and charts carefully, while thirty percent are likely to focus on the written text. The majority of teachers (65%) stated that they liked teachers who put a lot of diagrams on the board, while thirty-five percent liked teachers who spent a lot of time explaining. With regards to remembering, almost all the teachers (96%) said that they remember best what they see, while four percent remember best what they hear. When someone is showing data, sixty-nine percent said they prefer charts or graphs, while thirty-one percent prefer text summarizing the results. When meeting people at a party, sixty-nine percent of the teachers said they are more likely to remember what they looked like, while thirty-one percent said they are more likely to remember what they said about themselves. From the above findings, sixty-nine percent of the teachers preferred a visual learning style, while thirty-one percent preferred a verbal one. There were incongruences when these findings were compared with classroom and lesson observation findings.

Findings from classroom observations show that most of the visited classrooms had bare

Table 4: Summary of the visual and verbal learning styles

Question	*Learning style*	*Percentage (%)*
I prefer to get new information in		
o Picture, diagrams, graphs, or maps	Visual	64
o Written directions or verbal information	Verbal	36
When I get directions to a new place, I prefer		
o A map	Visual	74
o Written instructions	Verbal	26
When I see a diagram or sketch in class I'm most likely to remember		
o The picture	Visual	43
o What the instructor said about it	Verbal	57
In a book with lots of pictures and charts, I am likely to		
o Look over the pictures and charts carefully	Visual	70
o Focus on the written text	Verbal	30
I like teachers		
o Who puts a lot of diagrams on the board	Visual	65
o Who spends a lot of time explaining	Verbal	35
I remember best		
o What I see	Visual	96
o What I hear	Verbal	4
When someone is showing me data, I prefer		
o Charts or graphs	Visual	69
o Text summarizing the results	Verbal	31

walls with only one or two charts or pictures hanging in some cases. In their observation Eby et al. (2009) state that drab, undecorated spaces lead to expectations of dullness and boredom. These researchers argue for the necessity of creating a therapeutic environment that allows all students to succeed. The lack of visuals was also confirmed during the science lesson teaching as most of the teachers theorized with no visual aids. This was despite the response given by sixty-five percent of the surveyed teachers who stated that they liked teachers who put a lot of diagrams on the board. The dominating learning style in the classroom was verbal as most of the lessons were presented using words, both written on the board and in spoken explanation. These findings corresponded with the thirty-five percent of teachers who said that they liked teachers who spend a lot of time explaining. Lorsbach and Tobin (1992) argue that establishing and maintaining a learning environment that is conducive to learning should be a priority for science teachers.

Also, evident in most of the classrooms was that most teachers used questions and answers throughout the lesson. This approach appeared to be effective as it gave most teachers some indication of the learners' comprehension and challenges of the lesson being taught. Assessment is an essential component of science teaching. This view is also shared by the *International Academy of Education* (IAE 2008) who argues that teachers require sophisticated assessment skills if they are to identify what their students know and can do in relation to valued outcomes. In this case a major concern was that in using the question and answer approach, teachers hardly probed learners to measure the conviction of their responses. Every learner response was taken at face value and not scrutinized to ascertain how the learner came up with that response. According to IEA, teachers require a variety of approaches to assess their students' progress, and these should include and exceed standardized testing. Additional tools include interviews with students about their learning, systematic analyses of student work and classroom observations. It was also noted that none of the teachers reflected on the various learning styles present in their classrooms, nor on the possibility that some of the learners would not favor being quizzed throughout the lesson.

In the few classrooms where teachers used materials to teach, the materials were not aimed at ensuring a deeper learning that promoted critical and creative thinking. The teachers hardly used the material to probe and encourage critical learner thinking skills. The use of visuals should create a stimulating environment where learning is encouraged and students are ensured that the lesson is presented in a beneficial manner to reinforce certain concepts. The use of learning or teaching aids must help learners comprehend and recall the concepts being taught. They must help them make connections between what is taught and their real world, thereby developing deeper learning. Deeper learning must help learners master core science concepts and content. The goal of using teaching and learning aids should be to help learners think critically and be able to solve complex problems and develop the required scientific knowledge at their level and beyond.

Sequential and Global Learning Style

About fifty-three percent mentioned that they tend to understand the details of a subject but that they could be fuzzy about its overall structure, whereas forty-seven percent mentioned that they tend to understand the overall structure but said they may be fuzzy about its details. When doing homework, ninety-four percent said they are more likely to try to fully understand the problem while six percent noted that they are more likely to start working on the solution immediately. Teachers were also questioned about their response when considering a body of information. Here, ninety-one percent mentioned that they were more likely to try to understand the big picture before getting into the detail, while nine percent were more likely to focus on details and miss the big picture. About ninety-one percent believed that they learn at a fairly regular pace and felt that if they studied hard, they would get it. Nine percent believed that they learn in fits and starts and acknowledged that they would be totally confused before everything suddenly 'clicked.' About seventy-nine percent of the teachers said they like teachers who start their lectures with an outline and conceded that such outlines were somewhat helpful to them, while twenty-one percent noted that such outlines were very helpful to them. Most of the teachers (82%) seemed to be

more sequential in their learning than global (Table 5). This learning approach was also evident in how most of them taught in their classrooms.

During the classroom observation it was noticed that most of the teachers were more concerned about their learners understanding the details of a subject rather than understanding the overall structure. Felder and Soloman (1999) state that sequential learners tend to gain understanding in linear steps, with each step following logically from the previous one. They tend to follow logical stepwise paths to find solutions. Teaching aimed at students who possess these characteristics was evident in most of the classrooms. What seemed to be lacking in the observed classrooms was the encouraging of learners, or teaching for global learners. Devitt (2011) argues that learners need not be forced to learn how the teachers want them to learn, but rather be encouraged to develop their own ideas within settings, which teachers facilitate. O'Neill (2007) contends that effective teachers have high expectations of learners, both in terms of their standard of learning and behavior.

Although forty-seven percent of the teachers believed that they tend to understand the overall structure but may be fuzzy about the details, classroom observations showed that none of the observed teachers seemed to cater to this learning approach. Furthermore, none of the teachers seemed to be concerned about the bigger picture of the topic under discussion, in spite of the fact that ninety-one percent of them claimed that this was important. In this case the bigger picture would be teaching that connects what is being taught with the learner's real world. These connections can be made by using examples familiar to the students as well as various resource materials. What also did not resonate with the quantitative findings was the allowing of learners to learn at their own pace. Based on constructivism theory, learners should be allowed to learn at their own pace. Lorsbach and Tobin (1992) assert that learners need time to experience, reflect on their experiences in relation to what they already know, and resolve any problems that arise. In the observed classrooms, various assigned activities were timed and teachers constantly asked: *"are we done now eh, please finish up"* or *"hurry up hurry up, you need to finish now."* Another classroom observation that contradicted information gained in the questionnaires was that the teachers started their lectures without an outline, despite the fact that seventy-nine percent claimed that they preferred teachers who use them.

Intuitive and Sensing Learning Style

Teachers were asked what their preference was when required to perform a task. About eighty-nine percent of them said they prefer to come up with new ways of doing it, while eleven percent prefer to master one way of doing it. In regard to learning a new subject, eighty-one percent prefer to try and make connections between the subject and related subjects, while nineteen percent prefer to stay focused on that

Table 5: Summary of the sequential and global learning styles

Question	*Learning style*	*Percentage (%)*
I tend to		
o Understand details of a subject but may be fuzzy about its overall structure	Sequential	53
o Understand the overall structure but may be fuzzy about details	Global	47
When I start a homework, I'm more likely to		
o Try to full understand the problem	Sequential	94
o Start working on the solution immediately	Global	6
When considering a body of information, I am more likely to		
o Focus on details and miss the big picture	Sequential	9
o Try to understand the big picture before getting into the details	Global	91
I learn		
o At fairly regular pace. If I study hard I'll get it	Sequential	91
o In fits and starts. I'll be totally confused and then suddenly it all clicks	Global	9
Some teachers start their lectures with an outline of what they will cover. Such outlines are		
o Very helpful to me	Sequential	79
o Somewhat helpful to me	Global	21

subject, learning as much as they can about it. When solving a problem in a group, sixty-four percent would be more likely to think of possible consequences or applications of the solution in a wide range of areas, while thirty-six percent would be more likely to think of steps in the solution process. In reading non-fiction, sixty-one percent of teachers said they prefer something that gives them new ideas to think about while thirty-nine percent said they prefer something that teaches them new facts or tells them how to do something (Table 6). About fifty percent of the teachers find it easier to learn facts while the other fifty percent said they find it easier to learn concepts. About eighty-six percent of the teachers said they prefer courses that emphasize concrete material (for example, facts and data), while fourteen percent preferred courses that emphasize abstract materials (like concepts and theories).

Even though most of the teachers claimed to prefer an intuitive learning style, their classrooms did not seem to cater to this group of learners. Their learners seemed to be used to following the instructions or the approaches prescribed by the teachers. To be effective in teaching, Jang and Stecklein (2011) argue that teachers need to promote more student-to-student interaction in small groups and whole class discussions. In all the observed classrooms, teachers did not challenge their learners to come up with new ways or approaches to solve a problem or given activity. Also evident was the lack of questions from the learners directed to the teacher regarding the new information they were learning in the classroom. Somehow, it looked like the classrooms were not designed for innovative discussions or the exploration of new learner ideas. In most of the classrooms teachers seemed willing to involve the learners, but struggled to do so because most learners would not engage and remained silent. Learners seemed to be more concerned about learning the presented facts so that in tests they could recall them and score higher marks. Clearly lacking from all the classrooms was the use of an inquiry approach to help learners develop critical thinking skills through observing and developing their own questions, formulating hypotheses, collecting data, writing reports and presenting findings to their peers. According to Lorsbach and Tobin (1992), learners need to be given opportunities to make sense of what is learned by negotiating meaning. They need to compare what is known to new experiences, resolve discrepancies between what is known with what is learnt, and resolve discrepancies between what is known and what seems to be implied by new experiences. In some classrooms the issue of the medium of instruction was a challenge as most of the learners came from backgrounds where they do not speak English, which was the medium of instruction. Hence, in some classrooms the teachers would switch between the learners' mother tongue (mostly Xhosa) and the medium of instruction.

Table 6: Summary of the intuitive and sensing learning styles

Question	*Learning style*	*Percentage (%)*
When I have to perform a task, I prefer to		
o Master one way of doing it	Sensing	11
o Come up with new ways of doing it	Intuitive	89
When I am learning a new subject, I prefer		
o Try to make connections between that subject and related subjects	Intuitive	81
o Stay focused on that subject, learning as much about it as I can	Sensing	19
When solving problems in a group, I would be more likely to		
o Think of possible consequences or applications of the solution in a wide range of areas	Intuitive	64
o Think of steps in the solution process.	Sensing	36
In reading non-fiction, I prefer		
o Something that teaches me new facts or tells me how to do something	Sensing	39
o Something that gives me new ideas to think about	Intuitive	61
I find it easier		
o To learn facts	Sensing	50
o To learn concepts	Intuitive	50
I prefer courses that emphasize		
o Concrete materials (facts, data)	Sensing	86
o Abstract materials (concepts, theories)	Intuitive	14

Data analysis of the classroom observations shows that despite the teachers' claim that they preferred intuitive and sensing learning styles, there was no evidence that in their classroom practice these styles were accommodated or addressed. The NSTA (2002) asserts that learners value science best when various presentation modes are used to accommodate different learning styles. Overemphasizing one above the other is a mistake as both have a critical role to play in an individual and serve a purpose.

Do Teachers' Learning Styles Influence the Classroom Practice?

Based on the findings from both the questionnaire and observations, teachers preferred a variety of learning modalities. The most dominating learning modality seemed to be visual, active, sequential and intuitive. Clearly these findings raise some questions, as the teachers' classroom practice did not resonate with the perceptions of their own learning styles. In his study, Makoni (1998) claims that teaching styles are influenced by the teacher's own learning style irrespective of whether they are teaching a first or second language. Similar views are shared by Krueger and Sutton (2001) who state that learning styles not only influence how individuals learn but also how they teach. Nevertheless, findings from this study hardly support that idea or claim, as most teachers did not cater for their proclaimed preferred learning style. One would expect most of the teachers to teach the way they themselves prefer to learn, using various pedagogical approaches to accommodate and address the diverse learning modalities in their classrooms, but this was not the case.

Sims and Sims (1995) assert that effective teachers are those who comprehend the significance of including all their students in learning how to learn. They argue that effective learning materializes when teachers affirm the presence and validity of diverse learning styles and capitalize on the climate of condition for learning in and out of the classroom through the deliberate use of instructional design principles that take into account learning differences and increase the possibility of success for all learners. In addition, O'Neill (2007) asserts that effective teachers are able to personalize the learning for their students, monitor their progress and challenge each to take the next step in their learning. Nevertheless, findings from the observed classroom hardly support these qualities of effective teachers and teaching. There are no indications that teachers tried to match the students' learning styles with their teaching styles. Rather, there was a mismatch between what they proclaimed to be their learning styles and the learning styles they embraced in their teaching.

Findings from this study show that the teachers' identified or proclaimed learning styles were not emulated, translated into, or visible in their classroom teaching practices. Rather, many teachers seemed to be practicing what they claimed they did not prefer or like. Zhang et al. (2013) state that matching a style should not be simply regarded as the harmony of intellectual style between students and teachers, rather it should be more inclusive of other matching situations. Based on these findings, various possibilities emerge that can be the source for change, which can influence the existing status quo of teaching versus learning styles.

First, it can be argued that the dominant way of teaching is the way that most of the teachers were taught by their own teachers. This does not necessary mean they do not have a preferred learning style but it could be that the way that they were taught had developed roots and is now perceived to be the ideal way to teach in their classrooms. Literature stating that some teachers teach the way they have been taught has been thriving (Oleson and Hora 2013; Owens 2013; Kennedy 1999). Owens (2013) argues that teachers are taught to teach using the same irrelevant pedagogies, such as the taking of notes and memorizing of disconnected facts for regurgitation on multiple-choice exams. This approach, unfortunately, was evident in most of the observed classrooms.

The second possibility could be that as much as these teachers have a preferred learning style, when it comes to the classroom reality, they cannot teach the way that would meet their learning style needs because of inadequate materials. In the province where the study was undertaken, research shows that the inadequacy of teaching and learning resources, especially in the previously disadvantaged rural schools, is still an issue (Bantwini 2010, 2012; Makoni 1998). The lack of teaching resources can affect and alter the teacher's best wish to teach the way that they believe will benefit their students.

The third possibility to consider is that most teachers are teaching classes with a large number of students and this can hinder them from using pedagogical approaches that would address their learning styles, as well as those of their learners. Thus, the use of a lecture or textbook method becomes the ideal teaching approach. However, this approach hardly provides opportunities for learners to develop deeper scientific understanding and inquiry skills. Owen argues that science learning should involve an inquiry approach with learners being active in their own learning and engaging with ideas in authentic contexts and around productive group tasks. The severe challenges of teaching larger classrooms are well documented (Rhalmi 2013; Cooper and Robinson 2000).

The fourth possibility is that since most teachers were teaching more than two subjects, the lecture method was viewed as the easiest way to cover the syllabus within the set timeframes. According to Owen (2013), when most teachers enter active teaching after university, they are faced with a professional landscape in which the craft and science of teaching has been removed from the teachers' domain and placed in the hands of textbook companies and district pacing. Owens believes that scores of these teachers unquestionably accept the state of affairs, which the researcher argues has undesirable effects on the teaching and learning process. Though the researcher presents these possibilities, the researcher argues that further investigation is necessary in order to learn and understand the real cause for a lack of influence in teaching practice in the research context.

CONCLUSION

This paper concludes that a teacher's learning styles does not necessary shape or influence their teaching practice. Rather, there was contradiction which leads to a conclusion that having a preferred learning style may not necessarily signify that one will teach to accommodate or address such a preferred learning style. From the findings, it is also obvious that what is said to be an issue in an underdeveloped country may not necessarily be an issue in the developed world. Research conducted in developed countries suggests that the teachers' learning styles influence the way they teach but this was not necessarily the case with the teachers in the reported study. Rather, what was evident was the fact that various issues affect a teacher's ability to teach in their preferred learning style, and these include the teaching context, availability of resources, classroom sizes and school policies.

Findings from this study have implications for teacher education programs. It is of vital importance that pre-service teachers are exposed to and taught various pedagogical approaches that address a variety of student learning styles and also train them on how to diagnose their learner's learning styles. A lack of this knowledge is likely to result in teachers who barely understand their own learning style and so cannot accommodate and address their learners' various learning styles.

RECOMMENDATIONS

It is recommended that more research focusing on natural science teachers' learning styles and primary school learner performance and achievement be conducted. This would provide substantial evidence about the positive or negative role played by a teacher's learning style in their classroom practice. Furthermore, a necessity for studies interrogating teachers' and learners' learning styles and how these can be adjusted in order to increase learner performance and achievement in primary school science exists. The issues of gender, race and age did not receive attention in this study, and it is therefore recommended that further studies take these into account.

REFERENCES

Bantwini BD 2012. Primary school science teachers' perspectives regarding their professional development: Implications for school districts in South Africa. *Professional Development in Education Journal,* 38(4): 517-532.

Bantwini BD 2010. How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape Province, South Africa. *International Journal of Educational Development,* 30(1): 83-90.

Baines Ed, Blatchford P, Webster R 2015. The challenges of implementing group work in primary school classrooms and including pupils with special educational needs. *Education,* 43(1): 15-29.

Centre for Development and Enterprise 2015. Technical Report: Teacher Supply and Demand in South Africa: 2013-2025. From <http://www.cde.org.za/publications/education-skills-and-markets> (Retrieved on 20 April 2015).

Coffield F, Moseley D, Hall E, Ecclestone K 2004. *Learning Styles and Pedagogy in Post-16 Learning: A Systematic and Critical Review*. London: Learning and Skills Research Centre.

Cooper JL, Robinson P 2000. The argument for making large classes seem small. *New Directions for Teaching and Learning,* 81: 12.

Damrongpanit S, Reungtragul A 2013. Matching of learning styles and teaching styles: Advantage and disadvantage on ninth-grade students' academic achievements. *Educational Research and Reviews,* 8(20): 1937-1947.

Denzin NK 1970. *The Research Act in Sociology.* Chicago: Aldine.

Department of Basic Education 2014. *Annual Report 2013/2014.* Pretoria, Republic of South Africa.

Department of Basic Education 2013.Investigation into the Implementation of Maths, Science and Technology. From <http://www.education.gov.za/LinkClick.aspx? fileticket=rMWDa1cHh3I%3 D&tabid=358&mid=1301> (Retrieved on 12 August 2015).

Devitt A. 2011. Capitalizing in curiosity. *Science and Children,* 44-47.

Dunn R 1984. Learning styles: State of the science. *Theory into Practice,* 23(1): 10-19.

Dunn, RS, Dunn, KJ 1979. Learning styles/teaching styles: Should they . . . can they . . . be matched? *Educational Leadership,* 36: 238-244.

Eby JW, Herrell AL, Jordan M 2009. *Teaching in the Elementary Schools: A Reflective Action Approach.* 5th Edition. Upper Saddle River, New Jersey: Pearson Education, Inc.

Ellis, R 1985. *Understanding Second Language Acquisition.* Oxford: Oxford University Press.

Engelbrecht P, Oswald M, Forlin C 2006. Promoting the implementation of Inclusive Education in primary schools in South Africa. *British Journal of Special Education,* 33(3): 121-129.

Felder RM, Henriques ER 1995. Learning and teaching styles in foreign and second language education. *Foreign Language Annals,* 28(1): 21-31.

Fischer BB, Fischer L 1979. Styles in teaching and learning. *Education Leadership,* 36(1): 245-254.

Foncha JW, Abongdia JFA 2014. The significance of group work inn a FAL classroom: Language learning as a social practice in two high schools in Eastern Cape. *International Journal of Education Sciences,* 7(3): 535-546.

Frykedal KF, Chiriac EH 2014. Group work management in the classroom. *Scandinavian Journal of Educational Research,* 58(2): 222-234.

Glasersfeld EV 1989. Constructivism in education. In: T Husen, TN Postlethwaite (Eds.): *The International Encyclopedia of Education, Supplement Vol.1.* Oxford/New York: Pergamon Press, pp. 162–163.

Gillies RM, Boyle B 2010. Teachers' reflections on cooperative learning: Issues of implementation. *Teaching and Teacher Education,* 26: 933-940.

Holtman L, Rollnick M 2010. Research on teaching and learning in access courses. In: M Rollnick (Ed.): *Identifying Potential for Equitable Access to Tertiary Level Science.* New York: Springer Business and Science Media, pp. 109-134.

Human Sciences Research Council 2012. Highlights from TIMSS 2011. The South African Perspective. From <http://www.hsrc.ac.za/en/media-briefs/education-and-skills-development/Mathematics-and-science-levels-in-TIMSS-2011-shows-improvement-though-still-low#sthash.0HBJRUcd.dpuf>.

International Academy of Education 2008. Teacher professional learning and development. International Academy of Education, United Nations Educational, Scientific and Cultural Organization. From <http://www.ibe.unesco.org/fileadmin/user_upload/Publications/Educational_Practices/EdPractices_18.pdf.> (Retrieved on 15 June 2015).

James WB, Gardner DL 1995. Learning styles: Implications for distance learning. *New Directions for Adult and Continuing Education,* 67: 19-32.

Jang JY, Stecklein J 2011. Less talk but better teacher feedback: Using redirects to improve student-to-student discussions. *Science and Children,* 80-83.

Ko J, Sammons P, Bakkum L 2013. *Effective Teaching: A Review of Research and Evidence*. Berkshire: CfBT Education Trust.

Kennedy MM 1999. The role of pre-service teacher education. In: L Darling-Hammond, G Sykes (Eds.): *Teaching as the Learning Profession: Handbook of Teaching and Policy.* San Francisco: Jossey Bass, pp. 54-86.

Krueger A, Sutton J 2001. *ED Thoughts*: *What We Know About Science Teaching and Learning.* Aurora: Published by Mid-continent Research for Education and Learning.

Lorsbach AW, Tobin K 1992. Constructivism as a referent for science teaching. In: F Lorenz, K Cochran, J Krajcik, P Simpson (Eds.): *Research Matters ...to the Science Teacher. NARST Monograph, Number Five*. Manhattan, KS: National Association for Research in Science Teaching.

Makoni S 1998. Final Report: Investigation into Teaching Styles and Cognitive Processes in Language Learning, National Language Project. From <http://jet.org. za/publications/pei-research/001753% 20Makoni% 20National% 20Language% 20 Project % 20-%20main%20 body.pdf.> (Retrieved on 5 March 2015).

McChlery S, Visser S 2009. A comparative analysis of the learning styles of accounting students in the United Kingdom and South Africa. *Research in Post-Compulsory Education,* 14(3): 299-315.

McGrath V 2009. Reviewing the evidence on how adult students learn: An examination of Knowles' model of andragogy. *Adult Learner: The Irish Journal of Adult and Community Education,* 99-110.

Miles MB, Huberman MA 1984. *Qualitative Data Analysis: A Sourcebook of New Methods*. Newbury Park, California: Sage Publications.

National Education Evaluation and Development Unit 2013. *National Report 2012: Summary Report*. Pretoria, South Africa.

National Science Teacher Association 2002. NSTA Position Statement. Elementary School Science. From <http://www.nsta.org/about/positions/elementary. aspx.> (Retrieved on 19 August 2015).

Oleson A, Hora MT 2014. Teaching the way they were taught? Revisiting the sources of the teaching knowledge and the role of prior experience in shaping faculty teaching practice. *Higher Education,* 68(1): 29-45.

O'Neill S 2007. *Director General First Classroom Strategy*. Department of Education and Training, The Government of Western Australia, Australia.

Opdenakker MC, Van Damme J 2006. Teacher characteristics and teaching styles as effectiveness enhancing factors of classroom practice. *Teaching and Teacher Education*, 22(1): 1-21.

Owens SA 2013. We teach how we've been taught: Expeditionary learning unshackling sustainability education in U.S. public school. *Journal of Sustainability Education*, 5(3): 1-9.

Passarelli AM, Kolb DA 2012. Using experiential learning theory to promote student learning and development in programs of education abroad. In: Michael Vande Berg, R Michael Paige, Kris Hemming Lou (Eds.): *Student Learning Abroad: What Out Students are Learning, What They're not, and What We Can Do About it*. Sterling, VA. Stylus Publishing, LLCC, pp. 1-35.

Rhalmi M 2013. Teaching Large Classes: Problems and Suggested Techniques. From <http://www. myenglishpages. com/blog/teaching-large-classes-problems-and-suggested-techniques/> (Retrieved on 12 December 2014).

Shuard H, Brousseau G, Hall GS 1986. Constructivist Learning Theory1. From <http://academic.sun.ac.za/education/mathematics/malati/Files/Constructivism.pdf.> (Retrieved on 29 August 2015).

Sims RR, Sims JS 1995. *The Importance of Learning Styles: Understanding the Implications for Learning, Course Design, and Education*. USA: British Library Cataloguing in Publication Data.

Sjoberg S 2007. Constructivism and learning. In: E Baker, B McGaw, P Peterson (Eds.): *International Encyclopedia of Education*. 3rd Edition. Oxford: Elsevier.

Soloman BA, Felder RM 1999. Index of Learning Styles Questionnaire. From <http://www.engr.ncsu.edu/learningstyles/ilsweb.htm.> (Retrieved on 25 November 2014).

Sternberg RJ, Grigorenko EL, Zhang L 2008. Styles of learning and thinking matter in instruction and assessment. *Perspectives on Psychological Science*, 3(6): 486-506.

Taylor N, Fleisch B, Shindler J 2008. *Changes in Education Since 1994*. Pretoria: The Presidency: Input into the 15 Year Review Process.

Uzuntiryaki W 2007. Learning styles and high school students' chemistry achievement. *Science Education International*, 18(1): 25-37.

Webb NM 2009. The teacher's role in promoting collaborative dialogue in the classroom. *British Journal of Educational Psychology*, 79(3): 1-28.

Zhou M 2011. Learning styles and teaching styles in college English teaching. *International Education Studies*, 4(1): 73-77.

Zhang L, Sternberg RJ, Fan J 2013. Revisiting the concept of style match. *British Journal of Educational Psychology*, 83: 225-237.