RESEARCH TITLE:

The use of cooperative instructional strategies to cater for the learning style differences among high school science learners

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INTRODUCTION

- Physical Sciences play an increasingly important role in the lives of all South Africans owing to their influence on scientific and technological development, necessity for the country's economic growth and the social wellbeing.
- According to the Department of Basic Education (DBE, 2011), Physical Sciences promotes knowledge and skills in scientific inquiry and problem solving; the construction and application of scientific and technological knowledge; and an understanding of the nature of science.
- Despite the importance of physical sciences to the development of the nation, the related literature (for example Karacop, 2017) shows that learners at all levels of the educational ladder have difficulty in learning physical science and have developed negative attitude towards the subject.

Introduction cont.

- Some studies (for example, Mji &Makgato, 2006) in South Africa have investigated and reported on different factors that particularly affect the teaching and learning of physical sciences. These include; poor teaching strategies, lack of basic content knowledge of teachers and mismatches of teachers' teaching styles and learners' learning styles, among others.
- Hence, the need to use alternative teaching approach to cater for learner differences in the science classroom.

Background of the study

- In the O.R Tambo Inland district, the percentage pass rate in the physical science was 61.7 in 2017.
- Looking at the statistics, the performances of learners have not been encouraging at all, and this is some cause for concern.
- However, It has also been reported that outdated teacher-centred teaching practices still take centre stage in most of Mthatha schools .
- The traditional teacher method emphasises passive acquisition of knowledge that demands basic recall of knowledge from the learners (Zakaria & Iksan, 2007).
- Learners become passive recipients of knowledge and resort to rote learning. Learners seldom ask questions or exchange ideas.
- Teaching is therefore not for conceptual understanding but rather for memorizing and recalling of facts.

Cont.

- However, a careful perusal of the related studies(Timothy & Kimberly, 2010) revealed that, learner-centered instructional strategy could reach individual learners with different learning styles and promote individual learning.
- Unfortunately, most teachers are unable to implement such an approach, due to time constraints, and non-availability of resources in most schools across South Africa.
- However, Jigsaw, one of the techniques which is used in the implementation of cooperative learning, brings the cooperation to the forefront by providing support to learners' working together and removing competition in the classroom.
- Against this background, this study investigated the use of cooperative instructional strategy to cater for the learners learning style differences in the science classroom to improve their performance in the physical sciences.

THE Research problem

- Electricity and magnetism are pivotal concepts that play a central role in science. Nevertheless, these are also concepts that give learners difficulties.
- Most learners perceived the concept to be very difficult and too abstract to comprehend.
- This is often blamed on the use of the traditional teaching method in schools and classes which do not accommodate all learners equally.
- Therefore, this study aimed to overcome this problem by using cooperative instructional strategies as an instructional tool, considering learners learning style preferences to enhance Grade 11 learners' achievement in electricity and magnetism.

Research questions

The following research questions were raised for answering:

- What are the effects of using Jigsaw method based on cooperative instructional strategy to teach electricity and magnetism in physical sciences?
- How would performance in physical sciences differ between learners taught using Jigsaw method based on cooperative instructional strategy and learners taught using traditional teaching strategy?
- How would levels of interest and motivation in physical sciences differ between learners taught Jigsaw method based on using cooperative instructional strategy and learners taught using traditional teaching strategy?

Hypothesis:

- H_0 : There is no significant difference in physical science achievement between learners who were exposed to Jigsaw cooperative learning and those who were exposed to traditional teacher-centred instructional strategy.

Research rationale

- Theoretically, this study set to design pedagogical model of Physical Sciences that integrates learning styles into the teaching and learning process of Physical Sciences, and test if it relates to better students' academic achievement in the subject.
- Practically, this study provides empirical evidence about the learning styles and cooperative instructions that may lead to better achievement in Physical Sciences.

The literature review

THE THEORETICAL FOUNDATION

- The theoretical framework underpinning this study is Vygotsky's (1978) sociocultural theory. Sociocultural theory is a theory of the development of higher mental practices which regards social interaction as the core of teaching and learning process (Behroozizad, Nambiar & Amir, 2014). Therefore, it was important to use sociocultural theory as a framework for meaningful verbal interactions with others in the classroom as a social context which bring about complex and higher mental functions among learners (Lantolf & Thorne, 2006).
- From Vygotsky's perspective, the concept of the Zone of Proximal Development (ZPD) helps a child's interaction with an adult or more capable peer awakens mental functions that have not yet matured and thus lie in the region between actual and potential developmental levels. The Zone of Proximal Development "is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more knowledgeable peers" (Vygotsky, 1978, p. 86). Therefore, the social environment is a crucial element which supports the child culturally to adapt to new situations when needed.
- Hence, an instructional implication informed by a sociocultural perspective is thought to occur through interaction, negotiation, and collaboration. These features are characteristic of "cooperative learning".

Literature cont.

Strengths of these arguments (in support)

- Cooperative instructional strategy has been reported to produce a range of positive social, affective and psychological outcomes, including social support, the quality of learner relationships, attitude to learning skills and self-esteem (Van Dat & Ramon, 2012).
- According to Parr (2007), one of the main benefits of cooperative instructional strategy is that it can foster an environment that embraces the great diversity of learners that are found in today's classrooms.
- This viewpoint is shared by Lord (2001) who claims that cooperative instructional strategy allows learners to share their differences in a positive way and can add value to the team by bringing their different backgrounds to the group.
- Shimazoe and Aldrich (2010) provide several benefits of the use of cooperative instructional strategy in the science classroom. They specified that cooperative instructional strategy promotes deep learning of materials. In addition, learners achieve better grades. Furthermore, learners learn social skills and civic values, higher-order, and critical thinking skills. Cooperative instructional strategy also promotes personal growth.
- Finally, learners develop positive attitudes towards autonomous learning. Bilesami and Oludipe (2012) affirm the effectiveness of cooperative instructional strategy.

Jigsaw cooperative learning strategy

- Jigsaw cooperative learning strategy was originally developed by Aronson and Colleagues in 1978 (Sarah and Cassidy, 2006). Jigsaw II requires learners to work in group of five to six members. Each learner in a group is given information to which no one else in the group has access, thus making each learner “expert” on his or her section of the subject matter. After receiving their assignments, each team member reads a section. Next, members of different teams who have studied the same sections meet in “expert groups” to discuss their sections.
- Then the learners return to their original teams and take turn teaching their team mates what they have learnt. All learners in a group are expected to learn all the subject matter assigned to members of their group. After instruction in Jigsaw II, teachers test learners individually and produce team scores based on each learner’s test performance.

Point of departure

Given these complexities, research is therefore needed to clarify how much difference it makes if teaching methods are aligned to the learners' learning style;

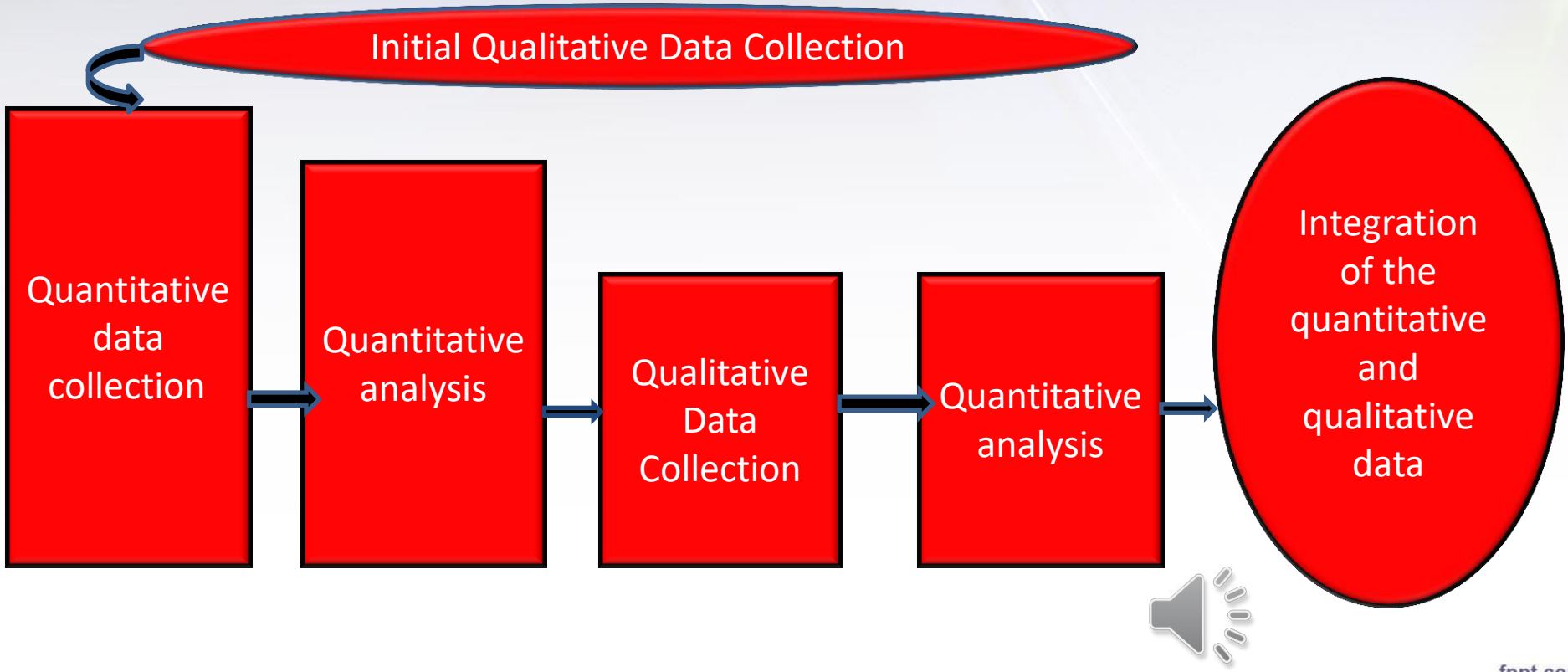
- A study that speaks to the role and potency of learning styles, seen in conjunction with other important variables, would help teachers significantly.
- The development of better instrumentation to identify styles should be a key part of such research.
- Such a research is needed to illuminate the connections and interactions between learning styles , disciplinary perspectives, and epistemology.
- A better understanding of the links between them would provide a helpful framework for examining teaching methodologies, and the role of learning in individual development.
- Therefore, this study is particularly necessary to fill the gap in the literature by exploring the effect of learning styles and cooperative learning strategy on the achievement of learners in Physical Sciences.

Research methodology and Paradigm

- This study employed a pragmatic sequential explanatory mixed method design .
- According to Morgan (2007), pragmatism provides a philosophical basis for researchers who used mixed methods; therefore, the use of both quantitative and qualitative assumptions to engage in their research.
- The quantitative phase of the study employed a quasi-experimental design consisting of treatment group and a control group, since the classes existed as intact groups.
- The experimental group was exposed to Jigsaw cooperative instructional strategies, while the control group was exposed to the traditional teacher-centred instructions.
- Three-day training was organized for the teacher in the experimental group on how to implement Jigsaw cooperative instructional strategy.
- The intervention lasted for six weeks during which the topic electricity and magnetism was taught in both the experimental group and the control group.

Methodology cont.

FIGURE 4.1 Visual Model for Mixed-Method Sequential Explanatory Design Procedures



Sample and Instrumentation

Design

Nonrandomised pre-test-post-test quasi-experimental design

Sampling

The study Population 89 learners and 2 teachers.

- **Sampling**: a purposive, convenience sampling technique was employed to select two schools with comparable characteristics in terms of location, learners, teaching and learning facilities from the target population.

Instrumentation

Data was collected using three instruments:

In the quantitative phase:

- Physical Sciences Achievement Test (PSAT) questions (pre-test and post-test).

In the qualitative phase of the study:

- observation schedule
- Structured interviews

Data collection procedures

❑ Phase 1

(a) Classroom observations to know Physical Sciences teachers' commonly used teaching methods. (b) Interview teachers to know why they used certain methods of teaching.

❑ Phase 2

(a). Administration of Index of learning style questionnaire.
(b). Analysis and coding of learners' learning styles by the use of Index of Learning Style Questionnaire (Learners).

❑ Phase 3

(a) Administration of Physical Sciences Test(Pre-Test).
(b) Development and implementation of cooperative learning instructional materials in the Physical Sciences classroom .
(c) Observation schedule during intervention.
(d) Administration of Physical Sciences Achievement Test(Post-test)
(e) Interview with teachers and learners.

Data analysis

Quantitative data analysis

- Quantitative data was analysed statistically, using descriptive statistics.
- Sample t-test was employed to test if there was statistical significant difference in academic achievement among the different Felder-Silverman learning styles.

Qualitative data Analysis

- Framework analysis involving thematic analysis between themes and cases were employed to analyse qualitative data.

Results and Discussions

- Table 1: Comparison of average scores of experimental and control groups

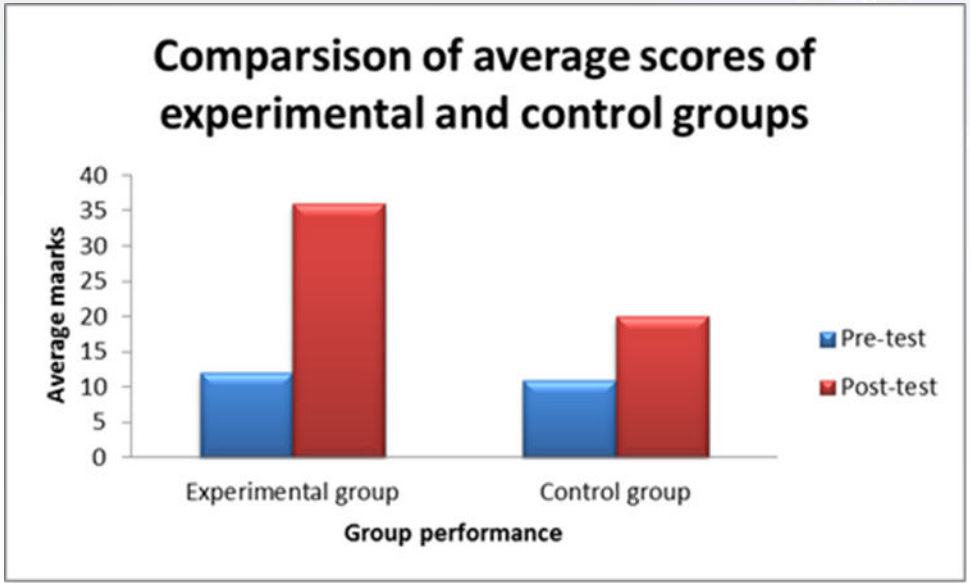


Table 2:Difference in performance of the Experimental group

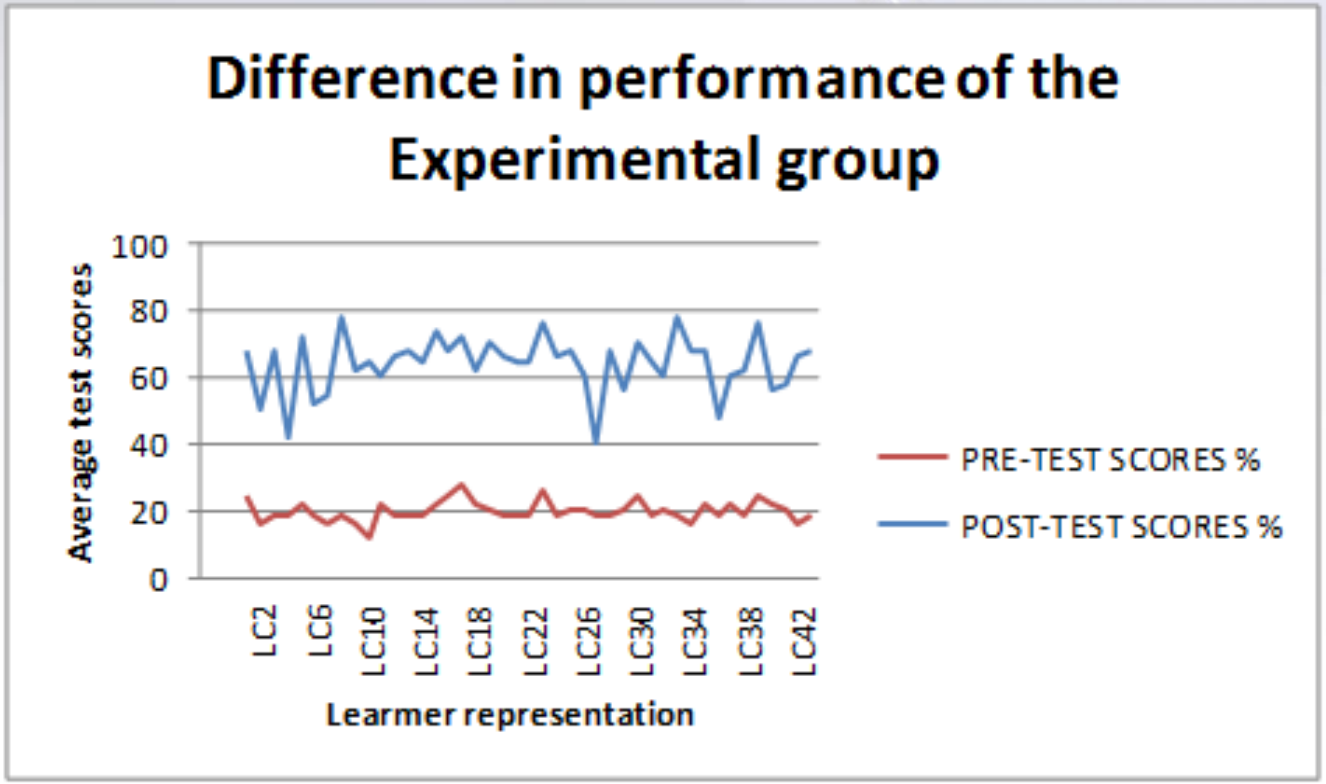
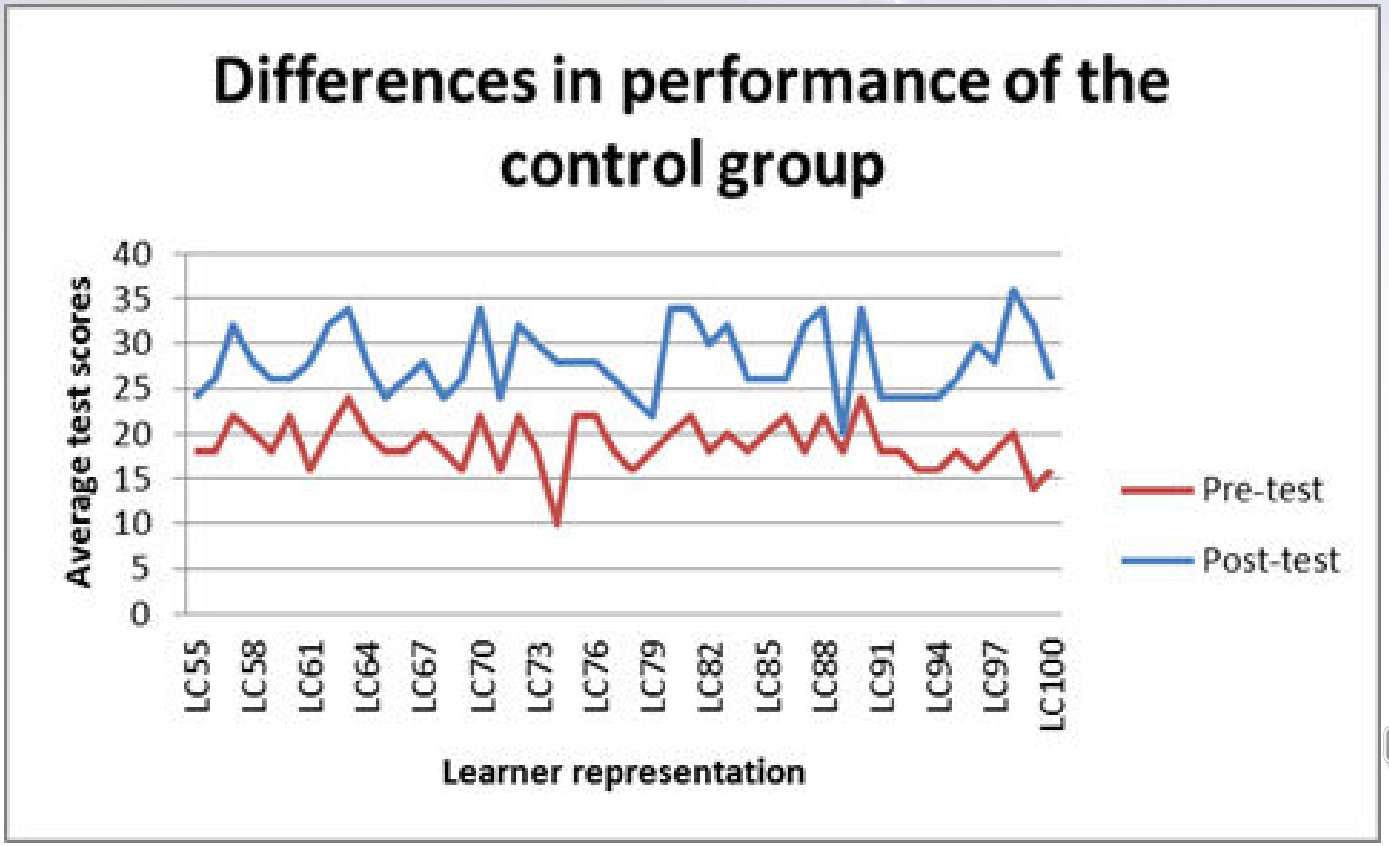


Table 3: Differences in performance of the Control group



Findings from the Quantitative data

- This study found that cooperative learning improved learner achievement in electricity and magnetism.
- The finding from the literature further indicated that the use of provided learners with opportunity of first-hand experience, learning together to enhance their achievement in science(Eom, Wen and Ashill, 2006).
- In most cases, learners indicated that the use of cooperative strategy by their teacher has helped them to achieve more in class. It has increased their attitude to learn more and helped them to perform better in class. This assertion by learners has been supported by Weinburgh (1995) that positive attitude towards cooperative learning contributes to greater achievement.

Findings from the Qualitative data

Findings 1: The Relationship between Cooperative Instructional Strategy, the Tradition Teaching Strategy and Learners' Achievement in electricity and magnetism

- The findings indicated that both cooperative instructional strategy and traditional teaching method enhanced performance in science after the intervention. However, the post-test scores of the learners showed that Jigsaw cooperative instructional strategy resulted in better performance than traditional teaching method. The finding support s the null hypothesis that there is no significant difference between the pre-test mean scores and the post-test mean scores between the experimental and the control groups.
- The findings are also in congruence with findings from the literature on the positive impact of cooperative instructions on learner achievement in a wide range of subject fields (see Shimazoe & Aldrich, 2010).

Findings cont....

Findings 3: Effect of Cooperative Learning on Interest and Motivation in physical sciences

- The study revealed that the use of cooperative instructional strategy encourages intrinsic motivation among learners in the study of electricity and magnetism. More specifically, those who received cooperative instructional strategy displayed higher sense of efficacy in learning and attached higher task value to their school work than those who received the traditional teaching approach.
- Cooperative learning also increased learners' interest and motivation in learning physical sciences. This was particularly evident in the sense of commitment and enthusiasm displayed by the learners during the treatment period in particular. These findings also converge with those of the literature, more specifically, with the views by William and Gerald (2003,) that when learners take initiative for their own learning, they are eventually motivated to learn more, spend more time and effort in studying physical sciences.
- The high level of self-worth displayed by the learners who received the cooperative instructions can be explained in the light of the Vygotsky's (1978) sociocultural theory and the social independence theory (Johnson & Johnson, 2009). The sociocultural theorist highlights that development depends on interaction with people and the tools that the culture provides to help form their own view of the world (Behroozizad, et al., 2014). Vygotsky contends that "social interaction and cooperation with peers are indispensable factors for inner speech and metacognition to take place" (p. 90).
- The social interdependence theory also supports the use of cooperative learning as it emphasises positive interdependence or cooperation which encourages and motivates group members to facilitate each other's efforts to learn.

Conclusion

- The improvement in the performance of the experimental group may be strongly attributed to the use of cooperative instructional strategy that engaged leaners to work in groups, as opposed to the teacher-centred teaching method used for teaching the control group.

- From the observation of all the lessons and the analysis of both the tests and the interview questions, it can be concluded that all the lessons went well especially the lessons with the experimental group. This is because the group works captured the attention of the learners, and this view is reflected by the learners in their responses to the interview questions.

- According to the theory of constructivism learning takes place by the learner completing tasks for which support is initially required. It is hoped that the findings of this study would improve the teaching and learning of physical sciences in the Grade 12 classrooms across South Africa.

Recommendation

- It is recommended that the teacher training programmes in universities should be revised so as to equip new teachers with the required and appropriate knowledge and skills to implement as cooperative instructional strategies teaching effectively.
- Based on the findings of the present study, science teachers could consider the effects of a number of cooperative learning methods, such as STAD, TGT, TAI, and CIRC in their classroom instructions.

THE END OF THE PRESENTATION

- THANK YOU FOR LISTENING