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THE EFFECT OF REFLECTIVE TEACHING METHOD ON GRADE 9 LEARNERS' ACADEMIC PERFORMANCE IN SCIENCE: A CASE OF TEN SELECTED JUNIOR SECONDARY SCHOOLS IN MUFULIRA DISTRICT-ZAMBIA

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Abstract

The purpose of the study was to assess the effect of Reflective Teaching Method on Grade 9 learners' academic performance in science in selected Junior Secondary Schools in Mufulira district in Zambia. Quasi-experimental was used in the study, that is, pre-test post-test control group design. The research sample consisted of two first-year students lecture groups. The study comprised an experimental group (n=50) and a control group (n=50) Grade 9 learners. Grade 9 learners in the experimental group were taught using Reflective Teaching Method and those in the control group were taught using traditional teaching method. A Science Achievement Test (SAT) and a 5-point Likert Scale confidence questionnaire was used to assess the effect of Reflective Teaching Method on Grade 9 learners' confidence on how to understand science concepts. An independent samples t-test was used to compare academic achievement of the two groups at 95% confidence level. Confidence in how to understand science concepts was analyzed using descriptive statistics (mean). The findings showed that Reflective Teaching Method had a positive effect on Grade 9 learners' academic performance ($df = 48, p - value = .000, t = 8.422, \alpha = 0.05$). The study also revealed that Reflective Teaching Method allowed the boy and girl-child and to learn how to understand science concepts at the same level and this led to a conclusion that Reflective Teaching Method is not discriminatory and effects positively on gender. The confidence results indicated that Grade 9 learners' confidence on how to understand science concepts was enhanced more in the experimental group compared to the control group

with confidence mean of 7.67 ($SD = 2.45$) and 6.19 ($SD = 4.05$) respectively. In view of these findings, Teachers of science should incorporate Reflective Teaching Method in science topics that are perceived to be difficult for both learners and teachers. Additionally, Teachers of science should be encouraged to use Reflective Teaching Method in the teaching of science. Further, Teachers of science should consider implementing Reflective Teaching Method in their teaching “to explain, to explore, and to model science concepts and the connections between these concepts.

Keywords: Grade 9 learners’ academic performance, Reflective Teaching Method, Reflective, Science, Teaching

Introduction

The teaching-learning process is as old as human being on the earth. It has been carried out by human beings and even by animals, to teach their young ones for successful adjustment to existing conditions in their environments (Owoeye, 2017). Teaching as conventionally understood by the traditional teacher, is just the act of disseminating information to learners in the classroom. Similarly, Filani (2010) cited in Boris (2019) defines teaching as systematic process of imparting desirable knowledge, values and skills to learners.

A teacher with training is more mature and confident to perform his task more efficiently. The quality of our human capital depends on the quality of our teachers. What learners learn is directly related to what, and how teachers teach, and what, and how teachers teach depends on their knowledge, skills and commitments. Conventional teaching is simply chalk-talk approach in which learners remain passive as learners. Instruction is not properly organized and rote learning is heavily emphasized. Mostly, the results of the learners are not satisfactory due to the use of this approach. Nwagbo (2007) cited in Boris (2016) affirms instruction in science is aimed at achieving two goals: the first is the acquisition of the body of organized knowledge in a particular domain, and the second important goal in science instruction is the ability to solve problems in that domain.

Boris (2019) opines that a teacher may profess to hold fifteen years’ experience, but the experience means nothing if he keeps on repeating the same thing without bringing innovation into his teaching. The winning edge comes when teachers do not rest on their past laurels but gear themselves up to impart innovative and intellectually challenging education, link their discipline with contemporaneous issues of global import, provide illustrations from life and promote constructive rethinking rather than rote learning, so that the students can be competent,

confident and conscientious in a complex and competitive future. If the child is not properly and adequately trained and educated, the nation might find it difficult to attain the set developmental goals, hence her hope on learning for scientific and technological development will be defeated.

The curriculum must be properly implemented in order to bring about the desired goals. For a curriculum to be properly implemented, appropriate instructional tools, method, learners' interest and attitude towards the teaching and learning of desired subjects must be properly taken into consideration. Hence, greater importance on the strategies, styles and methods of teaching, particularly one that can motivate the learner and bring desired learning outcomes should be employed.

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technology growth has been the yearning of every nation in the 21st century. Adediwura and Bada (2007), Ehindero and Ajibade (2000) supports good methods of teaching that would make the learners develop and have sound education.

Science is among the three major pillars of Physics, Chemistry and Biology. The importance of science for the development of a nation is, therefore, glaring. Science is the most basic and its concepts and techniques underpin the understanding of other disciplines: A thorough understanding of mechanics is necessary to the chemists and the material scientists since the structure of every atom in the universe is determined by mechanics.

Macmillan (2012) cited in Awodun (2015) that science is also a cross-cutting discipline that has applications in many sectors of economic development, including health, agriculture, water energy and information technology. There is no doubt that a good part of the scientific knowledge is derived from the principles of science. Indeed, the knowledge of science has led to so many inventions such as the production, application and utilization of integrated circuits, production and use of machines and other contrivances. It also accounts for the discovery and production of hydroelectric power, gas turbine and thermonuclear power plant, telephones, refrigerators, heaters and gas/electric cookers. Science as a subject that makes immense academic demands on students in its learning.

Ogonor and Badmus (2006) postulated that a number of factors have been identified a militating against learners' attainment of the objectives of science instruction, and the most pronounced factor identified by researchers is the inappropriate and uninspiring teaching methods adopted by science teachers. According to ECZ (2021), Zambia has witnessed persistent

poor learners' performance in science at the junior school certificate level. This has been linked to the adoption of instructional strategies which did not give enough consideration to learners' previous knowledge and how they reasoned in order for learners to construct their knowledge based on these.

To achieve the desired educational goals, teachers need to reflect on their teaching from the planning stage to the last process of their teaching in the classroom. This process will, according to Clarke (2003), allow the teachers to clarify their knowledge base, content and their students' learning styles and as well, crystallize the pedagogy to be implemented.

Methodology is very vital in any teaching- learning situation. The method adopted by the teacher may promote or hinder learning. It may sharpen mental activities which are the basis of social power or may discourage initiatives and curiosity, thus making self-reliance and survival difficult. (Ameh & Dantani, 2012). Teaching is not just standing in front of a class talking. The best teachers contemplate the manner in which they all present a topic and have a wide variety of instructional strategies at their disposal.

Reflective teaching orientates teachers towards self-focus and self-evaluation. It involves the transformation of professional values and actions of the teachers and that of others who he/she interact with. Reflective teaching means looking at what you do in the classroom, thinking about why you do it and thinking about if it works or not. It is a process of self-observation and self-evaluation in which strength and weaknesses are identified and then adjust to re-plan for better performance. It is a means of professional development which begins in the classroom. It is paying critical attention to the practical values and theories which inform everyday action by examining practice relatively and reflexively (Awodun, 2015). Reflective teaching is in three phases: planning, teaching and debriefing.

Gatumu (2006) opines that reflective teaching has to do with deliberate examination of how we teach and learn. It is more towards critical thinking of how we teach and learn. It is a kind of teaching strategy which has to be viewed in terms of what the teacher can do for himself and his students to ascertain productivity in his teaching and in his students' learning. Hence reflective teaching is a call to let the teacher combine theory and practice to maintain and sustain his teaching profession (Ige & Olayode, 2012).

Reflective teaching is also about a skilled teaching of knowing what to do. In this manner reflective teaching is a professional alternative to action research. It is a personal means of conducting one's own ongoing professional life by solving problems in a systematic manner

(Gatumu, 2006). Pollard (2006) regards reflective teaching as a cyclic process by which teacher interprets his/her classroom practice. Reflective teaching enables teacher to form the known to the unknown by making use of recalled experiences in a critical manner. Reflective teaching is a deliberate move to allow the teacher think critically of his/her teaching, so that his/her students can maximize their learning. Reflective teaching is a mark of a concerned teacher who is skilled enough to examine his/her beliefs, values and assumptions behind the teaching practice (Ige & Olayode, 2012).

Gibbs (2004) describes modes of reflection by taking into account the time in which they occurred. They described the reflection that takes place during the action as “reflective in action” and the reflection occurring after the action as “reflection on action”. These two types of reflection has been the source of identification of different kinds and levels of reflection.

Developing effective teachers has become one of the basic underlying principles of all teacher education courses and reflective teaching as an essential factor for the enhancement of the development of effective teachers. Ogonor and Badmus (2006) argued that it is more meaningful to promote reflective teaching among experienced teachers than novice teachers because experienced teachers are more intuitive whereas novice teachers take every step by careful consideration and deliberation. The skill of reflective teaching develops highly over time and this can be observed easily among the experienced teachers. Reflective teaching is used at both preservice and in-service levels of teaching, although coaching and peer involvements are the two aspects of reflective teaching seen most often at the pre-service level.

Navaneedhan (2006) opines that, reflective teaching involves recognizing, examining and ruminating over the way an individual teaches. As individual's possess their own background and experience, they bring certain beliefs, assumptions, knowledge, attitudes and values to teaching. A teacher finds his/her initial teaching effort stressful, but with experience he/she acquires a repertoire of teaching strategies that he/she draws on throughout his/her teaching, and this invariably constitutes his or her teaching style.

Boris (2016) associates continuous reflective teaching with lifelong learning resulting in the development of autonomous, qualified and self-directed professionals. Navaneedhan (2006) points out that becoming a reflective teacher involves moving beyond a primary concern with instructional techniques and how to question as well as asking ‘what’ and ‘why’ questions that regard instructions and managerial techniques, not as ends in themselves, but as part of broader education purposes. Asking the questions, ‘what and why’ gives certain power over individual's

teaching, resulting in the emergence of autonomy and responsibility in the work of teachers in reflecting on the above kind of questions, teachers begin to exercise control and open up the possibility of transforming every day classroom life.

Navaneedhan (2006) emphasizes that research on reflective teaching over the past two decades has shown that, it is linked to inquiry and continuous professional growth. Reflective teaching can be a beneficial form of professional development at both the pre service and in-service levels of teaching. It develops critical thinking and promotes experimental learning. It enhances personal growth. It gives freedom to teachers to impose their own methodology enhancing rational thinking.

Ogunbameru and Uwameiye (2012) explained that by engaging in reflective teaching, teachers show a capacity (or disposition) to analyze the process of what they are doing and to reconstruct their professional and personal knowledge schemes, while simultaneously making a judgment to adapt their practice to best match the needs of students. Reflective teaching involves critical examination of our motivation, thinking and practice, this leads Narvaez (2010) to described reflective teaching as an interpersonal experience leading to insight about ourselves as actors in our worlds.

Kullman in Ogonor and Badmus (2006) says a major focus of reflective teaching is personal growth. The reflective process involves continuous self-observation and evaluation of the trainee to understand individual actions and the reactions of learners. The process was conceptualized as an action research model whereby people learn and create knowledge by critically reflecting upon their own action and experiences, forming abstract concepts and testing the implications of these concepts in new situations. The value of engaging in reflective activity is enhanced if it is carried out in association with the colleagues, they may be trainees, teaching assistants, teachers or tutors (Pollard, 2006). Reflective teachers are likely to benefit from working together, experimenting, talking and reflecting with others. Apart from the benefits for learning and professional development, it is usually more interesting and more fun.

However, MoE (2019) reports that the ignorance of teachers and neglect of activity-oriented methods by teachers grossly contributed to learners' low performance in science. It is imperative to create room for further search for instructional tool that could appeal and arouse learners' interest and at the same time help to achieve the objectives of science education. Therefore, this study is intending to examine effect of Reflective Teaching Method on Grade 9

learners' academic performance in science in selected Junior Secondary Schools in Mufulira district in Zambia.

Methodology

This part presents the research methodology employed in the study. It encompasses, the research design, research approach, location of the study, sample size and sampling procedure, data collection instrument and procedure, validity and reliability, and data analysis.

Research design

The research design is a plan for studying the research problem that specifies the type of data, the methods to be employed to collect them, and how the collected data will be analysed (Collins & Stockton, 2018).). This research study used a quasi-experimental research design. The students were divided into two groups: Experimental group: it contained Grade 9 learners who were taught using Reflective Teaching Method (N= 50). Control group: It contained Grade 9 learners who by using Traditional Teaching Method (N=50). A diagnostic test was administered before the beginning of the study to ensure that Grade 9 learners had the same level of science knowledge and the background. A pre-test was given to the two groups to test the equivalency between the two groups before starting the study. After four weeks, a posttest was given to the two groups, in order to compare the achievements of the two groups after the implementation of the Reflective Teaching Method.

Research approach

Research approach refers to the fundamental set of principles and general procedural guidelines. Approaches are road maps that are associated with research purposes or scientific interests (Creswell, 2012). The researchers employed quantitative approach in achieving the research objectives. In this context, the researcher used the quantitative process to allocate meaningful numerical values to qualitative data, and they qualitatively analysed and assigned meaning to quantitative data (Cohen, Manion & Morrison, 2004).

Location of the study

This study was conducted in Mufulira district of Copperbelt Province. In line with Zulu and Nalube (2019), there are many motivating factors that could influence the researcher's choice of the study site, such as; the nature and incidence of the problem, research time frame, and data accessibility, clients' interest and instructions, availability of resources, performance in a particular field, goals and objectives of the study. Therefore, the researchers selected Mufulira

district of Copperbelt Province, as the choice of the site for the study because it has appeared that a study on the effect of the effect of Reflective Teaching Method on Grade 9 learners' academic performance in Science in Mufulira district, has not been conducted at the time of this present study; as such the knowledge gap for Mufulira district of Copperbelt Province, Zambia clearly appears to have existed. Additionally, poor grasping of Plants and Animal Cells concepts among the Grade 9 learners necessitated the authors to assess the effect of the effect of the effect of Reflective Teaching Method on grade 9 learners' academic performance in science in Mufulira district.

Sample size and sampling procedure

Hundred Grade 9 learners participated in this study and 50 of them were girls and 50 of them were boys' learners. To accommodate the gender differences, 10 girls and 10 boys' sections were chosen. The classes were selected using cluster sampling strategy. After the two classes were selected, one class was selected randomly to be the control group while the other one class was the experimental group. The experimental and the control group, each included a girl and a boy section.

Data collection instruments

Science Achievement Test (SAT) Much of the quantitative data was collected through the statistical achievement test. Validation of this instrument was guaranteed because the researchers adapted statistical tests already tested for validity. To assess the effect of reflective teaching method on Grade 9 learners' academic performance in science at junior secondary school, a science achievement test (SAT) was administered. the SAT was made up of the pre-test and post-test for both control group and experimental group. to prepare the SAT, questions were derived from the past examination past papers from institution A. confidence questionnaire a 5-point likert scale confidence questionnaire, ranging from strongly disagree (1) to strongly agree (5) developed by the researcher was used to collect data which was used to assess the effect of reflective teaching method on Grade 9 learners' academic performance in science at junior secondary school and confidence. it was administered as pre-test and post-test to both experimental group and control group. the questionnaire consisted of 3 statements (items):

Science achievement test (SAT)

Face and content validity for a Science Achievement Test (SAT) was done by the researchers at the University of Zambia. This was done in order to make sure that the test had appropriate

content and measured what it was intended to measure. The (SAT) was piloted on Grade 9 learners at a nearby Junior Secondary School. This allowed for detection of weaknesses in the test items and corrected accordingly before the final form was prepared for administration. Confidence Questionnaire Face and content validity of confidence questionnaire was done by the researchers. This was done in order to see if content was appropriate and measured what it was intended to measure. It was pilot tested at Junior Secondary School A.

Confidence questionnaire

The internal consistency of the confidence questionnaire was tested using Cronbach alpha and all the items appeared to be worthy of retention. With $\alpha \geq 0.9$ obtained, the instrument was declared reliable.

Data collection procedure

Pre-study

Experimental group

Grade 9 learners in the experimental group were introduced to Reflective Teaching Method before the beginning of the intervention for the purposes of familiarizing them with the method. This orientation took two (2) hours on the first day and the other one (1) hour on the second day. The Grade 9 learners liked Reflective Teaching Method.

Control group

The control group was taught using traditional lecturing method. The content that was taught in the control group was exactly the same as that which was taught in the experimental group. All questions and tasks were the same for the two groups; the only difference was the methodologies used. Experimental group was taught with Reflective Teaching Method while the control group was taught using traditional lecturing methods without Reflective Teaching Method. In the control group, Grade 9 learners primarily learnt by listening, observing, and discussions in small groups and as a whole class whenever question and answer strategy was employed in the teaching. Each lesson was 80 minutes long and teaching was done for one month.

Data analysis

Analysis of quantitative data from the test started with computation of test scores which were later analyzed by both inferential and descriptive means (Collins & Stockton, 2018). The data that was collected was analyzed using statistical package for social sciences (SPSS) version 26

(IBM, 2021). The independent samples t-test was used to check if there were statistically significant differences in the academic achievement mean scores between the experimental group and the control group. Data that was collected using a five-point Likert Scale confidence questionnaire was analysed using descriptive statistics (mean) and results were presented in form of tables for easy description of trends in the data. The level of significance for acceptance or rejection of null hypotheses was set at $\alpha = 0.05$, confidence level = 95%

Findings

The effect of Reflective Teaching Method on Grade 9 learners’ academic performance in science at Junior Secondary School

The first objective of the study sought to establish the effect of Reflective Teaching Method on learners’ academic performance in science at Junior Secondary School. In order to check equivalency of the control and experimental groups in terms of knowledge, a Reflective Teaching Achievement Test (RTAT) developed by the researcher was given to the respondents before the intervention as a pre-test.

Pres-test results

Table 1: Independent samples t-test

| Equal Variance Assumed | Group | N | Mean | Mean Diff | SD | t | df | Sig (2 tailed) |
|------------------------|--------------|----|-------|-----------|-------|-------|----|----------------|
| | Experimental | 25 | 40.00 | -1.4400 | 13.80 | -.359 | 48 | .722 |
| | Control | 25 | 41.44 | | 14.59 | | | |

Source: Field data, 2022

Table 6 above shows the independent samples t-test results for the pre-test scores for the control and experimental groups. The t-value was -.359 for 48 degrees of freedom and the probability value was .722. The probability value calculated is greater than the set α -level equal to 0.05. This simply means that there is no statistically significant difference in knowledge on the learners between the control group and the experimental group. This showed that the two groups were equivalent in terms of knowledge they had on science before the intervention. Another possible factor that led to such results in this domain is the type of questions learners are exposed to in their classes on a daily basis. Each time the researcher wrote science questions in science

with the control group, the researcher asked learners to come in front and solve science questions on the board.

Post-test results

Table 2: Independent samples t-test

| Equal Variance Assumed | Group | N | Mean | Mean | SD | t | df | Sig (2 tailed) |
|------------------------|--------------|----|-------|-------|-------|------|----|----------------|
| | | | | Diff | | | | |
| | Experimental | 25 | 80.28 | 34.92 | 12.18 | 8.42 | 48 | .000 |
| | Control | 25 | 45.36 | | 16.79 | | | |

Source: Field data, 2022

Table 7 shows the independent samples t-test results for the post-test scores for the control group and experimental group. The t-value was 8.42 for 48 degrees of freedom and p-value was .000. The p-value calculated is less than the level of significance α -level = 0.05. This means that there is a statistically significant differences in the post-test achievement mean scores between control group taught using traditional method of teaching without Reflective Teaching and experimental group taught using Reflective Teaching Method. This means that Reflective Teaching had a positive effect on learners' academic performance as compared to traditional method without Reflective Teaching.

What is the difference between the achievement of Boy and Girl learners taught using Reflective Teaching Method in Science?

Pre-test results

Table 3: Independent samples t-test

| Equal Variance Assumed | Group | N | Mean | Mean | SD | t | df | Sig (2 tailed) |
|------------------------|--------------|----|-------|-------|-------|-------|----|----------------|
| | | | | Diff | | | | |
| | Experimental | 25 | 43.56 | -.600 | 13.91 | -.131 | 48 | .896 |
| | Control | 25 | 44.16 | | 18.10 | | | |

Source: Field data, 2022

Table 3 shows an independent samples t-test results for pre-test for the Boy and Girl learners. The t-value was -1.131 for 48 degrees of freedom, p-value was 0.896. This p-value is greater than the level of significance $\alpha = 0.05$, meaning that there is no statistically significant

difference in science between boy and girl-child in the experimental group and control group. This showed that the boy and girl-child were at the same level in terms of graphing Hyperbolic Functions before the intervention.

Post-test results

Table 4: Independent samples t-test

| Equal Variance Assumed | Group | N | Mean | Mean Diff | SD | t | df | Sig (2 tailed) |
|-------------------------------|--------------|----------|-------------|------------------|-----------|----------|-----------|-----------------------|
| | Experimental | 25 | 55.36 | 1.12 | 15.98 | .226 | 48 | .822 |
| | Control | 25 | 54.24 | | 18.99 | | | |

Source: Field data, 2022

Table 4 shows the independent samples t-test for post-test scores for the boy and girl-child in the experimental group and control group. The t-value was .226 for 48 degrees of freedom and the p-value was .822. This p-value is greater than the level of significance $\alpha = 0.05$ ($p > 0.05$). Therefore, this means that there was no statistically significant difference in the post-test Science skills, concepts and understanding mean scores between boy and girl-child in the experimental group and control group. This means that Reflective Teaching Method had no effect on gender.

What is the effect of Reflective Teaching Method on Grade 9 Learners’ Confidence in Science?

The confidence of Grade 9 learners’ in science was investigated by using a questionnaire developed by the researcher with five (5) point Likert scale ranging from strongly disagree (1) to strongly agree (5) as a data collection instrument. The questionnaire was given as both pre and post-test.

Pre-test Confidence Results

The confidence questionnaire was administered before treatment in order to determine the initial Grade 9 learners’ confidence on understanding Science concepts in the experimental and control groups. The responses from the pre-test questionnaire were analyzed and outcomes summarized in Table 5 and 6. The confidence mean and standard deviation were calculated in order to show the mean for Grade 9 learners’ confidence on the five-point Likert scale. A mean score of above 5.0 meant a positive confidence (high confidence) on understanding Science concepts, a mean score of 5.0 meant neutral (not decided) and a mean score of below 5.0 meant negative

confidence (low confidence) on understanding Science concepts. The following are the column heading codes: SD-Strongly Disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly Agree, CM-Confidence Mean, and STD.D -Standard Deviation.

Table 5: Pre-test Confidence Results

| Group | SD | D | N | A | SA | CM | STD. D |
|---------------------|--------------|--------------|--------------|--------------|-------------|-------------|---------------|
| | (%) | (%) | (%) | (%) | (%) | | |
| Experimental | 14.23 | 21.34 | 23.12 | 18.34 | 8.23 | 4.15 | 2.123 |
| Control | 10.76 | 20.14 | 16.56 | 24.34 | 2.67 | 3.82 | 1.424 |

Source: Field data, 2022

Table 5 shows that the two groups were comparable in terms of their confidence on understanding Science concepts as seen from confidence mean (CM) responses of 4.15_{Experimental} and 3.82_{Control}, which on the 5-point Likert scale both groups had negative motivation on understanding Science concepts. The confidence questionnaire was administered after treatment in order to assess the effect of Reflective Teaching Method on Grade 9 learners' academic performance in science. The post-test questionnaire responses were analyzed in the similar manner as in the pre-test and the results were summarized and presented in Table 6.

Post-test Confidence Results

Table 6: Post-test Confidence Result

The following are the column heading codes: SD-Strongly Disagree, D-Disagree, N-Neutral, A-Agree, SA-Strongly Agree, CM-Confidence Mean, and STD.D -Standard Deviation.

| Group | SD | D | N | A | SA | CM | STD. D |
|---------------------|-------------|--------------|--------------|--------------|--------------|-------------|---------------|
| | (%) | (%) | (%) | (%) | (%) | | |
| Experimental | 2.45 | 15.13 | 16.76 | 23.14 | 20.14 | 7.67 | 1.45 |
| Control | 4.05 | 12.13 | 21.60 | 28.78 | 18.17 | 6.19 | 2.16 |

Source: Field data, 2021

Table 6 shows that the two groups were different in terms of their confidence understanding Science concepts as seen from confidence mean (CM) responses of 7.67_{Experimental} and 6.19_{Control}, which on the 5-point Likert scale meant positive confidence on understanding Science concepts.

Discussion

The effect of Reflective Teaching Method on Grade 9 Learners' Academic Performance in Science at Junior Secondary School

The findings of this research study revealed that there was statistically significant differences in the academic achievement mean score of the post Reflective Teaching Achievement Test (RTAT) results of learners in the experimental group which was taught with Reflective Teaching. When the average scores in the Reflective Teaching Achievement Test (RTAT) instrument were compared using an independent samples t-test, it was revealed that there was a statistically significant difference between the mean academic achievement score of the experimental group, which was taught with Reflective Teaching Method and that of the control group, which was taught using traditional methods without Reflective Teaching Method. Therefore, results of the study revealed that Reflective Teaching Method had a positive effect learners' academic performance.

Table 2 shows an independent samples t-test of Reflective Teaching Achievement (RTA) post-test ($df=48$, $p\text{-value}=0.000$, $t=8.422$, $\alpha=0.05$) under two tailed. Since the p-value is less than $\alpha=0.05$, results of the study established that there was a statistically significant difference in the Achievement mean score of learners in the post-test results for the experimental group taught with Reflective Teaching Method and control group taught without Reflective Teaching Method. The result shows that Reflective Teaching Method had positive effect on learners' academic performance in science.

This difference in science Achievement post-test between experimental and control groups (in favour of experimental group) is as a result of the use of Reflective Teaching Method which facilitated easier understanding of science concepts in the experimental group. These results also show that Reflective Teaching Method allowed learners to participate actively in their learning; hence the concepts of science questions were understood better.

The findings of this study are in line with the study conducted by Ameh and Dantani (2012) who found that Reflective Teaching Method presented an excellent opportunity to better understanding of science concepts; students demonstrated a deep abstracted conceptual understanding when moving forward in learning new science concepts. The findings of the study are also supported by Ogunbameru and Uwameiye (2012) who looked at the effectiveness of using Reflective Teaching Method on students' understanding in learning Physics. Results of the study showed that that not only student scores were increased, but Reflective Teaching Method

created an energetic classroom environment that was full of clear values of cooperation and collaboration among students.

In view of the above findings, researchers therefore argue that Reflective Teaching Method had a positive impact on learners' academic performance in science. The possible reasons for this finding could be that Reflective Teaching Method enabled students in the experimental group to check the correctness of their methods and the accuracy of their work. Being able to check one's own work goes a long way in determining achievement levels in general and in particular science concepts. Because Reflective Teaching Method is dynamic, learners in the experimental group had opportunities of re-examining their work and see how changing any parameter could affect the concepts of science, while those in the control group could not do the same.

Effect of Reflective Teaching Method on Gender in Relation to Understanding of Science Concepts and improving academic performance

The findings of this study with regards to gender revealed that there was no statistically significant difference in understanding of Science Concepts and improving academic performance between Boy and Girl child taught using Reflective Teaching Method (experimental group) and Traditional Method (Control group). Table 4 shows that the Boy and Girl child in the experimental group were equivalent in understanding of Science Concepts and improving academic performance before the intervention (pre-test means scores) with the control group. This is evidenced by an independent samples t-test for pre-test in Table 3 whose t-value was -1.131 for 48 degrees of freedom, p-value was 0.896 under two tailed. Since p-value is greater than the level of significance $\alpha = 0.05$, then the Boy and Girl child were equivalent in terms of understanding of Science concepts and improving academic performance before they were exposed to Reflective Teaching Method. Table 5 also shows an independent samples t-test for post-test, t-value was .226 for 48 degrees of freedom and the p-value was .822 under two tailed. Since the p-value is greater than 0.05 ($p > 0.05$), then there was no statistically significant differences in the post-test mean scores of the Boy and Girl child taught using Reflective Teaching Method (experimental group) and Traditional Method (Control group).

The Boy and Girl child taught in the experimental group (taught how to understand Science concepts and improving academic performance using Reflective Teaching Method) performed the same on average in terms of mean scores and the Control group taught with Traditional Method in both PreSAT and PoSAT. When the independent samples t-tests were done for Grade 9 learners with respect to gender in the experimental group and control group, there was no

statistically significant difference in achievement between the Boy and Girl child. One possible explanation to this finding is attributed to the fact that both Boy and Girl child were exposed to same software-rich learning environment. Reflective Teaching Method gave both the Boy and Girl child in the experimental group and control group the same opportunities on how to understand Science concepts through exploration and visualization.

Reflective Teaching Method acted as an important scaffold for both the Boy and Girl child to bridge the gap in the zone of proximal development as advanced by Vygotsky's social development theory (Vygotsky's, 1986). This finding showed that Reflective Teaching Method created an enabling learning environment that accorded equal chances of learning to both the Boy and Girl child. The study also revealed that Reflective Teaching Method allowed the Boy and Girl child to learn how to understand Science concepts and improving academic performance at the same level and this led to a conclusion that Reflective Teaching Method is not discriminatory gender-friendly and it impacts positively on both Boy and Girl child.

The findings of this study are in agreement with the study done by Ameh and Dantani (2012) who found that high level of corporation was visible among female and male students as they were helping each other most of the time. Therefore, researchers infer that working in groups and the degree of interaction between Boy and Girl child are huge benefits of using Reflective Teaching Method, Grade 9 learners were passionate to demonstrate their science skills and transfer their recent experience to their colleagues.

Effect of Reflective Teaching Method on Grade 9 learners' Confidence on how to understand Science Concepts

Based on the findings from Table 6, it was evident that there was positive effect of Reflective Teaching Method on Grade 9 learners' confidence on how to understand Science Concepts. Tables 5 showed that the pre-test overall confidence mean for experimental group was 4.15 (SD =14.23) and that of the control group was 3.82 (SD=10.76). This means that both experimental and control groups developed negative confidence (low confidence) on how to understand Science concepts. In Table 6, the confidence mean response for post-test of 7.67 for experimental group on the five-point Likert scale showed a positive confidence how to understand Science concepts ($7.67 > 5$) and the confidence mean response of 6.19 for control group also showed positive confidence to understand Science concepts on the five-point Likert scale ($6.19 > 5$). This means that both experimental and control groups developed positive confidence. Nevertheless, the confidence mean response in experimental group is higher than the

confidence mean response in the control group (mean = 7.67_{experimental} and 6.19_{control}). These results showed that Reflective Teaching Method had more positive effect on the confidence on how to understand Science concepts in the experimental group as compared to control group which was taught using traditional teaching method without Reflective Teaching Method. This rise in positive confidence for Grade 9 learners in the experimental group showed that using Reflective Teaching Method in teaching and learning of how to understand Science Concepts enhanced Grade 9 learners' confidence to learn the subject. On the other hand, the marginal rise in positive confidence developed by the Grade 9 learners in the control group was as a result of group discussions that were done during lessons.

Conclusion

This study investigated the effect of Reflective Teaching Method on Grade 9 Learners' Academic Performance in Science at Junior Secondary School. The study findings showed and provided evidence that using Reflective Teaching Method has a positive effect on Grade 9 learners academic performance and confidence in Science. The results have also shown that learning Science using Reflective Teaching Method is more effective without it in enhancing Science skills, improving academic performance, and confidence of the Grade 9 learners. Grade 9 learners who learnt Science with Reflective Teaching Method had improved their Science skills and academic performance after the treatment as it was shown in their higher scores than those who learnt the topic without using Reflective Teaching Method. The Reflective Teaching Method also allowed the Boy and Girl child to learn Science at the same level and this led to a conclusion that Reflective Teaching Method is not discriminatory and it impacts positively on both the Boy and Boy child. Furthermore, the results obtained from the questionnaire indicated that Grade 9 learners who were taught using Reflective Teaching Method developed more positive confidence on how to learn Science than their counter parts that were taught without using Reflective Teaching Method.

From the findings of this study, it can therefore be concluded that using Reflective Teaching Method on how to learn Science is an effective way of improving Grade 9 learners' academic performance and enhance confidence of Grade 9 learners on how to learn Science.

Recommendations

In the view of the study findings and conclusion, the following recommendations are made:

1. Teachers of science in Junior Secondary Schools should consider applying research-based teaching tools such as Reflective Teaching Method to teach Grade 9 learners on how to understand science concepts.
2. Teachers of science should consider implementing Reflective Teaching Method in their teaching “to explain, to explore, and to model science concepts and the connections between these concepts”.
3. Teachers of science should incorporate Reflective Teaching Method in science topics that are perceived to be difficult for both learners and teachers.
4. Teachers of science should be encouraged to use Reflective Teaching Method in the teaching of science.
5. Since the use of Reflective Teaching Method in science proved to be effective, the research should be conducted on a large scale and in other topics in science to see if the same results can be obtained.

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