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TSHWANE GRADE 9 LEARNERS' PERCEPTION OF ATTITUDE AND THEIR MATHEMATICS PERFORMANCE IN SOUTH AFRICA

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ABSTRACT

Learners' attitude has been a major concern as far as academic performance is concerned, especially in mathematics. It is a common understanding that a winning attitude wins the race, and such a positive attitude will enhance learning at all times, regardless of the subject in question. This has made it necessary to fact-check the effect of the learners' attitude on Tshwane learners' performance in mathematics. The study probed into the Tshwane grade 9 learners' perceptions of their attitude as influencing their mathematics performance in South African public high schools. A mixed-method approach (quantitative and qualitative) was applied in the study, with a descriptive survey design. A sample of four hundred learners was used (Two hundred and eighty females and one hundred and twenty males), using a self-made questionnaire for data collection, incorporating a few open-ended questions. The level of achievement of learners was also ascertained through their termly progress report in mathematics. The quantitative data analysis was done using the 24.0 version of the Statistical Package for the Social Sciences (SPSS), also the qualitative data analysis was achieved in a narrative form. The study tested the null hypothesis was rejected. The study result found that Tshwane grade 9 learners' perceptions of attitude as a predictor of their mathematics performance was a significant factor, hence, the study recommended that parents and teachers should inculcate and model positive attitude unto learners for better understanding and performance in mathematics; learners should love mathematics like every other subject, and shun truancy, absenteeism and boycott of mathematics lessons

Introduction

Every nation across the globe is mainly concerned about growing its economic activities, and these economic activities can be advanced through technology, thus making it a global issue. As a result, applying mathematical skills globally becomes crucial, hence, establishing mathematical sciences as a key to unlocking technological development in every nation (Kaiser, 2020; Odeyemi-Bsd, 2021; Odeyemi-Bsd, 2023). Across the global spectrum, many countries are facing challenges in acquiring the basic mathematical skills required for learners. Studies have portrayed how American learners have repeatedly failed mathematics in global assessments among 56 countries, and American learners did not attain the international benchmark (Mullis & Martins, 2019; OECD, 2020). The European learners also had the same woeful outcome (Lithner, 2011).

West African studies on learners' mathematics performance have also shown a highly unpleasant performance; some of these countries include Nigeria (Odeyemi-Bsd, 2024; Ohanyelu, 2021), Ghana (Abreh et al., 2018; Mensah et al., 2013), Gambia (Tomita & Savrimootoo, 2016), and Liberia (Gbolle & Keamu, 2017).

Many countries have discovered how useful and important mathematics is, and they recognise that their national well-being requires the mathematical acumen of their youth in nation-building (Wright & Ellis, 2019). This has pushed South Africa into action by considering mathematics as a compulsory subject at all levels and for the pursuance of a higher education required for highly skilled positions, for enhancing national development (Naidoo & Ranchod, 2018). The scarcity of mathematical experts in industries has risen immeasurably, and several of those without the knowledge of existing mathematical relationships and mathematical reasoning required for tentative conclusions are in workplaces (Sawatzki & Sullivan, 2018; Budinski & Milinkovic, 2017). Poor mathematics performance has remained a global plague which has been so worrisome to learners for years. This has attracted concerns from many (Arends, Winnaar & Mosimege, 2017; Pisa, 2018; Odeyemi-Bsd, 2020, Odeyemi-Bsd, 2023).

South African learners' poor performance in mathematics has aroused attention from numerous educational sectors, due to the invaluable contribution of mathematics to education, and the drive for attaining the technological feat in South Africa, which is non-negotiable (Department of Education, 2008; Jojo, 2019; Odeyemi-Bsd, 2020, 2023). This makes it necessary for learners to study mathematics literacy or mathematics compulsorily. The Human Sciences Research Council (HSRC) report revealed that Tshwane municipality learners have consistently performed below expectations, starting from Grade 1 to Grade 12. The breakdown of the results were, 68.4%, 61.8%, and 55.4% respectively for the lower grades of 1 to 3, while grade 4 had 37.3%, grade 5, 37.3%, grade 6, 43%, grade 9, 10.8%, grade 12, 14% in 2014 (Department of Education, 2014). In the 2017 Trends in International Maths and Science Study (TIMSS), 39 countries were examined, and South African grade 9 learners ranked 38th position among the 39 nations, which equals to 87% level of failure (Reddy et al.,

2016). Similarly, in the 2018 Programme for International Students Assessment (PISA), South African learners came out as the poorest from the 80 countries involved in the exam (PISA, 2018). In addition, the evaluation of the World Economic Forum (WEF) in 2018 presented that South African learners also failed to achieve a globally acceptable level of mathematics proficiency in comparison to other countries. Grade 9 learners in particular obtained the poorest grade globally in the TIMSS 2019 grade 9 results (Reddy et al., 2022). From this backdrop, the Government and the Department of Basic Education (DBE) made it a priority on their educational agenda to attain quality educational outcomes at all levels. It became imperative for an urgent and enduring solution to be proffered to the general poor mathematics performance of the South African learners (Hajovsky et al., 2020; Odeyemi-Bsd, 2023).

Statement of the problem

The background to the study has clearly shown the value of mathematics in human society; learners have consistently been finding it challenging to understand and pass the subject despite its importance (Odeyemi-Bsd, 2020; Naidoo & Ranchod, 2018). A large number of learners in South Africa are far behind in reaching an acceptable proficiency level in mathematics (Odeyemi-Bsd, 2020; Reddy et al., 2016; DOE, 2014; Tachie & Chireshe, 2013; Mullis et al., 2012). The background to the study gave a highlight of a few studies made on mathematics performance in various South African provinces, but none were done in Tshwane, nor were any done concerning the grade nine learners of Tshwane as well. It is against this information from background information that this present study sought to probe into Tshwane grade 9 learners' perceptions of their attitude as influencing their mathematics performance.

Objectives

- i. To establish the Tshwane grade 9 learners' perceptions of their attitude as a predictor of their mathematics performance.
- ii. To determine possible strategies for improving Tshwane grade 9 learners' mathematics performance as perceived by learners..

Research question

What is the perception of Tshwane grade 9 learners of their attitude and their mathematics performance?

Hypothesis of the study

The study hypothesis was quantitatively tested at $P < 0.05$.

Ho1: There is no significant relationship between Tshwane grade 9 learners' perceptions of attitude as influencing their mathematics performance.

Theoretical Framework

The study was premised on the Social Cognitive Theory as propounded by Bandura (1986). The SCT has a strong link in the network of interactions within the learning environment. This network of interactions comprises the application of self-observation and self-evaluation, role modelling and self-efficacy in the learning process. This posits that the academic performance of learners are directly linked to these interrelated components existing within the environment of learning. Learners' environment has consistently been a major platform required for effective learning and remarkable academic performance. However, the role of self-observation and self-evaluation, role models, and self-efficacy predict learners' attitude in every learning process, and places the learner rightfully (Odeyemi-Bsd, 2023; Redmond, 2010). Consequently, explaining the SCT under the three cardinal interrelated components of the theory underscores that effective learning is a function of learners' ability to cultivate the right attitude towards learning, regardless of the level of cognition. Based on the learner's self-observation and evaluation of himself, he can build a positive attitude to learn; where there are good role models modelling the right attitude needed for learning, and where the learner's self-efficacy projects a willing and winning spirit, learning becomes very easy, and better performances are achieved. This theory was found relevant in order to give a better explanation of the Tshwane grade 9 learners' perceptions of attitude as a predictor of their mathematics performance, also to propose a usable model for improving learners' mathematics performance.

Review of related literature

Mathematics performance in most cases has been attached to cognition; however, it has been established that cognition without learners' interest will not guarantee positive performance (Odeyemi-Bsd, 2020). Many have a misconstrued idea about attitude as being affective only, but attitude consists of cognitive, affective and behavioural identities (Ifamuyiwa et al., 2024; Odeyemi-Bsd, 2020; Prathmesh, 2024). Odeyemi-Bsd (2020) explains attitude as a positive or negative emotional construct or disposition about a situation or phenomenon. Hence, this is linked to how learners perceive their interest and performance in mathematics as a subject. To this end, learners' attitude about mathematics performance has been regarded as significant to school performance and experience (Middleton, Jansen & Goldin, 2017). Various studies posited a high level of relevance of learners' attitudes towards their mathematics performance. Studies across the globe ascertained this position stated above, pointing out that learners' attitude is a determinant key factor to improved academic performance. These studies were done in America (George & Adu, 2018; Jacoby-Senghor, Sinclair & Shelton, 2016; Bowen & McPherson, 2016); Canada (Bandura, 2007); Asia (Radhika, 2019; Mohd, Mahmood & Ismail, 2011); Europe (Bramlett &

Herron, 2009; Manoah et al., 2011; Kogce et al., 2009); Nigeria (Serin & Mohammadzadeh, 2008; Bassey et al., 2008; Oluwatelure & Oloruntegbe, 2010); Ghana (Abreh et al., 2018, Mensah et al., 2013) and South Africa (Buhagiar, 2013; Odeyemi-Bsd, 2020).

Schonfeld (2008) revealed that 10th to 12th-grade American learners perceived mathematics as difficult in comparison to other subjects. A longitudinal study of George (2006) on American learners also revealed that learners' attitude towards science was positive at the elementary stage, but declined over the middle school and high school years. The study posited that the major time-varying predictors of both attitudes were traced to poor self-concept in science, negative peer attitudes and learners' deliberate poor participation in science and mathematics-associated tasks. Likewise, Lukowski et al. (2016) posited that learners in American schools have shown that their poor mathematics performance was not unconnected from their attitude, especially their mathematics anxiety. Learners' negative attitude has been perceived as a major clog to learners' mathematics performance in secondary schools (Gunderson, Sorhagen, Gripshover, Dweck, Goldin-Meadow & Levine, 2017; Park, Gunderson, Tsukayama, Levine & Beilock, 2016). Jankowski (2017) also emphasised on the need for learners to develop a positive attitude for problem solving as a means to mathematical success. Learners without motivation most times come up with a negative attitude, while those who are well-motivated show a more positive attitude towards academic excellence (Uzezi & Deva, 2017). The present study sought to establish the influence of attitude on Tshwane grade 9 learners' Mathematics performance in South Africa.

Studies on mathematics performance from Europe have persistently concentrated on learners' attitudes when it comes to mathematics, and the studies found that attitude was a predictor of learners' performance in mathematics (Wen & Dube, 2022). A comparative study of Hassan (2008) among Australian tertiary students and secondary learners on the influence of attitude on performance in mathematics additionally disclosed that the attitude of learners about mathematics performance changes positively in the course of transition to a tertiary institution, while a few secondary learners exhibit a negative attitude toward mathematics performance. While the motivated learners also display a positive attitude towards class work and aspire for better grades through attentiveness in the classroom and gaining additional information on the subject matter, and possibly overcoming difficulties (Stafford-Brizard, 2016). In the light of the above discussion, the present study sought to establish whether the situation in Europe applies to Tshwane grade 9 learners in their performances in mathematics.

The Asian researchers have also revealed from their findings that attitude is a major barrier to the performance of learners in Mathematics (Radhika, 2019; Tahar et al, 2010). Radhika (2019) further explained that Asian learners who displayed a reasonable level of resilience worked harder to get desirable mathematics results at the end. This is an indication that learners who are always in a hurry may not do well in mathematics, this is because patience is required. Furthermore, students' interest in mathematics, anxiety about mathematics, mathematics self-efficacy, extrinsic motivation and self-concept were the five notable factors responsible for

Asian learners' mathematics attitude (Tahar, Ismail, Zamani & Adnan, 2010). From the above discussion, the present study sought to establish if the situation in Asia is relevant to that of Tshwane grade 9 learners in South Africa.

In West Africa, attitude has also been perceived as a critical factor undermining the mathematics performance of learners from studies in Nigeria (Serin & Mohammadzadeh, 2008; Bassey et al., 2008; Oluwatelure&Oloruntegbe, 2010). Similarly, learners' attitude towards mathematics has also been perceived as hindering learners' performance in Ghana (Abreh, Owusu, &Amedahe, 2018; Mensah, Okyere, &Kuranchie, 2013). The studies above reiterate the position of the SCT that informed the present study that people's perceptions and attitudes are most times associated with their learning experiences through the environment. The personal feelings of individuals about certain things have a major role in determining their actions (Williams & Finnegan, 2003).

In the South African background, learners' attitude towards mathematics performance has been considered detrimental to their mathematics success (Buhagiar, 2013; George & Adu, 2018; Middleton et al., 2016). Many South African learners have been performing badly in mathematics due to their negative attitudes towards the subject (Reddy et al., 2016; Department of Education, 2010).

Learners' attitudes have also been seen as insignificant in affecting academic performance. Instances of such literature are in America (Hwang, Choi, Lee, Culver & Hutchison, 2016; Honicke& Broadbent, 2016), Europe (Ozsoy et al., 2009; Alsop & Watts, 2003), and Asia (Najmi et al., 2018). These studies established that the link between attitude and learners' performance in mathematics was weak and cannot be perceived to be of serious significance. Attitude was also considered as a feeling and a construct of the affective domain that does not necessarily undermine the cognitive domain, regarded as important for academic tasks (Ozsoy et al., 2009; Alsop & Watts, 2003).

Methodology

This present study was carried out within the post-positivist paradigm, which emphasises the concept of unbiased reality. 400 participants (Tshwane grade 9 learners) were selected randomly from the overall population of 143,175, with 10 clusters identified, and the participants, totalling four hundred learners, were selected systematically using gender and classes. The study was descriptively surveyed, with a mixed method approach because of the few open-ended questions integrated in the questionnaire titled: Questionnaire on Student Academic Performance (QSAP). The questionnaire was assimilated from Auzmendi's scale of attitude for mathematics performance, which was used for sourcing data from participants, and the questionnaire was sectioned into two parts, namely, A and B, where part A addressed participants' demographic data, and section B addressed the data on the perceptions of learners on the predictors of their mathematics performance. Learners'

termly mathematics result was used as an achievement test to ascertain the level of performance, and the questionnaire.

A 4-point Likert scale was used to capture responses from the participants, with the choices of: strongly agree, agree, disagree and strongly disagree. These were scored 4, 3, 2 respectively, in tandem with every item of rating positive items, while negative items were rated reversely. To ascertain the validity of the questionnaire, measurement and evaluation, and psychology of education experts were employed; and a pilot test at different schools outside the study sample was done to achieve the reliability of the questionnaire as well. Using the test-retest technique, within the intervals of 28 days, the reliability was empirically achieved at a coefficient value of 0.65. Pearson Product-Moment Correlation was employed to establish the correlation of the variable on learners' performance in mathematics. The questionnaire was administered to participants by the researcher. In the analysis of the quantitative data collected, the Statistical Package for the Social Sciences was applied. In the qualitative data, its trustworthiness, credibility, dependability and transferability were also ascertained. The open-ended questions segment on strategies perceived by learners for the improvement of their performances was also narratively analysed. Using a mixed method approach in this study gave room for impartial and objective descriptions and explanations of information about the learners' perceptions and definitions within a natural context.

Results

Hypothesis Analysis

A null hypothesis was developed for this study, and it was statistically tested to enable accepting or rejecting the hypothesis. The hypothesis was tested at a significance level of 0.05, with the use of Pearson Product-Moment Correlation.

Hypothesis 1: There is no significant relationship between Tshwane grade 9 learners' attitude and their mathematics performance

Data Analysis

Table 1: Relationship between Tshwane grade 9 learners' attitude and academic performance in mathematics (N=400)

Variable	Mean	sd	n	df	r-cal	r-crit	Sig. Level
Attitude (motivation, confidence, fear, anxiety)	15.71	3.93	400	398	0.81	0.20	0.05
Performance	54.96	13.51					

Significant

Tab 1 gave us evidence showing a calculated r-value of 0.81 as the relationship between grade 9 learners' attitude and their performance in mathematics. Due to the greater value of the calculated r-value against the critical r-value of .20 given 398 degrees of freedom at .05 level of significance, this made the calculated r-value significant. This has strongly indicated a significant relationship between Tshwane grade 9 learners' attitude and mathematics performance.

The study made it known that learners perceived an existing relationship between their attitude and their mathematics performance. Additionally, Tshwane grade 9 learners had a positive rating of their satisfaction with the relationship between their attitude and their performance in mathematics. The study findings also established that learners portray a negative attitude towards learning mathematics as a subject. Learners' negative attitude has been considered a major setback confronting learners in learning mathematics. Where learners lack self-confidence, they would not perform well in any mathematical task, irrespective of teachers' teaching efforts. Therefore, the inability to perform well is centred on a negatively conceived opinion about the subject and themselves not being capable of doing well in the subject. The findings of the present study on learners' attitude and performance are in tandem with the views of George (2006), who posited that the overall trend for learners' attitude about the benefits of science was positive; however, as time goes on in their middle classes, their interest declines.

It was further revealed that learners believed that the most critical time-varying predictors of positive and negative attitudes were poor science self-concept, peer attitudes, and learners' poor participation in mathematics and science-related activities. Learners have at this time cultivated a negative attitude about mathematics, thereby having a fixed personal opinion, coupled with a lack of interest. This is also in line with the SCT, which mentioned that personal thoughts and beliefs of individuals have a strong influence on learning and understanding contextual events. With poor self-concept, learners may also be performing poorly in mathematics.

It was also discovered from the study that most learners perceived that mathematics is difficult, and cannot be easily comprehended like other subjects; hence, they felt that learning mathematics may not be necessary for them in the future, based on their opinion that mathematics is a very difficult subject that cannot be easily learnt or understood. Therefore, learners felt that they may not need the subject shortly. This finding is in tandem with Hassan (2008), who maintained that learners' desire to learn mathematics can be influenced by the joy and value derived from the subject. Lukowski et al. (2016) also shared the same view above about the European learners, while some Asian studies, such as (Radhika, 2019), Yilmaz et al., 2010), Tahar et al., 2010) were of the same views with the position of Lukowski et al. (2016) about the European learners' perceptions.

Further findings revealed that Tshwane grade 9 learners' perceptions of mathematics teaching methodology were ambiguous, rigorous, confusing, complex, and too boring; hence, learners lost desire for learning mathematics. This finding was consistent with some studies in Ghana (Abreh et al., 2018; Mensah et al., 2013), which reveal that mathematics involves the use of several rules, thereby preventing learners from exploring the beauty of mathematics and the several means required for developing competence, thereby contributing to learners' negative attitude towards mathematics. This finding is in line with Bandura's SCT, which informed the study, which states that individual perceptions and attitudes are often attached to learning experiences through individual feelings and attitudes within an environment. Ab initio, learners who do not have a positive attitude towards their studies have been found not to perform well in mathematics due to their negative attitude and perceptions of mathematics as a subject. In addition, the findings of the present study on learners' attitude concurs with Buhagiar (2013), who confirmed that most South African learners have tagged mathematics as difficult, unexciting, abstract and vague. Reddy et al. (2016) and Department of Education (2010) also confirmed that many South African learners in the 9th grade have been consistently backwards in mathematics as a result of their negative attitude formed for the subject, and this has prevented them from gaining admission into higher institutions of learning. The findings of the study further established the provision of a reward mechanism as a form of motivation; this may be a source of encouragement to learners in striving for excellence. This result was consistent with Stafford-Brizard (2016) in America, who posited that motivated learners exhibit more acceptable classroom behaviour, by becoming more attentive, working for higher grades and seeking additional information in order to overcome learning difficulties.

In contrast, some studies have revealed that attitude was not perceived as having a significant relationship with performance in mathematics; some of these studies were done in America (Hwang et al., 2016; Honicke & Broadbent, 2016); Europe (Ozsoy et al., 2009; Alsop & Watts, 2003); and Asia (Najmi et al., 2018). This study established that there is a weak correlation between attitude and performance in mathematics. The possible reason for the contrast in the previous literature, which states that attitude does not increase learners' performance, and the present study finding stating that attitude increases learners' performance was that attitude has been perceived as a construct of the affective domain without impacting human and learner cognition. The affective domain in science and mathematics has been identified as important to cognition in recent times, but it has not attracted much attention from scholars in the cognitive field of study. Attitude was also taken for a mere feeling, and feelings cannot be equated with reasoning (Alsop & Watts, 2003).

Possible strategies perceived for the improvement of Tshwane grade 9 learners' attitude and their performance in mathematics

The negative attitude of Tshwane grade 9 learners negative attitude has been observed as detrimental to their mathematics performance. Hence, the learners have perceived that obtaining good grades in mathematics requires a positive attitude and an undivided interest in solving mathematical problems if anyone wants to excel academically. Learners identified further that learners who have a hatred for mathematics have been perceived as unable to perform adequately in the subject. It is imperative for learners to love mathematics like every other subject. It has also been discovered that most times, learners who don't perform well in mathematics are often absent from mathematics class; hence, truancy and skipping classes were discouraged. It was also perceived that fearful learners lack confidence in themselves, hence, fail to perform well in mathematics. Learners displaying poor self-confidence are most times at the mercy of other learners. It was further perceived by the learners that every learner should summon courage within themselves and whatever they do, as far as academics are concerned. In doing this, such learners will be capable of becoming resilient and developing a winning attitude in themselves for pursuing academic excellence in mathematics.

The following extracts from the open-ended items confirmed the statements made above

I believe that having a positive attitude will promote success in Mathematics performance **(Grade 9 learner 301).**

I believe that learners must learn not to hate but love Mathematics as a subject **(Grade 9 learner 324).**

I believe that learners who don't succeed in Mathematics do not attend Mathematics classes **(Grade 9 learners 111).**

I believe that most learners are always afraid of Mathematics, and that is why they fail **(Grade 9 learner 400).**

From the Tshwane grade 9 learners' responses, the likely possible suggestions below were perceived to have an improvement on their performance in mathematics: 1. Cultivating a positive attitude for mathematics performance; 2. A need for loving mathematics like every other subject; 3. Developing an interest in mathematics at all costs; 4. Learners must have dogged determination to succeed.

The study further revealed the essence and need for improving the Tshwane grade 9 learners' mathematics performance in South Africa, which is in tandem with Hajovsky et al. (2020), for immediate remedy, and they are stated below. The grade 9 learners further posited that learners deserve to be motivated extrinsically with a reward for every positive attitude displayed in the classroom, which will further sustain the behaviour. Most learners who dislike mathematics have failed to perform well, possibly due to a lack of motivation. When learners are well motivated, they will strive for better performance through positive attitudes. Motivation has also been seen as a means for forestalling regular attendance in school and

mathematics classes; besides, learners can strive for success at all costs despite all odds (Stafford-Brizard, 2016; Lukowski et al., 2016).

Conclusion

The goal of the study was to figure out the Tshwane grade 9 learners' perceptions of their attitude and their performance in mathematics in South Africa, drawing inferences from the outcome of the study, a conclusion can be reached that the Tshwane grade 9 learners' perceptions of the relationship between their attitude and their mathematics performance were of significance.

Recommendations

A few recommendations were reached based on policy, these were: stakeholders should make learners understand the essence and reality of mathematics as a discipline of global relevance needed for South African growth, economically and nationally, as against the lazy choice of maths literacy.

It was also recommended that parents and schools should inculcate and model acceptable and positive attitudes in the learners via regular school programmes for proper academic orientations towards better mathematics performance. Parents should also make it a point of duty to instil the right mathematical attitude into the learners by creating time to assist and encourage them to learn mathematics. Furthermore, parents and teachers should adequately motivate learners; this would help learners cultivate an attitude of making regular school and mathematics class attendance a habit, thereby loving mathematics.

Contribution of the study

This study on the investigation of Tshwane Grade 9 learners' perceptions of factors influencing their performance in mathematics in South Africa, from the grade 9 learners' knowledge and views in a natural context, has not been previously investigated. Thereby making it uniquely the first of its kind. The study was able to depict and explore the influence of attitude on Tshwane grade 9 learners' mathematics performance with a sound approach, in contrast to the positions of literature not in support of attitude as influencing learners' performance in mathematics. The knowledge base on the Tshwane grade 9 learners' perceptions of factors influencing their performance in mathematics in South Africa is additionally refined and expanded. The study will further expose learners and the school community to the mathematical challenges of Tshwane grade 9 learners in South Africa.

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