INVESTIGATING FACTORS AFFECTING LEARNER PERFORMANCE IN MATHEMATICS FOR SOUTH AFRICA

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MOKOENA Amos Judas
amosjudasm@gmail.com

Abstract: Stakeholders in the within the education sector expect learners, especially Grade 12 learners to perform well in their studies. Indeed, learners do perform well in other learning areas but are not doing so well in Mathematics. Hence, the study intended to establish whether there is a relationship between factors influencing learner performance and Mathematics as a learning area in schools. A quantitative (survey) method was utilised using a questionnaire. A purposive sampling method was used, from the population (N=150). The questionnaire was administered to a sample (n=50). All administered questionnaires were returned without any errors. The results indicated a strong positive and significant correlation between independent variables (educator attitude, learner attitude, parental influence) and a dependent variable (learner performance in Mathematics) of the study. The study produced (r=.25, n=50, p-value-.00)); (r=.22, n=50, p-value=.00); and (r=.23, n=50, p=.00), respectively. The results indicated a statistically significant relationship between independent and dependent variables. The analysis of variance (ANOVA) model was statistically significant (F (5.982) = p-value=.00)). While the Model summary (R-Squared (R2)) produced 68% and the Durbin-Watson statistic 1.92. The results contributed to the body of knowledge within the education field.
Keywords: Learners, educators, parents, performance

Introduction

Siyabuswa Circuits is one of many circuits in Mpumalanga within the jurisdiction of Dr JS Moroka Municipality. Performance of Grade 12 learners in Mathematics has not been satisfactory. However, the root causes of such poor performance in Mathematics have not been deeply and widely researched within the Siyabuswa circuit. Poor performance does not affect the two schools (Somkhahlekwa, Vezilwazi) high schools but all schools within the circuit. The Grade 12 overall results in Mpumalanga were in 2020:70.7; 2021:60.5, and 2022:68.2, respectively. The overall Mathematics results in 2020, 2021 and 2022 were 50.9.; 54; 52.8, respectively. The Mathematics results in the province points to learners that are not doing well in Mathematics. This is also the reflection of all circuits and schools. Hence, this has raised concerns among educators, parents, department of Basic Education including stakeholders operating within the education sector. Various performance enrichment programmes in schools have been implemented but the results are not improving. The department of Basic Education in Mpumalanga has developed and implemented capacity programmes to capacitate educators. These programmes are intended to equip educators with teaching methods that makes Mathematics interesting and to increase levels of learner motivation to learn Mathematics (Prendergast & Hongning, 2016). The department is rolling out this support having recognised that there are skill shortages in the areas of Mathematics.

The department can do as much, however, it is in the hands of educators and parent component in schools, including learners themselves to be motivated about Mathematics

as a learning area. Furthermore, the department has exposed learners to lucrative careers that are available when one decides to specialise in Mathematics post-school.

Research purpose and objectives

The main purpose of this study is to investigate the impact of factors (learner attitude, educator attitude, parental influence) on learner performance in Mathematics within Siyabuswa Circuit, and to recommend methods to be applied to improve Mathematics results. To further establish reasons why learners are performing poorly in Mathematics.

Literature review

Educator attitude

A negative attitude towards anything determines whether one will be successful in that space. Educators play an important role in influencing learners, and to do better in their studies. However, when educators are not motivated or their attitude towards the subject, they offer they do not demonstrate a positive attitude towards it, then learners will follow suit in the footsteps of their parentis in loco (Khatoon & Mahmood, 2010). Such attitudes point to an educator who has doubts about his mathematical abilities to teach the subject. This is further alluded to in a study conducted by Makhubele and Luneta (2014) that poor performance in Mathematics is also negatively influenced by the perception in society that Mathematics is complicated and is not easy to pass. Educators in their position have that ability to positively influence the learners (Mabena, Mokgosi & Ramapela, 2021). In general learners that are doing well in their studies are those that have a strong bond with their educators, and this can be easily positively influenced (Borko, 2008). Of importance though as alluded to in Mampane (2018) that educators themselves in most instances require consistent professional development to develop their knowledge and confidence in offering the subjects. However, Karali (2022) highlighted that, educators encounter quite a number of challenges making the environment not conducive for proper learning and teaching. However, some of these challenges are beyond educators themselves. This include provision of teaching and learning aids, which are intended to assist learners to have a better grasp of the mathematical concepts, infrastructure to name a few, (Yucel & Koc, 2011).

Learner attitude

Learners themselves have misconceptions that Mathematics is a difficult subject, and in the process affect their performance in the subject (Asikhia, 2010). This causes a lot of anxiety, and some end up quitting Mathematics classes (Asikhia, 2010). Hlalele (2012) concurs with Asikhia (2010) that "students often develop mathematical anxiety in schools, often as a result of learning from teachers who are themselves anxious about their mathematical abilities in certain areas". In Ozgeldi and Osmanoglu (2017) a view on learner attitude towards Mathematics is that learners find it difficult to associate Mathematics with their daily activities, and as such making it so abstract. In instances where learners are able to associate themselves with activities in their daily lives, they perform better that their peers who cannot associate Mathematics with the outside world Yenilmez & Kakmac, 2008). Again, peer pressure and learners unfairly judging each other's abilities to understand Mathematics also has a negative effect on learners'

confidence (Hlalele, 2012). Therefore, it is crucial that schools have career programmes that are intended to conscientise learners about the importance of Mathematics for those who might have an interest in the subject (Ozgeldi & Osmanoglu, 2017).

Parental influence on learner performance

Khatoon and Mahmoud (2010) posit that society plays an important role in influencing learners. Therefore, the negative societal attitudes towards Mathematics have a long-lasting effect as alluded to in (Makhubele & Luneta, 2014). A shared perception in communities and society strengthen the notion that Mathematics is difficult. This does not start in school, but with members of society who themselves might not have done well in Mathematics in their schooling years (Aguilar, 2021). Therefore, it is important that parents and educators work hand in hand to dispel the perceptions that exists in society that Mathematics is difficult (Tambunan, 2018). Boyer and Mailloux (2015) concur with Tambunan (2018) that society should developing programmes that will be driven by academics in the space of Mathematics and science in general.

Research methodology and design

Research approach

This paper follows a quantitative approach wherein a questionnaire was used. This approach allows the researcher to collect data using a questionnaire wherein numerical data is collected and when analysed is generalize across groups in explaining the phenomenon under research (Rubin & Babbie, 2016). Descriptive studies are aimed at finding out "what is" and are designed to provide a bigger picture of a situation as it happens naturally (Rubin & Babbie, 2016).

Research participants

A population is considered to be the total number of elements in a particular setting. Furthermore, the sample is drawn from the population where it is feasible to do so (Rubin & Babbie, 2016). This study was executed in Siyabuswa Circuit wherein two schools (Somkhahlekwa, Vezilwazi) formed part of the study. The population was the combination of Grade 12 learners, educators, and parent component in these two schools. The target population for the study is (N=150) and the sample in this study was (n=50), divided as follows: Learners 30 (15 in each school), educators, 10 (5 in each school) and parents 10 (5 in each school). The questionnaire first piloted before being administered to stablish whether the tool was not ambiguous. The was 100% in respect of the response rate. Table 1 below reflects the demographic:

Table 1: Demographic profile of respondents

Dimension	Valid count	Valid %
Gender		
Female	32	64
Male	18	36
Age		
18-30 years	30	60
31-40 years	8	16
41-50 years	6	12

51-60 years	4	8
61 years and above	2	4
Level of Education		
Below Grade 12	32	64
Grade 12	2	4
Certificate/Higher Certificate	2	4
National Diploma	2	4
Undergraduate	11	22
Postgraduate Degree and above	1	2

The questionnaire was administered to the selected sample of fifty (50) learners, educators and parents divided as follows: Learners 30 (15 in each school), educators, 10 (5 in each school) and parents 10 (5 in each school). However, before the questionnaire was administered, it was first piloted to stablish whether the tool was clear and not ambiguous. The pilot results indicated the questionnaire was clear and understandable with no ambiguity.

Research instrument

A Likert was used in the questionnaire. Respondents chose from five-point scale. The scale was divided as follows, 1=Strongly disagree; 2=Disagree; 3=Neutral; 4=Agree; and 5=Strongly agree. The reason for using the five-point Likert scale is that it provides a wide range of responses which allows the researcher to receive fair responses from respondents. Cronbach's alpha was used to test the validity and reliability of the questionnaire. The Statistical Package for Social Sciences version 22 was used. The constructs met the adequate reliability level of above 0.6 (Fornell & Larcker, 1981). Table 2 below demonstrate the validity and reliability of the instrument used.

Table 2: Cronbach Alpha coefficient

Construct	Cronbach's Alpha	N of items
Learner attitude	0.8	7
Educator attitude	0.7	8
Parental influence	0.7	8
Learner performance in Mathematics	0.6	5

Table 3: Summary of descriptive statistics

Variable	N	Mean	Std. Dev
	Statistic	Statistic	Statistic
Learner attitude	50	3.45	.412
Educator attitude	50	3.52	.428
Parental influence	50	3.08	.402
Learner performance in Mathematics	50	3.02	.398
Valid N (listwise)	50		

Research procedure and ethical considerations

This was survey research wherein a questionnaire was utilised. The questionnaire was used for the purpose of establishing whether there is a relationship between factors such as learner and educator attitude including parental influence and learner performance in Mathematics. A questionnaire is a simple yet effective research tool and is cost effective. Furthermore, a questionnaire guarantees respondents' confidentiality (Hennink, Hutter &

Bailey, 2011). The questionnaire was administered to the selected sample of fifty (50) learners, educators and parents divided as follows: Learners 30 (15 in each school), educators, 20 (10 in each school) and parents 10 (5 in each school). However, before the questionnaire was administered, it was first piloted to stablish whether it was clearly understood. The pilot pointed to a questionnaire that was clearly written and in simple language.

Respondents were given at least ten working days to complete the questionnaire and respondents were requested to drop them in a box placed in the educators' staff room. The researcher after collecting the questionnaire, data was captured in an MS Excel, and further validated in respect of whether the data was properly captured. Once data was validated it was transferred to the Statistical Package for Social Sciences (SPSS) version 22. The analysis process commenced after data was transferred to SPSS. It should, however, be emphasised that personal information of the respondents was kept confidential and was not shared with any person beside for the purposes of this study. Furthermore, there was no harm intended to respondents by participating in the study and respondents were given an opportunity to withdraw from the study in instances when they felt uncomfortable to continue participating (De Vos, Strydom, Schulze & Patel, 2011).

Statistical analysis

Percentages and frequencies were used to analyse the data for the demographics (gender, age group, level of education), this included mean and standard deviation. The nature of the demographics are such that they are not complicated to analyse, hence MS Excel was used to analyse them. However, for more complicated statistics such as establishing relationships and other complex statistics SPSS version 22 was used. In establishing relationship between variables and the strength of the relationship, a Pearson product-moment correlation was utilised. In addition, the significance value was tested at a 95% confidence level ($p \leq 0.05$). Tables were used to present the data which indicated the strength of the variables independent (learner attitude, educator attitude, parental influence) on dependent variable (learner performance in Mathematics). Furthermore, to test whether there was a significant regression between the independent variables and a dependent variable Analysis of variance (ANOVA) was used. Again, to measure how close the data was to the fitted regression line R-Squared was used (Dhakal, 2018).

Results

The demographic results in Table 1 with regards to gender were female 32 (64%), male 18(36%), The age group of respondents indicated that most respondents were in the age group category of 18-30 years of age, which accounted for 30 (60%) and the least number in this category were respondents in the age group of 61 years of age and above, which accounted for 2 (4%). There is clear indication that the average age of the respondents was in thirties. Furthermore, with regards to levels of education, results indicated that most respondents were below Grade 12, and the least respondents possessed postgraduate degrees. The results above are inclusive of all respondents, learners, educators, and parents. Below Table 4 indicate the results after testing the relationships of the variables in line with the hypotheses.

Table 4: Relationships between factors affecting learner performance and Mathematics

		Learner attitude	Learner performance in Mathematics
Learner attitude	Pearson correlation	1	.255**
	Sig. (2-tailed)		.000
	N	50	50
		Educator attitude	Engagement
Educator Attitude	Pearson correlation	1	.228**
	Sig. (2-tailed)		.001
	N	50	50
		Parental influence	Engagement
Parental influence	Pearson correlation	1	.236**
	Sig. (2-tailed)		.000
	N	50	50

**. Correlation is significant at the 0.01 level (2-tailed).

Table 5: Hypotheses of factors affecting learner performance and Mathematics

No	Hypotheses	Path Coefficients (β\P value)	Supported/not supported
(Ho1)	There is no relationship between learner attitude on learner performance in Mathematics.	(r = .255, *P*>0.05)	Null hypothesis not supported
(Ho2)	There is relationship between educator attitude on learner performance in Mathematics.	(r = .228, *P*>0.05)	Null hypothesis not supported
(Ho3)	There is no association between parental influence on learner performance in Mathematics.	(r =-.236, *P*>0.05)	Null hypothesis not supported

Table 6: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	1.448	3	2.148	5.982	.002a
	Residual	22.612	47	.359		
	Total	24.542	50			
a. Predictors: (Constant), learner attitude, educator attitude, parental influence						
b. Dependent variable: Learner performance in Mathematics						

Table 7: Model summary

Model	R	R-Squared	Adjusted R-Squared	Std. Error of the estimate	Durbin-Watson
1	.275a	.068	.044	.34024	1.922

a. Predictors: (Constant), learner attitude, educator attitude, parental influence

Discussion

Outline of results

The study intended to establish whether there was a relationship between independent variables (learner attitude, educator attitude, parental influence) and dependent variable (learner performance in Mathematics) in schools within Siyabuswa Circuit. There were three hypotheses that were tested. Findings with regards to the hypotheses: Table 4 and 5, Ho1: There is no relationship between learner attitude on learner performance in Mathematics. The results produced (r=.25, n=50, p-value-.00), which indicated that there was a strong positive relationship between learner attitude and learner performance in

Mathematics, the results further demonstrate that the relationship was positively significant. Therefore, the null hypothesis was not supported. Findings of the results in Table 4 and 5 Ho2: There is no relationship between educator attitude on learner performance in Mathematics within schools in Siyabuswa Circuit. The results produced (r=.22, n=50, p-value=.00), which indicated that there is a strong positive linear correlation between the variables, which is statistically significant. Therefore, null hypothesis was not supported. Findings of the results in Table 4 and 5 Ho3: There is no association between parental influence on learner performance in Mathematics within schools in Siyabuswa Circuit. The results produced (r=.23, n=50, p=.00), which indicated that there is a strong positive linear correlation between the variables, which is statistically significant. Therefore, null hypothesis was not supported. Analysis of variance was utilised to establish how well the regression equation fitted the data. The findings were F (5.982) = p-value=.00. This means that the model is statistically significant and as such predicted the outcome variable. Lastly, the R-Squared (R2) produced .68, which is equal to 68% and the Durbin-Watson statistic was 1.922, which is not less than 1 or greater than 3. This means that the model falls within the acceptable norm.

Practical implications

The study makes contribution to the body of knowledge within the education sector in respect of factors affecting learner performance in Mathematics as a learning area. The knowledge generated by this will assist the department of education in as far as understanding variables that impact learner performance in Mathematics. Again, the study can be used to used side by side with other studies conducted in this area of learner performance.

Limitations and recommendations

The study focused only on two selected schools within the Siyabuswa Circuit and not any other school in the Circuit. The study did not include Foundation, Intermediate and Senior phase schools within the Circuit. The Siyabuswa Circuit Manager, school principals did not form part of the study. The study focused only on the impact of selected factors that have an influence on learner performance in respect of Mathematics as a learning area in schools.

Conclusion

This study intended to establish whether there is a relationship between independent variables (learner attitude, educator attitude, parental influence) with regards to learner performance in Mathematics within Siyabuswa Circuit. The findings pointed out to a positive relationship between independent variables and a dependent variable, which was statistically significant.

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