

Measuring Learners' Disposition and Attitude Towards Mathematics: A Quantitative Case Study of Commerce-Stream Learners



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Abstract

Today teaching is one of the most stressful professions globally with potentially harmful effects on teachers' well-being. This is further exacerbated by the negative attitude of learner's towards certain subjects. Some of the prominent behaviours of these learner's include but not limited to dislike, fear, anxiety and even hatred (Neale) [1]. Mathematics educators are not an exception given the age "cohort/progressed learners" in South Africa. We conducted a case study research on the attitude and disposition of commerce-mathematics/commerce stream learners towards mathematics in one of the Free State High schools in South Africa, to determine whether they had negative or positive attitude towards mathematics. The results were aimed at presenting possible interventional strategies to curb negative attitude situation should it exist and prevent it from infiltrating into poor performance in Mathematics and thereby having domino-effects on system's stakeholders. Our case study used quantitative data to achieve the said objective in which case the results calculated a 0.617 Cronbach Alpha coefficient for reliability which is in the lowest acceptable range. It was hypothesised that these learners have negative attitude, but surprisingly the results rejected this hypothesis. Therefore the selected school is not vulnerable to damaging effects of negative attitude of the commerce-mathematics learners which would contribute to the school's disfunctionality.

Keywords: Attitude; Commerce-Stream Learners

Introductory Background and Problem Statement

Mathematics serves as an integral constituent of many successful careers and as well as in the development of society, especially in the extraordinary and fast changing circumstances [2]. Similarly, Ullah Shah and Farooq [3] view attitude towards Mathematics as a crucial player in the teaching and learning of Mathematics. The students' achievement is proportionately linked with the attitude they have towards the subject. Several factors account for the desired outcomes, such as teaching methods, school support structures, families and the way Mathematics is presented to learners in the classroom. According to Islam and Mahanta [4] Mathematics should be received by every student in the foundation phases to prepare for higher education and as such basic quantum levels of Mathematical knowledge must be gained for general education. It is therefore imperative that the academia and those with high interest in the teaching and learning fraternity conduct empirical studies in order to curb problems that permeate and disrupt learners' academic success in Mathematics since today this subject dominates every field of one's career endeavours. Despite the usefulness and challenges of this subject faced by learners globally, several research reports have shown variations in scores gender-wise and otherwise. In South Africa the minimum requirements for one to obtain a National Senior Certificate (NSC) are four compulsory subjects plus three choice subjects to

make up seven in all (SAQA and Higher Education and Training Department) [5]. It is at this juncture that schools build their own curriculum where other schools offer Mathematics and Commercial subjects. On the contrary, there is currently an outcry from Mathematics educators about poor performance and negative attitude of learners who are doing mathematics and Commerce towards Mathematics. We therefore in this study investigate the attitude of these learners (Commerce-stream) towards Mathematics.

Brief Literature Review

We conducted a brief literature review in order to understand the link between attitude and disposition towards Mathematics and identify gaps to be filled from the previous studies.

Hazard: Hazard is defined as a dangerous phenomenon, substance or a condition that has a potential to cause loss of life, injuries and or loss of service as well both socio-economic disruption (UN) [6]. In South Africa, Mathematics has been the lowest performed subject nationally for the past four years with, 46.3%, 54%, 59.1% and 53.5% in 2014 (Department of Basic Education) [7]. Given this condition, Mathematics is exposed to high rates of failure that can be exacerbated by reigning conditions of vulnerability such as learners' attitude and other socio-economic factors. High Mathematics failure rate is

therefore in this study perceived as a hazard that threatens good functionality and smooth running of the Department of Basic Education.

Attitude: Attitude refers to the predisposition or a tendency to respond either negatively or positive towards a certain person, object and idea. This normally influences people's choice of actions and responses to stimuli (Business Dictionary) [8].

Vulnerability: Vulnerability as a characteristics as well as circumstances of a system that make prone to damaging effects of a hazards. Given the negative attitude of learners and poor socio-economic learners' environment, Mathematics is then at risks of being poorly performed thereby having damaging effects on Education system as a whole.

Commerce-Stream Learner: For the purpose of this study a Commerce-stream learner is defined as any learner who takes Mathematics and commercial subjects.

Effects of Attitude Towards Mathematics Performance

Peixoto et al. [9] in Portugal investigated whether variables such background, motivation and social support could explain the attitude of students towards Mathematics. The findings from the study revealed that students showed positive attitude towards Mathematics. However, there were no differences in gender except that girls' attitude patterned a declining trend as they progressed to higher grades. The study focused on fifth to twelfth grades. Attitude can lead anxiety, however Hlalele in his study in the rural areas of the Free State Province in South Africa which explored the learners' experience with Mathematics anxiety revealed that every learner experienced some level of anxiety which ultimately lead to some adverse effects on academic performance.

Environmental and Socio-Economic Status and Academic Performance

A study undertaken in India whose aim was to examine the effects of gender and socio-economic status on academic performance showed that there were no significant differences between girls and boys. However, those who belonged to high socio-economic status families performed better [10]. This results are consistent with found by Okiooga at Kissi College University where socio-economic status stratified students in terms of academic performance. Better-off parents seemed to have had an important role in the education of their children.

Summary

From the literature reviewed many research articles used only quantitative methods approach, however, those which used mixed methods used other research paradigm such as intrinsic motivation theory. Other gaps identified by this study are the target respondents and geographical location of the research sites which were countries other than South Africa. There may be differences in terms of results based on economy and environmental factors. Although these articles and reports

focused on primary schools in the lower grades, high school and university students, no research has made a mention of learners from commerce stream (commerce-mathematics). This study therefore finally finds in its way in the use of a Fennema-Sherman Attitude Scale as its conceptual framework.

Significance of the Study

This study aims to identify factors underlying bad attitude of Commerce-stream learners towards Mathematics that negatively impact on the overall academic school performance. The study will further present possible interventional strategies to curb this situation from infiltrating into poor performance in Mathematics. Moreover, findings from this empirical study will inform authorities and policy makers in devising appropriate strategies to deploy in improving Mathematics performance in a South African context.

Aim of the Study

We aimed at determining the attitude of Commerce-mathematics stream learners towards mathematics.

Hypothesis

- Null hypothesis, H_0 : Commerce-stream learners have negative attitude towards mathematics.
- Alternative hypothesis, H_1 : Commerce-stream learners have positive attitude towards mathematics.

Methods

This study used a quantitative case study. Quantitative research involved large number of respondents and measurements are objective. The results can be generalised unlike qualitative research which focus on small sample size and results cannot be generalised. This design seeks an in-depth understanding of phenomenon in questions [11]. A case study design is defined as detailed investigation of group or single individual (National Centre for Technology Innovation, 2015) [12], however, though a quantitative case study was used, results cannot be generalised because the study still focused on one setting.

Population and Sampling

There is total of 75 learners who are taking commercial subjects and mathematics at this chosen school. Therefore, purposive sampling was used to select the school for study and commerce-mathematics learners specifically. The commerce-stream learners were randomly chosen for participation in the study. We only targeted the 12th grade.

Data Collection and Analysis

A 5-point likert-scale questionnaire was handed over to randomly selected commerce-learners to complete. Individual respondent scores per item were aggregated and ranked. From these data, the 25th (P25) and 75th (P75) percentiles were determined, where all scores (\leq P25) show negative attitude and those (\geq P75) show positive attitude towards mathematics.

The percentiles were used to form two independent groups. We used descriptive statistics to analyse variations between the groups' scores. We used SPSS for reliability test and Heymath! For descriptive statistical analysis. The Tables 1 & 2 below show two groups of learners having negative and positive attitude respectively (Tables 3 & 4).

Table 1: Group1 with negative attitude.

Respondent number	Group 1 scores
58	31
50	35
52	36
9	38
32	39
11	40
60	41
45	42
54	43
59	43
31	44
4	45
49	45
18	46
43	46
51	46

Table 2: Group2 with positive attitude.

Respondent number	Group 2 scores
30	54
36	54
47	54
28	55
5	56
27	56
38	56
39	56
10	57
17	57
25	57
6	58
20	58
2	60
35	61
37	63

Table 3: Univariate Statistics for Group 1.

Univariate Statistics for Group 1	
Number of observations	16
Mean	41.25
Median	42.5
Mode	46
Min	31
Max	46
Range	15
First Quartile	38.5
Third Quartile	45
Inter Quartile Range	6.5
Population Variance	18.69
Population Standard Deviation	4.32
Sample Variance	19.93
Sample Standard Deviation	4.46

Table 4: Univariate Statistics

Univariate Statistics for Group 2	
Number of observations	16
Mean	57
Median	56.5
Mode	56
Min	54
Max	63
Range	9
First Quartile	55.5
Third Quartile	58
Inter Quartile Range	2.5
Population Variance	6.13
Population Standard Deviation	2.47
Sample Variance	6.53
Sample Standard Deviation	2.56

Validity and Reliability

A cronbach's alpha coefficient value of less than 0.6 is considered poor and any value in the range 0.6-0.7 is considered acceptable, therefore 0.6 is referred to as the common threshold for sufficient values of Cronbach's alpha [13,14]. Therefore our results showed a reliability value of .617 which is slightly above the threshold value as shown in Table 5.

Table 5: Reliability test statistics.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.617	.600	20

Looking at Table 6 below, there was no item (s) to be removed or replaced in order to improve the calculated Cronbach's alpha coefficient value. We therefore accepted the results as they were.

The factor analysis below revealed five factors instead of the chosen three through the use "Eigenvalues greater than one" rule as depicted by the screen plot in Figure 1 below.

Table6: Cronbach's alpha if items deleted.

Item-Total Statistics						
		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
LIKING MATHS-DIMENSION 1						
L1	Enjoy learning Maths	47.7377	40.797	.036	.310	.625
L2	I hate Maths	45.8361	35.039	.413	.605	.572
L3	Maths is boring	45.9016	35.290	.410	.600	.574
L4	I like to take more Maths	47.9016	40.223	.110	.376	.616
SELF-CONCEPT IN MATHS-DIMENSION 2						
S1	I do well in Maths	47.3770	39.839	.126	.344	.615
S2	Mathematics is not one of my strengths	46.5902	35.946	.313	.532	.589
S3	Maths is difficult	47.5246	41.120	.025	.558	.624
S4	Males are not naturally better than females in math.	46.1803	39.350	.042	.263	.639
S5	It's hard to believe a female could be a genius in mathematics.	47.8361	39.806	.170	.356	.610
S6	I am sure of myself when I do math.	47.5902	40.813	.038	.381	.625
S7	I'm not the type to do well in math.	46.0656	35.429	.336	.350	.585
S8	Most subjects I can handle OK, but I just can't do a good job with math.	47.1803	35.417	.321	.450	.587
UTILITY IN MATHS-DIMENSION 3						
U1	Maths will help me in my daily life	47.9672	41.466	.005	.495	.624
U2	I need Maths to learn other subject	47.9016	40.257	.137	.381	.613
U3	I need mat to get into the university	48.1475	38.928	.432	.400	.592
U4	I need Maths to get a job of my choice	47.8852	41.270	.035	.442	.621
U5	Knowing mathematics will help me earn a living.	47.8197	40.017	.167	.441	.610
U6	Math will not be important to me in my life's work.	45.6066	34.543	.522	.679	.558

U7	Doing well in math is not important for my future.	45.4754	34.687	.446	.615	.567
U8	Math is a worthwhile, necessary subject.	47.6885	40.918	.042	.359	.623

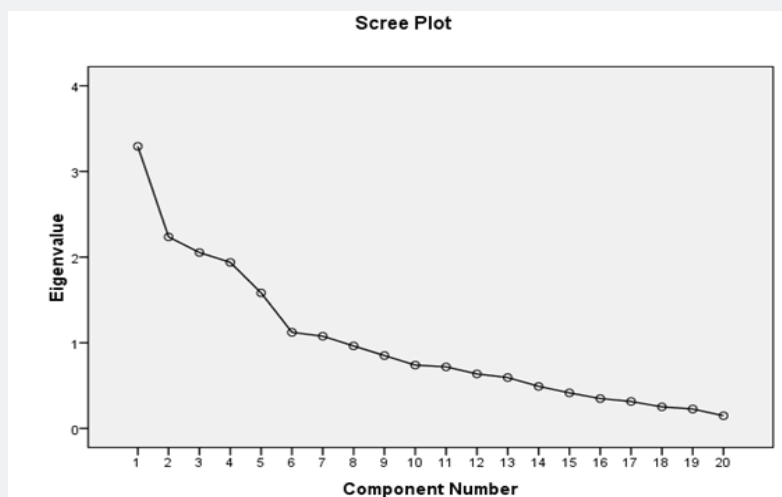


Figure 1: Eigen-value scatter plot.

Ethical Considerations

A written letter was drafted and presented to the director of the Free State Education Department for permission to conduct the study. A further permission letter was given to chosen school’s principals to accept the study to be conducted. Confidentiality and anonymity of the school was observed and only the aggregated results will be published. Every selected learner who part-took in the study was informed that his/her participation was voluntary and withdrawal could be executed at any given stage.

Results and Findings

The smaller the standard deviation between scores, the better the results, therefore the group 2 sample standard deviation was found to be smaller than that of group 1. This therefore rejects the hypothesis that commerce-stream learners have negative attitude towards mathematics. The results are not consistent with those found in the reviewed literature.

Limitations of the Study Recommendations for Future Research Directions

Given the fact that this study used a case study research design is a limitation on its own since the found results cannot be generalised. This study focused only on one high school in the Motheo District in the Free State Province of South Africa. Sample size was restricted due to lack of financial capacity and researchers’ jobs commitments and pressures. We also used a modified Fennema-Sherman Attitude Scales as our conceptual framework in which case, the calculated Cronbach’s Alpha coefficient was in the lowest acceptable range interval. If a full

Fennema-Sherman Attitude Scale was used or other theoretical and conceptual frameworks adopted that take several factors into account, such as socio-economic status of learners and environmental background, the results could have been better off than they are now as shown by the factors analysis which indicated two more factors than the chosen ones. We therefore recommend that the next research engages in large sample sizes and takes other research designs other than a case study to reach out larger population for generalisation of the results.

Conclusion

Finally, this study was aimed determining commerce-stream learner’s disposition and attitude towards mathematics using a Fennema-Sherman Attitude Scale as a conceptual framework. The results revealed that these learners have positive attitude towards mathematics thereby rejecting the stated hypothesis of the study, implying no further interventional strategies at commerce-stream learners in particular.

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