

Secondary School Students' differences on attitude and anxiety towards mathematics by gender and schools' status and type in Musanze District in The Republic of Rwanda

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Abstract

This study aimed at exploring secondary school students' differences on attitude and anxiety towards mathematics grouped by gender and schools' status and type. The participants of the study consisted of 763 secondary school students (301 Males and 462 Females were 462). The Statistical Procedures for Social Sciences was used to analyse the data. Findings showed the following: there was a gender-based significant difference on attitude towards mathematics but there was no gender-based significant difference on anxiety towards mathematics; there was no significant difference on attitude and anxiety towards mathematics based on schools status (Government, Government-aided and Self-financed secondary schools); there was a significant difference between Government and self-financed secondary school students' anxiety towards mathematics ; and finally, there were significant differences on attitude and anxiety towards mathematics based on type of schools (Boarding schools, Non-Boarding school and Technical, Vocational Education and Training).

Key words: Gender, mathematics anxiety, mathematics attitude, school status, school type.

1. Introduction

In Rwanda, emphasis in Education is being put on Science, Technology, Engineering and Mathematics (STEM) at all levels of Education. In general, Mathematics is a basic subject in many of the applied subjects. A positive attitude and low anxiety towards mathematics have been revealed to be key factors to learning and achievement in mathematics (Pourmoslemi, Erfani & Firoozfar, 2013; Recber, Isiksal & Koç, 2018) and consequently such attitude and anxiety influence success in all subjects that are rooted in Mathematics such as all STEM subjects. Therefore, an analysis of these factors in order to identify its levels among various categories identifiable within students can stimulate innovation in methodologies of teaching and learning mathematics at all levels of education. In XXXXXXXX (2018), descriptive data on levels of secondary schools students' anxiety and attitude towards mathematics were presented. In the current paper, findings on secondary

school students' differences on attitude and anxiety towards mathematics grouped by gender, status and type are presented.

Anxiety and Mathematics anxiety

Dursun(2015), defined anxiety as “a feeling which sometimes encourages people to carry out creative and positive behaviors by motivating them in everyday life and sometimes hinders such positive attitudes and generally creates uneasiness” (p. 1773). While referring to Ashcraft and Faust (1994), he elaborated further on what mathematics anxiety is and what its effect is on learning mathematics by saying that “mathematics anxiety as mental disorder, fear of mathematics and a feeling of intense anger and frustration when one is required to solve and understand mathematical procedures and problems” (p. 1774). Furthermore, quoting Richardson and Suin (1972), he said that mathematics anxiety is a “feelings of tension and anxiety that interfere with manipulation of numbers and solving of mathematics problems in a wide variety of ordinary life and academic experiences” (p. 39).

Attitude and Mathematics attitude

Darsun (2015) defined attitude as “a tendency attributed to the individual and regularly constitutes his/her thoughts, feelings and behaviours related to the psychological incident” (p. 1774). Zan and Di Martino (2007, p. 158) defined attitude towards mathematics in three different ways, namely, i) attitude toward mathematics is just a positive or negative emotional disposition toward mathematics, ii) an individual's attitude toward mathematics is defined in a more complex way by the emotions that he/she associates with mathematics (which, however, have a positive or negative value), and iii) attitude toward mathematics is therefore seen as the pattern of beliefs and emotions associated with mathematics. .

Differences based on students' gender and schools' status and type

Various studies dealt with Mathematics Anxiety, Mathematics attitude and related Gender differences and other kinds of differences (Farooq & Shah, 2008; Mohamed & Waheed, 2011; Pourmoslemi, Erfani & Firoozfar, 2013; Dursun, 2015; Kannan, Sivapragasam & Senthilkumar, 2015; XXXXXXXX (2016, 2018); Yaser (2016); Karjanto (2017); Kasimu & Imoro (2017); Recber, Isiksa & Koç, 2018).

Farooq and Shah (2008) found that male and female students of 10th grade of the secondary schools of Lahore have same type of attitude towards mathematics and concluded that gender differential has no impact on the attitude of students towards mathematics in Pakistan. The results found by Mohamed and Waheed (2011) showed that the students' positive attitude towards mathematics is medium and there is no gender difference in their attitudes.

Pourmoslemi, Erfani, and Firoozfar (2013) found significant differences between men and women's evaluation anxiety and no significant difference was observed concerning field of study. Also, there

is a significant correlation between high level anxiety and low academic performance. They also that there is a significant correlation between high level anxiety and low academic performance.

The study of Dursun (2015) showed that gender and class levels had no significant effect on the students' attitude and anxiety levels towards mathematics, whereas school type (Vocational high school, Anatolian school, Science High school) had significant effect on the attitude and anxiety.

Kannan et al.(2015) found the following findings about differences related to the status of the schools:Self – financed secondary school students have a better attitude towards mathematics than that of Government secondary school students; Government –Aided secondary school students have a better attitude towards mathematics than that of Government secondary school students;there is no significant difference between Government-Aided and Self-financesecondary school students attitude towards mathematics. With regard to gender and location, the secondary school female students have a better attitude towards mathematics than that of male students and there is no significant difference between urban and rural secondary students attitude towards mathematics. Finally, they found that there is no significant difference between English and Tamil medium secondary students attitude towards mathematics.

XXXXXXXX (2016) found that students displayed positive attitudes towards mathematics at medium level and no significant differences were found in the sampled data when grouped by gender and he found; however, significant differences when data were grouped by academic levels and departments of the Institute. In XXXXXXXX (2018), no significant difference of Mean scores of students' attitudes and anxiety between secondary students attending urban and rural schools in Musanze district at $p < 0.05$ was revealed from the sampled data. In addition, he found that the students' attitudes were mostly high and female students were less anxious than their counterpart males in urban and in rural secondary schools. A t-test for comparing the mean scores of students' attitudes and anxiety disaggregated by location (urban and rural) revealed that there were no significant differences in attitude and anxiety towards mathematics based on the two distinct areas.

The findings of Yaser (2016) showed that there is no meaningful difference between the gender of the students. The same results that there is no significant difference between male and female students in terms of their attitude toward mathematics were found by Karjanto (2017).

While dealing with the status of schools, Kasimu and Imoro(2017)found no significant difference between the attitudes of both private and public JHS students towards mathematics and in terms of gender difference on attitude towards mathematics their study revealed that boys and girls, irrespective of either private or public school, in the study area generally had similar attitude towards mathematics.

Recber et al. (2018)'s findings revealed that there was a significant main effect of gender on mean mathematics attitude scores and anxiety scores. They revealed, however, that school type did not have significant main effect on anxiety scores, but have significant effect on attitude scores.

From this literature, it can be seen that the findings of the various studies did find similar findings. Some founds that Gender has impact on anxiety and attitude towards mathematics while others found that there is no gender differences in these factors. Similar inconsistent were found on the impact of status and type of schools involved in the studies. The contradictory situation shades light on the aim of current study which to find what the current situation is in Rwandan context especially in Musanze District

Objectives of the study

1. To find out the significance of the difference on attitude and anxiety towards mathematics male and female secondary students.
2. To find out the significance of the difference on attitude and anxiety towards mathematics among Government, Government-aided and Self-finance secondary school students attitude and anxiety towards mathematics.
3. To find out the significance of the difference on attitude and anxiety towards mathematics among Boarding schools, Non-Boarding schools and Technical, Vocational Education and Training (TVET) school students

Hypotheses

The following null hypotheses were formulated by the above objectives:

Hypothesis No 1: There is no significant difference on attitude and anxiety towards mathematics between male and female secondary students.

Hypothesis No 2: There is no significant difference on attitude and anxiety towards mathematics among Government, Government-aided and Self-financed secondary school students.

Hypothesis No 3: There is no significant difference on attitude and anxiety towards mathematics among Boarding schools, Non-Boarding schools and TVET secondary school students.

2. Methods and Instruments

Research design:

Dependent variable:

1. Attitude towards mathematics
2. Anxiety towards mathematics

Independent Variable:

1. Gender of student,
2. Status of school,
3. Type of school,

Data collection and Sampling technique

After getting the authorization of the authorization of Musanze District to conduct the study, I applied the convenience sampling technique by which I used one of my students who was doing also his undergraduate research on schools mapping to go at the field and contact the Headteacher of the school and ask him or her if he can get a convenient sample to fill the questionnaire. Once my student got a positive response then the Headteacher helped him to gather the students in an available classroom to respond to the questionnaire on attitude towards Mathematics conceived by Tapia and Marsh II (2004) with translation in mother tongue – Kinyarwanda - to ease the understanding of the items. A detailed distribution of the numbers of student by Gender, status and type of the schools can be found in Habineza (2018).

Data analysis

The Statistical Package for Social Sciences (SPSS) version 17.0 as presented by Muijs (2004) was used to create the Data Base and to analyse the data. A t-test was used to identify the gender differences and an ANNOVA test was used to identify the differences by status and type of schools attended by the sampled students.

3. Findings and Discussion

The table No 1 shows the distribution of the sampled population according to categories and subcategories. It is noticed from the Table 1 below that the Government-aided schools have high number of students 50.6%, while the Non- Boarding schools have the highest number of students 58.1%. Furthermore, the female students represent 60.6% and the rural students 78.0%.

Table 1: Number of students in the sampled secondary schools

Categories	Status (n=763)			Type (N=763)			Gender (n=763)		Location (n=763)	
	Gov	Gov-aided	Self-financed	Boarding	Non-Boarding	TVET	Male	Female	Urban	Rural
Number of students	258	386	119	102	443	218	301	462	168	595
%	33.8	50.6	15.6	13.4	58.1	28.6	39.4	60.6	22.0	78.0

Hypothesis No 1

There is no significant difference between male and female secondary students' attitude and anxiety towards mathematics

Table 2: A t-test for comparison of Mean scores of students' attitudes and anxiety towards mathematics between male and female secondary students

		Independent Samples Test								
		Levene's Test for Equality of Variances				t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper	
Attitude	Equal variances assumed	8.644	.003	-4.714	761	.000	-.25666	.05445	-.36355	-.14978
	Equal variances not assumed			4.599	587.299	.000	-.25666	.05581	-.36627	-.14705
	Equal variances assumed	4.008	.046	1.529	761	.127	.10299	.06736	-.02924	.23522
	Equal variances not assumed			1.504	604.807	.133	.10299	.06849	-.03152	.23750

Table 2 shows that the significance value of attitude is 0.000 which is lesser than 0.05. Consequently there is a gender-based significant difference on attitude towards mathematics. However, there is no gender-based significant difference on anxiety towards mathematics. The hypothesis No 1 is partially rejected. This study showed opposite findings to those found by Farooq and Shah (2008), Mohamed and Waheed (2011), Yaser (2016) and Karjanto (2017) who found that students' gender has no significant impact on attitude towards mathematics.

Hypothesis No 2:

There is no significant difference among Government, Government-aided and Self-financed secondary school students' attitude and anxiety towards mathematics.

The following table No.3a and Table No.3b show the results of an ANNOVA test to verify the significance of the differences among Government, Government-aided and Self-financed secondary school students attitude and anxiety towards mathematics

Table 3a: ANOVA for comparison of Mean scores of students' attitudes and anxiety disaggregated by Schools Status (Public, Government-aided and Self-financed)

		ANOVA					
		Sum of Squares	df	Mean Square	F	Sig.	Significance level
Attitude	Between Groups	1.845	2	.923	1.664	.190	Not significant at p<0.05
	Within Groups	421.330	760	.554			
	Total	423.175	762				
Anxiety	Between Groups	4.523	2	2.261	2.742	.065	Not significant at p<0.05
	Within Groups	626.724	760	.825			
	Total	631.246	762				

The Table 3a of the ANNOVA Test shows that the significance value for attitude is 0.190 which is greater than 0.05; also it shows that the significance value for anxiety is 0.065 which is greater than 0.05. Consequently, it can be concluded that there is no significant difference on attitude and anxiety towards mathematics based on schools status (Government, Government-aided and Self-financed secondary schools). However, the subsequent Table 3b, showing findings of a corresponding Posthoc analysis, reveals that there is a significant difference between Government and Self-financed secondary school students' anxiety towards mathematics. Consequently, the hypothesis No2 is partially rejected as far anxiety is concerned.

Table No. 3b: PosthocANNOVA analysis for comparison of Mean scores of students' attitudes and anxiety disaggregated by Schools Status (Public, Government-aided and Self-financed)

Multiple Comparisons							
Tamhane							
Dependent Variable	(I) 1:Public; 2:Subsidised; 3:Private)	(J) 1:Public; 2:Subsidised; 3:Private)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Attitude	1	2	-.00824	.06016	.999	-.1523	.1358
		3	.13023	.07736	.255	-.0558	.3162
	2	1	.00824	.06016	.999	-.1358	.1523
		3	.13846	.07377	.174	-.0390	.3160
	3	1	-.13023	.07736	.255	-.3162	.0558
		2	-.13846	.07377	.174	-.3160	.0390
Anxiety	1	2	-.03489	.07201	.949	-.2073	.1375
		3	-.22865*	.08953	.033	-.4439	-.0133
	2	1	.03489	.07201	.949	-.1375	.2073

		3	-.19376	.08875	.087	-.4072	.0196
	3	1	.22865*	.08953	.033	.0133	.4439
		2	.19376	.08875	.087	-.0196	.4072

*. The mean difference is significant at the 0.05 level.

The findings of this study are in agreement with Kannan et al. (2015) who found that there was no significant difference between Government-Aided and Self-financed secondary school students' attitude towards mathematics. In a similar trend, Kasimu and Imoro (2017) found no significant difference of attitudes of both self-financed and Government JHS students towards mathematics.

Hypothesis No 3

There is no significant difference among Boarding school, Non-Boarding school and Technical, Vocational Education and Training (TVET) secondary school students attitude and anxiety towards mathematics.

Table 4a: ANOVA for comparison of Mean scores of students' attitudes and anxiety among Boarding school, Non-Boarding school and Technical, Vocational Education and Training

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
Attitude	Between Groups	30.375	2	15.188	29.386	.000
	Within Groups	392.800	760	.517		
	Total	423.175	762			
Anxiety	Between Groups	33.219	2	16.609	21.108	.000
	Within Groups	598.027	760	.787		
	Total	631.246	762			

Table 4b: PosthocANNOVA analysis for comparison of Mean scores of students' attitudes and anxiety disaggregated by Schools Type

Multiple Comparisons							
Tamhane							
Dependent Variable	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
	1:Excellent/Boarding; 2:NonBoarding/12ybe; 3:TVET	1:Excellent/Boarding; 2:NonBoarding/12ybe; 3:TVET				Lower Bound	Upper Bound
Attitude	1	2	.39390*	.06164	.000	.2456	.5422
		3	.65553*	.06926	.000	.4891	.8219
	2	1	-.39390*	.06164	.000	-.5422	-.2456
		3	.26162*	.06025	.000	.1172	.4060
	3	1	-.65553*	.06926	.000	-.8219	-.4891
		2	-.26162*	.06025	.000	-.4060	-.1172
Anxiety	1	2	-.51564*	.07660	.000	-.7001	-.3312
		3	-.68702*	.09192	.000	-.9078	-.4662
	2	1	.51564*	.07660	.000	.3312	.7001
		3	-.17139	.07843	.086	-.3594	.0167
	3	1	.68702*	.09192	.000	.4662	.9078
		2	.17139	.07843	.086	-.0167	.3594

*. The mean difference is significant at the 0.05 level.

The Table 4a of the ANNOVA Test shows that the significance value for attitude is 0.000 which is lesser than 0.05; also it shows that the significance value for anxiety is 0.000 which is lesser than 0.05, except between Non-Boarding and TVET schools.

Consequently, there are significant differences on attitude and anxiety towards mathematics based on schools type, that is, Boarding school, Non-Boarding school and Technical, Vocational Education and Training (TVET) schools. More specifically, the subsequent Table 3b, that showed findings of a corresponding Posthoc analysis, confirmed that there were significant differences on attitude and anxiety towards mathematics based on type of schools (Boarding, Non-Boarding school and Technical, Vocational Education and Training). Consequently the hypothesis No 3 is rejected.

Such findings are similar to findings presented by Dursun (2015) who showed that school type (Vocational high school, Anatolian school, Science High school) had significant effect on the attitude and anxiety towards mathematics. However, they are in agreement with Reber, Isiksal, and Koç (2018) who found that school type did not have significant effect on anxiety scores, but have significant effect on attitude scores.

4. Conclusion and Recommendations

This study presents the second part of analysis of data presented in XXXXXXXX (2018) so that the two studies are complementary. The first study focused more on the data description while the current study is more analytical about various differences based on students' gender, schools' status

and type. The major findings are: There is a gender-based significant difference on attitude towards mathematics but there is no gender-based significant difference on anxiety towards mathematics; there is no significant difference on attitude and anxiety towards mathematics based on schools status (Government, Government-aided and Self-financed secondary schools); however, there is a significant difference between Government and self-financed secondary school students' anxiety towards mathematics ; there were significant differences on attitude and anxiety towards mathematics based on type of schools (Boarding schools, Non-Boarding school and Technical, Vocational Education and Training). These findings can orient Mathematics Teacher and Education Leaders to decide on which appropriate measures to introduce in order to increase students' attitude towards mathematics and reduce their anxiety towards mathematics since various studies showed that these two factors have impact on students' achievements in mathematics (Adamu, 2014; Akin & Kurbanoglu, 2011, Pourmoslemi et al., 2013). Such kind of studies on relationships between mathematics attitude, mathematics anxiety and mathematics achievements should be initiated in Rwandan schools in order to support continued efforts that are being engaged to reinforce STEM Education (White, 2014). Furthermore, some strategies should be put in place to alleviate the gender-based differences on attitude and anxiety towards mathematics in Non-Boarding and TVET schools. Finally, strategies should be put in place in order to overcome the significant differences on attitude and anxiety towards mathematics based on school type (Boarding school, Non-Boarding school and Technical, Vocational Education and Training).

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