Journal of Education and Learning; Vol. 8, No. 3; 2019
ISSN 1927-5250 E-ISSN 1927-5269
Published by Canadian Center of Science and Education

Assessing the Correlation Between Academic Self-Concept and Mathematics Achievement in Secondary Schools in Nairobi County, Kenya

Priscilla Gachigi Njoki[1], Dakota King-White[2], Theresia Kinai[3] & Edward Kigen[4]

[1] Faculty of Education and Arts, KCA University, Nairobi, Kenya

[2] College of Education and Human Services, Cleveland State University, Cleveland, Ohio, USA

[3] School of Education, Kenyatta University, Nairobi, Kenya School of Education, Kenyatta University, Nairobi, Kenya

[4] School of Education, Kenyatta University, Nairobi, Kenya

Correspondence: Dakota King-White, College of Education and Human Services, Cleveland State University, Cleveland, Ohio, USA. E-mail: d.l.king19@csuohio.edu

Received: February 21, 2019 Accepted: March 20, 2019 Online Published: May 10, 2019

doi:10.5539/jel.v8n3p102 URL: https://doi.org/10.5539/jel.v8n3p102

Abstract

Students in Kenya have been performing poorly in mathematics in both primary and secondary schools, with the majority of the students scoring below average. The purpose of this study was to explore the extent to which academic self-concept correlates with mathematics achievement of secondary school students in Nairobi County. The study targeted 9,641 Form 3 students in public secondary schools that had registered students for Kenya Certificate of Secondary Education examinations for the past three years. A sample of 500 respondents was drawn using stratified and simple random sampling. A questionnaire that included items from the Academic Self-Concept Questionnaire was used to measure academic self-concept. The average score in mathematics for three consecutive terms was used as the mathematics achievement for each participant. The results from the study showed that academic self-concept positively and significantly predicted mathematics achievement. Based on findings, this article includes recommendations on effective ways that teachers, parents, and other stakeholders can help increase students' academic self-concept and boost students' mathematics achievement.

Keywords: self-concept, mathematics, secondary schools

1. Introduction

Mathematics finds its application in several fields and forms the basis for most scientific subjects. Performance in mathematics therefore is of great interest across all levels of education. Good performance in mathematics is valuable both for students and for a country's economic wellbeing. Available research indicates that the number of high achievers in mathematics in most states is below that of the world's leading industrialized nations (Hanushek, Peterson, & Woesmann, 2010).

Mathematics is a compulsory subject in both primary and secondary schools in Kenya. A good score in mathematics is also a prerequisite for most courses in science-learning colleges and universities. This is in line with the notion that mathematics lays the foundation of scientific technical knowledge for industrial and technological advancement (Tella, 2007). Despite its perceived importance, mathematics achievement of Kenyan students on the final secondary school examination did not improve in the years 2011 to 2013 (Githua, 2013). Statistics from the County Director's Office in Nairobi County indicate that only 15% of the schools scored a mean grade of C+ and above in mathematics, while 65% of the schools scored a mean grade of D+ and below in the years 2013–2017. The Kenya Certificate of Secondary Education (KCSE) mean scores in mathematics for Nairobi County were as follows: 2013: 4.02; 2014: 3.89; 2015: 4.02; 2016: 4.00; and 2017: 3.86 (Kenya National Examinations Council [KNEC], 2018). This underachievement has implications for attainment of national educational goals because for a student to be enrolled in a science-oriented course, he or she needs to have scored at least an average of C+ in mathematics.

Academic self-concept (ASC) refers to students' perceptions of their skills, capability, and interest in learning (Liu, Wang, & Parkins, 2005). Liu et al. (2005) pointed out that academic self-concept is a product of effort and confidence. Effort refers to the amount of physical and mental energy dedicated to the study of a subject, while confidence refers to the feeling that a student has in relation to his or her ability in a subject. Mathematics self-concept, therefore, is academic self-concept but with a bias toward mathematics. It is a product of a student's effort and confidence in mathematics. Though some studies have highlighted the link between academic self-concept and achievement (Erdogan & Sengul, 2014; Kwena, 2007; Osei, 2014), they have not specifically isolated mathematics self-concept. Other studies in the area have found significant relationships between academic self-concept and gender on achievement in the science subjects (Manger & Eikeland, 2006; Visi, 2015).

Mathematics achievement among students in Nairobi County is below average. Statistics indicate that 65% of schools scored a mean grade of D+ and below in mathematics in the years 2013 through 2017 (KNEC, 2018). As a consequence, many students do not qualify to take science and mathematics courses at higher institutions of learning, which the country needs for technological advancement. Eventually, there will be inadequate manpower skilled in the math and science fields, leading to loss of profit in production industries due to lack of or inadequate technological expertise. Additionally, there will be low levels of job creation in fields that require mathematical skills. The scarcity of students pursuing science and mathematics courses at the tertiary level may also hinder the realization of Kenya's Vision 2030, which is strongly anchored on technological advancement.

This trend of poor mathematics achievement may be reversed by understanding factors that lead to poor mathematics achievement. Once the factors are identified, devising a plan to overcome the barriers is key to helping students succeed. An improvement in mathematics performance may help maintain the country's innovative edge in the world while improving its competitive advantage by developing a highly qualified force of scientists and engineers that the country needs for the achievement of Vision 2030.

From a global perspective, a positive relationship has been reported between students' academic self-concept and mathematics achievement. In Kenya, however, few studies that focus on ways to improve mathematics achievement exist. Moreover, very few studies have been conducted in Nairobi County on how academic self-concept may predict mathematics achievement. Studies have been carried out in other locations among primary and university students, but the extent to which these results may be generalized calls for empirical investigation.

Research on the relationship between academic self-concept and mathematics achievement has reported contradictory findings. Some studies have reported positive correlation, while others have found no correlation. For instance, Osei (2014) conducted a study using a sample of 120 high school students from four schools—two urban and two rural—in Ghana. This sample was selected using a stratified random sampling technique. Data were collected using the Inventory of School Motivation and the Self-Concept Scale. Data analysis was performed using percentages and Pearson product moment correlation. Results indicated that a large number of students were highly motivated, had a high self-concept, and performed well in mathematics. Further analysis showed that students with high self-concept performed better on the mathematics achievement test and aimed to pursue mathematics-related courses upon admission to higher learning institutions.

These findings were echoed by Zahra, Arif, and Yousuf (2010), who investigated whether different classes of self-concept, like academic, physical, and social, among students were correlated to their academic achievement. In Zahra et al.'s study, 1,500 female university degree students in Islamabad who had been selected using a two-stage cluster sampling technique completed questionnaires. The self-descriptive questionnaire by Marsh (1992) was used to collect data on self-concept. Factor analysis and Kendalls-Tau-b revealed that physical and social self-concepts were not related to academic achievement, but the relationship between academic self-concept and academic achievement in all subjects was found to be significant with a weak correlation.

Kwena (2007), in a study of factors that influence academic performance among primary school pupils in Bondo District, found that the relationship between academic self-concept and academic achievement was significant and positive. The sample consisted of 972 pupils, of which 497 were males and 475 were females. The study focused on sixth- to eighth-grade students. Data were collected using academic self-concept ladders for academic self-concept and questionnaires for other factors. This study was carried out among primary school students from a rural area and considered academic achievement in all subjects. This limited the possibility of generalization of results to students in secondary schools as well as to primary school pupils in an urban environment.

A study conducted in Nigeria by Mnyandu (2001) on the effects of gender and mathematics ability on academic performance of students found that there was no significant difference in the performance of male and female

students in chemistry. The sample consisted of 200 high school students (100 boys and 100 girls) who had been randomly selected. Data were collected through the use of questionnaires and analysis of teacher evaluations. The study concluded that gender does not have any significant effect on the academic performance of students.

Due to the contradictory findings and limited information on the connection between academic self-concept and mathematics achievement in the literature, the researchers of this study sought to examine the extent to which academic self-concept predicts mathematics achievement of secondary school students in Nairobi County, Kenya.

2. Materials and Methods

2.1 Research Design

This study employed a predictive correlational research design that involves the measurement of two or more variables and the relationship between or among those variables (Stangor, 2011). This design also involves the measurement of variance on the dependent variable relative to variance on the predictor variable(s). There was no manipulation of the variables or subjects under study; the study was conducted in the subjects' natural environment, that is, on a normal school day with no pre-preparations, and achievement was measured using the normal student evaluation tests. It was presumed that the dependent variable would be determined to some extent by the independent variable; thus, the study drew conclusions based on the predictive levels of each of the independent variables on the dependent variable. In this case, the link between students' academic self-concept and mathematics achievement was investigated.

2.2 Target Population

The study targeted 9,641 Form 3 students (5,541 boys and 4,100 girls) in public secondary schools in Nairobi County. Nairobi County has 79 public schools. Form 3 students were chosen for the sample because they had already spent three years in school and so were likely to have developed a well-defined academic self-concept. Form 3 students were also preferred because they had already selected subjects for the KCSE and were expected to be seriously settled into their studies. In addition, these students were chosen because they had already registered for the KCSE.

2.3 Sample and Sampling Technique

Two types of sampling procedures were employed: stratified and simple random sampling. Stratified sampling was used to classify schools into national, county, and sub-county strata based on the need to obtain a representative sample for all sub-groups in the population (Stangor, 2011). Simple random sampling was used to pick two national, four county, and seven sub-county schools by lottery method using the gender criterion. Simple random sampling was also employed to select student participants. In total, 13 schools participated in the study.

The sample size was arrived at using the formula by Yamane, as cited in Israel (1992): $n = N/1+N(e)^2$, where n is the desired sample; N is the total population; and e is the margin of error, which was set at .05. Using the formula, a total of 384 was obtained as the base sample. Thirty percent of the base sample was added to compensate for non-response. A total of 500 respondents were sampled. Proportionate stratified sampling was employed to allocate respondents in the national, county, and sub-county schools to ensure that the size of the sample drawn from each stratum was proportionate to the relative size of that stratum in the population (Stangor, 2011). This was calculated based on the total number of students per strata relative to the total number of students in public secondary schools in Nairobi County and the sample size; thus, the number of students per strata was given by $n_1/N*n$, where n_1 is the population size of the particular strata, N is the total population, and n is the sample size.

2.4 Research Instruments

The data for this study were collected using questionnaires and document analysis. To ensure content validity, the questionnaire was examined by research experts who reviewed the items critically and gave feedback in the form of suggestions for modifications, insertions, and deletions. Secondary school teachers were also consulted since they are more aware of what is appropriate for students at the different levels of education. The researchers then modified the items using the suggestions put forward by these experts. In addition, a pilot study was conducted, and necessary adjustments were made to improve the validity.

To ensure the reliability of the questionnaire, the items were tested for internal consistency using Cronbach's alpha, and the coefficients obtained per sub-scale were used to compute the overall instrument reliability. The calculated Cronbach reliability of the whole instrument had been given as .74 to .89. The instrument was piloted with a sample of 40 secondary school students, and the reliability of the whole instrument was computed as .78.

2.5 Data Analysis and Presentation

Data collected were coded and entered into the computer for analysis using Statistical Package for Social Sciences (SPSS). Both descriptive and inferential statistics were used. Data were presented in tabular form. The following null hypotheses were tested at $\alpha = .05$.

$H_0$1: Academic self-concept does not significantly predict mathematics achievement of secondary school students in Nairobi County. (Statistical test: multiple linear regression.)

$H_0$2: There are no significant gender differences in academic self-concept and mathematics achievement of secondary school students in Nairobi County. (Statistical test: independent sample *t*-test.)

$H_0$3: There are no significant differences in academic self-concept and mathematics achievement between students in national, county, and sub-county schools in Nairobi County. (Statistical test: one-way analysis of variance [ANOVA].)

3. Results

Findings are presented in line with the study hypotheses. Descriptive statistics are included first to describe the various aspects of the study variables.

3.1 Demographic Data

The sampled schools were classified into national, county, and sub-county strata. Two national schools in the county contributed 39 respondents, accounting for 8.42% of the entire sample, while the four selected county schools contributed 31.32% of the sample, which is equivalent to 145 students. Seven sub-county schools contributed 279 students, accounting for 60.26% of the sample. In total, the sample consisted of 250 (54.00%) male and 213 (46.00%) female students from 13 public secondary schools in Nairobi County. The students' age distribution is shown in Table 1.

Table 1. Students' age distribution

Age	Boys	Percentage	Girls	Percentage	Total	Percentage
16.00	54	21.60	98	46.01	152	32.80
17.00	101	40.40	85	39.90	186	40.20
18.00	76	30.40	24	11.27	100	21.60
Over 18	19	7.60	6	2.82	25	5.40
Total	250	100.00	213	100.00	463	100.00

Table 1 shows that the age variance was not significant and therefore it would not have contributed to differences in mathematics achievement and academic self-concept.

3.2 Hypothesis One

The first hypothesis of the study focused on the extent to which academic self-concept predicts mathematics achievement of secondary school students in Nairobi County. The tested null hypothesis stated the following: Academic self-concept does not significantly predict mathematics achievement of secondary school students in Nairobi County.

Multiple linear regression analysis was used to test the predictive levels of the domains of academic self-concept. First, the relationships between the two domains of academic self-concept—confidence and effort (both independently as well as collectively)—and academic achievement were tested for linearity using bivariate correlation. The results are shown in Table 2.

Table 2. Correlation coefficients for confidence, effort, ASC, and MA

Domains of ASC	MA	Sig.
Effort	.02	.72
Confidence	.11	.02
ASC	.09	.07

Table 2 reveals that independently, the two domains of academic self-concept had positive linear relationships with mathematics achievement, given by $r = .02$, $p = .72$ and $r = .11$, $p = .02$ for effort and confidence,

respectively. It also reveals that academic self-concept (effort and confidence collectively) was positively correlated to mathematics achievement, $r = .09$, $p = .07$. However only confidence had a statistically significant relationship with mathematics achievement, at $p = .02$. The findings revealed positive correlations between both domains of academic self-concept and mathematics achievement. This means that students with high academic self-concepts are highly likely to perform highly in mathematics. The correlational matrix, shown in Table 3, was used to test for multicollinearity of the two domains of academic self-concept to establish the fitness of multiple regression analysis as the statistical test for the null hypothesis.

Table 3. Correlational matrix for the domains of ASC

	MA	Effort	Confidence	ASC
MA	1			
Effort	0.02	1		
Confidence	.11*	.18**	1	
ASC	0.09	.76**	.78**	1

Note. * Significant at the .05 level, ** Significant at the .01 level.

As seen in Table 3, effort and confidence were significantly but not strongly correlated. This suggests that multiple regression analysis can be used to test the null hypothesis. However, to eliminate any doubts, the variance inflating factor (VIF) was computed, and the results indicated a VIF equal to 1.03 for both effort and confidence, meaning that the collinearity between the two was negligible. A multiple regression model was run to find the extent to which academic self-concept predicts mathematics achievement. From the analysis, the predictive value of academic self-concept was statistically significant, $F(2, 460) = 2.98$, $p = .05$, although academic self-concept contributed just 1% of variance in mathematics achievement ($R^2 = .01$). The null hypothesis was therefore rejected. Table 4 shows the ANOVA for the academic self-concept regression model.

Table 4. ANOVA for academic self-concept model

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	538.13	2	269.07	2.98	.05
	Residual	41,605.46	460	90.46		
	Total	42,143.60	462			

The researcher further investigated the predictive values of each of the two domains of academic self-concept toward mathematics achievement. The coefficients for the model are shown in Table 5.

Table 5. Beta coefficients for confidence and effort on mathematics achievement

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	38.54	5.12		7.53	.00
	Effort	-.01	.12	-.00	-.07	.94
	Confidence	.28	.12	.11	2.41	.02

Findings in Table 5 show that effort with $\beta = -.01$, $p = .94$ is a negative and insignificant predictor of mathematics achievement. However, confidence was a significant predictor of mathematics achievement, $\beta = .28$, $p = .02$.

3.3 Hypothesis Two

The second hypothesis focused on gender differences related to students' academic self-concept and mathematics achievement. The tested null hypothesis stated the following: There are no significant gender differences in academic self-concept and mathematics achievement of secondary school students in Nairobi County.

To test this hypothesis, independent sample *t*-tests were carried out for each of the test variables. The findings showed no gender differences in terms of students' academic self-concept and mathematics achievement. The null hypothesis was therefore retained. The findings are presented in Table 6.

Table 6. Mean differences for mathematics achievement and self-concept by gender

		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
Mathematics achievement	Equal variances assumed	.13	.72	.85	461	.40	.76	.89
Academic self-concept	Equal variances assumed	.01	.92	-.60	461	.55	-.33	.54

The findings in Table 6 indicate that the mean differences in mathematics achievement and academic self-concept were statistically insignificant. Assuming equal variances for mathematics scores, $t(461) = .85$, $p = .89$; $t(461) = .10$, $p = .11$; and $t(461) = -.60$, $p = .55$, for academic self-concept. Thus, no significant gender differences in mathematics achievement and academic self-concept appeared. The differences in mean were not only marginal but also statistically insignificant. Similar findings were reported by Mnyandu (2001) and Agarawal and Kumar (2015) in their studies of gender differences in chemistry and mathematics achievement respectively the null hypothesis was therefore retained.

3.4 Hypothesis Three

The third hypothesis focused on determining differences in respondents' academic self-concept and mathematics achievement based on the type of school. The following null hypothesis was tested: There are no significant differences in academic self-concept and mathematics achievement between students in national, county, and sub-county schools in Nairobi County. A one-way ANOVA was used to test the hypothesis. The results are presented in Table 7.

Table 7. ANOVA of academic self-concept and mathematics achievement

		Sum of squares	*df*	Mean square	*F*	Sig.
Mathematics achievement	Between groups	10,038.14	2	5019.07	71.91	.00
	Within groups	32,105.45	460	69.79		
	Total	42,143.60	462			
ASC	Between groups	12.92	2	6.46	.19	.83
	Within groups	15,565.63	460	33.84		
	Total	15,578.54	462			

Significant differences existed in the means of mathematics achievement among the school types—$F(2,460) = 71.91$, $p < .01$. The mean differences for academic self-concept—$F(2,460) = .19$, $p = .83$—between the school types were, however, statistically insignificant. Tukey's post hoc analysis was then done to find the extent of differences in means. The findings are presented in Table 8.

Table 8. Post hoc analysis

Dependent variable	Type of school (I)	Type of school (J)	Mean difference (I-J)	Std. error	Sig.
Mathematics achievement	National	County	12.46*	1.51	0.00
		Sub-county	16.71*	1.43	0.00
	County	National	-12.46*	1.51	0.00
		Sub-county	4.25*	0.86	0.00
	Sub-county	National	-16.71*	1.43	0.00
		County	-4.25*	0.86	0.00
Academic self-concept	National	County	-0.19	1.05	0.98
		Sub-county	-0.48	0.99	0.88
	County	National	0.19	1.05	0.98
		Sub-county	-0.28	0.60	0.88
	Sub-county	National	0.48	0.99	0.88
		County	0.28	0.60	0.88

As shown in the post hoc analysis results in Table 8, significant differences in mathematics achievement between national and county schools existed, with a difference of 12.46, $p < .01$; between national and sub-county schools, with a mean difference of 16.71, $p < .01$; and between county and sub-county schools, with a mean difference =

4.25, $p < .01$. The differences between school categories in academic self-concept were statistically insignificant. These results show that the level of academic self-concept is not determined by the type of school attended.

4. Discussion

The first hypothesis focused on the extent to which academic self-concept predicts mathematics achievement, and the study found a positive and significant relationship between the two variables. Of the two domains for academic self-concept, effort negatively and insignificantly predicted mathematics achievement, while confidence positively and significantly predicted mathematics achievement. These findings indicate that efforts should be enhanced to raise the academic self-concept of students, which will in turn boost their confidence in mathematics and thus improve grades. If students' confidence is boosted, then they are highly likely to increase their efforts in mathematics. These findings support earlier results reported by Ajogbeje (2010), Kwena (2007), and Macharia (2011). For instance, Ajogbeje (2010), using a sample of secondary school students, also reported a remarkable correlation between students' academic self-perceptions and their mathematics performance. Kwena (2007), in her sample of primary school pupils, reported a significant relationship between academic self-concept and mathematics achievement. The findings show that the level of schooling may not influence the outcome of the relationship between the two variables because some of the samples reported were drawn from primary school pupils while others were drawn from university students.

Other researchers have reported contradictory findings, including Erdogan and Sengul (2014) and Zahra et al. (2010). Their findings indicated a negative and insignificant relationship between mathematics achievement and academic self-concept. Though the samples used in the three studies were different in terms of level of schooling, those studies found that irrespective of cultural differences and different study locations, it appears that academic self-concept may negatively predict mathematics achievement. There is a need to increase students' self-beliefs of their mathematical ability in order to raise their grades in mathematics.

Please note that the findings revealed no significant gender differences between academic self-concept and mathematics achievement. In the rest of the variables, that is academic motivation and academic resilience, gender differences were marginal hence insignificant. In comparison to other writers, some have reported similar findings while others have contradictory findings. Interventions for academic-self-concept need not be directed to girls only but to boys as well.

The second hypothesis focused on gender differences in academic self-concept and mathematics achievement. The findings indicated that male and female students were not significantly different in academic self-concept and mathematics achievement. These findings are similar to those reported by other researchers in the field (Agarawal & Kumar, 2015; Mnyandu, 2001). Agarawal and Kumar (2015), in their study on gender differences in academic self-concept of boys and girls, found no differences between the two genders. Further, the results of Mnyandu's (2001) investigation of the effects of gender and mathematics ability on academic performance indicated no significant difference in the performance of male and female students in chemistry. Thus, these studies imply that environment notwithstanding, gender does not have any significant effect on mathematics achievement.

However, contrasting findings have been reported by other researchers (Dai, 2001; Makworo, Wasanga, & Olely, 2014; Manger & Eikeland, 2006; Muchera, Dixon, & Hartley, 2010). For example, Dai (2001) sought to determine if there were gender differences in academic self-concept, self-esteem, and academic motivation of high school adolescents and found that boys from the regular school had a higher verbal self-concept than girls, while from the key school, boys and girls had comparable mathematics self-concepts. The differences in the findings of this study to the current one could be due to the study location. One was done in the Western world, while the other was carried out in the developing city of Nairobi, Kenya. Further, Muchera et al. (2010) echoed Dai's findings. They examined the perceptions of self-concept and actual academic performance in mathematics and English among high school students in Kenya. The results indicated sex and grade differences in performance and academic self-concept. Girls performed better in mathematics, while boys rated higher in the self-concept measures. This difference may have been due to the fact that the study only sampled two schools; therefore, it was not generalizable across other schools.

4.1 Differences in Academic Self-Concept and Mathematics Achievement by Type of School

The last objective of the study was to establish differences in academic self-concept and mathematics achievement by the type of school attended.

Data on respondents' academic self-concept and mathematics achievement were collated and are presented in Table 9.

Table 9. Mean scores for academic self-concept and mathematics achievement by school type

	National		County		Sub-county	
	Mean	Std. deviation	Mean	Std. deviation	Mean	Std. deviation
Mathematics achievement	62.14	5.27	49.68	8.36	45.43	8.69
Academic self-concept	66.56	4.85	66.76	5.32	67.04	6.17

Findings in Table 9 indicate that National schools had the best performance in mathematics as compared to county and sub-county schools. This could be due to the entry behavior because the top performers are selected to join national schools while others join county and sub-county schools. Strangely, students in sub-county schools reported the highest mean in academic self-concept. This could be due to the pressure in national schools to obtain high grades while the learning environment in county and sub-county schools is a bit relaxing hence the high academic self-concept.

4.2 Gender Differences in Academic Self-Concept, Academic Motivation, Academic Resilience, and Mathematics Achievement

The study sought to establish gender differences in academic self-concept and mathematics achievement. The means of respondents' scores on the variables were collated and are presented in Table 10.

Table 10. Means of academic self-concept and mathematics achievement by gender

	Boys (250)		Girls (213)	
	Mean	Std. deviation	Mean	Std. deviation
Academic self-concept	66.76	5.90	67.09	5.70
Mathematics achievement	48.52	9.55	47.76	9.55

As depicted in Table 10, girls had higher means in academic self-concept, 67.09, than boys, 66.76. Additionally, boys scored higher in mathematics than girls, as seen from the table—48.52 and 47.76 for boys and girls, respectively.

Finally, the third hypothesis focused on determining differences in academic self-concept and mathematics achievement by the type of school. Findings revealed that the type of school had a significant influence on academic self-concept and mathematics achievement. These findings are similar to those reported by Baran and Maskan (2011); Momanyi, Too, and Simiyu (2011); Mwangi, Okatcha, Kinai, and Ireri (2015); and Srivastara and Joshi (2011). Baran and Maskan (2011) examined the relationship between students' academic self-concept and certain variables, such as type of school, gender, and family background. Results revealed that students attending vocational high schools had a lower self-concept compared to students attending other schools. Similarly, Srivastara and Joshi (2011) examined the effect of school and area on academic self-concept and academic achievement and found that academic self-concept and academic achievement of adolescents were higher in high facility schools than in low facility schools.

4.3 Study Limitations

The results of this study presented evidence of the existence of a relationship between academic self-concept and mathematics achievement. It was found that effort negatively and insignificantly predicted mathematics achievement, while confidence positively and significantly predicted mathematics achievement. Overall academic self-concept, however, had a weak positive predictive value, meaning that academic self-concept predicted mathematics achievement only to some extent. No significant gender differences in mathematics achievement were found. This finding suggests that both male and female students had the same capacity to achieve if all other factors were held constant. Moreover, in the independent variables, there were no gender differences, implying that if both male and female students were exposed to similar study conditions, they could be expected to exhibit similar levels of achievement, all other factors notwithstanding. The type of school was found to insignificantly influence students' academic self-concept and mathematics achievement.

Due to the study only being done in Nairobi County, Kenya, the researchers cannot generalize the results across various cultural groups. However, the study gives a framework and recommendations to support secondary students across various countries.

5. Conclusions and Recommendations

Based on the study findings, the researchers propose the following policy recommendations:

- Mathematics teachers should be trained on skills that may be utilized in improving learners' academic self-concept in order to encourage students who have no confidence to view themselves as capable of performing better in math. Effective guidance and counseling programs could be introduced in schools to help raise students' academic self-concept. Frequent use of effective reinforcement strategies may help raise mathematics self-concept.
- Mentoring programs should be introduced to assist in raising students' academic self-concept. Students should be exposed to successful role models and motivational speakers to encourage them to work hard in mathematics, which is a prerequisite for many prestigious courses.
- Teachers should encourage students to excel, regardless of the type of school they attend. There should be efforts to organize forums where students from different categories of schools are brought together to compete with each other. This will boost the morale of students who are in the sub-county schools.
- Teachers should encourage students to participate in the learning process through peer teaching as a way of improving students' academic self-concept.

Recommendations for further research include the following:

- Similar studies in other parts of the country are needed to determine whether there might be rural-urban disparities in students' academic self-perceptions and mathematics achievement.
- This study found that academic self-concept predicts mathematics achievement. However, the study did not investigate the determinants of this construct. Further research is required concerning other factors that may relate to mathematics achievement and influence the development of the constructs.
- A similar study is needed to determine other factors that may influence mathematics achievement, such as students' intellectual ability, peer influence, school climate, academic motivation, and academic resilience.
- A similar study in other counties is recommended for the purpose of generalization of findings. Such a study will help resolve cultural and geographical differences.
- The current study found no significant gender differences in students' academic self-concept and mathematics achievement. Further research is needed, however, to draw conclusions.
- The type of school was found to have a significant influence on students' academic self-concept and mathematics achievement. More research is needed in other parts of the country for comparison.
- The current findings were based on secondary school students. To contribute to a better understanding of the constructs, a similar study should be replicated using a sample of university or primary school students.
- The study investigated mathematics achievement only. A similar study should consider investigating the prediction of academic self-concept on other subjects.

References

Agarawal, M., & Kumar, A. T. (2015). Academic achievement and self-concept of secondary level students. *Journal of Educational Psychology*, *1*(3), 26–33.

Ajogbeje, J. O. (2010). Mathematics achievement among secondary school students in Ado-Ekiti, Nigeria. *Nigerian Journal of Guidance and Counseling*, *15*(1), 261–278.

Baran, M., & Maskan, A. K. (2011). A study of relationships between academic self-concepts, some selected variables, and physics course achievement. *International Journal of Education*, *3*(1), E2. https://doi.org/10.5296/ije.v3i1.586

Dai, D. Y. (2001). A comparison of gender differences in academic self-concept and motivation between high-ability and average Chinese adolescents. *Journal of Advanced Academics*, *13*(1), 22–32. https://doi.org/10.4219/jsge-2001-361

Erdogan, F., & Sengul, S. (2014). A study on the elementary school students' mathematics self-concept. *Procedia-Social and Behavioural Sciences*, *152*, 596–601. https://doi.org/10.1016/j.sbspro.2014.09.249

Githua, B. N. (2013). Secondary school students' perceptions of mathematics formative evaluation and the perception's relationship to their motivation to learn the subject by gender in Nairobi and Rift Valley Provinces, Kenya. *Asian Journal of Social Sciences & Humanities*, *2*(1), 174–183.

Hanushek, E. A., Peterson, P. E., & Woesmann, L. (2010). *U.S. math performance in global perspective: How well does each state do at producing high achieving students?* PEPG Report No. 10–19. Harvard, Kennedy

School. Retrieved from https://sites.hks.harvard.edu/pepg/PDF/Papers/PEPG10-19_HanushekPetersonWoessmann.pdf

Israel, G. D. (1992). *Sampling the evidence of extension program impact.* Retrieved from http://edis.ifas.ufl.edu/pd005

Kenya National Examinations Council (KNEC). (2018). *KNEC results 2018*. Retrieved from https://www.knec.ac.ke/services/release-results/

Kwena, A. J. (2007). *An investigation into selected factors on academic self-concept among primary school pupils in Bondo District*. Unpublished PhD thesis, Kenyatta University, Nairobi, Kenya.

Liu, W., Wang, C. D., & Parkins, E. J. (2005). A longitudinal study of students' academic self-concept in a streamed setting: The Singapore context. *British Journal of Educational Psychology*, *74*(4), 567–586. https://doi.org/10.1348/000709905X42239

Macharia, R. W. (2011). *Investigation of factors influencing academic self-concept and academic achievement among day secondary students in Githobokoni division, Gatundu District*. Unpublished master's thesis, Kenyatta University, Nairobi, Kenya.

Makworo, B. K., Wasanga, C. M., & Olely, W. (2014). Psychological factors that affect girls' academic performance in secondary schools in Kenyanya, Kisii County, Kenya. *International Journal of Psychology and Counseling*, *6*(9), 119–132. https://doi.org/10.5897/IJPC2014.0270

Manger, T., & Eikeland, O. (1998). The Effect of Mathematics Self-Concept on Girls' and Boys' Mathematical Achievement. *School Psychology International*, *19*(1), 5–18. https://doi.org/10.1177/0143034398191001

Marsh, H. W. (1992). Content specificity of relations between academic achievement and academic self-concept. *Journal of Educational Psychology*, *84*(1), 35–42. https://doi.org/10.1037/0022-0663.84.1.35

Mnyandu, P. T. (2001). *The relations between self-determination, achievement motivation and academic achievement*. Unpublished MA dissertation, University of South Africa, Pretoria.

Momanyi, J. M., Too, J. K., & Simiyu, C. (2011). Influence of type of school on academic motivation and academic performance among secondary schools in Kenya. *International Journal of Current Research*, *7*, 23368–23372.

Muchera, W., Dixon, F., & Hartley, K. (2010). Perceptions of self-concept and actual academic performance in mathematics and English among high school students in Kenya. *Educational Research*, *1*(8), 263–275.

Mwangi, C. N., Okatcha, F. M., Kinai, T. K., & Ireri, A. M. (2015). Relationship between Academic Resilience and Academic Achievement among Secondary School Students in Kiambu County, Kenya. *International Journal of School and Cognitive Psychology*, *2*, 345–367. https://doi.org/10.4172/ijscp.S2-003

Osei, E. (2014). Achievement and motivation, academic self-concept and academic achievement among high school students. *European Journal of Research and Reflection in Educational Studies*, *2*(2), 24–37.

Srivastara, R., & Joshi, S. (2011). The effect of school and area on academic self-concept and academic achievement of adolescents. *Delhi Psychiatry Journal*, *1*(2), 331–336.

Stangor, C. (2011). *Research methods for the behavioural sciences* (4th ed.). Belmont, CA: Cengage Learning.

Tella, A. (2007). The impact of motivation on students' academic achievement and learning outcomes in mathematics among secondary school students in Nigeria. *Eurasia Journal of Mathematics, Science and Technology*, *3*(2), 149–156. https://doi.org/10.12973/ejmste/75390

Visi, N. (2015). The relationship between students' academic self-concept, motivation and academic achievement. *Journal of Applied Environmental and Biological Sciences*, *5*(4), 270–276.

Zahra, A., Arif, M., & Yousuf, M. (2010). Relationship of academic, physical and social self-concepts of students with their academic achievement. *Contemporary Issues in Educational Research*, *3*(3), 73–78. https://doi.org/10.19030/cier.v3i3.190