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Effect of Gender on Performance of Students in Biology and Geography Taught using Preferred Learning Styles in Secondary Schools in Nairobi County, Kenya

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Abstract: Learning styles influence students in all levels of education and a mismatch of teaching styles to preferred learning styles makes learning a stressful experience to many learners. In Nairobi County, students in both private and public schools have not been performing satisfactorily in sciences. Matched teaching styles with preferred learning styles were conceptualised as the independent variables that determine their performance in biology and geography. The purpose of this study was to establish the Effect of gender on performance of students in biology and geography taught using preferred learning styles in secondary schools in Nairobi County, Kenya. This County was chosen because of unsatisfactorily performance in sciences as, only 12.632% of the schools got a mean grade of B- and above, in the years 2004 to 2010. The study was based on Felder Learning Style Theory, and Grasha Teaching Style Theory. A purposive sample of 1,322 students from 18,536 Form Two Students in private and public schools randomly selected for the study. The study employed quasi-experimental research design, which utilised a pre-test, treatment of experimental group and a post-test to estimate impact of an intervention of mismatch due to traditional teaching styles to preferred leaning styles on target population of 69,634 in 146 secondary schools. Questionnaires and pre-test and post-test were used to collect quantitative data. A full disclosure of the nature of the study was given to subjects with an extended opportunity to ask questions and get their free consent to participate. The collected data was analysed with the aid of the Statistical Package for Social Sciences (SPSS) version 22. Data was described and summarized using, percentages, and means. Multivariate analysis of variance and linear regression analysis showed statistically significant effect on performance of students taught using preferred learning styles in geography and biology. In conclusion, this study sensitised teachers of the need to identify and teach their learners according to their preferred learning styles in order to enhance their performance in sciences. It recommended the ministry of education science and technology in Kenya to in-service, and train teachers to acquire the skills of detecting learning style preferences of students.

Keywords: Learning styles, Teaching Styles, Gender, Match, Performance, and Biology and Geography**.**

INTRODUCTION

In the Kenyan Education System (8-4-4), examinations and tests assess learning at each level of a student's life. This is a valid and undoubtedly, a fine way of determining students' learning ability and capacity. Learning is the process of acquiring, understanding, applying, and extending skills, attitudes, knowledge and concepts [1]. On the other hand, learning style is the way students prefer to receive and process information [2]. Performance is determined by testing what the student can remember or apply, analyse, synthesize, or evaluate in a new situation. Testing evaluates teaching effectiveness. Felder and Soloman [3] found that students preferentially take in and process information in different ways: by seeing and hearing, reflecting and acting, reasoning logically and intuitively, analysing and visualizing. On the other hand, traditional teaching styles are those enduring personal qualities and behaviours that appear in how teachers conduct classes, which includes the expert, formal authority and personal model styles, facilitator and delegator teaching styles [4]. These styles are founded on traditional teaching methods lectures, discussions, demonstrations, laboratories, projects, inquiry problem solving and activities [5]. These styles may not necessarily match the preferred learning styles in a classroom situation [6]. The traditional teaching styles are either teacher centred or student centred who believe students have definite and fixed perceptions

and ideas of their own roles and those of their teachers. The students are there to learn through instructions, and the focus is mainly passing tests and assessment where those who fail are because of their low ability or laziness [7]. On the other hand, matched teaching style is an interactive process of sharing knowledge and skills with students, with a view to improving students' understanding and ability to manipulate the social, economic, political, and physical environment to enhance their survival [8].

In Australia, a study by Brett, Ted, and Christian [9] was done to investigate the learning style preferences of undergraduate paramedic students using a cross-sectional paper-based version of the Kolb Learning Style Inventory (K-LSI) to a cohort of students enrolled in an undergraduate paramedic degree programme. The results indicated that undergraduate paramedic students prefer two learning styles: the Diverge style of learning (31%) and the Accommodator style of learning (26.5%). This study implied that different learners even in secondary level could have specific preferences of styles of learning. The researcher recommended that educators take into consideration the learning style preferences of undergraduate paramedic students when developing curriculum and evaluating teaching approaches, to enhance their academic performance, which could also be suggested to secondary school teachers. In a study in South Africa by Pather, Norodien-Fataar, Cupido, & Mkonto, [10] to determine whether students awareness of their learning styles improve their academic performance, it was found that college students' knowledge of their learning styles increased academic success and reduced dropout rate.

LITERATURE REVIEW

Gender Differences in Relation to Preferred Learning Styles and Performance in Biology and Geography

Most studies on gender in relation to learning styles have been done to establish gender preferences to different learning styles tertiary institutions and not gender preferred learning styles in relation to academic performance secondary schools. For instance in a study by Yemane *et al*., [11] on gender, differences on learning styles preferences among regular undergraduate students of Mekelle University Collage of Health Science indicated no significant gender differences. Un-modal way of learning was dominantly chosen by both genders. Out of which most of the students were visual learners with the least students preferring kinaesthetic way of learning. This was the same for both Male and female students', both of which preferring the un-modal, out of which most were visual learners. Ora, Sahatcija, and Ferhataj [12] in their study on Learning Styles and the Hybrid Learning observed that gender does not have an impact of learning style. In a study by Shuiband Azizan [13] on learning style preferences among male and female students in Universiti-Sains Malaysia, the results indicated that, there is a strong representation of visual learners from both male and female respondents. On the other hand, the respondents, irrespective of the gender difference, are well balanced in the dimensions of sensing/intuitive, active/reflective, and sequential/global. In addressing the gender difference, it was found in this study that there is no significant difference between male and female students in their preferred learning. Thus, this study revealed that, gender does not help differentiate students' learning preferences. Female students have the same preferences as male students. Geetha and Praveena, [14] in their study on learning styles of secondary school students and their interest in biology in Karnataka, India observed that there are no significant differences in learning styles preference among male and female student's interest in biology. This seems to suggest the differences in males and females in relation to biology geography performance are created by society.

Scherpereel and Bowers [15] observed that gender significantly correlated with self-evaluation, indicating that boys rated their performance in calibration in a more optimal fashion than girls did. In addition, in relation to gender differences, Zulekha and Aqil [16] found that there are particular learning modes preferred by female and male students who reflect their attitudes toward sciences. The contributions of this study shows that even with less than a 1% variance in knowledge of science concepts, gender differences in self-beliefs were statistically significant and of meaningful size [17]. Both teachers and parents reported that they were more inclined to interpret the performance of girls as an attribute of their hard work, while they expressed surprise that boys' performance was so high in relation to their lack of work. Shields [18] concluded that messages from parents, teachers, and peers given to students might be intrinsically affecting students' self-efficacy beliefs. According to Seifert [19], a mother's beliefs about her children's capabilities have a stronger predictive value for math achievement than the children's actual grades in math. This lends credence to the existing math and science gap between males and females in that the socialization and emerging self-concepts related to specific gender abilities in boys and girls formulate at a very young age [20].

As early as elementary school, far before high school or college, there exist disparities in math and science aspirations for young female students when compared to their male counterparts [21]. Amirali [22] found strong self-regulation contributes to positive self-efficacy; the lack thereof may cause students to develop diminished engagement in that subject, thus impairing their decision-making related to that subject. Negative early experiences produce the result of a negative attitude about math and science. McCoach

[23] found that the correct educational strategies were conducive to increasing science literacy self-efficacy beliefs, thus supporting the fact that these constructs of self-efficacy are not static, but rather can be changed and improved.

On gender differences, a study by Orora, Keraro and Wachanga [24] to find out whether there were gender differences in achievement when students were exposed to cooperative e-learning teaching strategy, analysis of Biology Achievement Test mean scores indicated that boys and girls were not at the same level of achievement at the start of the treatment. Boys had significantly higher mean achievement scores compared to that of girls (mean scores for boys and girls was statistically significant; t (85) = 3.50, p < 0.05). However, there were no statistically significant differences between the mean scores of boys and girls after the treatment; t (85) =1.25; P > 0.05. In Kenya, no studies have been done on effect of gender on performance in sciences of students taught in their preferred learning styles. This created the need to investigate the differences in performance in sciences, in terms of gender among those students taught in their preferred learning styles, from those taught without considering their learning styles.

RESULTS

Determination of Effect of Gender Differences on Performance in Biology and Geography of Students Taught Using their Preferred Learning Styles in Secondary Schools in Nairobi County

The data used to compare, main effect of gender differences on performance in biology and geography of students taught using their preferred learning styles in secondary schools in Nairobi County was arranged in stacked format. Multivariate analysis of variance (MANOVA) and linear regression were used in SPSS windows. Multivariate analysis of variance (MANOVA) was analysed using the command'Analyse' > 'General Linear Model' > 'Multivariate' > 'Model' > 'Custom' > 'Main effect' > 'Option' >' Descriptive statistcs', > 'Esimate of effects' > 'Observe power' > Ok . Descriptive statistics of gender differences on performance in biology and geography of students taught using their preferred learning styles (Table 1) indicated that males had higher mean scores in geography (*M* = 74.0, *SD* = 5.94) and biology (*M* = 73.8, *SD* = 5.02) compared to female students in geography (*M* = 73.9, *SD* = 5.53) and biology (*M* = 73.5, *SD* = 5.57).

Table-1: Descriptive Statistics of Gender Differences on Performance in Biology and Geography

Test	Gender	N	Mean	Std. Deviation
Post-test Geography	Male	328	74.0030	5.94496
	Female	331	73.9275	5.52906
	Total	659	73.9651	5.73559
Post-test Biology	Male	328	73.8049	5.01725
	Female	331	73.4864	5.57013
	Total	659	73.6449	5.30053

Table-2: Linear Regression Model Summary for Effect of Gender on Performance in Geography

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.007[a]	.000	-.001	5.73983
a. Predictors: (Constant), Gender				

The adjusted r square (r^2 = .000) revealed that 0% of variation in performance in geography is determined by gender differences of students taught using preferred learning styles. The ANOVA results (Table-3) showed that:

Table-3: ANOVA of Significance of Gender effect on Performance in Geography

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.940	1	.940	.029	.866[b]
	Residual	21645.257	657	32.946		
	Total	21646.197	658			
a. Dependent Variable: Post-test Geography						
b. Predictors: (Constant), Gender						

There were no statistically significant contribution of gender differences in performance of students taught using preferred learning style in geography *F* (1, 657) = .029, *p* = .866

Analysis firstly was done using general linear model (GLM) multivariate analysis of variance (MANOVA) (Table-4).

Multivariate analysis of variance (MANOVA) (Table-1) indicated that there were no significant gender differences in performance in geography F (1, 657) = .029, p = .866) and in biology F (1, 657) = .594, p = .441). In addition, linear regression analysis of effect of gender on performance of students in geography taught using preferred learning styles (Table 2) indicated that.

Table-4: Multi Variate Analysis of Gender Differences- Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power[c]
Corrected Model	Post-test Geography	.940[a]	1	.940	.029	.866	.000	.029	.053
	Post-test Biology	16.709[b]	1	16.709	.594	.441	.001	.594	.120
Intercept	Post-test Geography	3605222.852	1	3605222.852	109429.583	.000	.994	109429.583	1.000
	Post-test Biology	3574131.380	1	3574131.380	127134.746	.000	.995	127134.746	1.000
Gender	Post-test Geography	.940	1	.940	.029	.866	.000	.029	.053
	Post-test Biology	16.709	1	16.709	.594	.441	.001	.594	.120
Error	Post-test Geography	21645.257	657	32.946					
	Post-test Biology	18470.201	657	28.113					
Total	Post-test Geography	3626927.000	659						
	Post-test Biology	3592622.000	659						
Corrected Total	Post-test Geography	21646.197	658						
	Post-test Biology	18486.910	658						
a. R Squared = .000 (Adjusted R Squared = -.001)									
b. R Squared = .001 (Adjusted R Squared = -.001) c. Computed using alpha = .05									

Table-5: Coefficients of Determination of Effect of Gender on Performance of Students in Geography Taught Using Preferred Learning Styles

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	74.079	.708		104.626	.000
	Gender	-.076	.447	-.007	-.169	.866
a. Dependent Variable: Post-test Geography						

The β coefficient (Table-5) was -.076, which indicated there was a negative association of gender and performance of students taught using preferred learning style in geography. One unit increase in gender (i.e. moving from man to woman) there is a decrease in performance in geography by .076 units.

The results of the regression indicated that the model explained 0% of the variance and that the model was not a significant predictor of performance in geography, F (1, 657) = .029, p = .866 While gender did not contributed significantly to the model (β = -.076, p = .866).The final predictive model was geography score = 74.079 + (-.076* Gender differences). This indicated the differences in gender performance in geography of students taught according their preferred learning style were statistically non-significant.

Linear regression analysis of effect of gender on performance of students in biology taught using preferred learning styles (Table-6) indicated that:

Table-6: Linear Regression Model Summary for Effect of Gender on Performance in Biology

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.030[a]	.001	-.001	5.30216
a. Predictors: (Constant), Gender				

The adjusted r square (r^2 = .001) revealed that 0.1% of variation in performance in biology is explained by gender differences of students taught using preferred learning styles. The ANOVA results (Table-7) showed that

Table-7: ANOVA of Significance of Gender effect on Performance in Biology

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.709	1	16.709	.594	.441[b]
	Residual	18470.201	657	28.113		
	Total	18486.910	658			
a. Dependent Variable: Post-test Biology						
b. Predictors: (Constant), Gender						

There were no statistically significant contribution of gender differences in performance of students taught using preferred learning style in biology F (1, 657) = .594, p = .441.

Table-8: Coefficients of Determination of Effect of Gender on Performance of Students in Biology Taught Using Preferred Learning Styles

Model		Un-standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	74.123	.654		113.331	.000
	Gender	-.318	.413	-.030	-.771	.441
a. Dependent Variable: Post-test Biology						

The β coefficient (Table-8) was -.0318, which indicated there was a negative association of gender and performance of students taught using preferred learning style in biology. One-unit increase in gender (i.e. moving from man to woman) there is a decrease in performance in biology by .0318. The results of the regression indicated that the model explained 0.1% of the variance and that the model was not a significant predictor of performance in biology, F (1, 657) = .594, p = .441 While gender did not contributed significantly to the model (β = -.318, p = .441).The final predictive model was biology score = 74.123 + (-.318* Gender difference). This indicated the differences in gender performance in biology of students taught according their preferred learning styles were statistically non-significant.

In conclusion, the multivariate analysis of variance and linear regression analysis showed that gender differences had no statistically significant effect on performance of students taught using preferred learning styles in geography and biology. Given multivariate analysis of variance in geography F (1, 657) = .029, p = .866) and in biology F (1, 657) = .594, p = .441) linear regression in geography, F (1, 657) = .029, p = .866 and in biology, F (1, 657) = .594, p = .441. Thus the null hypotheses was accepted that there are no statistically significant effects of gender differences on performance in biology and geography of students taught according to their preferred learning styles, in secondary schools in Nairobi County.

This study shows that when students are taught according to their preferred leaning styles both males and females perform equally well in sciences. This clearly shows that mismatch of teaching to their preferred learning styles causes observed gender differences among students in performance in sciences. This study supports Olatoye, Fatokun, Olasehinde and Abdulmalik [25] in their study of Female Students' Participation and Performance in Science Subjects in Senior Secondary Schools in Katsina State, Nigeria. The results showed that female students are still under-represented in biology, chemistry, and physics with percentage enrolment as 31.8, 30.5%, and 31.6% respectively. However, there were no significant differences between male and female students' overall performance in biology, chemistry and physics (t = 0.296, p > 0.05).

In addition, this study agrees with Ahmed, Oliver and Danmole [26] that significant difference does not exist between the biology performance of male and female students in boarding and day secondary schools. The researcher in this study observed that gender, as a factor does not have significant influence on preferred learning styles and performance of students in sciences. However, the result of this study differed with the findings of Parvin, Feyzollah, Ali, Nasram, Nasrollah, and Roghaye [27], who observed significant differences between boys and girls in reflective observation and active experimentation in performance in science and

mathematics. However, the observed difference could be due to environmental differences as observed by Alhassane [28] that the only obstacles that affect the expression of education ability of the girl child are their cultural social aspects in our societies. Among the socio cultural aspects impeding the schooling of girls, include parental attitudes in relation to the education of a girl and the burden of domestic chores of the little girl. Further, confounded by the social conceptions of the role of women as which the female child should seek to prepare for the future wife task, mother, or should do priority, which engages them perennially in non-academic chaos. However, this study supports Bruce [29] that, men and women show important differences most clearly in sexual anatomy and in cultural roles, which lead to differences for men and women in every culture. On the other hand, neither boys nor girls have any inherent advantage in general. When exposed to their preferred learning style, they perform equally well in sciences.

CONCLUSION

Descriptive statistics of gender differences on performance in biology and geography of students taught using their preferred learning styles indicated that males had higher mean scores in geography (M = 74.0, SD = 5.94) and biology (M = 73.8, SD = 5.02) compared to female students in geography (M = 73.9, SD = 5.53) and biology (M = 73.5, SD = 5.57). However, multivariate analysis variance (MANOVA) of main effect of gender differences on performance in sciences of students taught using their preferred learning styles indicated that there were no statistically significant gender differences in performance in geography F (1, 657) = .029, p = .866) and in biology F (1, 657) = .594, p = .441). The results of the regression indicated that the model explained 0% of the variance and that the model was not a significant predictor of performance in geography, F (1, 657) = .029, p = .866 While gender did not contributed significantly to the model (β = -.076, p = .866).The final predictive model was geography score = 74.079 + (-.076* Gender differences). This indicated the differences in gender performance in geography of students taught according their preferred learning style were statistically non-significant. In addition, the results of the regression indicated that the model explained 0.1% of the variance and that the model was not a significant predictor of performance in biology, F (1, 657) = .594, p = .441 While gender did not contributed significantly to the model (β = -.318, p = .441).The final predictive model was biology score = 74.123 + (-.318* Gender difference). This indicated the differences in gender performance in biology of students taught according their preferred learning styles were statistically non-significant.

In conclusion, the multivariate analysis of variance and linear regression analysis showed that gender differences had no statistically significant effect on performance of students taught using preferred learning styles in geography and biology. Given multivariate analysis of variance in geography F (1, 657) = .029, p = .866) and in biology F (1, 657) = .594, p = .441) linear regression in geography, F (1, 657) = .029, p = .866 and in biology, F (1, 657) = .594, p = .441. Thus the null hypotheses was accepted that there are no statistically significant effects of gender differences on performance in biology and geography of students taught according to their preferred learning styles, in secondary schools in Nairobi County.

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