

## **Effect of Teaching Using Preferred Learning Styles on Students' Performance, in Biology and Geography in Secondary Schools in Nairobi County, Kenya**

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### **ABSTRACT:**

The purpose of this study was to determine the effect of teaching using preferred learning styles on students' performance, in Biology and Geography in secondary schools in Nairobi County. Students in both private and public schools in Nairobi County have not been performing satisfactorily in sciences. A study, therefore, was done to establish the effect of matching teaching styles with preferred learning styles on students' performance in Biology and Geography. Multivariate analysis of variance in Geography  $F(1, 1315) = 2870.1, p = .000$  and in Biology  $F(1, 1315) = 2994.1, p = .000$ , and linear regression in Geography,  $F(1, 1315) = 2870.056, p = .000$ , and in Biology,  $F(1, 1315) = 2994.137, p = .000$  analysis showed statistically significant effect on performance of students taught using preferred learning styles. The findings lead to a conclusion that there is a need to inform teachers to identify and teach their learners according to the learners' preferred learning styles to enhance their performance in sciences.

Key Terms: Preferred Learning Styles, Biology, Geography, Teaching

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## **Introduction**

An analysis of repeated difficulty areas in the performance of sciences, which refers to Biology, Chemistry, Physics, and Geography in Kenyan Education System in the last few years, indicates possible teacher-learner style mismatches in their learning process. In Biology Examination Reports of years 2006 to 2011 by Kenya National Examination Council (KNEC) on candidates' responses across the three Biology papers out of 84 difficulty items, 21 (25%) indicated common use of wrong spelling of biological terms, 14 (16.66%) incorrect use of biological terms, and 14 (16.66%) inadequate application of practical skills. A higher percentage, 35 (41.67%) indicated inadequate knowledge of the subject content (KNEC, 2007, 2008, 2010, 2011, 2012). In Chemistry and Geography, the situation was not different. An analysis of Chemistry Examination Reports of years 2006 to 2011 by KNEC on candidates' responses across the three Chemistry papers, out of 52 difficulty items 18 (34.62%), indicated inadequate exposure to practical procedures, 7 (13.46%) inability to write correct equations and symbols of reactants, and 6 (11.54%) weakness in stating accurately observation made. A higher percentage 21 (40.38 %) were on inadequate knowledge of content (KNEC, 2007, 2008, 2010, 2011, 2012).

## **Literature Review**

### **The Concept of Preferred Learning Styles and Creation of Mismatch among Students**

The concept of preferred learning styles is the combination of characteristics of cognitive, affective, and psychological elements (Abidin et al., 2011). According to Bayrak (2012), learning styles are collections of personal characteristics, strengths, and preferences, describing how individuals acquire, store, and process information. The different factors that influence personal qualities include information processing modes, environmental and instructional preferences, cognitive capabilities, gender and personality features. The cognitive capabilities involve meta-learning, which is the awareness of learning styles

one possesses, which creates the need for high levels of meaningful learning to enhance creativity and new knowledge creation. It consists of a product (knowledge), thought process (the routes to new learning), and a behavioural process (the regulation of behaviours that enhance learning) (Alharbi et al., 2011). These elements determine the way of perceiving, interacting with, and responding to the learning environment. They determine how one particular individual will react to a specific situation and how he or she will behave in a unique or common learning situation (Abidin et al., 2011).

Most of the high school students are not aware of how they learn and why certain ways of learning resonate with them. Seifert (2016) noted that students do not tend to reflect on the learning processes that are most productive for them. They simply learn and produce outcomes with little thought of the process itself. However, students who are aware of their own learning styles easily adapt to varied teachers' instructions, which enhance performance in sciences. This also creates self-regulated learning, which does not completely rely on the teachers' participation. Furthermore, Hendry et al. (2005) have found that awareness of learning styles and choice of study strategy options are positively correlated to students' achievement. Hendry investigated how offering students different instructional options based on their learning styles affected learning outcomes in a positive way. It was observed that such offering had a significant effect on students' overall achievement. Conversely, Gilakjani (2012) examined how students cope with the experience of having to learn when their learning style does not match that of the teachers' style of teaching. Gilakjani (2012) found that students had lower achievement when teaching approaches did not match their learning styles, and he advocated for adaptive instruction within their learning perception. Students who endure incongruent learning experiences suffer from diminished self-efficacy for tackling novel learning experiences in the future (Luedtke, 2016).

In a study in South Africa by Pather et al. (2017) to determine whether students' awareness of their learning styles enhanced academic performance, it was observed that students coming from the previously disadvantaged educational backgrounds were not aware of their own learning styles, which could otherwise empower them to understand how to be adequately prepared for tertiary learning. In Kenya according to Musamali (2014), the best performing schools have the practice of training their candidates on study skills, which articulate their learning styles; nevertheless, a gap remains in the literature of the effect of matching of teaching styles with preferred learning styles and performance of students in Biology and Geography. In-depth research revealed three models that display what teachers should consider in their style of presentation of content to enhance the performance of students. The three models include the personality patterns model, perceptual model, and information-processing model.

### **Traditional Teaching Styles and Students' Performance, in Biology and Geography**

Teaching at any level of education and type of school, private, or public has the sole purpose of ensuring that all learners can acquire information and apply those skills (Guirguis, & Pankowski, 2017). Therefore, it is necessary for all educators, to not only know their teaching style but also realise that teaching has a two-fold goal, where teachers teach, and students learn. Therefore, knowing how your students learn and what strategies best fit your classroom and school are fundamental in the process of learning. The skill of teachers' perception in recognising and accommodating for diverse learning styles, in private and public secondary schools' students need enhancement for better performance in sciences. However, just as people possess individual learning styles, teachers also have teaching styles that seem to work best for them.

According to Neuro-Linguistic Programming (NLP), which is the science and art of communicating, to ourselves and others (Bandler, 2008), we communicate in almost the same way we receive, perceive and process information. Christenson (2010) defines teaching styles as a set of attitudes and actions that open a formal and informal world of learning to students. Teaching style is a pervasive quality in the behaviour of an individual, way of approaching the learners, a quality that persists though the content may change and might be consistent with several methods of teaching (Felder, & Brent, 2017). These styles are founded on traditional teaching methods; lectures, discussions, demonstrations, laboratories, projects, inquiry problem solving, and activities (Akhtar, & Saeed, 2017). 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. It includes the expert, formal authority and personal model styles, facilitator and delegator teaching styles (Mohanty, 2015). Mwangu and Sibanda (2017) observed that teachers used both teacher-centred and student-centred methods in teaching Biology practical lessons and various factors constrained the teaching of practical lessons in Zimbabwe. In Kenyan Secondary Schools, the prescribed traditional teaching style is ASEI-PDSI (Activity-focused Student-centred learning Experiment Improvisation - Plan, Do, See, Improve) approach in teaching which has not yielded the expected high performance in the recent past (Makewa, Role, & Beigo, 2011).

### **Personality Patterns Model**

As stated by Keirse (2013) and Longchamp (2017), personality patterns model views learning styles as personal qualities that influence a student's ability to acquire information, to interact with peers and the teachers, and otherwise participate in learning experiences. This implies that there are personalities a teacher must demonstrate and practice during the learning

process in order to activate the innate qualities for learning to take place. In this sense, personality model seems to articulate aspects of learning that are motivational and critically influence learning. However, a mismatch occurs in the event where teachers cannot accurately identify the preferred personality learning styles of the learners. Personality learning styles refers to distinctive behaviours, which serve as indicators of how a person learns from and adapts to his environment, and provide clues as to how a person's mind operates (Al-Sarem, Bellafkih, & Ramdani, 2014). This implies that to match and sustain personality-learning styles of different learners in a class, teachers must develop emotional intelligence.

### Methodology

The study employed quasi-experimental research design. It utilised a pre-test, treatment of experimental group and a post-test to estimate the impact of an intervention of mismatch due to traditional teaching styles to preferred learning styles on the target population of 69,634 in 146 secondary schools in Nairobi County. A purposive sample of 1,322 Form 2 students in private and public schools were randomly selected for the study. Questionnaires and pre-test and post-test were used to collect quantitative data. 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 content and face validity of the two instruments were examined by experts and which were used to improve the tools before they were used to gather data. The reliability of treatment questionnaire and achievement test in the pilot study were estimated using the Pearson's Correlation method and yielded a reliability coefficient of .723 and .955 respectively which were high enough to judge the instruments as reliable. The collected data was analysed using the Statistical Package for Social Sciences (SPSS) version 22. Data was described and summarized using, percentages, and means.

### Results and Data Analysis

#### Determination of the Differences in Effect of Traditional Teaching and Teaching According to Preferred Learning Styles on Students' Performance, in Biology and Geography in Secondary Schools in Nairobi County

The objective of this study was to determine the differences in the effect of traditional teaching and teaching according to preferred learning styles, on students' performance, in Biology and Geography in secondary schools in Nairobi County. Determination of interaction effects of gender and school preceded the analysis of the main effect of treatment using MANOVA (multivariate analysis of variance) in SPSS windows version 22. The researcher wanted to find the differences in the main effect of traditional teaching and teaching according to preferred learning styles on performance in Biology and Geography of students in private and public secondary schools in Nairobi County. The data used to compare, main effect traditional and preferred teaching styles was arranged in a stacked format. Multivariate analysis of variance (MANOVA) of stacked data in SPSS windows was analysed using the command 'Analyse' > 'General Linear Model' > 'Multivariate' > 'Model' > 'Custom' > 'Main effect' > 'Option' > 'Descriptive statistics', > 'Estimate of effects' > 'Observe power' > Ok

**Table 1: Descriptive Statistics of Students Taught According to Traditional and Preferred Learning Styles.**

| Sciences            | Teaching style | N   | Mean    | Std. Deviation |
|---------------------|----------------|-----|---------|----------------|
| Post-test Geography | Traditional    |     | 2.5296  | 8.50926        |
|                     | Preferred      |     | 3.9559  | 5.73538        |
|                     | Total          | 346 |         | 12.94161       |
| Post-test Biology   | Traditional    |     | 2.6222  | 8.30268        |
|                     | Preferred      |     | 73.6307 | 5.30117        |
|                     | Total          |     | 63.1185 | 12.60637       |

Descriptive statistics (Table 1) revealed that students taught according to preferred learning styles had higher means scores in Geography ( $M = 74.0, SD = 5.74$ ) and Biology ( $M = 73.6, SD = 5.30$ ) compared to students taught according to traditional teaching styles in geography ( $M = 52.5, SD = 8.51$ ) and Biology ( $M = 52.6, SD = 8.30$ ). Using general linear model (GLM) multivariate analysis of variance (MANOVA) of performance of students that taught according to traditional and preferred learning styles, (Table 1) indicated that main effect of teaching according to preferred learning style on performance on performances of sciences was significant ( $p < .001$ ).

**Students taught according to preferred learning styles had significantly higher mean scores compared to students taught according traditional styles in Geography  $F(1, 1315) = 2870.1, p = .000$  and in Biology  $F(1, 1315) = 2994.1, p = .000$ .**

Regression analysis to determine how the teaching styles influenced performance in geography (Table 2)

**Table 2: Linear Regression Model Summary for Geography**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|-------------------|----------------------------|
| 1     | a |          |                   | 714                        |

a. Predictors: (Constant), Teaching styles

The adjusted r square ( $r^2 = .686$ ) revealed that 68.6% of the variation in performance in Geography is determined by the model. Teaching according to preferred learning styles explains 68.6% of the performance in geography. The ANOVA results (Table 3) shows that:

**Table 3: ANOVA of Significance between Teaching Styles and Performance in Geography**

| Model | Sum of Squares | Df | Mean Square | F | Sig. |
|-------|----------------|----|-------------|---|------|
|-------|----------------|----|-------------|---|------|

|   |            |            |   |            |          |                   |
|---|------------|------------|---|------------|----------|-------------------|
| 1 | Regression | 151154.606 | 1 | 151154.606 | 2870.056 | .000 <sup>b</sup> |
|   | Residual   | 69255.895  |   | 52.666     |          |                   |
|   | Total      | 220410.501 |   |            |          |                   |

a. Dependent Variable: Post-test Geography

b. Predictors: (Constant), Teaching styles

The model was a significant predictor of performance in Geography  $F(1, 1315) = 2870.056, p = .000$ . The unstandardized beta coefficients for the model (the  $\beta$  values) (Table 4) indicated the relationships between the outcome and predictor variables.

**Table 4: Coefficients of Determination of Effect of Teaching Using Preferred Learning Styles on Performance in Geography.**

| Model |                | Unstandardized Coefficients |       | Standardized Coefficients | t      | Sig. |
|-------|----------------|-----------------------------|-------|---------------------------|--------|------|
|       |                |                             | Error | Beta                      |        |      |
| 1     | Constant)      | 31.103                      |       |                           | .96    | .000 |
|       | Teaching style | 21.426                      |       |                           | 53.573 | .000 |

a. Dep Variable: Post-test Geography

The  $\beta$  coefficient (Table 4) is 21.426, which indicate there is a positive effect of teaching using preferred learning styles. In addition, this indicated that the performance of students taught using preferred learning styles is 21.426 higher among those taught using preferred learning styles compared to those taught using traditional teaching styles. The results of the regression indicated that the model explained 68.6% of the variance and that the model was a significant predictor of performance in Geography,  $F(1,$

1315) = 2870.056,  $p = .000$ . While teaching using preferred learning styles contributed significantly to the model ( $\beta = 21.426$ ,  $p = .000$ ). The final predictive model was: Geography score = 31.103+ (21.426\* Teaching using preferred learning styles). Linear regression analysis to determine how the teaching styles influenced performance in biology (Table 5) indicated that:-

**Table 5: Linear Regression Model Summary for Biology**

| Model | R                 | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|-------------------|----------|-------------------|----------------------------|
| 1     | .834 <sup>a</sup> | .695     | .695              | 6.96663                    |

a. Predictors: (Constant), Teaching style

The adjusted r square ( $r^2 = .695$ ) revealed that 69.5% of the variation in performance in Biology is determined by the model (teaching according to preferred learning styles). Teaching according to preferred learning styles explains 69.5% of the performance in biology. The ANOVA results (Table6):

**Table 6: ANOVA of Significance between Teaching Styles and Performance in Biology**

| Model | Sum of Squares | Df         | Mean Square | F         | Sig.    |                   |
|-------|----------------|------------|-------------|-----------|---------|-------------------|
| 1     | Regression     | 45317.345  |             | 45317.345 | 994.137 | .000 <sup>b</sup> |
|       | Residual       | 63822.176  |             | 48.534    |         |                   |
|       | Total          | 109139.522 |             |           |         |                   |

a. Dependent Variable: Post-test Biology  
b. Predictors: (Constant), Teaching style

The model was a significant predictor of performance in Biology  $F(1, 1315) = 2994.137$ ,  $p = .000$ . The unstandardized beta coefficients for the model (the  $\beta$  values) (Table 7) indicated the relationships between the outcome and predictor variables.

**Table 7: Coefficients of Determination of Effect of Teaching Using Preferred Learning Styles on Performance in Biology**

| Model |                | Unstandardized Coefficients |            | Standardized Coefficients | t      | Sig. |
|-------|----------------|-----------------------------|------------|---------------------------|--------|------|
|       |                | Beta                        | Std. Error |                           |        |      |
| 1     | Constant       | 31.614                      |            |                           | 52.089 | .000 |
|       | Teaching style | 21.009                      |            |                           | 54.719 |      |

a. Dependent Variable: Post-test Biology

The  $\beta$  coefficient (Table 7) is 21.009, which indicate there is a positive effect of teaching Biology using preferred learning styles. In addition, this indicated that the performance of students taught Biology using preferred learning styles is 21.009 higher among those taught using preferred learning styles compared to those taught using traditional teaching styles. The results of the regression indicated that the model explained 69.5% of the variance and that the model was a significant predictor of performance in Biology,  $F(1, 1315) = 2994.137$ ,  $p = .000$ . While teaching using preferred learning styles contributed significantly to the model ( $\beta = 21.009$ ,  $p = .000$ ). The final predictive model was Biology score = 31.614+ (21.009\* Teaching using preferred learning styles).

In conclusion, both multivariate analysis of variance and linear regression analysis showed a statistically significant effect on the performance of students taught using preferred learning styles in Geography and Biology. Given multivariate analysis of variance in Geography  $F(1, 1315) = 2870.1$ ,  $p = .000$ ) and in Biology  $F(1, 1315) = 2994.1$ ,  $p = .000$ ), and in addition linear regression analysis in

Geography,  $F(1, 1315) = 2870.056, p = .000$ , and in Biology,  $F(1, 1315) = 2994.137, p = .000$ . Thus, the null hypothesis was rejected since there are no statistically significant effects in performance in Biology, Geography between students taught in their preferred learning styles, and those taught using traditional teaching styles in secondary schools in Nairobi County.

This study shows that teaching students according to their preferred learning styles enhances their performance while teaching students in the traditional styles without considering their preferred learning styles creates a mismatch, which lowers their performance in sciences. The finding of this study implies that when teachers establish the preferred learning styles of students and match their styles of teaching to these preferences, it improves significantly the performance of their students in sciences. This study supports the findings of Akbarzadeh and Fatemipour (2014) when students' learning styles match with appropriate teaching approaches, then their motivation, performances, and achievement will increase. The study likewise was in agreement with findings of Bastable (2008) that matching teaching pedagogy with learning styles of students enhances their academic performance. On the other hand, the gap between matching students' learning styles and teachers' instructional styles lead to low retention rates and affect students' academic performance.

### Conclusion and Recommendations

In conclusion, both multivariate analysis of variance and linear regression analysis showed a statistically significant

effect on the performance of students taught using preferred learning styles in Geography and Biology. Given multivariate analysis of variance in Geography  $F(1, 1315) = 2870.1, p = .000$  and in Biology  $F(1, 1315) = 2994.1, p = .000$ , and in addition linear regression analysis in Geography,  $F(1, 1315) = 2870.056, p = .000$ , and in Biology,  $F(1, 1315) = 2994.137, p = .000$ . The students taught according to their preferred learning styles performed statistically higher compared to the students taught according to traditional teaching styles without considering their preferred learning styles. This implies mismatch of teaching styles to preferred learning styles, affects negatively the performance of students in Biology and Geography in secondary schools in Nairobi County.

Based on the findings and conclusions of this study, the following recommendation is made. Every teacher and instructor should endeavour to assess and identify the preferred learning styles of their learners before commencement of instructions and teach their learners according to their preferred learning styles in order to enhance their academic performance in Biology and Geography. In the course of this study, the researcher realized that many learners were insensitive of their own learning styles and suggests further research on sensitisation of the learners to exploit the hidden treasure, which could otherwise empower them to understand how to adequately be prepared for continuous learning.

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