Preferred Learning Styles of Secondary Schools Students in Nairobi County, Kenya

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Abstract

The purpose of this study was to determine the different preferred learning styles of secondary school students in Nairobi County. The study was based on Felder Learning Style Theory and Keirsey personality learning styles theory. A purposive sample of 1,317 Form Two Students in private and public schools, 659 students were randomly selected for the study. The reliability of the treatment questionnaire in the pilot study was estimated using Pearson’s Correlation method and yielded a reliability coefficient of .723 which was high enough to judge the instrument as reliable. The collected data was analysed with the aid of the Statistical Package for Social Sciences (SPSS) version 22. Data were described and summarized using percentages, and means. Univariate Analysis of Variance (ANOVA) of students’ preferred learning styles showed significant differences in preference to visual and verbal learning styles in receiving of information \( F(1,653) = 6.42, p = .012 \); in intuition and sensing learning styles in perception of information \( F(1,653) = 9.77, p = .011 \); in preference to visual and verbal categories of learning styles in receiving of information \( F(1,653) = 6.42, p = .012 \); and in preference to sequential and global learning styles in order of progressing the processing of information \( F(1,653) = 6.10, p = .014 \). The study recommends that the ministry of education science and technology ensure facilitation is done to enable teachers to detect the learning styles to use in a different setting.

Keywords: Learning styles, Gender, preferred styles, mismatch, private and public schools.

LITERATURE REVIEW

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.

The information processing model or cognitive styles describes learning style as the manner of
acquiring and processing information by the brain [6]. The brain must actively generate meaning to make sense of new experience, to create the neural networks in which knowledge resides, and to organize them in ways that facilitate easy retrieval [7]. This implies that learning can be impaired if the learner perceives incongruence of the preconditions [8]. Mohsen [9] argues that successful teaching for comprehension, application, analysis, synthesis, and evaluation involves guiding the learner to generate relations among concepts and between new information and prior learning.

On the other hand, according to Keirsey [10] and Longchamp [11], 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 to activate the innate qualities for learning to take place. In this sense, the 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 [12]. This implies that to match and sustain the personality learning styles of different learners in a class, teachers must develop emotional intelligence. Goleman, Boyatzis, and Mc Kee [13] upholds that Emotional Intelligence is the capacity for recognizing our feelings and those of others, for motivating ourselves, and for managing emotions well in ourselves and in our relationships. Teachers must develop the emotional and social intelligence to teach learners with diverse personality learning styles [14]. This involves development in the aspects of Self-awareness, Self-regulation, Motivation, Empathy, and Social skills. Self-awareness is the ability to recognize and understand your moods, emotions, and drives as well as their effects on the learners. This includes paying attention to how learners influence your emotional state and having realistic self-assessment and self-deprecation sense of humour. Self-regulation is the ability to control or redirect disruptive impulses and moods. It involves the propensity to suspend judgment and think before acting to accommodate deserving learners and the development of comfort with ubiquity and openness to change and organizational commitment.

Besides, Felder and Brent [15] postulates a perceptual model and describes learning style as the way a student prefers to perceive, receive, progress and process information, which is more comprehensive and easily linked to classroom experiences. It incorporates the aspects of information processing and personal qualities that influence a student’s ability to acquire information [16]. This implies there are choices the learners make to learn which can be referred to as their instructional preferred learning styles. Felder and Brent [15] classified preferred learning styles into four dimensions based on the way learners prefer to process information and convert it to knowledge, the way people preferentially perceive information, the sensory channel by which people most effectively perceive information, and how people progress to understand and master the material.

On the other hand, Wang and Mendori [17] classifies learners into four paired types of learning styles and strategies as active and reflective learners, sensing and intuitive learners, visual and verbal learners, and sequential and global learners. However, Janet [18] adds an aspect of kinaesthetic learning style a subgroup of sensing learning style. All the four-paired type of learners uses strategies, which involve memory that can be impaired by, stress experiences, which accrues due to mismatch of teaching styles to learners’ preferred learning styles [19]. Active and reflective dimension deals with the way learners prefer to process information and convert it into knowledge [20]. Active learners learn by trying things out, working in a group, and discussing which is ideal for practically oriented sciences. Reflective learners learn by thinking things through and working alone [15].

Sensing/intuitive dimension deals with the way the learners tend to perceive the world either through the senses or through thinking [20]. Sensing learners are practical, oriented towards facts and procedures, and favour information arriving through their senses. They prefer getting facts and procedures using senses in knowledge acquisition to feelings. Intuitive learners are conceptual, innovative, oriented towards theories and meanings, and favour information that arises internally through memory, reflection and imagination [21]. They prefer to know something using feelings to consider the facts. Sensing perception includes a kinaesthetic learning style. The kinaesthetic learning style refers to the ability to absorb information best by experiencing, touching, doing, moving and being active in some manner [21, 15]. Preferences for tactile/kinaesthetic learners include hands-on activities (experiments, etc.), projects, and take frequent study breaks to allow movement, visual aids, role-play, and field trips [22]. Move around to learn new things (e.g. read while using an exercise bike; model in clay to learn a new concept [18].

On the other hand, intuition involves indirect perception by way of the unconscious speculation, imagination, insight, and abstraction [21, 15]. Intuitive learners like innovation, and are quick and good at grasping new concepts. They prefer principles, theories,
welcome complications and they favor internally generated information (memory, conjecture, interpretation) [21]. Graf and Liu [23] argue that intuitive learners prefer to learn abstract material, like challenges, and are more innovative than sensing learners are. Intuitive learners are more comfortable with symbols. They read science fiction and mystery novels voraciously. Since words are symbols, translating them into what they represent comes naturally to intuitive learners [15]. Visual and Verbal dimension deals with the sensory channel the learners prefer to receive external information. Visual learners prefer pictures, diagrams, graphs, flow charts, experiments, and demonstrations, but verbal auditory learners prefer written or spoken explanations and formulae [20].

METHODOLOGY

All the schools in Nairobi County were purposively grouped into two categories private and public. Also, they were further grouped into Boys, Girls, and Mixed schools. From the list of 1,317, a sample of 659 students was randomly selected for the study using computerized random number generators, which minimized selection bias. This was achieved by using the command ‘data’ > ‘select cases’ > ‘random sample of cases’ > ‘sample’ > ‘sample size’ % all cases. A questionnaire adapted from Felder-Silverman Model [17] designed to assess the preference of the students on four learning areas: preferred way of perceiving information-the intuitive/sensing learners, preferred processing of information- the active/reflective learners, preferred receiving Channel of information-the visual/verbal learners and preferred progressing to understanding the global and sequential learners was used to collect data. The data collected using learning style questionnaires were analysed in General Linear Model in SPSS windows using the command ‘Analyse’ > ‘General Linear Model’ > ‘Univariate or Multivariate’ > ‘Model’ > ‘full factorial’ > ‘Option’ > ‘Display descriptive statistics’ > ‘Observe power’ > ‘Continue’ > ‘Post hock’ > ‘Tukey’ > ‘Continue’ > Ok. The data was organized in terms of preferred learning styles in the perception of information, processing, preferred channel and progressing to understanding. Both Univariate and multivariate analysis of variance was done to capture the different preferred styles of learning in the perception of information, processing, receiving and progressing in understanding.

RESULTS AND DATA ANALYSIS

Preferred way of perceiving information in learning

The researcher wanted to find whether the students of private and public secondary schools in Nairobi County had different preferred styles of learning in the perception of information. Univariate analysis of variance of responses from 659 respondents done descriptive statistics (Table 1), revealed that 59.5 % (392) are sensing learners (that is they prefer to perceive information through the senses) while 40.5 % (267) are intuitive learners who prefer to perceive information through thinking or internally through memory, reflection and imagination [22]. The distribution of preferences varied across gender, private, and public schools. The data indicated 58.2% (191) of the males are sensing learners and 41.8% intuitive learners. On the other hand, 60.7% (201) of the females are sensing learners and 39.3% (130) intuitive learners. In public schools, 63.7% (221) are sensing learners and 36.3% (126) intuitive learners. In private schools, 54.8% (171) are sensing learners and 45.2% (141) intuitive learners. In private schools 26.3% (82) having balanced, 58% (181) moderate preference for two of the dimensions and 15.7% (49) very strong preference for one of the dimensions. In public schools 25% (87) having balanced, 59.7% (207) moderate preference for two of the dimensions and 15.3% (53) very strong preference for one of the dimensions. In addition, of the total treatment sample 659, the data indicated 25.6% (169) had balanced preference for two of the dimensions, 58.9% (388) had moderate preference for two of the dimensions and 15.5 % (102) had very strong preference to one of the dimensions (Table 1).
| Gender | School | Preferred style of Learning | Perception choice | N   | Mean  | Std. Deviation |
|--------|--------|-----------------------------|-------------------|-----|-------|---------------|
| Male   | Public | Balanced Preference for two of the dimensions | Sensing           | 26  | 2.3846| 1.09825       |
|        |        |                              | Intuitive         | 21  | 1.9524| 1.02353       |
|        |        |                              | Total             | 47  | 2.1915| 1.07619       |
|        |        | Moderate Preference for two of the dimensions | Sensing           | 36  | 3.1667| 2.04939       |
|        |        |                              | Intuitive         | 72  | 3.3333| 2.09627       |
|        |        | Very strong Preference for one of the dimensions | Total             | 108 | 3.2778| 2.07267       |
|        |        |                              | Sensing           | 17  | 4.5294| 2.40909       |
|        |        |                              | Intuitive         | 4   | 4.0000| 3.46410       |
|        |        | Total                        | 21               | 4.4286| 2.54109|
|        |        | Total                        | Sensing           | 115 | 3.2957| 2.05612       |
|        |        |                              | Intuitive         | 61  | 2.8033| 1.95635       |
|        | Private| Balanced Preference for two of the dimensions | Total             | 176 | 3.1250| 2.02013       |
|        |        |                              | Sensing           | 16  | 1.8750| 1.02470       |
|        |        |                              | Intuitive         | 25  | 2.4400| 2.00634       |
|        |        | Very strong Preference for one of the dimensions | Total             | 41  | 2.2195| 0.98773       |
|        |        |                              | Sensing           | 47  | 3.6383| 1.91590       |
|        |        |                              | Intuitive         | 37  | 3.5405| 1.98038       |
|        |        | Total                        | 84               | 3.5952| 1.93334|
|        |        | Very strong Preference for one of the dimensions | Sensing           | 13  | 6.3846| 3.30501       |
|        |        |                              | Intuitive         | 4   | 5.4286| 2.84779       |
|        |        | Total                        | 14               | 5.4436| 2.87479|
|        |        | Total                        | Sensing           | 76  | 3.7368| 2.48391       |
|        |        |                              | Intuitive         | 76  | 3.5263| 2.15081       |
|        |        | Very strong Preference for one of the dimensions | Total             | 192 | 3.4167| 2.01391       |
|        |        |                              | Sensing           | 42  | 2.1905| 1.08736       |
|        |        |                              | Intuitive         | 46  | 2.2174| 0.98678       |
|        |        | Total                        | 88               | 3.4167| 2.01391|
|        | Female | Balanced Preference for two of the dimensions | Sensing           | 24  | 2.5833| 1.66594       |
|        |        |                              | Intuitive         | 16  | 2.7500| 1.00000       |
|        |        | Total                        | 40               | 2.6500| 1.42415|
|        |        | Very strong Preference for one of the dimensions | Sensing           | 63  | 4.3651| 2.20923       |
|        |        |                              | Intuitive         | 36  | 4.4444| 2.00634       |
|        |        | Total                        | 106              | 4.4717| 2.68047|
|        |        | Total                        | Sensing           | 51  | 3.2900| 3.19026       |
|        | Private| Balanced Preference for two of the dimensions | Total             | 58  | 2.9310| 1.79534       |
|        |        |                              | Sensing           | 39  | 3.4103| 1.66572       |
|        |        | Total                        | 97               | 3.1237| 1.75153|
|        |        | Very strong Preference for one of the dimensions | Sensing           | 10  | 3.2000| 3.07482       |
|        |        |                              | Intuitive         | 12  | 3.0000| 3.05563       |
|        |        | Total                        | 22               | 3.0909| 3.05563|
|        |        | Total                        | Sensing           | 95  | 3.0211| 1.98922       |
|        |        |                              | Intuitive         | 65  | 3.5538| 2.07689       |
|        |        | Total                        | 160              | 3.2375| 2.03580|
|        | Female | Balanced Preference for two of the dimensions | Total             | 51  | 2.4902| 1.43349       |
|        |        | Total                        | Sensing           | 51  | 3.2900| 3.19026       |
|        |        |                              | Intuitive         | 12  | 3.0000| 3.07482       |
|        |        | Total                        | 22               | 3.0909| 3.05563|
|        |        | Total                        | Sensing           | 95  | 3.0211| 1.98922       |
|        |        |                              | Intuitive         | 65  | 3.5538| 2.07689       |
|        |        | Total                        | 160              | 3.2375| 2.03580|
|        |        | Total                        | Sensing           | 51  | 2.4902| 1.43349       |
|        |        |                              | Intuitive         | 12  | 3.0000| 3.07482       |
|        |        | Total                        | 22               | 3.0909| 3.05563|
|        |        | Total                        | Sensing           | 95  | 3.0211| 1.98922       |
|        |        |                              | Intuitive         | 65  | 3.5538| 2.07689       |
|        |        | Total                        | 160              | 3.2375| 2.03580|
|        |        | Total                        | Sensing           | 51  | 2.4902| 1.43349       |
The results of Univariate Analysis of Variance (ANOVA) of tests of between-subjects effects on preferred learning style on perception of information (Table 2) showed that the preference of intuition and sense in the perception of information was not equally distributed in the schools and gender. An analysis of variance showed that difference in gender preference to categories of learning styles in the perception of information was significant $F(1,653) = 9.77, p = .002$. In addition, private and public schools had significant differences in preference to categories of learning styles in the perception of information $F(1,653) = 9.77, p = .011$.

| Dimensions             | Intuitive | Sensing | Total |
|------------------------|-----------|---------|-------|
| Moderate Preference for two of the dimensions | 30        | 2.7333  | 1.25762 |
| Total                  | 81        | 2.5802  | 1.36807 |
| Sensing                | 121       | 3.6777  | 2.13781 |
| Intuitive              | 75        | 3.9067  | 1.89718 |
| Total                  | 196       | 3.7653  | 2.04714 |
| Sensing                | 29        | 6.5172  | 3.14666 |
| Intuitive              | 25        | 6.3600  | 2.98440 |
| Total                  | 54        | 6.4444  | 3.04474 |

| Dimensions             | Sensing | Total |
|------------------------|---------|-------|
| Moderate Preference for two of the dimensions | 201     | 3.7861 |
| Total                  | 331     | 2.35015 |
| Sensing                | 50      | 2.4800 |
| Intuitive              | 37      | 2.2973 |
| Total                  | 87      | 2.4023 |
| Sensing                | 135     | 6.5172 |
| Intuitive              | 72      | 6.3600 |
| Total                  | 207     | 6.4444 |
| Sensing                | 36      | 5.9444 |
| Intuitive              | 17      | 6.7647 |
| Total                  | 53      | 6.2075 |
| Sensing                | 221     | 2.99588 |
| Intuitive              | 126     | 2.42464 |
| Total                  | 347     | 2.43308 |
| Sensing                | 17      | 6.7647 |
| Intuitive              | 15      | 2.99588 |
| Total                  | 32      | 2.43308 |

| Dimensions             | Sensing | Total |
|------------------------|---------|-------|
| Moderate Preference for two of the dimensions | 93      | 2.2093 |
| Total                  | 181     | 1.16615 |
| Sensing                | 43      | 2.3548 |
| Intuitive              | 39      | 2.4211 |
| Total                  | 82      | 1.84807 |
| Sensing                | 105     | 1.7076 |
| Intuitive              | 76      | 1.87484 |
| Total                  | 181     | 1.84807 |
| Sensing                | 171     | 3.4737 |
| Intuitive              | 141     | 3.5390 |
| Total                  | 312     | 2.10956 |
| Sensing                | 93      | 5.8696 |
| Intuitive              | 76      | 5.3900 |
| Total                  | 169     | 5.3900 |
| Sensing                | 312     | 2.18328 |
| Intuitive              | 93      | 1.2265 |
| Total                  | 169     | 1.2265 |
| Sensing                | 171     | 2.24438 |
| Intuitive              | 141     | 2.10956 |
| Total                  | 312     | 2.10956 |
| Sensing                | 93      | 5.5306 |
| Intuitive              | 76      | 5.3900 |
| Total                  | 169     | 5.3900 |
| Sensing                | 171     | 2.18328 |
| Intuitive              | 141     | 1.2265 |
| Total                  | 312     | 1.2265 |
| Sensing                | 93      | 2.24438 |
| Intuitive              | 76      | 2.10956 |
| Total                  | 169     | 2.10956 |
| Sensing                | 171     | 5.3900 |
| Intuitive              | 141     | 5.3900 |
| Total                  | 312     | 5.3900 |
| Sensing                | 93      | 2.18328 |
| Intuitive              | 76      | 2.24438 |
| Total                  | 169     | 2.24438 |
| Sensing                | 171     | 5.3900 |
| Intuitive              | 141     | 5.3900 |
| Total                  | 312     | 5.3900 |
| Sensing                | 93      | 2.18328 |
| Intuitive              | 76      | 2.24438 |
| Total                  | 169     | 2.24438 |
Table-2: Tests of Between-Subjects Effects in Perception of Information

| Source                      | Type III Sum of Squares | df | Mean Square | F     | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power |
|-----------------------------|-------------------------|----|-------------|-------|------|---------------------|-------------------|---------------|
| Corrected Model             | 846.654                 | 5  | 169.331     | 40.807| .000 | .238                | 204.034          | 1.000         |
| Intercept                   | 7508.157                | 1  | 7508.157    | 1809.383| .000 | .735                | 1809.383         | 1.000         |
| Gender                      | 40.557                  | 1  | 40.557      | 9.774 | .002 | .015                | 9.774            | .877          |
| School                      | 27.166                  | 1  | 27.166      | 6.547 | .011 | .010                | 6.547            | .724          |
| Preferred styles            | 768.635                 | 2  | 384.317     | 92.616| .000 | .221                | 185.233          | 1.000         |
| Perception choice           |                         |    |             |       |      |                     |                   |               |
| Error                       | 2709.668                | 653| 4.150       |       |      |                     |                   |               |
| Total Corrected Total       | 12275.000               | 659|             |       |      |                     |                   |               |
| a. R Squared = .238 (Adjusted R Squared = .232) |
| b. Computed using alpha = .05 |

Post hoc analyses, (Table 3), indicate that in perception of information, learners with balanced preference for two dimensions of learning styles (intuitive and sensing) had significantly lower mean scores (M = 2.38, SD = 1.21, p = .000) compared to individuals with moderate preference (M = 3.59, SD = 2.04) and very strong preference for a particular dimension of learning style (M = 5.88, SD = 3.03). In addition, learners with very strong preference for a particular dimension of learning style had significantly higher mean scores (M = 5.88, SD = 3.03, p = .000) compared to individuals with moderate preference (M = 3.59, SD = 2.04) and balanced preference for two dimensions of learning styles (M = 2.38, SD = 1.21). This suggests that different learners have different styles of perceiving information in the learning process. This implies that in the teaching process teachers should present information to learners according to their perception. In every lesson teachers and instructors, should analyse the teaching content to identify the relevant practical activities for every concept and physical materials necessary for them to observe data through senses to cater to the sensing learners. At the same time allowing them to manipulate as well as present or demonstrate the skills to cater to their personality. On the other hand, the teachers should provoke the imagination of intuitive learners by challenging them to analyse, synthesize, and evaluate the concepts for them to think through how the simple concepts apply in greater life. Also, giving them adequate time to think through to fulfil their personality.

Table-3: Post Hoc Tests Preferred Style of Learning in Perception of Information Multiple Comparisons

| Tukey HSD                      | (I) Preferred style of Learning | (J) Preferred style of Learning | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval | 95% Confidence Interval |
|--------------------------------|--------------------------------|---------------------------------|-----------------------|------------|------|------------------------|------------------------|
|                                | Balanced Preference for two of the dimensions | Moderate Preference for two of the dimensions | -1.2082* | .18775 | .000 | -1.6492               | -1.7671               |
|                                | Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -3.4977* | .25541 | .000 | -4.0977               | -2.8978               |
|                                | Moderate Preference for two of the dimensions | Very strong Preference for one of the dimensions | 1.2082* | .18775 | .000 | .7671                 | 1.6492                |
|                                | Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | 3.4977* | .25541 | .000 | 2.8978                | 4.0977                |

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Preferred by way of processing information in learning

The researcher wanted to find whether the students of private and public secondary schools in Nairobi County had different preferred styles of processing of information. Univariate analysis of variance of responses from 659 respondents done. Descriptive statistics (Table 4), revealed that 71.5 % (471) are active learners (that is they prefer to process information by trying things out, working in a group, and discussing) while 28.5 % (188) are reflective learners who prefer to process information by thinking things through and working alone (Rivera, 2016). The distribution of preferences varied across gender, private, and public schools. The data indicated 71.0% (233) of the males are active learners and 29.0% (95) reflective learners. On the other hand, 71.9% (238) of the females are active learners and 28.1% (93) reflective learners. In public schools, 70.9% (246) are active learners and 29.1% (101) reflective learners. In private schools, 72.1% (225) are active learners and 27.9% (87) reflective learners. In private schools 26.3% (82) having balanced, 58% (181) moderate preference for two of the dimensions and 15.7% (49) very strong preference for one of the dimensions. In public schools 25% (87) having balanced, 59.7% (207) moderate preference for two of the dimensions and 15.3% (53) very strong preference for one of the dimensions. In addition, of the total treatment sample 659, the data indicated 25.6% (169) had balanced preference for two of the dimensions, 58.9% (388) had moderate preference for two of the dimensions, and 15.5 % (102) had very strong preference to one of the dimensions.

The results of Univariate Analysis of Variance (ANOVA) of tests of between-subjects’ effects on preferred learning styles on the processing of information (Table 5) showed that gender preferences to active and reflective learning styles in the processing of information were not significantly different $F(1,653) = 2.65, p = .104$

| Source Corrected Model | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Powerb |
|------------------------|-------------------------|----|-------------|---|------|---------------------|-------------------|-----------------|
| Intercept              | 5030.601                | 1  | 5030.601    | 1154.836 | .000 | .639 | 1154.836 | 1.000 | .369 |
| Gender                 | 11.546                  | 1  | 11.546      | 2.651 | .104 | .004 | 2.651 | 1.000 | .107 |
| School                 | 21.325                  | 1  | 21.325      | 4.895 | .027 | .007 | 4.895 | .598 |
| Preferred style        | 504.318                 | 2  | 252.159     | 57.886 | .000 | .151 | 115.772 | 1.000 |
| Processing choice      | 2.128                   | 1  | 2.128       | .488 | .485 | .001 | .488 | .107 |
| Error Total            | 2844.544                | 653| 4.356       |      |      |      |      |      |
| Corrected Total        | 3382.507                | 659|            |      |      |      |      |      |

However, students in private and public schools had significant differences in preference to active and reflective learning styles in the processing of information $F(1,653) = 4.99, p = .027$ (Table 5). Post hoc analyses, (Tables 6), indicate that in processing of information, learners with balanced preference for two dimensions of learning styles (active and reflective) had significantly lower mean scores $(M = 2.14, SD = 1.25, p = .000)$ compared to individuals with moderate preference $(M = 3.42, SD = 1.98)$ and very strong preference for a particular dimension of learning style $(M = 4.92, SD = 3.31)$. 

Table 5: Tests of Between-Subjects Effects in Processing of Information

Dependent Variable: Processing Preference Active/Reflective

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Table 6: Post Hoc Tests Preferred Style of Learning of Processing Information Multiple Comparisons

| Tukey HSD | Dependent Variable: Processing Preference Active/Reflective |
|-----------|----------------------------------------------------------|
| (I) Preferred style of Learning | (J) Preferred style of Learning | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |
| Balanced Preference for two of the dimensions | Moderate Preference for two of the dimensions | -1.2866* | .19236 | .000 | -1.7385 to -.8347 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -2.7855* | .26169 | .000 | -3.4002 to -2.1707 |
| Moderate Preference for two of the dimensions | Very strong Preference for one of the dimensions | 1.2866* | .19236 | .000 | .8347 to 1.7385 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -1.4989* | .23224 | .000 | -2.0444 to -.9533 |
| Balanced Preference for two of the dimensions | Moderate Preference for two of the dimensions | 2.7855* | .26169 | .000 | 2.1707 to 3.4002 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | 1.4989* | .23224 | .000 | .9533 to 2.0444 |

Based on observed means.

The error term is Mean Square (Error) = 4.356.

* The mean difference is significant at the .05 level.

In addition, learners with very strong preference for a particular dimension of learning style had significantly higher mean scores (M = 4.92, SD = 3.31, p < .000) compared to individuals with moderate preference (M = 3.42, SD = 1.98) and balanced preference for two dimensions of learning styles (M = 2.14, SD = 1.25).

This suggests that different learners have different styles of processing scientific information in the learning process. This implies that in the teaching process teachers should facilitate the conversion of information into knowledge by making active learners process the information through trying/doing experiments, observing, and recording. Besides, allowing the students to manipulate the variables by doing something physical with presented material like calculations of dimensions to realize their personality. On the other hand, the teachers should assist reflective learners to convert information into knowledge by making them give reasons for the observations / justify information observed. Also, according to the time to think before acting and to assimilate before commenting or demonstrating the concepts to appreciate their personality.

These finding supports Alavi and Toozandejani [24], that most people have a preference to identifiable method of interacting with, taking in, and processing information. Besides, the study agrees with the findings of Kaushik [25] in his study that attempts to bridge David Kolb’s theory of Learning Styles with Gardner’s Theory of Multiple Intelligences to overcome criticisms to both that different learner have a preferred way of thinking, processing, and understanding information. This further implies that understanding the student’s level, developmental stage and preferred style of processing information help the instructors choose the best teaching style to achieve the negotiated goals.

Preferred Styles of Receiving Information in Learning

The researcher wanted to find whether the students of private and public secondary schools in Nairobi County had different preferred channels of receiving information. Univariate analysis of variance of responses from 659 respondents done descriptive statistics (Table 7) revealed that 53.0 % (349) are visual learners (that is they prefer to use sight as the sensory channel to receive external information) while 47.0 % (310) are verbal learners who prefer to hear external information. The distribution of preferences varied across gender, private, and public schools. The data indicated 51.8 % (170) of the males are visual learners and 48.2% (158) verbal learners. On the other hand, 54.1% (179) of the females are visual learners and 45.9 % (152)
verbal learners. In public schools, 55.3% (192) are visual learners and 44.7% (155) verbal learners. In private schools, 50.3% (157) are visual learners and 49.7% (155) verbal learners. In private schools 26.3% (82) having balanced, 58% (181) moderate preference for two of the dimensions and 15.7% (49) very strong preference for one of the dimensions. In public schools 25% (87) having balanced, 59.7% (207) moderate preference for two of the dimensions and 15.3% (53) very strong preference for one of the dimensions. In addition, of the total treatment sample 659, the data indicated 25.6% (169) had balanced preference for two of the dimensions, 58.9% (388) had moderate preference for two of the dimensions, and 15.5% (102) had very strong preference to one of the dimensions.

The results of Univariate Analysis of Variance (ANOVA) of tests of between-subjects effects on preferred learning styles of receiving of information (Table 8) showed that gender preferences to visual and verbal learning styles in receiving of information were not significantly different $F(1,653) = 3.15, p = .077$

### Table 8: Tests of Between-Subjects Effects in Preference of Receiving Information

| Source Corrected Model | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared | Eta Noncent. Parameter | Observed Power |
|------------------------|-------------------------|----|-------------|---|------|---------------------|-----------------------|-----------------|
| Intercept              | 261.674                 | 5  | 52.335      | 13.379 | .000 | .093                | 66.894               | 1.000           |
| Gender                 | 3550.574                | 1  | 3550.574    | 907.668 | .000 | .582                | 907.668               | .425            |
| School Preferred style | 25.097                  | 1  | 25.097      | 6.416  | .012 | .010                | 6.416                 | .715            |
| Receiving choice       | 220.819                 | 2  | 110.409     | 28.225 | .000 | .080                | 56.450                | 1.000           |
|                       | 1.413                   | 1  | 1.413       | .361   | .548 | .001                | .361                  | .092            |
| Error Total            | 2554.375                | 653| 3.912       |        |      |                     |                       |                 |
| Corrected Total        | 2816.049                | 659|             |        |      |                     |                       |                 |

a. R Squared = .093 (Adjusted R Squared = .086)  
b. Computed using alpha = .05

However, students in private and public schools had significant differences in preference to visual and verbal learning styles in receiving information $F(1,653) = 6.42, p = .012$ (Table 8). Post hoc analyses, (Tables 9), indicate that in receiving of information, learners with balanced preference for two dimensions of learning styles (visual and verbal) had significantly lower mean scores ($M = 1.82, SD = 1.03, p = .000$) compared to individuals with moderate preference ($M = 2.42, SD = 1.91$) and very strong preference for a particular dimension of learning style ($M = 3.69, SD = 3.15$).

### Table 9: Post Hoc Tests Preferred Style of Learning in Receiving of Information Multiple Comparisons.

| (I) Preferred style of Learning | (J) Preferred style of Learning | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|--------------------------------|--------------------------------|-----------------------|------------|------|-------------------------------------|-------------------------------------|
| Balanced Preference for two of the dimensions | Moderate Preference for two of the dimensions | -7.247* | .18229 | .000 | -1.1529 | -2.965 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -1.8697* | .24799 | .000 | -2.4522 | -1.2872 |
| Moderate Preference for two of the dimensions | Balanced Preference for two of the dimensions | .7247* | .18229 | .000 | .2965 | 1.1529 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -1.1450* | .22007 | .000 | -1.6620 | -6.281 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | 1.8697* | .24799 | .000 | 1.2872 | 2.4522 |
| Very strong Preference for one of the dimensions | Moderate Preference for two of the dimensions | 1.1450* | .22007 | .000 | .6281 | 1.6620 |
Based on observed means. The error term is Mean Square (Error) = 3.912.

In addition, learners with very strong preference for a particular dimension of learning style had significantly higher mean scores \((M = 3.69, SD = 3.15, p = .000)\) compared to individuals with moderate preference \((M = 2.42, SD = 1.91)\) and balanced preference for two dimensions of learning styles \((M = 1.82, SD = 1.03)\). This suggests that different learners have different preferred styles/channels of receiving of scientific information in the learning process. This implies that in teaching process teachers should use the channel the learners prefer by presenting information in form of pictures, diagrams, graphs, flow charts, experiments, demonstrations, using legible writing on instructional boards as well encouraging the visual learners to write legibly in their notebooks because they remember best what they have seen. Besides, proper lighting of the study rooms should be ensured to make them see clearly to satisfy their personalities. On the other hand speaking clearly, explaining points and processes clearly at their pace and clarifying written assignments verbally help the verbal learners. In addition, making sure, they have the opportunity to speak and express their opinion in discussions to fulfil their personality.

Preferred Order of the Processing of Information in Learning

The researcher wanted to find whether the students of private and public secondary schools in Nairobi County had a different preferred order of progressing the processing of information into knowledge in learning. Univariate analysis of variance of responses from 659 respondents done descriptive statistics (Table 10) revealed that 73.7% (486) are sequential learners (that is they prefer to gain understanding linearly, with each new piece of information building logically from previous pieces) while 26.3% (173) are global learners who absorb information almost randomly, in no apparent logical sequence. The distribution of preferences varied across gender, private, and public schools. The data indicated 72.0% (236) of the males are sequential learners and 28.0% (92) global learners. On the other hand, 75.5% (250) of the females are sequential learners and 24.5% (81) global learners. In public schools, 72.6% (252) are sequential learners and 27.4% (95) global learners. In private schools, 75.0% (252) are sequential learners and 25.0% (78) global learners. In private schools 26.3% (82) having balanced, 58% (181) moderate preference for two of the dimensions and 15.7% (49) very strong preference for one of the dimensions. In public schools 25% (87) having balanced, 59.7% (207) moderate preference for two of the dimensions and 15.3% (53) very strong preference for one of the dimensions. Besides, of the total treatment sample 659 the data indicated 25.6% (169) had a balanced preference for two of the dimensions, 58.9% (388) had a moderate preference for two of the dimensions, and 15.5% (102) had very strong preference to one of the dimensions.

The results of Univariate Analysis of Variance (ANOVA) of tests of between-subjects effects on preferred learning styles on order of progressing the processing of information (Table 10) showed that gender preferences to sequencing and global learning styles in the order of progressing the processing of information were significantly different \(F (1.653) = 4.53, p = .034\)

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. | Partial Eta Squared | Noncent. Parameter | Observed Power\(^b\) |
|--------|----------------------|----|-------------|---|-----|---------------------|-----------------|-------------------|
| Corrected Model Intercept | 315.434\(^a\) | 5 | 63.087 | 15.066 | .000 | .103 | 75.329 | 1.000 |
| | 3895.464 | | 3895.464 | 930.282 | .000 | .588 | 930.282 | 1.000 |
| Gender School Preferred style | 18.971 | 1 | 18.971 | 4.531 | .034 | .007 | 4.531 | .566 |
| | 25.544 | 1 | 25.544 | 6.100 | .014 | .009 | 6.100 | .694 |
| | 266.242 | 2 | 133.121 | 31.791 | .000 | .089 | 63.582 | 1.000 |
| Progressing choice Error | 2.881 | 1 | 2.881 | .688 | .407 | .001 | .688 | .132 |
| | 2734.374 | 653 | 4.187 | | | | |
| Total Corrected Total | 8755.000 | 659 | | | | | |
| | 3049.809 | 658 | | | | | |

\(a: R Squared = .103\) (Adjusted \(R Squared = .097\))

\(b: \) Computed using alpha = .05
Also, students in private and public schools' students had significant differences in preference to sequential and global learning styles in order of progressing the processing of information $F(1,653) = 6.10, p = .014$ (Table 11).

Post hoc analyses, (Table 12), indicate that in preferred order of progressing the processing of information, learners with balanced preference for two dimensions of learning styles (sequential and global) had significantly lower mean scores ($M = 1.82, SD = 1.03, p = .000$) compared to individuals with moderate preference ($M = 2.42, SD = 1.91$).

Table-12: Post Hoc Tests Preferred Style of Learning of Preferred Order of Progressing the Processing of Information Multiple Comparisons

| Dependent Variable: Progressing Preference Sequencing / Global Learning | (I) Preferred style of Learning | (J) Preferred style of Learning | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval Lower Bound | 95% Confidence Interval Upper Bound |
|---|---|---|---|---|---|---|---|
| Balanced Preference for two of the dimensions | Moderate Preference for two of the dimensions | -1.0220* | .18860 | .000 | -1.4650 | -.5789 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -2.0096* | .25657 | .000 | -2.6123 | -1.4069 |
| Moderate Preference for two of the dimensions | Balanced Preference for two of the dimensions | 1.0220* | .18860 | .000 | .5789 | 1.4650 |
| Very strong Preference for one of the dimensions | Balanced Preference for two of the dimensions | -.9877* | .22770 | .000 | -1.5225 | -.4528 |
| Very strong Preference for one of the dimensions | Moderate Preference for two of the dimensions | 2.0096* | .25657 | .000 | 1.4069 | 2.6123 |
| Based on observed means. The error term is Mean Square (Error) = 4.187. |

In addition, learners with very strong preference for a particular dimension of learning style had significantly higher mean scores ($M = 3.69, SD = 3.15, p = .000$) compared to individuals with moderate preference ($M = 2.42, SD = 1.91$) and balanced preference for two dimensions (sequential and global) of learning styles ($M = 1.82, SD = 1.03$).

This suggests that different learners have a different preferred order of progressing the processing of scientific information in the learning process. This implies that in teaching process teachers should order the style of presentation and development of lessons towards the understanding of global learners who are holistic, systems thinkers and learn in large leaps by giving an outline of every concept and sub-topic. Also, being friendly and patient in helping them slowly discover how the concepts assist and relate to their life to uphold their personality. On the hand developed the understanding of the sequential learners who gain understanding in a linear orderly fashion by moving step-by-step in every point, analysing the concepts by giving their similarities and differences, insisting they write the points and summarise the concepts. Besides, moving at their pace to enhance their personality.

This study supports several studies Mona and Clas [26] and Gaikwad [27] that different students have different preferred styles of order of progressing the assimilation of information, further that teachers in secondary schools must consider both the structure of the content, and the order different students prefer to assimilate the content as new knowledge.

The global learners need to grasp the big picture before they have any chance to understand the details of the subject. However, if there is no picture it may difficult for them to study. They may feel stupid.
when they are struggling to master material with which most of their contemporaries seem to have little trouble. Some eventually become discouraged with education and drop out if there is no proper support school system [28]. On the other hand, Narayani further observed that the mean value of the academic achievement of sequential learners is greater than the mean value of the academic achievement of global learners. They learn in a logical progression and small incremental steps. Generally, they have more learning success because the majority of books and teaching strategies used by schoolteachers are sequential [28].

CONCLUSION

The findings of this study demonstrates and supports Wouter and Katrien [29] that assessment of concept learning styles needed a more appropriate articulation of the discourse to help reduce misunderstandings in the preference of learning styles. Past research work held that the assumption that people can be clustered in different groups is not supported by empirical evidence [24, 29]. The clustering contributed to the misunderstandings. This study demonstrates that all learners display specific preferred learning styles in the perception of information, processing information, preferred channel of receiving information and order of progressing the processing information rather than possessing only one of the learning styles. Univariate Analysis of Variance (ANOVA) of students’ preferred learning styles showed significant differences in preference to visual and verbal learning styles in receiving of information $F(1,653) = 6.42, p = .012$; in intuition and sensing learning styles in perception of information $F(1,653) = 9.77, p = .011$; in preference to visual and verbal categories of learning styles in receiving of information $F(1,653) = 6.42, p = .012$; and in preference to sequential and global learning styles in order of progressing the processing of information $F(1,653) = 6.10, p = .014$.

Besides, there were significant differences in gender preference to intuitive and sensing of learning styles in the perception of information $F(1,653) = 9.77, p = .002$. In addition, in preferences to sequencing and global categories learning styles in the order of progressing the processing of information $F(1,653) = 4.53, p = .034$. On the other hand, gender preferences showed no significant differences to active and reflective learning styles in processing of information $F(1,653) = 2.65, p = .104$ and to visual and verbal learning styles in receiving of information $F(1,653) = 3.15, p = .077$.

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