GENDER, LEARNING STYLES AND PERFORMANCE OF 1ST YEAR ARCHITECTURE STUDENTS: FIRST STAGE OF A LONGITUDINAL STUDY

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Abstract

Student gender and learning styles have been discovered to sometimes impact on the performance of architecture students. Scholars also assert that learning styles of students may metamorphose as they progress in school of architecture. Using the Inventory of Learning styles (ILS) developed by Felder and Soloman (1993) and fifty (50) first year architecture students in a private university in Nigeria as a sample, the authors have embarked on a longitudinal study which seeks to investigate the relationship between the learning styles of students of architecture and their performance as they progress in their study of architecture. First, the ILS was administered to the students to determine their learning styles. The individual learning styles were then juxtaposed with the students' overall semester performance scores. The results were analysed to determine how these varied by gender. This paper reports the findings for the first stage of the study.

Keywords: Gender, Learning Styles, Performance, students of architecture.

1   INTRODUCTION

The increased interest of architectural educators in the learning patterns of their students has motivated several studies in different parts of the world [1-6]. Different theories and models of learning have been used to investigate learning among students of architecture. Some of them are the keirsey temperament sorter [6], Kolb's learning style inventory [3], Johnston's learning combination inventory [6], Grasha Reichmann learning styles [7] and more recently Inventory of learning style by Felder and Soloman [8]. The findings from these studies are often mixed pointing to the fact that several other factors have a part to play in how students of architecture learn. Some of these factors include the context, race, gender and socioeconomic status of the students [6] [9 [10]. Since the overall goal however is to enhance the performance of the students and hence their learning experience, it becomes pertinent to continue in this quest of investigating the learning characteristics of the students among several other factors.

In a study [5], most of the students of Landscape architecture in a Canadian university were found to be either intuitive feelers and intuitive thinkers which implied their preference for problem based learning, group work, seminars, workshops and colloquia rather than traditional lecturing methods. Other studies [11] [12] found students of interior architecture in a Turkish university to be mostly assimilators and convergers while another [4] found the students of architecture in a Chinese university to be mostly assimilators and divergers. Introducing gender into the investigation, another study [13] found no significant gender based differences in the creative thinking abilities of students of architecture. More studies [3] [12] in the Turkish university found that learning styles and gender were independent. Another study based in Ireland [6] found gender differences in learning in the design studio of an Irish university with the females higher in sequential processing and the males more disposed to technical processing. Further exploration of these learning styles in relation to gender either alone or combined with performance yielded different outcomes. One study [12], found mixed outcomes in freshman course performance in interior architecture with respect to gender. Sometimes the females outperformed the males and vice versa but females to excelled in overall grade point average scores. Learning styles had significant interaction effects with performance in some cases but had no overall interaction effect with gender and academic performance. Another study [2] did not find any significant interaction between cognitive style, gender and performance scores but found that individuals and female students with certain cognitive styles were not likely to complete their course in architecture.

Of particular interest is the inventory of learning styles used in the Turkish-based study [3] to assess the learning characteristics of students of architecture first in relation to gender and performance and later as an investigative parameter into knowledge building preferences [14]. The author's [8] revision

to a previous version was used. This inventory is based on the premise that an individual builds his knowledge on four major dimensions. The first dimension is that of action and reflection (A/R). The second is that of sensing and intuition (S/I). The third is that of visualizing and verbalizing (V/V) while the last is sequential and global (S/G). Table 1 shows a summary of definitions of the characteristics of this scale.

Table 1: The characteristics of the four Subscales of the ILS

ACTIVE - REFLECTIVE SCALE	
ACTIVE	**REFLECTIVE**
✓ Discussions. ✓ Application of knowledge. ✓ Explaining to or teaching others.	✓ Thinking quietly first.
SENSING - INTUITIVE SCALE	
SENSING	**INTUITIVE**
✓ Facts ✓ Solving problems by established methods ✓ Real world connections	✓ Innovation and creativity. ✓ Discovering relationships and possibilities.
VISUAL - VERBAL SCALE	
VISUAL	**VERBAL**
✓ Visual context: pictures, charts, diagrams, time lines, films, demonstrations.	✓ Verbal or written context: written or spoken explanations.
SEQUENTIAL - GLOBAL SCALE	
SEQUENTIAL	**GLOBAL**
✓ Gains understanding in logical, linear steps. ✓ May not fully grasp material but can do something with it because the pieces absorbed are logically connected. ✓ Concepts must have a logical flow and explanation. ✓ Likes to follow stepwise paths in finding solutions.	✓ Learns in large jumps, absorb material almost randomly. ✓ They may be able to solve complex problems quickly or put things together in novel ways once they have grasped the big picture, may have difficulty explaining how they did it

(Source: Felder and Soloman [8])

1.1 Problem statement and Research questions

Using the index of learning styles, this study partly replicates that by Demirkan and Demirbas [3] but reports the first stage of a longitudinal study. In this first stage, the focus is to investigate how the gender, learning characteristics and performance interact among students of architecture in a Nigerian privately owned university at the end of the freshman year of their bachelor degree program.

1 What is the learning style distribution of freshman architecture students in four learning scales?

2 Are there any significant differences in the performance scores of freshmen architecture students across learning styles and gender?

2 METHODOLOGY

2.1 The Participants

The study sample comprised of 50 freshman students in the department of architecture in covenant university, Nigeria. Their ages ranged from 16 to 22 years of age (M=18, SD=1.16). The participants comprised 28 males and 22 females.

The Instrument

To gather data on learning styles, the index of learning styles (ILS) [8], was used. The ILS is made up of 4 bi-polar subscales each having 11 items with 2 responses tagged 'a" or "b". Combining the 11 items from each subscale, namely, active/ reflective, sensing/ intuitive, visual/verbal, and sequential/global, the scale is made up of 44 items all together.

2.2   Treatment of Data

The collected data was treated as recommended by the developers of the scale. To get a student's score for each scale, the corresponding weight of -1 or 1 was assigned to each response indicating whether it was "a" or 'b". At the end of the test, the score for that scale was determined by adding up the scores. This would show the user's strength on each end of the pole. For example, a person who scored 5 on the sensing intuitive scale scored 3 for sensing and 8 for the intuitive end respectively. If a user scores from 1 to 3 on a scale, he is well balanced. If he scores 5 to 7, his ability on that scale is moderate and if he scores, 9 to 11, he is judged as having a strong preference for that dimension of the scale. The user in the example who scored 5 indicated a strong preference for the intuitive dimension of that scale. For this study, the scores were recoded 1 to 5 with 5 being at the negative end, 3 being balanced and 1 being at the positive end, hence a score of 5 compared to a score of 2 did not indicate one being higher or lower, it only indicated the direction. The bipolar scales are illustrated in Fig. 1

Active											Reflective
-11	-9	-7	-5	-3	-1	1	3	5	7	9	11

Sensing											Intuitive
-11	-9	-7	-5	-3	-1	1	3	5	7	9	11

Visual											Verbal
-11	-9	-7	-5	-3	-1	1	3	5	7	9	11

Sequential											Global
-11	-9	-7	-5	-3	-1	1	3	5	7	9	11

Figure 1: The Scoring Axis for the four ILS subscales
(Source: Felder and Soloman [8])

3   RESULTS

3.1   Learning style distribution of students

From the student's responses, the distribution of their learning styles according to the scales was done (see Fig. 2). More than half of the students were found to be balanced on the active/reflective (78%), sensing/ intuitive (76%) and visual/ verbal (68%) subscales. On the sequential/ global subscale however, only 26% were balanced and ta total of 68% had strong and moderate preference for the sequential dimension of the subscale. A one-way correlated analysis of variance revealed that there was a significant difference between the students' mean scores in the four subscales. $F_{(3, 47)} = 22.78$, $p < .001$.

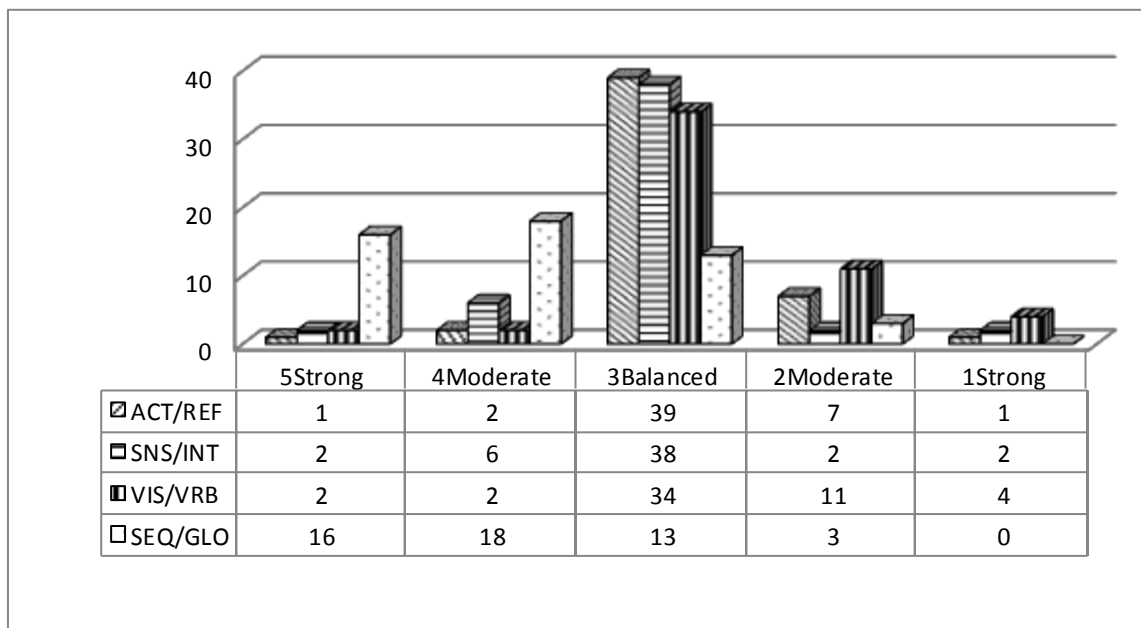|	5Strong	4Moderate	3Balanced	2Moderate	1Strong
⊠ACT/REF	1	2	39	7	1
☐SNS/INT	2	6	38	2	2
⊞VIS/VRB	2	2	34	11	4
☐SEQ/GLO	16	18	13	3	0

Figure 2: Students learning style classification according to the ILS

Like in a previous similar study [3], recoding of the scores was done with weights ranging from 1 to 5 assigned to each category. The weights ranged from 5 on the extreme left to1 on the extreme right in relation to figure 2 and the mean scores of the class on each subscale were determined. The mean scores for active/ reflective scale is 2.90, for sensing/ intuitive is 3.08, for visual verbal is 3.36 and for sequential global is 3.94. This indicates that the students generally have a preference for reflective, sensing, visual and sequential dimensions.

3.2 Learning style characteristics according to gender

The scores of the students from the ILS and the weighted mean score were disaggregated by their gender. The scores are shown in Table 2. Like the males, Most of the females were balanced in their position on the first three scales and were stronger on the sequential/global scale.

Table 2: The distribution of ILS learning styles by gender

	5 Strong		4 Moderate		3 Balanced		2 Moderate		1 Strong		
	M	F	M	F	M	F	M	F	M	F	
Active	1	0	2	0	23	16	2	5	0	1	Reflective
Sensing	1	1	2	4	23	15	2	0	0	2	Intuitive
Visual	3	1	7	4	18	16	0	1	0	0	Verbal
Sequential	8	8	10	8	8	5	2	1	0	0	Global

Going by frequency distribution, from the outcome of Fishers exact test, there was no statistically significant relationship between the students gender and learning styles for the active/reflective (p=.136), sensing/intuitive (p=.248), visual/verbal (.607), and sequential/global (p=.971) learning subscales. By the comparing actual mean scores through a one-way ANOVA test, the females (M=2.91, SD=3.463) were found to have scored significantly differently than males (M=-.14, SD= 3.827) on the active/reflective scale as can be seen in Table 3. Despite this difference, both were still balanced on that scale according to the ILS scoring directions. Differences in all other subscales were not significant.

Table 3: Comparison of between-groups means for learning subscales (one-way ANOVA)

SCORE ON SUBSCALE	Gender	N	Mean	Std. Deviation	Min.	Max.	F	df	Sig.
ACTREF SCORE	Male	28	-.14	3.827	-11	5			
	Female	22	2.91	3.463	-3	11	8.510	1, 48	.005
	Total	50	1.20	3.943	-11	11			
SNSINT SCORE	Male	28	-.5000	3.717	-11	7			
	Female	22	-.2727	4.997	-9	11	.034	1, 48	.854
	Total	50	-.4000	4.281	-11	11			
VISVRB SCORE	Male	28	-2.64	4.218	-11	3			
	Female	22	-1.45	3.751	-11	5	1.076	1, 48	.305
	Total	50	-2.12	4.024	-11	5			
SEQGLO SCORE	Male	28	-5.07	4.438	-11	5			
	Female	22	-5.55	4.194	-11	5	.147	1, 48	.703
	Total	50	-5.28	4.295	-11	5			

3.3 Relationship of academic performance to learning scale and gender

The academic performances of the students were measured by their cumulative grade point average (CGPA) at the end of their freshman year. The highest attainable CGPA in the school is 5.00. Series of ANOVA tests were run to compare the mean performance of males and females. First it was discovered that the CGPA of the females (M=4.21, SD=0.47) was significantly higher than that of their male (M=3.59, SD= 0.49) counterparts from a one way ANOVA test [F (1, 46) = 19.361, p= .000]. Also series of one way ANOVA tests revealed that the CGPA of the students differed significantly only on the active /reflective subscale of the ILS [F (3, 44) = 3.060, p=.038]. Series of two-way ANOVA tests were also conducted to investigate for interaction effects of gender, learning style and CGPA. No significant interaction effect was found when CGPA was the dependent variable and gender with student categories on each of the four learning subscales were the independent variables. However, there remained a main effect for gender on all four subscales as shown in Table 3.

Table 3: Two-way ANOVA Tests of Between-Subjects Effects

	Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Dependent Variable: CGPA	Gender	2.43	1	2.43	10.94	.002*	.207
	UNIACTREF	.68	3	.23	1.02	.395	.068
Independent Variables: Gender, A/R score	Gender * UNIACTREF	.28	1	.28	1.27	.265	.029
Dependent Variable: CGPA	Gender	3.83	1	3.83	17.67	.000*	.306
	UNISNSINT	.98	4	.24	1.12	.359	.101
Independent Variables: Gender, S/I score	Gender * UNISNSINT	1.04	2	.52	2.40	.104	.107
Dependent Variable: CGPA	Gender	3.06	1	3.06	12.35	.001*	.232
	UNIVISVRB	.18	3	.061	.25	.864	.018
Independent Variables: Gender, V/V score	Gender * UNIVISVRB	.351	2	.18	.709	.498	.033
Dependent Variable: CGPA	Gender	3.894	1	3.89	16.19	.000*	.288
	UNISEQGLO	.346	3	.12	.48	.699	.035
Independent Variables: Gender, U/G score	Gender * UNISEQGLO	.914	3	.31	1.27	.299	.087

4 DISCUSSION AND CONCLUSION

From the findings it was seen that most of the freshman students irrespective of their gender were well balanced in their learning styles across the active/reflective, sensing/intuitive, and visual/verbal scales. On the sequential/global scale however, most of them were stronger on the sequential dimension. This meant that they tended to gain understanding of subject matter in a method which relied on understanding basic principles, concepts and methods. This could be attributed to the fact that they were freshmen and as such still relied heavily on traditional instruction methods for their learning as had been highlighted by scholars [8] [16]. Comparing their strengths, both genders were equally competent on all scales except for the active/reflective where the males scored differently from the females. Since this was a bipolar scale, it meant that the females had a higher tendency towards the reflective end and males towards the active end. This implied that the males were deeper in the aspect of learning with activities which required engaging in discussions with others and applying this knowledge to problem solving or using it to teach others, while the females had greater tendency towards quietly pondering on learning tasks or reflection which is greatly needed in architecture.

Considering the second research question which focused on how the students' performance varied across gender and learning styles. The performance scores were found to vary across learning styles only on the active/reflective subscale and across gender to the advantage of the females. The fact that the female students outperformed the males and also had preference for reflective dimension suggested a corroboration of the fact by scholars [3] [15] that the reflective dimension was most valued in architectural education. . This higher performance however could not be explained by the learning styles as there was no significant interaction discovered by way of the statistical test. This meant that irrespective of the learning style of the individual, the females outperformed the males according to their CGPA.

Comparing the findings of this study to a similar previous one [3], there were both similarities and dissimilarities. The students in both studies were well balanced in active/reflective and sensing/intuitive scales. There were however differences in the distributions in the other two subscales. Most of those in the previous study (77%) had a preference for the visual dimension while most of those in the present study (68%) were balanced on the visual verbal scale. For the sequential global scale most of those in the previous study (65%) were balanced while most of those in the present study (68%) had a preference for the sequential dimension of that scale. The differences between these studies could however have occurred because of the difference in level of studies (freshmen versus seniors), the location (Nigeria versus Turkey) and the socio-educational context [6]. For example the global, reflective and visual abilities or preferences of the freshman students are expected to soar the more they stay in the school of architecture [11]. It is expected that at the end of the present longitudinal study, the students will have become more balanced and well-adjusted in their distribution across learning styles and in their performance scores by gender. The findings about performance corresponded with a previous study [12] where the female students outperformed the males in terms of overall CGPA. This higher performance of the females is a trend that needs more investigation.

To enhance the pedagogical practice for that class, the educators could employ the suggestions by the developers of the scale to enhance balance on the sequential/global scale. A good example is for the instructor to first try and give the broad picture of a subject matter emphasizing how the topics fits before teaching them in a class that has a majority of sequential learners. It is recommended that educators take out time at the beginning of each new course to understand the learning patterns of their students in order to know how best to teach them.

Finally, this study is of a class of freshmen students which will be concluded at the end of their fourth year. The findings of this study are not expected to be generalisable to other places, but it is recommended that similar longitudinal studies of architecture students be embarked on. This is most likely to help to shed understanding on matters relating to gender, performance and learning styles. The end result of such studies will enhance student performance and increase diversity in architectural education giving room for more specialized pedagogy.

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