

# Learning Style Preference: Impact on Academic Performance of Preclinical Medical Students, a Nigerian Survey

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## Abstract

**Background:** Understanding the differences in learning styles among medical students and their impact on the learning processes may enhance better learning and knowledge acquisition that is necessary for improving learning outcomes. This study aimed at the determination of the learning style preferences of the University of Nigeria preclinical medical students and the impact they have on their academic performance. **Materials and Methods:** The study involved 158 third-year medical students (102 males and 56 females). Each student completed the VARK questionnaire (Version 7) comprising 16 questions that identified four different learning style preferences, namely V – visual, A – aural, R – read–write, and K – kinesthetic. The academic performance of the students was obtained from the results of their second MBBS professional examination. Analysis of data was done using Statistical Package for the Social sciences (SPSS) version 21; the percentages and charts of distribution for each VARK component were determined. The presence/absence of significant interactions between academic performance and learning style preferences was determined using Chi-square test. **Results:** The results showed that 30.4% of the students were unimodal (V-2.5%, A-7%, R-17.1% and K-3.8%), while 69.6% were multimodal in learning. With respect to gender, the males (70.6%) and females (67.9%) preferred multimodal learning, and both genders showed similar patterns in their preferences (read–write, followed by aural, kinesthetic, and visual). Visual learners exhibited the highest scores among unimodal learners, followed by kinesthetic, aural, and read–write learners, although the mean performance of multimodal learners (65%) was higher than those of unimodal learners (54%) ( $P < 0.001$ ). **Conclusion:** A blend of V-A-R-K instructional techniques would benefit most students. Students who are strongly unimodal in learning need to be specifically targeted with their unique learning style.

**Keywords:** Anatomy, Nigeria, learning style. academic performance, preclinical students, V-A-R-K

## INTRODUCTION

The objective of any medical school is to create an enabling environment to teach, equip and assess the competence of future doctors, motivate and direct the learning process, and evaluate the efficiency of the programs. Frequently, medical colleges experience dissatisfaction in both the academic performance of students and the performance of graduates in the field of practice.<sup>[1]</sup> Several factors have been identified which influence academic performance.<sup>[2,3]</sup> Some of the factors are learning style preference of the students, the students interest in the subject, and their training environment.

The differences in the students' preference of learning styles account for unequal learning of same materials/subjects.<sup>[4]</sup> The impression that teaching is just the transfer of knowledge from teachers to students is becoming obsolete, and recently, there has been a modification in the medical education

from teachers-centered (pedagogy) to students-centered learning (andragogy).<sup>[5]</sup> Thus, recognizing the students' characteristics of learning cannot be overemphasized for the improvement of learning and academic performance.

Learning style preference may be defined as a person's preferred style of the collection, procession, interpretation, organization, and analysis of information.<sup>[5]</sup> It was established that there is a good match between a student's learning style preference and a teacher's teaching method with a positive effect on student

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performance.<sup>[6]</sup> Teachers who want to train medical doctors effectively should comprehend the variations in the learning style of their students and must find the best way to improve the processes of learning.<sup>[7]</sup> Therefore, it is crucial to comprehend the students' characteristics to become an effective teacher and improve the learning outcome of the students.<sup>[8,9]</sup>

There are several different ways to define and assess learning styles, they are: V-A-R-K inventory,<sup>[10]</sup> Briggs questionnaire,<sup>[11]</sup> Kolb learning style inventory,<sup>[12]</sup> Felder's index of learning style,<sup>[13,14]</sup> and Gregorc style delineator.<sup>[15]</sup> In a study involving first-year medical students in a regional University in United States, Johnson<sup>[16]</sup> demonstrated that learning style preferences affected their learning outcomes. The V-A-R-K inventory—development of this inventory was by Fleming and Mills'.<sup>[10]</sup> It offers students a style of learning which is dependent on the sensory modalities that help in collecting information. The acronym "V-A-R-K" stands for visual, aural, read–write, and kinesthetic sensory modalities. It gives insight into the preference in processing information, including the acquisition of information via multiple modalities.<sup>[10]</sup> This inventory is the preferred method because it provides teachers and students with a way to enhance students' learning and understand the best mode of transferring information, is widely distributed and used in educational institutions and in the study of the medical profession, has the highest learning mode, and it is easy and simple to use.<sup>[9,10]</sup>

Learners who prefer V-modality need to sit at the front of lecture halls see the teacher's movements and demonstrations to actually comprehend the content of lectures. They learn more with diagrams, drawings, pictures, cues, and textbooks with illustrations.

Learners who prefer A-modality learn best through verbal lessons, listening to lectures, participating in discussions, and attending tutorials. They benefit mainly from reading out textbooks and notes aloud. They listen to records of information and notes from textbooks.

R-modality learners prefer information displayed as words, and they take notes verbatim and re-read their notes repeatedly. Attention is given to textbook-based materials. They prefer working with the internet, dictionaries, and encyclopedias.

K-modality learners perform better by a hands-on approach such as lectures that emphasize doing/performing an activity, dissecting/practical, and working with objects. This group of learners does not sit in a place for a long time. In medical training, case studies are used in assisting students in applying what they learn during clinical/ward rounds.

Some students are able to use most of the sensory modalities, though each person has a particular preference, or preferences, with one dominant mode. A learner with one learning style is said to be a unimodal learner, those with more than one learning style are said to be multimodal learners. The multimodals can be grouped into bimodal, trimodal, and quadmodal learners – that is those who preferred 2, 3, or 4 modalities, respectively.

This study aimed at determining the learning style preferences of the University of Nigeria preclinical medical students and the impact they have on their academic performance.

## MATERIALS AND METHODS

### Study area

This study was done in the Anatomy Department at College of Medicine of University of Nigeria, Enugu Campus, Southeast of Nigeria.

### Study population

A total of 158 third-year medical students (102 males and 56 females) took part in the study. This represented 83.2% of the 190 students targeted. The students' age ranges from 18 to 25 years.

### Study procedure

Their learning style preference was determined using V-A-R-K questionnaire (version 7). The questionnaire measured four perceptual preferences (visual, aural, read–write, and kinesthetic). It was comprised of 16 questions with four options each. The questionnaire was administered in hardcopy format and was completed in the classroom. Students could select two or more options for determining the preferences for multimodal styles. The responses of the participants were tallied for each of the four modalities (V, A, R and K) as well as the possible combinations of modalities (e.g., VK, VR, ARK, VARK, etc.). A scoring algorithm obtained from the V-A-R-K website was used to determine the student's preferred modality.

Information regarding the students' academic performance was obtained from the results of their second MBBS professional examination.

### Data analyses

Data analyses were done using Version 21 of Statistical Package for the Social Sciences (SPSS Inc. Chicago Illinois). The percentages and charts of the distributions for each V-A-R-K component were obtained using descriptive statistical analysis. The presence/absence of significant interactions between academic performance and the variables was determined using Chi-square test of association.

### Ethics

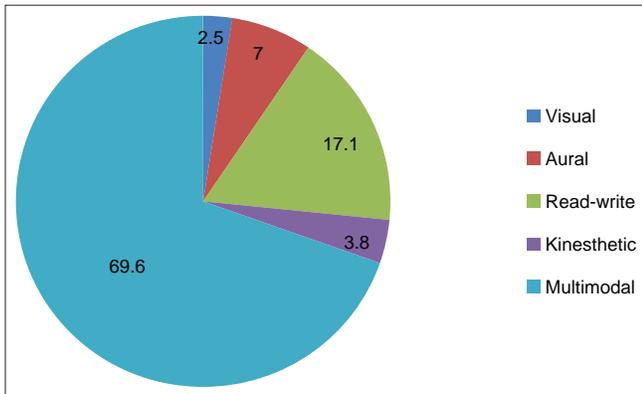
The protocol approval was gotten from the Ethics Committee of College of Medicine, University of Nigeria, Enugu Campus, with approval number 014/06/16. All the participants gave their informed consent.

## RESULTS

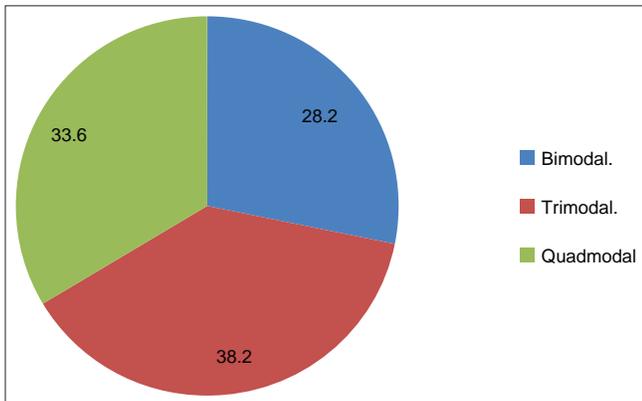
Figure 1 shows that most of the students (69.6%) preferred multimodal style of learning. Out of them, 28.2% were bimodal, 38.2% were trimodal, and 33.6% were quadmodal [Figure 2]. However, it was shown that out of the 30.4% who were unimodal, 2.5% preferred visual, 7% aural, 17.1% read–write, and 3.8% were kinesthetic.

Figures 3 and 4 show the relationship between gender and sensory modality preferences of the students.

Both males (70.6%) and females (67.9%) preferred multiple modes of learning styles rather than a single mode [Figure 3]. Of the singular learning style preferences, both genders also displayed similar patterns of preferences. Both mostly preferred read–write sensory modality, followed by aural, kinesthetic, and visual [Figure 4].



**Figure 1:** The percentages of students with unimodal and multimodal learning preferences ( $n = 158$ ). Majority of the students prefer multiple learning modalities, while read–write modality recorded highest among the unimodal learners



**Figure 2:** The percentages of students with bimodal, trimodal, and quadmodal learning style preferences ( $n = 158$ ). Trimodal learners recorded a higher percentage than quadmodal and bimodal

As shown in Figure 5, the learning style preferences dominant among bimodal students were AR (8.2%), AK (8.2%), and VK (7.3%). Only 2.5% and 1.8% of students preferred VA and RK, respectively. None of the students preferred VR. Figure 5 also shows that ARK (19.1%) was the learning style preference dominant in the trimodal category. Ten percent and 5.5% of students preferred VAK and VRK, respectively.

The impact of learning style sensory modality preferences on academic performance [Table 1] shows that students who preferred multiple modes of learning (multimodal) scored significantly higher than those who preferred single mode (unimodal) ( $P < 0.001$ ).

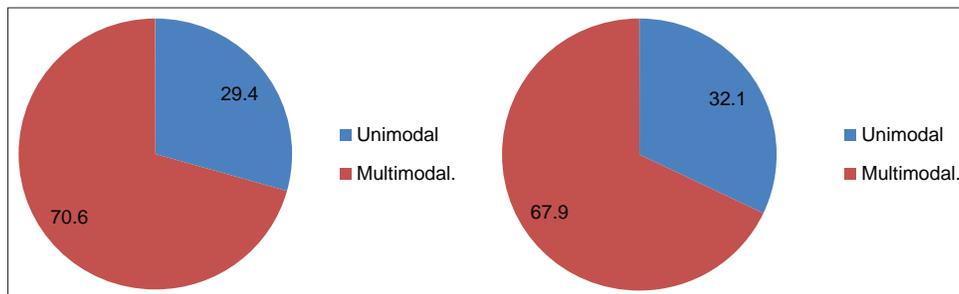
Table 2 shows that among unimodal learners, those who had a preference for visual learning had the highest mean performance. This was followed by kinesthetic, aural, and read–write learners. Among the multimodal learners, students who preferred three or four modalities performed better than students who preferred two sensory modalities of learning [Table 3].

## DISCUSSION

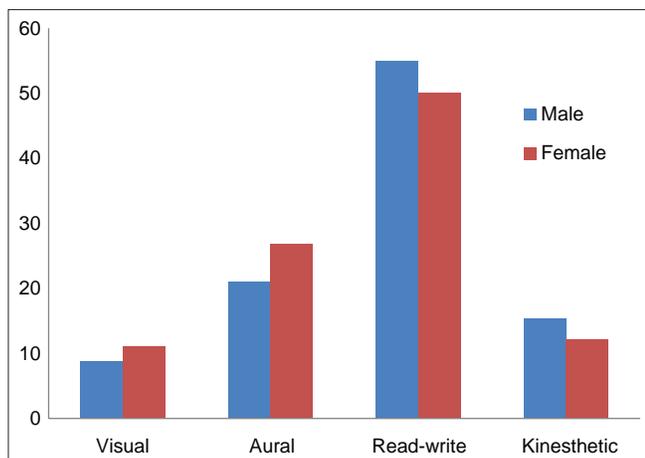
### Medical students are mostly multimodal learners

This study showed that 110 (69.6%) students were multimodal in learning. Among these multimodal learners, most students were trimodals and quadmodals (38.2% and 33.6%, respectively). There is the likelihood that multimodal learners have a better academic outcome that helped them to meet-up with the competitiveness of admission into colleges of medicine. Our result is in keeping with the earlier findings<sup>[17]</sup> which noted that year-one students of medicine who were multimodal in learning were significantly greater than students with unimodal preferences. Other researchers showed that medical students are highly multimodal in learning. For instance, Samarakoon *et al.*<sup>[18]</sup> reported that over 69% of their year-one medical students were multimodal learners. Muralidhara *et al.*<sup>[19]</sup> showed that 84% of preclinical students were multimodal in learning.

In specific bimodal combinations, the students preferred AR, AK, and VK. In trimodal combinations, students preferred ARK and VAK. This implied that most of the medical students will do well in information presentation involving the four modalities of learning. Our findings are in agreement with the



**Figure 3:** The percentages of male (left) and female (right) students with unimodal and multimodal learning style preferences



**Figure 4:** The percentages of students with various unimodal learning style preferences by gender. Read–write recorded the highest percentage among the unimodal learners in both genders

**Table 1: Academic performance (score %) by modalities of learning**

	Unimodal	Multimodal	P
Mean score±SD	54±11	65±10	<0.001
n	48	110	

Multimodal learners scored significantly higher (65±10) than unimodal learners (54±11) ( $P<0.001$ ). n: Number of students, SD: Standard deviation

**Table 2: Academic performance (score %) by various unimodal learning style preference**

	Visual	Aural	Read-write	Kinesthetic	P
Mean score±SD	56±5	45±8	40±8	50±6	<0.001
n	4	11	27	6	

Among unimodal learners, visual learners had the highest mean performance (56±5), followed by kinesthetic (50±6), aural (45±8) and read-write (40±8) learners. n=Number of students, SD: Standard deviation

**Table 3: Academic performance (score %) by various multimodal learning style preference**

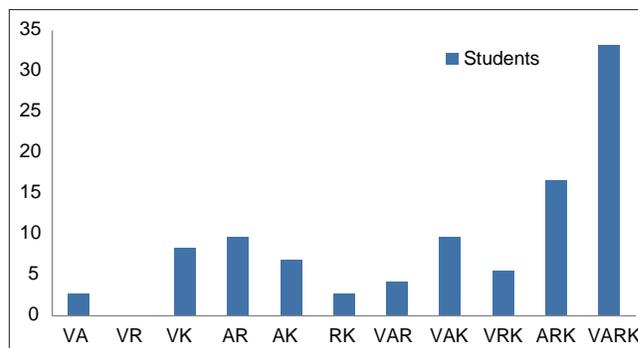
	Bimodal	Trimodal	Quadmodal	P
Mean score±SD	55±8	63±8	65±10	<0.001
n	31	42	37	

Quadmodal learners had the highest score (65±10), followed by trimodal (63±8) and then bimodal learners (55±8). n=Number of students, SD: Standard deviation

earlier results.<sup>[20,21]</sup> Lujan and DiCarlo<sup>[4]</sup> found that the bimodal preferences of medical students were VK, AR, and AK, and trimodal preferences were VAK, ARK, and VRK, while Nuzhat et al.<sup>[20]</sup> noted that AK and VAK were their students’ dominant bimodal and trimodal preferences, respectively.

**Both genders have a preference for multimodal learning**

Using Fleming’s V-A-R-K assessment questionnaire in the



**Figure 5:** The percentages of students with various combinations of multimodal learning style preferences (n = 158)

determination of the students’ learning modality preference, the result showed that both genders (males: 70.1%, females: 67.9%) have a preference for multimodal style of learning. The multimodal preference is not surprising because most people without a disability should use all their sense organs in learning. Students with multimodal learning have the tendency of adjusting to varied teaching styles or adapt to any modality. Our finding is in keeping with the results from previous studies on year-one medical students<sup>[4,16,17,21,22]</sup> and dental students.<sup>[23]</sup> It was noted that 92% of males and 76% of females have preference for multiple modes of information presentation.<sup>[21]</sup> Slater et al.<sup>[17]</sup> reported that over 56% of both genders have preference for multimodal learning.

**Students who are unimodal learners**

The study showed that 30.4% of students preferred learning that uses single sensory modality, either visual, aural, read–write, or kinesthetic. Among these unimodal learners, most were read–write learners. It is important to note that students with single mode of learning do not completely exclude the use of other modalities. For instance, students who have V-A-R-K scores of this nature, V = 3, A = 1, R = 8, and K = 2, will be grouped as unimodal learners who have a preference for the read–write mode of information intake. The read–write preference will make the students adjust to the learning conditions peculiar to that preference. Thus, unimodal learners may experience some difficulties understanding the lecture except if special attention is paid by teaching with the learners’ preferred modality.

This finding is in concordant with the reports of other researchers.<sup>[4,24]</sup> In a study by Dobson,<sup>[24]</sup> 30% of his subjects have a preference for a single modality for learning, Lujan et al.<sup>[4]</sup> also noted that 36% of their students were unimodal learners.

**Impacts of learning style preference on academic performance**

When the academic performance of unimodal learners was compared to those of multimodal learners, it was noted that the multimodal learners scored significantly higher than the unimodal learners. Furthermore, among the multimodal learners, the quadmodal and trimodal learners obtained higher

scores compared to bimodal learners. A probable explanation is that these students could adapt and absorb content in various lectures irrespective of the teaching method or strategy used. On the contrary, unimodal learners may not absorb the content once the teaching method does not tally with their preferred learning style.

Another important finding in this study is the correlation existing between preferred sensory modalities with academic performances. Visual learners obtained the highest mean score, followed by kinesthetic learners, aural learners, and read–write learners. This is probably due to the fact that visual learners are more likely to appreciate the teaching strategies in the classroom where most of the lectures are presented through PowerPoint presentations with different hues, fonts, and diagrams. Another probable explanation is the use of good anatomy textbooks. The extensive laboratory aspect of the course (cadaver dissections, demonstrations, and the use of mannequins) may have contributed to the high performances of the kinesthetic learners. A similar outcome was obtained by Omar *et al.*<sup>[25]</sup> Dobson<sup>[26]</sup> also noted positive correlations between academic outcome and sensory modality preference, but in his result, Aural learners topped in the class, whereas kinesthetic learners had the least. However, his findings were based on physiology students. On the contrary, Almigbal<sup>[27]</sup> reported insignificant correlation between academic performance and styles of learning.

## CONCLUSION

Using Fleming's and Mills' V-A-R-K assessment questionnaire helped in determination of the sensory modality preferences of students. Read–write learning was mostly preferred, followed by aural, kinesthetic, and visual. However, the visual learners had the best academic performance, followed by kinesthetic learners, and read–write learners had the least. Majority of our students have a preference for multiple learning modes, and the multimodal learners performed significantly better than the unimodal learners. Among the multimodal learners, the quadmodal learners and trimodal learners performed better than the bimodal learners. Therefore, a blend of V-A-R-K instructional techniques may benefit most students. Students who strongly depend on a single learning modality will need to be lectured with a particular technique unique to their learning style.

## Recommendations

For students, identifying and understanding learning style preference is important in providing a basis to help plan and modify learning strategies to improve academic performance. It also encourages students to expand their capabilities for learning by making use of their learning style preferences.

For faculty, lecturers need to incorporate all the sensory modalities to enable every student have active participation in the learning processes. This will enhance effective and efficient teaching–learning experiences.

For college and university authorities, there is a need to make changes in medical education that will reflect the global best practices.

Knowledge of varieties of learning preferences from this study calls for a change from the original large-group teacher-centered lecturing to interactive, small-class student-centered lecturing.

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## Conflicts of interest

There are no conflicts of interest.

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