An Assessment of Learning Styles among Undergraduate Medical Students at King Saud bin Abdulaziz University (KSAUHS), King Saud University (KSU) and Imam Mohammad Ibn Saud Islamic University (IMSIU)

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Abstract

Background

Learning style refers to how students prefer to receive, process and recall information. Research in academia suggests that different teaching strategies could have an impact on learning style. The study aims to identify the learning style of medical students in three different universities in Riyadh, Saudi Arabia.

Method:

This cross-sectional study examined the learning preferences among medical students in basic science years in three universities in Riyadh, Saudi Arabia. By using consecutive sampling, we collected 316 responses. The questionnaire consisted of sociodemographic data and Index of Learning Style (ILS) instrument. Descriptive data were analyzed using chi-square by SPSS.

Results

Of the 316 participants, the male to female ratio was 1:1. Gender was associated with significant difference in the visual/verbal dimension ($P = 0.034$). Irrespective of college, most of the participants are primarily balanced in active/reflective (mean = 0.7), with slight shift toward sensing (mean = -3.2), visual (mean = -3.2), and sequential (-1.7). Significant differences between colleges were found in sensing/intuitive ($P = 0.005$) and sequential/global ($P = 0.012$) dimensions. There was no significant association between academic years with learning style in the three universities.

Conclusion

The study showed that age and GPA had no association with students' learning styles, while gender was significantly correlated with the visual/verbal dimension. Most of the participants can learn alone, and/or in groups, and prefer visual illustrations supported by hands-on teaching in a stepwise process. It has also been shown that students in a single university tend to develop the same learning styles as they advance through the years.

Introduction:

Recently, medical education has shifted from traditional, teacher-focused learning into a student-centered approach. Knowledge of the favorable student learning style can enhance the learning process as well as student performance, and provide a better understanding of the learning difficulties that learners may encounter.(1) Learning style, also known as "learning modalities," "learning strategies," "approaches to learning," refers to how students prefer to receive, process, and recall the information.(2, 3) Learning style questionnaires are an essential tool to identify the pros and cons of the applied learning strategy and create better programs that meet the student's needs.(4) Generally, student learning can be enhanced when the medical curriculum includes a variety of teaching methods suitable for different learning styles.(3) It can be argued, however, that the influence of the medical curriculum type on students' learning style preferences is not well studied.

The student-centered approach focuses on delivering information in various ways to different students. It is crucial to use effective tools that help identify specific types of learning styles. Many instruments have been invented to determine students' learning styles to make the most of their abilities. Visual, Aural, Read/Write, and Kinesthetic (VARK) is a case in point, developed by Fleming.(5) VARK divides learners into Visual, Auditory, Write/Read, and Kinesthetic. While VARK is easy to use and provides reliable results, it depends mainly on the sensory modality to obtain the information rather than the process of how students comprehend new information. On the other hand, Kolb's learning style inventory (K-LSI) is a widely used tool for the identification of the different learning styles.(6) K-LSI divides learners into four main learning styles: divergent, assimilator, convergent, and accommodator, based on experiential learning theory (ELT) by David Kolb.(6) Another learning style instrument is the Index of Learning Styles (ILS), invented by Richard M. Felder and Linda K. Silverman.(7–10) ILS has been recently validated for research in the medical field(11–13), and several studies utilized ILS due to its simplicity and accessibility.(14–16) It has four dimensions: active/reflective, sensing/intuitive, visual/verbal and sequential/global. Every dimension has two categories, and learners could be strong in one category or balanced.

In Saudi Arabia, several studies have been conducted to determine the learning style preferences of medical students.(17–22) These studies used a variety of tools to determine the learning styles of the participants;(5–7, 23) however, none compared the different learning styles of medical students in colleges.

Due to the limitations of global and local research on the impact of different learning strategies on the development of learning styles, this study aims to identify the learning styles of medical students in three universities, namely King Saud bin Abdulaziz University for Health Sciences (KSAUHS), King Saud University (KSU) and Imam Mohammad Ibn Saud Islamic University (IMSIU). Each university follows a distinct learning strategy. In KSAUHS, the main principle is self-directed learning represented by three Problem-Based Learning (PBL) sessions per week during the pre-clinical phase where students are innovative and active throughout the learning process. KSU adopts an approach to teaching in which lectures are the primary focus. Finally, IMSIU uses a hybrid approach to teaching strategies, focusing on lectures, and student-centered learning such as PBL. This study compares the different learning styles adopted in the three universities.

Method:

This cross-sectional study was conducted on pre-clinical year students in three medical colleges at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), King Saud University (KSU), and Al-Imam Mohammad Ibn Saud Islamic University (IMSIU) in Riyadh, Saudi Arabia. Only colleges that share a similar PBL-based curriculum were included. Students in the preparatory year and clinical year programs, interns, and incomplete ILS responses were excluded. Prior to data collection, an IRB approval was obtained from King Abdullah International Medical Research Center (KAIMRC). Informed consent was secured before participants' enrollment in the study.

By using consecutive sampling techniques, we collected data from 334 pre-clinical year medical students in three universities. Out of 334 students, we excluded 18 questionnaires with missing data. We used a self-administered Index of Learning Styles (ILS) questionnaire to assess the different learning styles, developed by Richard M. Felder and Barbara A. The Index of Learning Styles (ILS) was distributed among students along with sociodemographic data, including age, gender, university, basic medical year, and GPA. The ILS has four dimensions: active/reflective, sensing/intuitive, visual/verbal, and sequential/global. Each dimension consists of 11 statements (a total of 44 statements) and has 2 options: (A) which scores for active, sensing, visual, and sequential, and (B) which corresponds to other categories in the dimensions. The highest score in A or B determines the participant's inclination towards that learning style. The learner's styles in each dimension are represented as follows:

1- Knowledge procession:

2- Knowledge perception:

3- Knowledge input:

4- Knowledge comprehension:

We utilized Google forms for data entry and SPSS version 22 for data analysis. We presented categorical data as percentages and frequencies and used chi squared test to compare students' learning styles. For numerical data, we calculated mean and standard deviation. A P value less than 0.05 was considered statistically significant.

Results:

A total of 316 responses were found eligible. The male to female ratio was 1:1. Most of the students were in the 20-year-old age group. The most received responses were from IMSIU (36%), as 40% of the participants have a 5–4.75 GPA. The complete demographic information is illustrated in Table 1. Irrespective of college, most of the participants are primarily balanced in active/reflective (mean = 0.7), with slight shift toward sensing (mean =-3.2), visual (mean =-3.2), and sequential (-1.7).

Table 1
Participants' characteristics

	Frequency	Percentage
Gender		
Male	158	50%
Female	158	50%
Age		
18–19 Years	71	22.6%
20 Years	103	23.8%
21 Years	90	28.7%
22 + Years	50	15.9%
University		
KSAUHS	90	28.4%
KSU	113	35.6%
IMSIU	114	36.0%
Year		
First year	134	42.3%
Second year	156	49.2%
Third year	27	8.5%
GPA		
5-4.75	117	39.9%
4.74–4.50	98	33.5%
4.49–4.25	77	26.2%
Learning Style		
Active/Reflective		
active	38	12%
Balanced	213	67.2%
reflective	66	20.8%
Sensing/Intuitive		
Sensing	151	47.6%
balanced	138	43.5%
Intuitive	28	8.8%
Visual/Verbal		
Visual	136	42.9%
Balanced	162	51.1%
Verbal	19	6%
Sequential/Global		
Sequential	81	25.6%
Balanced	218	68.8%
global	18	5.7%
KSAUHS: King Saud bin Abdulaziz University for Health Sciences. KSU: King Saud University. IMSIU: Imam Mohammad ibn Saud Islamic University.		

Table 2 represents the association of participants' learning styles with gender, age, and GPA. A significant difference between males and females was shown in the visual/verbal dimension ($P = 0.034$). Females (9.5%) were slightly more verbal than males (2.5%). Other demographic characteristics showed no association with learning styles.

Table 2
Association of participants' learning styles according to participants' characteristics

	Active/Reflective			Sensing/Intuitive			Visual/Verbal			Sequential/Global		
	Active	Balanced	Reflective	Sensing	Balanced	Intuitive	Visual	Balanced	Verbal	Sequential	Balanced	Global
Gender												
Male	18 (11.4)	103 (65.2)	37 (23.4)	79 (50)	66 (41.8)	13 (8.2)	70 (44.3)	84 (53.2)	4 (2.5)	40 (25.3)	112 (70.9)	6 (3.8)
Female	20 (12.7)	109 (69)	29 (18.4)	72 (45.6)	71 (44.9)	15 (9.5)	66 (41.8)	77 (48.7)	15 (9.5)	41 (25.9)	105 (66.5)	12 (7.6)
P-value	0.537			0.723			0.034			0.327		
Age:												
18–19 Years	9 (12.7)	43 (60.6)	19 (26.8)	34 (47.9)	32 (45.1)	5 (7)	34 (47.9)	33 (46.5)	4 (5.6)	14 (19.7)	51 (71.8)	6 (8.5)
20 Years	14 (13.6)	69 (67)	20 (19.4)	44 (42.7)	51 (49.5)	8 (7.8)	42 (40.8)	54 (52.4)	7 (6.8)	30 (29.1)	68 (66)	5 (4.9)
21 Years	10 (11.1)	61 (67.8)	19 (21.1)	48 (53.3)	33 (36.7)	9 (10)	37 (41.1)	48 (53.3)	5 (5.6)	27 (30)	60 (66.7)	3 (3.3)
22 + Years	5 (10)	37 (74)	8 (16)	24 (48)	20 (40)	6 (12)	22 (44)	26 (52)	2 (4)	10 (20)	37 (74)	3 (6)
P-value	0.794			0.646			0.96			0.517		
GPA:												
5-4.75	9 (7.7)	80 (68.4)	28 (23.9)	53 (45.3)	53 (45.3)	11 (9.4)	49 (41.9)	57 (48.7)	11 (9.4)	27 (23.1)	81 (69.2)	9 (7.7)
4.74–4.25	17 (17.3)	61 (62.2)	20 (20.4)	49 (50)	40 (40.8)	9 (9.2)	40 (40.8)	53 (54.1)	5 (5.1)	25 (25.5)	69 (70.4)	4 (4.1)
< 4.25	10 (13)	55 (71.4)	12 (15.6)	35 (45.5)	36 (46.8)	6 (7.8)	37 (48.1)	39 (50.6)	1 (1.3)	24 (31.2)	51 (66.2)	2 (2.6)
P-value	0.182			0.932			0.18			0.411		

The comparative assessment of medical students' learning styles in the three universities revealed similar patterns among students, in particular the active/reflective and visual/verbal dimensions. Negative mean indicates preference of learning toward active, sensing, sequential, and visual, while positive mean indicates preference toward reflective, intuitive, global, and verbal. The mean of active/reflective is 0.9, 0.6, and 0.6 for KSAU-HS, KSU, and IMSIU, respectively. The equal mean is shown in visual/verbal category – 3.6, -3, and – 3.2 for KSAU-HS, KSU, and IMSIU, while the mean (-2.5) is slightly less sensing in KSU than KSAU-HS (-3.3) and IMSIU (-3.7) participants. Also, KSU students have a more balanced mean (-1) in sequential/global dimension compared with KSAU-HS (-1.7) and IMSIU (-2.2) students. In sensing/intuitive and sequential/global categories, there was a marked difference in the median, minimum, and maximum results, as shown in graph 1. The median (-3) of IMSIU was shifted to sequential in comparison to KSAU-HS and KSU, while KSU participants had narrower quartiles than KSAU-HS and IMSIU. KSU median was less sensing (-3) in comparison to KSAU-HS (-4) and IMSIU (-5).

The comparative assessment also showed no significant association in the active/reflective and visual/verbal dimensions. However, a significant association between universities in sensing/intuitive ($P = 0.005$) and sequential/global ($P = 0.012$) categories was reported. In the active/reflective dimension, two quarters of each college are balanced. KSAU-HS (50%) and IMSIU (57.9%) participants shifted toward sensing while most KSU participants were balanced. In visual/verbal and sequential/global categories, most of the participants were balanced (Table 3).

Table 3
Association of participants' learning styles according to participants' university

	Active/Reflective			Sensing/Intuitive			Visual/Verbal			Sequential/Global		
	Active	Balanced	Reflective	Sensing	Balanced	Intuitive	Visual	Balanced	Verbal	Sequential	Balanced	Global
KSAUHS	7 (7.8)	68 (75.6)	15 (16.7)	45 (50)	38 (42.2)	7 (7.8)	40 (44.4)	45 (50)	5 (5.6)	24 (26.7)	63 (70)	3 (3.3)
KSU	15 (13.3)	73 (64.6)	25 (22.1)	40 (35.4)	64 (56.6)	9 (8)	48 (42.5)	57 (50.4)	8 (7.1)	20 (17.7)	81 (71.7)	12 (10.6)
IMSIU	16 (14)	72 (63.2)	26 (22.8)	66 (57.9)	36 (31.6)	12 (10.5)	48 (42.1)	60 (52.6)	6 (5.3)	37 (32.5)	74 (64.9)	3 (2.6)
P-value	0.371			0.005			0.973			0.012		
KSAUHS: King Saud bin Abdulaziz University for Health Sciences. KSU: King Saud University. IMSIU: Imam Mohammad ibn Saud Islamic University.												

There was no significant association between academic years in each university, but it should be noted that a slight insignificance ($P = 0.064$) was found in the visual/verbal category in IMSIU. The visual/verbal domain in IMSIU showed that as students progress towards last year of basic science, they become more balanced (74.1%) in comparison with first (43.5%) and second (48.8) years, respectively. (See Table 4)

Table 4
Association of participants' learning styles according to participants' academic year

	Active/Reflective			Sensing/Intuitive			Visual/Verbal			Sequential/Global		
	Active	Balanced	Reflective	Sensing	Balanced	Intuitive	Visual	Balanced	Verbal	Sequential	Balanced	Global
KSAUHS												
First year	2 (7.4)	21 (77.8)	4 (14.8)	14 (51.9)	11 (40.7)	2 (7.4)	12 (44.4)	13 (48.1)	2 (7.4)	9 (33.3)	17 (63)	1 (3.7)
Second Year	5 (7.9)	47 (74.6)	11 (17.5)	31 (49.2)	27 (42.9)	5 (7.9)	28 (44.4)	32 (50.8)	3 (4.8)	15 (23.8)	46 (73)	2 (3.2)
P-value	0.943			0.974			0.876			0.628		
KSU												
First year	6 (9.8)	42 (68.9)	13 (21.3)	19 (31.1)	36 (59)	6 (9.8)	29 (45.9)	29 (47.5)	4 (6.6)	12 (19.7)	41 (67.2)	8 (13.1)
Second Year	9 (17.3)	31 (59.6)	12 (23.1)	21 (40.4)	28 (53.8)	3 (5.8)	20 (38.5)	18 (53.8)	4 (7.7)	8 (15.4)	40 (76.9)	4 (7.7)
P-value	0.451			0.499			0.727			0.487		
IMSIU												
First year	3 (6.5)	32 (69.6)	11 (23.9)	27 (58.7)	16 (34.8)	3 (6.5)	23 (50)	20 (43.5)	3 (6.5)	16 (34.8)	29 (63)	1 (2.2)
Second Year	20 (24.4)	22 (53.7)	9 (22)	25 (61)	11 (26.8)	5 (12.2)	20 (48.8)	20 (48.8)	1 (2.4)	12 (29.3)	29 (70.7)	0 (0)
Third Year	3 (11.1)	18 (66.7)	6 (22.2)	14 (51.9)	9 (33.3)	4 (14.8)	5 (18.5)	20 (74.1)	2 (7.4)	9 (33.3)	16 (59.3)	2 (7.4)
P-value	0.19			0.737			0.064			0.401		
KSAUHS: King Saud bin Abdulaziz University for Health Sciences. KSU: King Saud University. IMSIU: Imam Mohammad ibn Saud Islamic University.												

Discussion:

One of the most effective ways to achieve quality education in student-centered learning is to identify and adapt the learning styles to the education system, which can ultimately improve students' learning performance. To this end, we identified the learning styles of basic science year medical students and found discrepancies in the learning styles between the three universities.

Irrespective of college, most of the participants are primarily balanced in active/reflective with a slight shift toward sensing, visual, and sequential, which means they can learn effectively from active discussions in groups, or independently, and think the situation through before acting. Also, they slightly prefer facts and use visual materials such as pictures, graphics, and books for stepwise learning. A study conducted on undergraduate health education students ($n = 505$) showed similar results.(24) Out of 505 participants, 72 Pre-medicine students are more likely to be reflective (56.9%), sensing (83.4%), visual (76.4%), and sequential (70.8).(24) First-year medical students' learning preferences were sensing (54.9%), active (50.9%), sequential (60.5%), and visual (80.8%) with medians equal - 0.9, 0.7, -0.8, and - 5.1, respectively.(15) Two studies revealed that participants were mainly more visual (76.7% and 90%) and sensing (79.3% and 64%).(25, 26)

The current study reported a significant difference between colleges and information perception $P = 0.005$ (sensing/intuitive dimension). About 90% of the participants shifted toward sensing and balanced. Only KSU had more balanced participants than sensing. The higher number of sensing learners in IMSIU could be attributed to the intensive teaching sessions, as sensing learners prefer to learn facts, solve problems, and perform hands-on tasks and dislike being tested on materials that have not been fully explained during the sessions. On the other hand, KSAUHS deliver less lectures, and provide more PBL's and case-discussions. The sessions conducted KSAUHS offer general information about the subject and depend mostly on self-learning. For example, case-discussions and PBL are introduced to encourage students to become more active and articulate when sharing their thoughts and ideas with colleagues, while the tutor, i.e. supervisor, corrects mistakes and directs the session with limited interference. Generally, KSAUHS and IMSIU has PBL case every week. KSU curriculum has lower number of PBL in comparison for the other universities. For example, foundation block includes 4 PBL cases in 13 weeks duration while musculoskeletal block include 3 in 7 week duration.

It is usually assumed that medical students are more sequential (learning stepwise) than global (gaining knowledge by covering a lot of ground). Medical students learn step-by-step because the nature of subjects studied, for example microbiology, anatomy, and embryology, requires a process of incremental phases that reflect the sequential aspect. However, KSU students tend to be more global than KSAU-HS, and IMSIU with significant difference ($p = 0.012$). Similarly, a study conducted in 2014 to identify the differences between learning styles in Indian versus Malaysian medical schools showed no difference

between the students.(27) However, the study includes only two categories, for example, sensing and global without including balanced learners. In this study, the learning styles of junior medical students were comparable to those of the seniors. The lack of distinctiveness between the two groups indicates that if medical students failed to adapt or improve their learning styles, they would likely develop a static form of learning throughout college.

In this data, gender was not associated with the learning styles of medical students, except in the visual/verbal category. Though both have low verbal preference, it was slightly higher in females than in males. Females are more likely to learn from listening, writing, and reading than males. A study that uses the ILS instrument showed that there is a gender difference in learning, where females are more sequential than males.(15) A study carried out in Saudi Arabia, which adopts the VARK questionnaire, showed that gender affects learning preferences among medical students ($P = 0.019$).(28) Another study targeting physiology students revealed that there is a gender gap in learning .(29) In contrast, a study on first-year medical students concluded that there is no gender difference. (30) In the present study, GPA was not associated with the learning styles. The results correspond with the findings of other studies that reported a similar conclusion.(30, 31)

The study highlights the importance of learning preferences among medical students. Educators are advised to incorporate discussions and hands-on activities into the classroom, and students should be given enough time to grasp new information. Through visual illustrations, step-by-step learning could be highly beneficial. Educators should also evaluate their teaching methods to determine whether the instructional materials complement students' learning preferences. For example, some educators tend to give lectures in a disjointed manner, where they jump from one point to another, then return to the previous point. In this class, students with sequential learning style, most of whom are medical students, may find it difficult to keep up with the progress of the lesson.

Despite the pedagogical benefits of the study, it has some limitations. The cross-sectional design was one of the drawbacks that proved inadequate to determine a causal relationship. Further, the sample was considerably small and only examined the pre-clinical years. It is recommended to opt for longitudinal studies on a larger sample, including clinical-year students, which will provide more reliable data on the learning preferences among medical students in Saudi Arabia.

Conclusion:

The study showed that age and GPA had no association with students' learning styles, while gender was significantly correlated with the visual/verbal dimension. Most of the participants can learn alone, and/or in groups, and prefer visual illustrations supported by hands-on teaching in a stepwise process. It has also been shown that students in a single university tend to develop the same learning styles as they advance through the years.

Abbreviations

KSAUHS
King Saud bin Abdulaziz University for Health Sciences.
KSU
King Saud University.
IMSIU
Imam Mohammad Ibn Saud Islamic University.
VARK
Visual, Aural, Read/Write, and Kinesthetic.
K-LSI
Kolb's learning style inventory.
ELT
experiential learning theory.
ILS
Index of Learning Styles.

Declarations

Ethical approval and consent to participate:

Prior to data collection, an IRB approval was obtained from King Abdullah International Medical Research Center in Riyadh city. Informed consent was secured before participants enrollment in the study. The identity of the participants shall be kept anonymous and confidential.

Consent for publication:

Not applicable

Availability of data and material:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interest:

The authors declare that they have no competing interests

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Authors' contributions:

- AF: contributes effectively in data collection from KSAUHS and writing and Coordinate between the authors
- OF: contributes effectively in data collection from KSU and writing:
- RE: contributes effectively in data collection from KSAUHS and writing
- AT: contributes effectively in data collection from IMSIU and writing
- KS: contributes effectively in data collection from IMSIU and writing
- AO: contributes effectively in data analysis
- SA: provides supervision, revision, and guidance of the project.
- MM: provides supervision and participate in the conception of the project.

All authors read and approved the final manuscript.

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Figures

KSAUHS: King Saud bin Abdulaziz University for Health Sciences. KSU: King Saud University. IMSIU: Imam Mohammad ibn Saud Islamic University. ACT: active. REF: reflective. SNS: sensing. INT: intuitive. SEQ: sequential. GLO: global. VIS: visual. VRB: verbal. The score range is from +11 to -11.

Figure 1

Graph 1: Box whisker plot of participants' learning styles according to participants' university