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Original Article

Learning styles and satisfaction with educational activities of Saudi Health Science University Students

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الملخص

أهداف البحث: تتغير المعرفة الطبية باستمرار مما يشكل ضغطا على المعلمين لتكييف استراتيجيات تعليمية مناسبة لأسلوب تعلم طلابهم. لذلك، قد يساعد تحديد أسلوب تعلم طلاب الطب المعلمين في تطوير استراتيجيات التدريس لتحقيق مخرجات أفضل. كان الغرض من هذه الدراسة هو تحديد أسلوب تعلم طلاب جامعة علوم صحية، وتقييم العلاقة بين أسلوب التعلم والرضا عن الأنشطة التعليمية.

طرق البحث: أُجريت هذه الدراسة الوصفية المستعرضة في كليات الطب والعلوم الطبية التطبيقية، بجامعة الملك سعود بن عبد العزيز للعلوم الصحية بجدة. استخدمنا أسلوب ديفد كولب للتعلم والدراسة الاستقصائية المعدلة عن رضا الطلاب من كلية موط للمجتمع في ميشيجن. تم توزيع استبانة ذاتية التعبئة لجميع المشاركين واستخدام أسلوب التعلم والبيانات الديموغرافية كمتغيرات تنبئية. واعتبار مستوى رضا الطلاب المتغير الناتج.

النتائج: شارك ٣٥٩ طالبا (متوسط العمر ١٩٫٠ +/- ١٫٤ عاما، ٥٣٫٥٪ ذكور). كان أسلوب التعلم الأكثر شعبية الأسلوب التوافقي (٢٩٫٢٪)، يليه الأسلوب الاستيعابي (٢٧٫٩٪) والأسلوب التشعبي (٢٥٫٦٪)، في حين أن الأسلوب التقاربي (١٧٫٣٪) كان أسلوب التعلم الأقل تفضيلا. أظهرت درجات رضا الطلاب أنهم راضون بشكل عام، بدرجة متوسطة قيمتها ٦٤٫٤٪. وُجد أن الذكور لديهم رضا أعلى في جميع المتغيرات مقارنة بالإناث.

الاستنتاجات: لم تستطع هذه الدراسة العثور على أسلوب تعلم غالب أو اختلاف رضا عبر أساليب التعلم بين طلاب العلوم الصحية. وبالتالي، فإن البرامج التعليمية الحالية بجامعة الملك سعود بن عبد العزيز للعلوم الصحية تلبي أساليب تعلم الطلاب ورضاهم. يحتاج المعلمون إلى توسيع استراتيجياتهم لتشمل تعليمات لبناء بيئة تعليمية فعالة.

الكلمات المفتاحية: أساليب تعلم؛ رضا الطلاب؛ طلاب الطب؛ توافقي؛ استيعابي

Abstract

Objectives: Medical knowledge is constantly changing; this puts pressure on educators to adapt instructional strategies to their students' learning styles (LSs). Therefore, identifying the LSs of medical students could help teachers to develop teaching strategies to achieve better outcomes. The purpose of this study was to determine the LSs of health science university students, and to assess the relationship between LSs and student satisfaction with educational activities.

Methods: This cross-sectional descriptive study was conducted in the Colleges of Medicine and Applied Medical Sciences, King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) Jeddah. We used Kolb's LS and a modified Student Satisfaction Survey from Mott Community College, Michigan. All participants received self-administered questionnaires; LS and demographic data were used as predictor variables. Students' satisfaction levels were considered the outcome variable.

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Results: A total of 359 students were recruited (mean age 19.0 ± 1.4 years; 53.5% males). The most popular LS was Accommodator (29.2%), followed by Assimilator (27.9%) and Diverger (25.6%), while the Converger style (17.3%) was the least preferred LS. The satisfaction scores of the students showed that they were generally satisfied with a mean score of 64.4%. Males were found to have higher satisfaction across all variables than females ($p = 0.002$).

Conclusions: This study could not find a predominant LS or satisfaction difference across LSs among health science students. Thus, the current educational programmes in KSAU-HS meet students' LSs and satisfaction. Educators need to broaden their strategies for instruction, so as to build an effective learning environment.

Keywords: Accommodator; Assimilator; Learning styles; Medical students; Student satisfaction

Introduction

Recent trends have focused on student-centred learning instead of a traditional teacher-centred approach, and on understanding how students acquire and process information.[1] Since each student has a distinctive way of learning, understanding their weaknesses and strengths in this respect will help teachers devise appropriate teaching techniques. Over time, medical knowledge has undergone a series of changes leading to revisions in the curriculum and putting pressure on educators to adapt their instructional strategies to better suit their students' learning styles (LSs). Therefore, identifying medical students' preferred LSs is important, as this can help teachers develop pedagogical strategies that can lead to better outcomes. It can also help the faculty determine a variety of ways in which information can be disseminated among students.[2] There are a variety of LS models, the most common ones being the Kolb model[3] (experiential learning theory); the Honey and Mumford model[4] (a modified version of Kolb's experiential model); and Fleming's VAK/VARK model[4] (categorizing individuals into visual, auditory, read/write and kinaesthetic learner categories). All LSs are equally important, and knowing them allows teachers to choose from a wide array of instructional strategies.

Kolb defines learning as "the process whereby knowledge is created through the transformation of experience".[4] He describes learning as a cycle with four stages: concrete experience; observation and reflection; abstract concept formulation; and lastly, active experimentation.[4] Each LS is a unique way of obtaining information and is influenced by the individual's background and altered by his/her acquired knowledge and expectations in a particular situation.[4,5] Kolb's experiential learning theory outlines two linked approaches to gaining understanding: concrete experience and abstract conceptualization on the one hand and reflective observation and active experimentation (associated with transforming experience) on the other.[4,5] To ensure effective learning, individuals try to practice all four methods. LS theory suggests that each individual learns in a unique and characteristic manner, because of certain patterns of behaviour. However, since this process is circular in nature, it can evolve from one LS to the next with the passage of time. Nevertheless, it tends to reinforce an individual's strong points and the resilience of their experience-grasping and experience-transforming techniques. Subsequent LSs are a mixture of a person's favoured styles.

The four LSs are Diverger, Converger, Assimilator, and Accommodator.[6] These four LSs are defined according to the notion, put forward by Kolb, that learning preferences pertain to two continuums − active experimentation-reflective observation and abstract conceptualization-concrete experience. Convergers, who prefer active experimentation-abstract conceptualization, use the application of thought and deductive reasoning to solve problems.[5] Assimilators, who prefer reflective observation-abstract conceptualization, are highly capable of generating theoretical models via inductive reasoning: they outperform the users of the other three LSs when it comes to investigating and organizing wide-ranging material into a manageable format.[5] Accommodators, who prefer active experimentation-concrete experience, are more open to interacting with others and performing 'hands-on' work; furthermore, they respond well to on-the-spot situations and react to challenges spontaneously, instead of using logical analysis.[5] Finally, the Divergers, who prefer reflective observation-concrete experience, tend to use their imagination to solve problems. They are excellent at developing concepts, and can offer keen insights from diverse perspectives.[5]

These LSs are influenced by five patterns of behaviour − culture, personality type, educational specialization, career choice, current job and tasks.[7] Kolb's LS inventory (LSI) is a widely used instrument that is employed by medical students and experts to postulate the LSs of different individuals.[4−6] Studies show that students with specific LSs prefer specific subject areas, and that this may influence their preference for specific teaching methods.[7,8] In a study involving public health students, Piane et al. showed that LS can predict test scores; thus, Assimilators got considerably higher theoretical exam scores and course grades than users of the other three LSs.[9] Many studies have looked into student success and satisfaction with traditional training and student-centred learning methods such as PBL. However, there are very few studies that have assessed health care students' satisfaction with educational activities and their academic achievements in relation to their LSs.[9]

The LS technique is an emerging, though greatly underutilized, approach that is and can improve classroom academics if properly identified. The purpose of this study was to identify the different learning styles employed by health science university students at King Saud bin Abdulaziz University for Health Sciences (KSAU-HS), Jeddah, and to examine the relationship between LS and student satisfaction with educational activities at KSAU-HS.

Materials and Methods

The present study was carried out at the Jeddah campus of King Saud bin Abdulaziz University for Health Sciences (KSAU-HS) in KSA. There are four colleges on campus, namely the College of Medicine, the College of Applied Medical Sciences (AMS), the College of Nursing and the College of Science and Health Professions, with over 2000 male and female students. Convenience sampling was done, and all available students who agreed to contribute to the study were included. The study sample consisted of 359 students from the College of Applied Medical Sciences and the College of Medicine (Medicine and Stream II-Medicine). Convenience sampling was also conducted, and targeted students attending AMS and the College of Medicine.

Instruments

The survey instruments comprised Kolb's Learning Styles Inventory (LSI) (Version 3.1),[6] previously used in a well-validated study of medical students, and a satisfaction questionnaire based on the Mott Community College Student Satisfaction Survey of the MCC Institutional Research Office in Flint, Michigan.[10] These instruments were also used in our previous study on pediatricians.[11] The questions in the satisfaction questionnaire were grouped into four themes: (1) the general environment of the college and the university, as well as the relationship between the students, the faculty, and the administration; and the institutional appreciation and recognition of students and their achievements; (2) available educational facilities, such as classrooms, audio-visual media, and computer and Internet services; (3) theoretical academic activities conducted in the colleges, such as lectures, tutorials and case presentations; and (4) practical academic activities conducted in the colleges or at the hospital, such as clinical rounds, simulation sessions (e.g., BLS, PALS and NRP courses), educational procedures and workshops.

Data analysis

This was a cross-sectional study, the purpose of which was to collect quantitative data on two key variables − LS and student satisfaction levels − from each college. These variables were studied using the two questionnaires mentioned above.[6,10,11] The predictor or grouping variables comprised demographic data such as age, gender, nationality, and college that the student belonged to (Applied Medical Sciences or Medicine) and LS. The outcome variable was the student's satisfaction level/score. For the data analysis process, the subjects in the study were assigned to one of two groups: AMS Students or Medicine Students. The levels of satisfaction in these two groups were compared and analysed with respect to the four LSs.

The data were entered and analysed using the Statistical Package for Social Sciences software (SPSS) v.23. Descriptive statistics are presented as frequencies and as percentages of categorical variables such as gender, nationality, LS, and college of the student (AMS and Medicine). Mean ± standard deviation was presented for numerical variables (e.g., age and satisfaction score). A 95% confidence interval was determined for the outcome variable (satisfaction score). Chi-square and analysis of variance (ANOVA) were used to compare satisfaction scores across the two student categories and the four LSs (categorical variables). Students' t-tests were used to draw comparisons between the four themes of satisfaction, and the gender or position (continuous variables and categorical variables) of the two groups. ANOVA was used to compare the four themes of satisfaction and the LSs. A p-value of <0.05 was considered significant for the statistical tests.

Validity

We used the previously modified Mott Community College survey to accommodate our local educational activities.[11] The modified questionnaire was reviewed and validated by two faculty members from the Department of Medical Education for the local study setting (face validity). The modified questionnaire had a high level of readability, as was apparent from our previous study.[10] This was confirmed by a high Flesh-Kincaid Readability Ease score, indicating that the sentences were clear and easy to understand and unlikely to cause confusion among participants (content validity).[10]

Reliability

For reliability analysis, Cronbach's alpha coefficient was computed for the five Likert scale statements of satisfaction with education. The values of the coefficient were 0.88 for overall satisfaction statements; 0.76 for environment of education statements; 0.81 for facilities of education statements; 0.76 for practical education statements; and 0.77 for theoretical education statements. The results ensured an appreciable level of reliability as all coefficients were greater than 0.75.

Results

A total of 359 students participated in the study. Fifty percent of the students (n = 180) were from AMS, while 49.9% of the sample were students from the College of Medicine (n = 179), as shown in Table 1. The students were equally distributed by gender, with males and females constituting 192 (53.5%) and 167 (46.5%), respectively, of the study population. The mean age of students was found to be 19.0 ± 1.4 years. Almost two-thirds of the students came from government secondary schools and had strong academic records as evidenced by the mean values of their secondary school GPAs, achievement scores, aptitude scores, and their current King Saud bin Abdulaziz University (KSAU) GPAs.

The overall distribution of the four LS types in this study is shown in Figure 1, with the Accommodator style having the highest number (n = 105) of students (29.2%), followed by the Assimilator style (27.9%) and the Diverger style (25.6%). The Converger style (17.3%) was found to be the least prevalent among students. The distribution of student LSs according to gender and college is shown in Table 2. Males had the highest proportion of Assimilators (32.8%) compared to females (22.2%), while females had

Table 1: Student characteristics (N = 359).

Characteristic	N (%)
College	
Applied Medical Sciences	180 (50.1)
Medicine	179 (49.9)
Gender	
Male	192 (53.5)
Female	167 (46.5)
Age (years)	19.0 ± 1.4
Type of secondary school	
Government	252 (70.8)
Private	105 (29.2)
Academic performance indicators	
Secondary school GPA (Maximum = 100)	97.4 ± 5.5
Achievement score (Maximum = 100)	88.2 ± 7.2
Aptitude score (Maximum = 100)	87.1 ± 4.8
Current KSAU GPA (Maximum = 5)	4.5 ± 0.58
Daily reading hours	
<2 h	112 (31.2%)
2−3 h	105 (29.2%)
3−5 h	86 (24.0%)
>5 h	56 (15.6%)
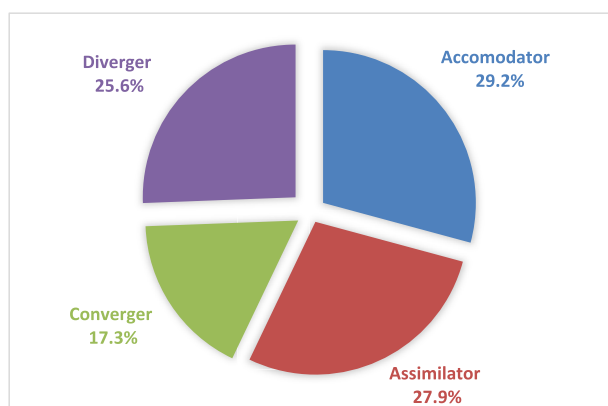
Figure 1: Distribution of learning styles: (N = 359).

the highest proportion of Divergers (29.3%) compared to males (22.4%), $\{X^2$ (df:3) = 9.21 (p = 0.027)\}. There was also a significant difference in student LSs across the various colleges (p = 0.049) as shown in Table 2 with the AMS students having the highest proportion of Divergers (31.7%), and medical students having the highest proportion of Assimilators (30.7%). This shows the range and variety of the LSs employed by the medical students.

An interesting finding, presented in Table 3, is the notable link between LS and the number of hours students spent reading on a daily basis (p = 0.04). The Accommodator style (33%) was predominant among students with low daily reading hours (<2 h), while the Assimilator style (35.7%) was predominant among students with high daily reading hours (>5 h). No significant differences were observed between LSs and students' secondary school GPAs, achievement scores, aptitude scores or current University GPAs (see Table 4).

The second part of the study focused on the satisfaction that participants felt with the educational programmes at their respective colleges. The responses to the satisfaction survey questions were totalled, and the percentage mean scores were calculated. Figure 2 shows the overall mean score for satisfaction with education at 64.4%. The satisfaction score for 'practical education' was lowest at 62.5% and the highest score was for 'educational facilities' at 69.6%. Looking at satisfaction scores according to gender, males were found to experience greater satisfaction in all components compared to females (p = 0.002), while both males (72%) and females (67%) had the highest satisfaction score with respect to educational facilities (p = 0.004) as shown in Table 5. No association was seen between AMS and College of Medicine students and their satisfaction scores. Different LS groups' satisfaction scores for 'educational program' were also compared using a one-way ANOVA as seen in Table 6.

Table 6 shows the overall distribution of the various LSs among the medical students. No significant differences was seen between LS groups and satisfaction scores in this study.

**Table 2: Learning style according to gender and college.**

	Total	Accommodator n (%)	Assimilator n (%)	Converger n (%)	Diverger n (%)	χ^2	P value
Gender							
Male	192	60 (31.2)	63 (32.8)	26 (13.5)	43 (22.4)	9.21	0.027
Female	167	45 (26.9)	37 (22.2)	36 (21.6)	49 (29.3)		
College							
AMS	180	52 (28.9)	45 (25.0)	26 (14.4)	57 (31.7)	7.88	0.049
Medicine	179	53 (29.6)	55 (30.7)	36 (20.1)	35 (19.6)		

Table 3: Learning style and daily reading hours.

	Total	Accommodator n (%)	Assimilator n (%)	Converger n (%)	Diverger n (%)	χ^2	P value
<2 h	112	37 (33.0)	20 (17.9)	19 (17.0)	36 (32.1)	17.821	0.037
2−3 h	105	33 (31.4)	33 (31.4)	13 (12.4)	26 (24.8)		
3−5 h	86	26 (30.2)	27 (31.4)	17 (19.8)	16 (18.6)		
>5 h	56	9 (16.1)	20 (35.7)	13 (23.2)	14 (25.0)		

Table 4: Differences in learning styles according to academic performance variables.

Variable	Learning style				F value	P value
	Accommodator Means + SD	Assimilator Means + SD	Converger Means + SD	Diverger Means + SD		
Secondary school GPA	98.1 + 1.8	96.6 + 9.7	97.5 + 2.4	97.4 + 5.5	1.25	0.29
Achievement score	87.9 + 9.9	88.8 + 5.5	88.4 + 6.2	87.9 + 5.4	0.36	0.78
Aptitude score	86.7 + 5.1	87.8 + 5.1	87.4 + 4.6	86.7 + 4.0	0.91	0.44
Current KSAU GPA	4.5 + 0.5	4.5 + 0.6	4.6 + 0.6	4.4 + 0.6	0.85	0.47
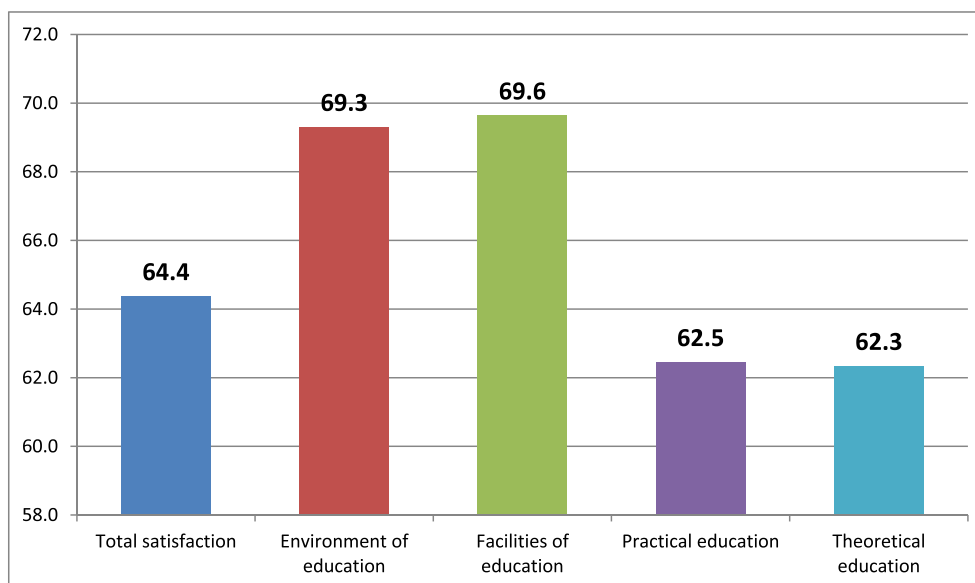
Figure 2: Satisfaction with education.

Table 5: Satisfaction and gender.

Satisfaction	Male (n = 192) Means + SD	Female (n = 167) Means + SD	t value	p value
Total satisfaction	66.3 + 14.1	62.2 + 10.8	3.093	0.002
Educational environment	71.6 + 14.8	66.7 + 14.7	3.112	0.002
Educational facilities	72.0 + 16.9	66.9 + 15.5	2.925	0.004
Practical education	65.3 + 17.6	59.2 + 17.9	3.281	0.001
Theoretical education	64.1 + 16.9	60.4 + 16.2	2.108	0.036

Table 6: Satisfaction and learning style.

Satisfaction	Accommodator (n = 105) Means + SD	Assimilator (n = 100) Means + SD	Converger (n = 62) Means + SD	Diverger (n = 92) Means + SD	F value	p value
Total satisfaction	64.6 + 11.9	63.7 + 13.5	64.8 + 12.4	64.6 + 13.6	0.133	0.94
Educational environment	69.0 + 13.3	69.2 + 15.2	71.0 + 15.2	68.7 + 16.3	0.327	0.81
Educational facilities	69.9 + 16.7	68.8 + 16.7	70.3 + 16.5	69.8 + 16.1	0.133	0.94
Practical education	63.0 + 17.7	61.4 + 19.1	63.9 + 17.3	62.0 + 17.6	0.304	0.82
Theoretical education	63.6 + 15.4	60.8 + 17.0	62.9 + 17.3	62.2 + 17.4	0.514	0.67

Discussion

Of the various LSs, three were uniformly distributed among 25%−29% of the students in this study, except for the Convergers (17.3%). This suggests that no one LS predominates and that a variety of learning techniques are needed to cater to the needs of all students − as seen in other studies targeting dental, nursing, and medical students.[12,13] While some studies found the Converger and Accommodator styles to be the predominant LS of medical

students, in this study participants demonstrated a slight preference for the Accommodator style.[14,15]

We found significant gender-based differences in LSs between other studies and our own, with the majority of males in our study being "reflective observation-abstract conceptualization" Assimilators and the majority of females being "reflective observation-concrete experience" Divergers.[1,16–19] A meta-analysis of gender differences in other academic fields conducted by Severiens and Ten Dam yielded similar results, where males were found to be more likely to favour an abstract mode of learning than females.[20] Using Fleming's VARK questionnaire, Wehrwein et al.'s study of physiology students' LS preferences found significant gender differences.[21] Using the VARK model, a similar (and significant) set of differences was observed between both male and female first-year medical students' LS preferences.[13,22] However, some results have shown no significant gender differences in LS groups.[16,23]

As was the case in previous studies, there was no evidence of significant differences between academic achievements and LS groups in this study either.[1,24,25] The overall student satisfaction scores in this study too indicated that a majority of the participants were satisfied with their educational program, which is consistent with the findings of an earlier study.[10] Our study identified significant differences between male and female students' satisfaction scores. The score for satisfaction with educational facilities was the highest among both males and females, while that for satisfaction with both theoretical and practical education was the lowest among males and females. We found no significant differences between the satisfaction scores of students from either of the two colleges.

In keeping with the findings of other studies, our study has shown no association between LS type and degree of satisfaction with instructional methods.[1,10] While Batista and Cornachione have demonstrated that LS does not influence perceived learning, or satisfaction with business-related studies, in the case of medical undergraduates in Istanbul, Gurpinar et al. have shown that LS does not predict student satisfaction with altered teaching methods.[1,19]

This study has several strengths. It had a well-designed survey, a sufficient number of participants, and well-validated instruments. It also provided student and institution-specific corroboration of data collected from different colleges and settings, particularly with regards to a possible relationship between LSs and satisfaction with educational activities. Therefore, the results of this study have many implications for both learning and teaching — especially in medical institutes and universities.

One limitation of this study is the quantitative nature of the data. Neither did our research generate sufficient in-depth qualitative data to provide useful information about the degree of participant satisfaction, nor did it comprehensively examine the reasons for participant dissatisfaction. We examined various independent variables that could affect the dependent variable (i.e., the level of satisfaction) such as gender, age, years of education, and educational background; however, not all of those independent variables could be used for actual adjustments to curricula. The study also involved a mixed population (medical and AMS students) who viewed satisfaction with instructional methods and learning from a wide variety of perspectives. Moreover, the study was performed only on second-year students; therefore, generalizing the study's findings to students at different stages of their respective programmes would require a more varied approach.

Conclusions

This is the first study of its kind to determine the link between LS and satisfaction among college students. The results of this study demonstrate that there are no significant disparities in the degree of satisfaction experienced by different LS groups, which suggests that educational programmes at KSAU-HS Jeddah, Kingdom of Saudi Arabia (KSA) do not need to be altered based on specific LSs to achieve student satisfaction. However, in the interests of generating more productive educational and instructional strategies, teachers need to vary their style and range of presentation. This will help to build a more effective and positive learning environment for students' varied LSs.

Recommendations

Further in-depth exploration is needed to determine the reasons for the high level of student dissatisfaction with educational facilities. We would also recommend that educators use a variety of learning methods in order to encourage students to adapt to different learning approaches and to avoid limiting themselves to a fixed set of LSs.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

The research proposal was approved by King Abdullah International Medical Research Center's (KAIMRC) IRB committee. All participants received an explanation letter in English to inform them of the purpose and execution of the study and how the data would be used. The cover letter accompanying the questionnaire stated that filling and returning the questionnaire would constitute consent to participate (informal consent).

An explanatory session was conducted by the principal investigator on how to complete the survey materials, and an Arabic translation of difficult words was provided. The principal investigator clarified any unclearly worded questions and collected the completed questionnaires. The self-administered questionnaire did not request any identifying information in order to maintain the confidentiality and anonymity of the participants. We used the serial number of the questionnaires as an identifying variable on

the data collection form, thus maintaining data confidentiality.

Authors contributions

AMS, AAD, and HMJ prepared the proposal and data collection sheet. Data were collected by AMS, AAD, and EBS. Data entry was done by AMS and MEA. Data were interpreted by MZH, MEA, and AAD. AMS, AAD, and MZH prepared and reviewed the initial and final drafts of the article and provided logistical support. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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