Evaluation of the Relationship Between Students' Learning Styles and Academic Engagement at the Faculty of Medicine, Zagazig University, Fakous Branch

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Abstract:

Background: **Individual learning differences personality, learning styles, techniques, and concepts are interrelated and collectively shape how effectively people learn. Personality can influence preferred learning styles and the motivation to use certain techniques, while learning styles may guide how individuals approach concepts. Effective learning techniques help bridge the gap between personal preferences and conceptual understanding, enhancing retention and comprehension.** *Aim:* **Enhance student engagement through exploring different learning styles.** *Materials and Methods:* **This analytical, cross-sectional design was conducted at the Faculty of Medicine, Zagazig University, Fakous Branch, to assess the preferred learning styles and its effects on students' engagement (1st, 2nd and 3rd year) students by using quantitative tools in the form of questionnaire: VARK Learning Styles Questionnaire- Arabic version, and Medical Students' Engagement Questionnaire.** *Results:* **Our study revealed that there was a significant positive relationship between student engagement and each learning style. The strongest correlation was observed in students with a visual learning style, followed by a strong correlation for those with a kinesthetic learning style and a moderate correlation for those with an auditory learning style. Which echoes the importance of increasing the understanding of learning styles for educators and students about their significance and consequences for enhancing medical education and developing more capable physicians.** *Conclusion:* **Most medical students prefer a unimodal learning style. First-year students predominantly use a kinesthetic learning style, while second- and third-year students favor an auditory learning style. We should increase our efforts in attracting students' attention, increasing their involvement in their studies, take their opinions and feedback into account and offer them a variety of activities within a learner-centered approach to accommodate the diverse styles present in the classroom which in turn will increase their engagement.**
Keywords: learning styles, academic engagement, medical education.

Introduction

Education is an approach of assisting learning, which includes the acquisition of knowledge, skills, values, beliefs, and behaviors. A student's preferred way for knowledge acquiring, interpreting, memorizing, and recall is known as their learning style [1].

Everyone has a particular learning style. A single learner may adapt one or several strategies of gaining knowledge [2].
The ways or the circumstances under which students perceive, store, process, and recall what they are trying to learn most efficiently and effectively are another description of learning styles [3].

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To determine learning preferences, numerous studies have been carried out globally in various departments. The Fleming and Baume method, which categorizes learning patterns into four sensory pathways: visual (V), aural (A), read/write (R), and kinesthetic (K), (VARK) is one of the most widely utilized. After observing classes for many hours, several various learning styles were identified. Every pupil has a preferred method that they prefer to use [4].

A complicated meta-construct that has been conceptualized in various ways is student engagement. Three separates, yet connected, elements of engagement: cognitive, behavioral, and emotional/affective make up the most common conceptual paradigm [5].

A fourth dimension, such as social engagement, was added by other researchers [6], academic engagement or agentic engagement [7].

Learning engagement and school engagement are two concepts that are conceptually distinct but linked, according to a recent definition of student engagement [8].

The multidimensional conceptual model was developed to help define the student involvement construct.

A general description of student involvement sees it as two theoretically distinguished aspects of students' academic experience in instruction, study, and research through interactions with other students, faculty, and the community at the cognitive (thinking), emotional (feeling), and psychological (doing) levels [9].

The mental resources that students devote to their study are reflected in the cognitive component of student engagement. Deep learning strategies, intense focus, reflection on learning activities, the estimation of the importance of academic assignments, and the use of higher-order skills are all examples of this. A student's emotional engagement is defined as the feelings they have in response to their teacher, learning environment, and peers. These sentiments encompass both negative and positive emotions, such as joy, pride, anxiety, enthusiasm, pleasure, and boredom [10]. Additionally, emotionally involved children feel a sense of attachment to their school, teachers, and friends [11].

Academic achievement and involvement in extracurricular activities are examples of behaviors that imply students are engaged. This entails showing up for class, participating in the activities, being persistent, participating in extracurricular activities, and paying attention to the lessons being taught [8].

The present work aims to improve the students' engagement clarifying and responding to various learning styles at the Faculty of Medicine, Zagazig University, Fakous Branch.

Subjects and methods

Design:

This analytic, cross-sectional study was conducted at the Faculty of Medicine, Zagazig University, Fakous Branch. The target population includes (1st, 2nd and 3rd) year medical students in the academic year 2023-2024, at the Faculty of Medicine, Zagazig University, Fakous Branch. This study was approved by our Institutional Review Board (IRB) on the twenty fifth of December 2022 (research.committee@med.suez.edu.eg) . The research was conducted in response to the World Medical Association's Code of

Ethics (Helsinki Declaration) for human research.

Methods:

Sampling was convenient as students volunteered to respond to the questionnaires that had been posted on official social media (e.g: Telegram and Facebook) groups of each year A total of 552 students responded exceeding the originally estimated sample size which was 210. Informed consent has been taken from all individuals in this investigation.

Main study variables: Independent: Learning styles. Dependent: Students' engagement. Background variables: gender, social level, type of School before joining the faculty and place of origin (rural and urban).

Data collection

The two questionnaires were used for data collection:

VARK Learning Styles Questionnaire – Arabic version:

The questionnaire includes 16 items and four alternatives for evaluating learning styles [12]. Visual (V) learners learn best by visualizing data, such as diagrams, charts, and mind maps. Auditory (A) learners learn better by hearing material. The Read/Write (R) learner understands best when knowledge is presented in words. The Kinesthetic (K) learner understands best through practice and modeling, students may select more than one response to each question.

The score was according to scoring table, each question has 4 options with category (a, b, c and d), each category measures visual, reading, auditory, and kinesthetic learning style.

There were four possible answers to each question, and each one assessed a single aspect of learning style. For each answer, participants might select more than one option. Every option connected to a specific style domain received a single score. In a single model, the lowest possible score was 0 and the highest possible score was 16. Furthermore, the multi-model approach had minimum and maximum scores of 16 and 64, respectively. A person's higher affinity for a particular learning style was indicated by a high score in each of the learning types. Individuals were classified as having multi-model learning styles if they received comparable scores in two or more of the fields.

Ultimately, the ultimate score was determined by adding together all the student responses, taking into account the choices made. Once the survey is finished, there are four learning modes that can be identified: unimodal (which includes visual, auditory, or tactile learning styles); bimodal (which includes two learning styles); trimodal (which includes three learning styles); or quadrimodal (which includes three learning types).

University Student Engagement Inventory

The questionnaire consists of 15 statements to assess the student engagement in the learning process. Maroco et al., [13] had documented evidence of adequate reliability, factorial, convergent and discriminant validities. Each item is scored on a five-point likert scale from 1 (Strongly disagree) to 5 (Strongly agree).

Ethical considerations:

Throughout the investigation, the following ethical guidelines were adhered to:

- The study protocol received approval from the faculty administration, including the dean and vice dean.

- Participants were informed that there would be no repercussions for opting out or withdrawing at any point.

- The study's objectives were clearly communicated to participants, who were kept informed of relevant developments.
- Participation was entirely voluntary, with no coercion involved.
- Key stakeholders, including research participants and institutional members, were provided with clear, concise information about the study's practical importance and findings.
- All collected data were kept confidential and anonymized to protect participants' privacy.
- The questionnaire was designed to ensure anonymity, preventing any risk of privacy invasion or data confidentiality breaches.
- Participants were assured of their right to skip any question they found inconvenient or stressful and to withdraw at any time.

Statistical Analysis:

Data were analyzed using SPSS version 25. The means and standard deviations were used to display the quantitative data. Mean and percentage were used for displaying the categorical data. Comparisons were performed using T test (for quantitative data) and chi square (for qualitative data). The correlation was done by Pearson's correlation. Significance was considered at p value of < 0.05.

Results

A total of 94 students were in the 1st medical year (48 males and 46 females), 310 were in the 2nd medical year (141 males and 168 females), and 147 were in the 3rd medical year (73 males and 75 females).

Most of the students in the 1st academic year, 76 (80.9%) have unimodal learning styles. About 5 (5.3%) students were visual learners, 18 (19.1%) students were auditory learners, 13 (13.8%) students were read /write learners, and 43 (45.7%) students were kinesthetic learners. (Figure. 1)
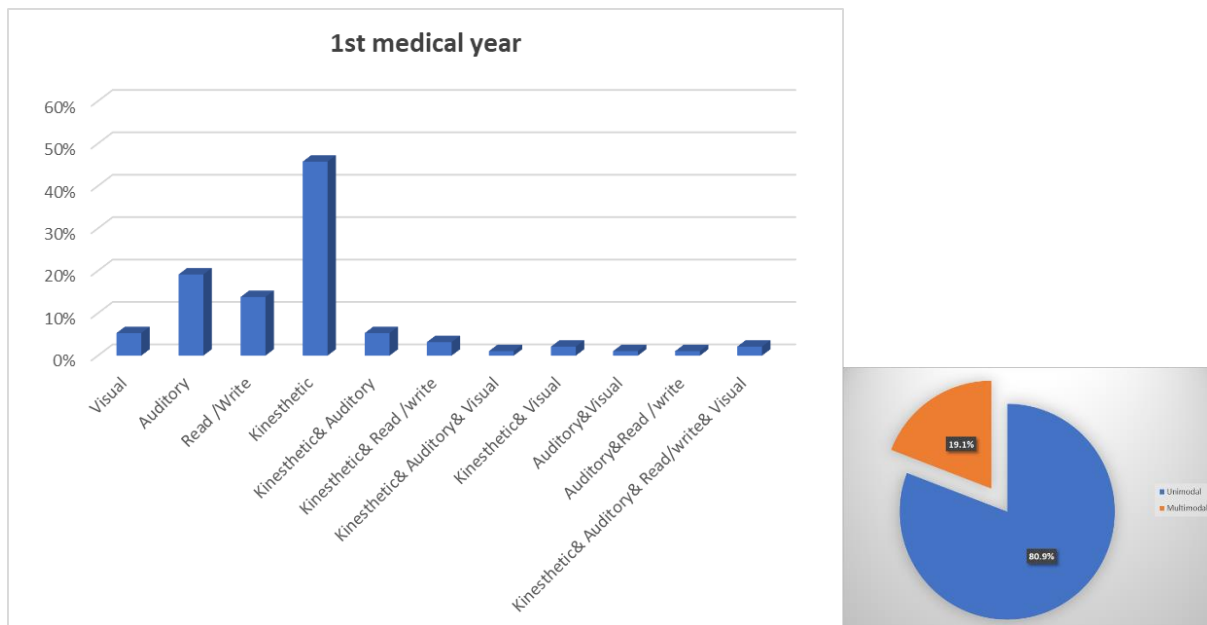

Figure 1: Learning styles among the 1st academic year students

Most of the students in the 2nd academic year 251 (81.0%) have unimodal learning styles. About 26 (8.4%) students were visual learners, 96 (31%) students were

auditory learners, 34 (11%) students were read /write learners, and 85 (27.4%) students were kinesthetic learners. 22

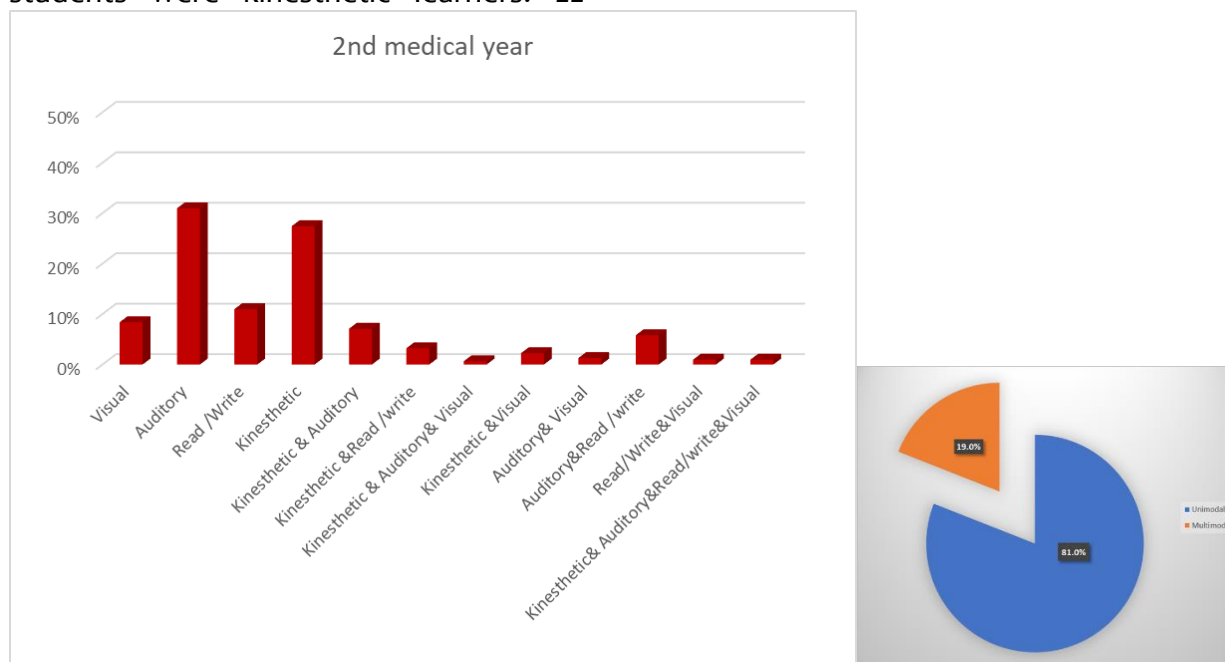(7.1%) students were kinesthetic& auditory learners. (Figure 2)

Figure 2: Learning styles among the 2nd academic year students.

Most of the students in the 3rd academic year 126 (85.1%) have unimodal learning styles. About 14 (9.5%) students were visual learners, 53 (35.8%) students were auditory learners, 14 (9.5%) students were read /write learners, and 39 (26.4%) students were kinesthetic learners. 10 (6.8%) students were kinesthetic& auditory learners. (Figure 3)
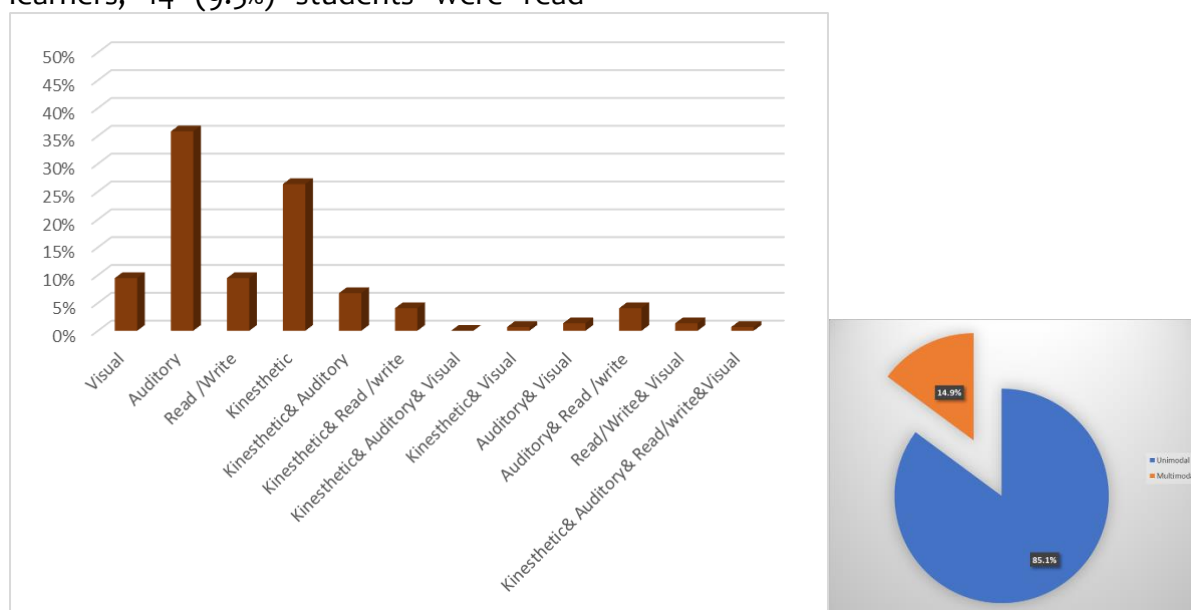

Figure 3: Learning styles among the 3rd academic year students.

There was insignificant difference among the studied medical years regarding the different learning styles. Additionally, each of the learning styles; unimodal, bimodal,

trimodal or quadrimodal was insignificantly different among the studied medical years. (Table 1)

Table 1: Different learning styles among the studied groups					
	1st medical year (n=94)	2nd medical year (n=310)	3rd medical year (n=148)	P-value	P-value
Unimodal	76 (80.9%)	251 (81%)	126 (85.1%)	0.764	0.523
Bimodal	15 (16%)	54 (17.4%)	19 (12.8%)		0.456
Trimodal	1 (1.1%)	2 (0.6%)	2 (1.4%)		0.745
Quadrimodal	2 (2.1%)	3 (1%)	1 (0.7%)		0.543

Auditory and Kinesthetic learning styles were significantly different among the studied groups (P=0.021, 0.002 respectively). (Table 2)

The mean VARK score in K tool was 5.02 ± 2.28, the mean VARK score in A tool was 4.32 ± 2.22, the mean VARK score in R tool was 3.62 ± 1.67 and the mean VARK score in V tool was 2.93 ± 1.67. (Table 3)

Table 2: Learning styles among the studied groups				
	1st medical year (n=94)	2nd medical year (n=310)	3rd medical year (n=148)	P-value
Visual	5 (5.3%)	26 (8.4%)	14 (9.5%)	0.504
Auditory	18 (19.1%)	96 (31%)	53 (35.8%)	**0.021***
Read /Write	13 (13.8%)	34 (11%)	14 (9.5%)	0.571
Kinaesthetic	43 (45.7%)	85 (27.4%)	39 (26.4%)	**0.002***
Kinaesthetic& Auditory	5 (5.3%)	22 (7.1%)	10 (6.8%)	0.833
Kinaesthetic & read /write	3 (3.2%)	10 (3.2%)	6 (4.1%)	0.892
Kinaesthetic & Auditory& Visual	1 (1.1%)	2 (0.6%)	0 (0%)	0.512
Kinaesthetic & Visual	2 (2.1%)	7 (2.3%)	1 (0.7%)	0.479
Auditory & Visual	1 (1.1%)	4 (1.3%)	2 (1.4%)	0.980
Auditory & read /write	1 (1.1%)	18 (5.8%)	6 (4.1%)	0.145
Read/Write& Visual	0 (0%)	3 (1%)	2 (1.4%)	0.549
Kinaesthetic & Auditory & read/write& Visual	2 (2.1%)	3 (1%)	1 (0.7%)	0.543

Table 3: Mean VARK score of the studied population						
		K		A	R	V
VARK score	**Mean**	5.02		4.32	3.62	2.93
	SD	2.28		2.22	1.67	1.67

Regarding the first question: there was a significant variance reported among the groups studied (P=0.022). However, there was no significant variance detected among the groups regarding the other question.

Engagement score of medical students ranged from 29 to 75 with a mean of 54.58 ± 7.03. (Table 4)

Table 4: Academic engagement score of the studied population		
		Total students (n=552)
Engagement score	**Mean ± SD**	54.58 ± 7.03
	Range	29 - 75

There was a substantial relationship between visual, auditory and kinesthetic learning styles and academic engagement score of medical students; as visual learners had significantly higher engagement score (indicating that they were more engaged in the learning process) than the non-visual ones (P value=0.031), auditory learners had significantly higher engagement score (indicating that they were higher engaged in the learning process) than the non-auditory ones (P value=0.044) and

Kinesthetic learners had significantly higher engagement score (indicating that they were more engaged in the learning process) than the non-kinesthetic ones (P value=0.042). There was a substantial association between number of students' learning styles and academic engagement core as quadrimodal learners had a higher engagement score (indicating that they were more engaged in the learning process) than the unimodal ones (P value=0.04). (Table 5)

Table 5: Relation between students' VARK learning styles and academic engagement score				
		Engagement score		P value
		Mean	**SD**	
VARK learning styles				
Visual	**No**	53.57	6.98	**0.031***
	Yes	57.94	7.56	
Auditory	**No**	53.89	6.93	**0.044***
	Yes	55.11	7.07	
Read/write	**No**	54.65	7.26	0.642
	Yes	54.31	6.07	
Kinesthetic	**No**	54.13	6.31	**0.042***
	Yes	58.41	7.27	
Number of learning styles				
Unimodal		49.57	5.81	**0.04***
Bimodal		53.08	6.54	
Trimodal		57.25	7.75	
Quadrimodal		61.67	7.82	

There was a remarkable Positive correlation between visual, auditory and kinesthetic learning scores and engagement score of students (r=0.516, P value=0.001), (r=0.368, P value=0.022) and (r=0.472, P value=0.011) respectively. (Table 6)

Table 6: Correlation between students' learning styles scores, their number, and academic engagement score

	Engagement score	
	r$_s$	**P value**
VARK learning styles		
V (Visual score)	0.516	**0.001***
A (Auditory score)	0.368	**0.022***
R (Read/write score)	0.017	0.685
K (Kinesthetic score)	0.472	**0.011***
Number of learning styles	0.511	**0.048***

r$_s$: *Spearman's rank correlation coefficient, *: statistically significant as P value<0.05.*

Discussion

Considering students' learning preferences and study habits is just as important to effective teaching as having a solid grasp of the subject matter. Students differ in terms of their motivation, learning capacities, styles, and methods. By having a better knowledge of them, teachers can enhance their pedagogical approaches and increase student engagement, meaning, and enjoyment. Students' learning style refers to how they start to concentrate on, absorb, process, and retain new and challenging material [14].

According to the current study's findings, most students throughout various academic years favor unimodal learning techniques. Unimodal learning is used by the majority of first-, second-, and third-year students (80.9%, 81.0%, and 85.1%, respectively).

This result was consistent with an investigation held by Haq et al., [15] among medical and dental students in their 1st, 2nd and 3rd years at Islamabad University, Which revealed that The vast proportion of these learners have a particular learning style, whereas just one-sixth of medical and one-third of dentistry students have several styles of learning.

We propose that the reason for the students' majority in using single learning styles is that they weren't taught to use more than one style from the beginning of their educational life from first grade to high school using the single auditory learning method, in which the system relies primarily on lecturing, and that the styles of learning are fairly stable designs of behavior.

However, our findings were in contradiction with several research, such as a study conducted in Turkey by Baykan and Naçar [16] which reported that multimodal learning style of first year medical student as being 64%. Another study held by Nuzhat et al., [17] conducted in the Kingdom of Saudi Arabia demonstrated that medical students' diverse learning styles accounted for 73%.

Kharb et al., [18] and Moayyeri [19], showed that most undergraduate Students tend to acquire and learn new data through a variety of learning strategies. This means that learners learn better when they get instructed in several ways of data display rather than just one.

In the current study, in the 1st, 2nd and 3rd medical year groups, learning styles were insignificantly different between males and females. The majority of both males and females were unimodal learners.

This finding was consistent with Payaprom and Payaprom [20] who found that there

was no significant difference between male and female regarding learning style. These results agreed with previous investigation [21,22].

Although these disparities are not statistically significant, the variety of students' learning approaches must be considered when establishing learning resources and activities. Significantly, evidence indicates that teaching based on students' styles improves students' academic progress [23].

In addition, the learning styles method of teaching boosts learning outcomes and engagement among students. Consequently, it is crucial that educators are aware of their students' learning patterns. Students' approaches to learning are not static; they can alter and evolve significantly over time based on their educational task, experience, and context [24]. Furthermore, understanding students' learning styles will help them adjust their favorite learning modality and select relevant learning tactics to improve their learning [18].

Providing educators with training that clarifies how students learn is the first step toward transforming their classrooms into learner-centered environments.

Our study's primary objective was to assess the association between students' learning styles and academic engagement.

Starting with the correlation between the subscales of both questionnaires, our study stated that there was a Positive correlation between visual, auditory and kinesthetic learning styles and engagement of students which may be explained by students benefit from seeing information presented through pictures, diagrams, charts, graphs and other visual aids. This helps them process and remember concepts effectively.

They learn best by hearing information explained, like lectures, discussions, or even songs. Engaging explanations and listening activities keep them involved.

They thrive on physical movement and hands-on activities. Experiments, simulations, role-playing and building models solidify their understanding through doing.

The findings were consistent with Franzoni et al. [25] who found that visual learners are eager to participate and share their knowledge in interactive instruction.

Riazi and Riasati [26], showed that students with a visual learning style liked to actively participate in class activities. They prefer to communicate with the other learners in class.

Visual learners recall information best when it is presented to them in the form of graphs, charts, pictures, or diagrams. To improve retention of information, these students should take notes during lectures. These learners also demonstrate good visual skill [27].

Halif et al., [28] found that students who utilized a visual learning style experienced a significant impact on their classroom engagement, particularly in terms of behavior ($\beta=.543$, $p<0.05$). Nevertheless, kinesthetic and auditory learning modalities have been demonstrated to have minimal impact on student participation in behavioral components. The study found that students' emotional and affective involvement was strongly influenced by their visual learning style ($\beta=.592$, $p<0.05$). In contrast, kinesthetic and auditory learning modalities had no effect on emotional or affective student commitment.

Furthermore, the results indicated that both visual and auditory learning styles

influenced student engagement cognitively. However, among these dimensions, the visual learning style exhibited the greatest impact on student engagement ($\beta=.577$, $p<0.05$), surpassing the impact of the auditory learning style ($\beta=.152$, $p<0.05$). Meanwhile, the kinesthetic learning style did not show any effect on cognitive student engagement.

Payaprom and Payaprom, [20] identified several predictors of student engagement, including auditory learning style, self-directed learning, learner control, logical learning style, and intuitive learning style.

Students with auditory learning skills, as noted by Gülbahar & Alper [29], possess the ability to discern various sounds and derive enjoyment from listening. The study's findings suggest that students exhibiting these characteristics are inclined to exert the requisite effort to comprehend complex situations or problems pertinent to their learning environments.

Mahdjoubi and Akplotsyi, [30] found that auditory learners exhibit a preference for acquiring new information through listening to sounds and music. This group of learners gravitates towards activities involving listening and the use of oral or written language for expression, such as articulation, speeches, and poetry. This approach primarily relies on hearing and speech as the primary modalities of information absorption. Engagement through auditory methods proves more effective when directions are presented orally, speeches are delivered clearly, or information is conveyed and requested verbally.

Activities falling within this category necessitate ample opportunities for honing listening skills and providing verbal explanations of tasks. Auditory learners often take the lead in group discussions compared to visual and kinesthetic learners.

Abouzeid et al., [31] found that there was a remarkable association between kinesthetic learning methods and academic performance. This could be ascribed to their medical school's teaching and learning methodologies, in addition to the substance of their undergraduate curriculum, both of which support the usage of these unique learning styles and, as a result, boost academic engagement and accomplishment.

In the current study, there was a positive association between the number of students' learning styles and engagement of students.

Therefore, it is recommended that teachers employ a diverse range of activities and utilize various modes of communication when imparting new information to cater to the different learning styles of language learners. For instance, in a speaking class, students should be afforded opportunities for role-playing and group discussions within the classroom setting. These activities not only allow students to practice speaking but also hone their listening skills.

In addition, it has been suggested that teachers distribute class time to a range of activities within a learner-centered method, such as group work, discussion groups, role-play, simulations, and collaborative projects, to meet the various learning styles found in the classroom [32]. When teaching tactics and resources are customized to correspond with students' learning styles, both student involvement and academic accomplishment have increased [33].

Conclusion

Most of the medical students prefer unimodal learning style. While most of the first-year students use kinesthetic learning style, most of the second- and third-year students use auditory learning style. There was a moderate engagement of the students in the learning process. This engagement was represented in forms of following the school rules, doing their homework on time, participating in group assignments and talking to people outside the school on matters that their learned in class. There was a significant variable positive association between engagement and each learning style. Finally, this study identified students' learning styles and their association with engagement. Deep understanding of this relationship is essential to tailor learning environment according to students' needs.

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