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An Analysis of Medical Students' Learning Experiences in Small Group-Based Teaching in Kurdistan Region-Iraq

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Abstract

Objective: This study aims to evaluate the learning styles, activities, and experiences of medical students within the context of small group-based teaching in the Kurdistan Region of Iraq.

Methods: A cross-sectional study was conducted between February and May 2022 at Zakho College of Medicine, involving students from various medical colleges in the region. A pre-designed questionnaire was administered both in-person and online. Comprising two main parts in addition to demographic information, the questionnaire assessed students' learning styles based on O'Brien's modality learning channel preference and their preferences and experiences in small-group settings.

Results: The sample included students from the 1st to the 5th stage, totaling around 400 participants. The cohort was predominantly female (60.05%) and largely from the 2nd stage of medical education (55.03%). Visual Learning was the most common learning style, particularly among female students. Significant variations in learning styles were noted across different academic stages and universities. Small-group activities and formative assessments were generally favored. While most students were either "satisfied" or found it "natural" concerning group size, dissatisfaction was prominent regarding available teaching resources. Statistical analyses confirmed significant differences in learning styles, preferred teaching methods, and feelings about the learning environment.

Conclusion: The study offers critical insights into the diverse learning preferences and experiences of medical students in small-group settings. Despite a general preference for Visual Learning and small-group activities, significant variations exist, warranting a nuanced approach to educational strategy. Given the diverse learning preferences and significant dissatisfaction with available resources, a multifaceted educational approach is recommended, including diverse teaching and assessment methods and increased investment in teaching resources.

Keywords: Medical education, small-group teaching, learning styles, student satisfaction, formative assessment

Introduction

Medical education encompasses foundational medical training, advanced postgraduate studies, and ongoing professional development. This educational journey starts with entry into medical school and extends through to the physician's retirement from active clinical work. The overarching aim is to equip medical professionals with the most current scientific insights so they can enhance public health, diagnose and treat illnesses effectively, and manage symptoms. Physicians are ethically obliged to uphold high educational standards, both for their personal growth and for the benefit of the profession and the patients they serve.[1]

The use of the flipped classroom (FC) model in undergraduate medical education has been on the rise. In this approach, students initially engage with educational material online, allowing in-person class sessions to focus on interactive, student-centered learning activities. While the FC model has garnered positive feedback in different educational settings, its reception among medical students remains uncertain.[2]

Small-group teaching combines the best of traditional and modern educational methods, fostering individualized learning, critical thinking, and teamwork. It's especially apt for contemporary medical education. Additionally, healthcare students must develop strong patient communication skills. While traditional methods like clinical demos and isolated lectures offer limited practice opportunities, the interactive nature of small-group teaching allows for ongoing assessment and skill refinement in both academic and clinical settings.[3]

Strong evidence now exists to show that small-group instruction offers an enriching academic atmosphere, particularly in healthcare education, and fares better than traditional lectures. When students engage actively with peers, their comprehension of subject matter improves as they can compare and extend their own understanding. Small-group settings not only facilitate collaborative learning but also nurture essential team-building skills, which are indispensable for effective work in healthcare environments.[4] It was shown that small group teaching serves as an effective method for improving student performance in clinical environments. This approach can be extended to various clinical fields within the medical curriculum to cultivate graduates who are both safe and clinically proficient.[5]

In medical education, recognizing different learning styles—visual, auditory, and kinesthetic—is key to improving learning outcomes. Visual learners prefer charts and written materials, auditory learners thrive in lecture settings, and kinesthetic learners benefit from hands-on activities, especially in clinical scenarios. The field has seen a transition from traditional didactic approaches to more student-centered methods like problem-based learning. These modern strategies are crucial in a discipline that requires high levels of knowledge retention. Studies suggest that the effectiveness of such

learning methods can vary, particularly between secondary and graduate students, with the latter focusing more on critical thinking.[6]

The visual-aural-read/write-kinesthetic (VARK) questionnaire, a readily accessible and straightforward tool, allows students to identify their learning preferences among visual, auditory, reading/writing, and kinesthetic styles. This approach doesn't gauge intelligence or innate talents; instead, it focuses on how individuals prefer to gather and comprehend new information. Utilizing the VARK model can aid in knowledge acquisition, skill development, and attitude formation.[7]

It was suggested that for teaching to be effective, teachers must comprehend the learning styles of their students and employ appropriate teaching techniques and strategies accordingly.[8] Understanding students' learning styles—be it visual, auditory, reading/writing, or kinesthetic—allows educators to customize their teaching methods. This personalized approach boosts student engagement and comprehension, leading to better academic performance. For example, visual learners benefit from diagrams, while auditory learners excel in discussion-based settings. A mix of strategies caters to diverse learning preferences, creating a more inclusive and effective educational environment. This awareness is especially impactful in higher education, where students often adapt their learning styles for academic success.[6]

There is a notable lack of thorough assessment and documentation concerning the challenges and developmental needs in Iraq's medical education sector. Significant problems plague the existing system, necessitating comprehensive improvements in multiple areas. Further in-depth research is crucial for a better understanding of the complexities and requirements of this vital field of education.[9] The Kurdistan region of Iraq faces unique challenges in medical education, including resource constraints and outdated teaching methods. However, it also offers opportunities like a growing educational infrastructure, high demand for medical professionals, and a tech-savvy youth. Government focus on education is encouraging innovation.

Our study on small group-based teaching is vital for adapting curricula to this unique landscape. This study aims to explore the effectiveness of small-group-based teaching in medical education in Iraq's Kurdistan region. Focused on meeting the area's healthcare needs with limited resources, the research evaluates medical students' learning experiences, critical thinking, teamwork, and communication skills. It also conducts a comparative analysis based on gender, academic stage, and university affiliation to identify patterns or disparities. The findings will inform curriculum development, guide educational policy, and contribute to the broader discourse on medical education in resource-limited settings.

Materials and Methods

Study Design and Sampling Method

This is a cross-sectional study based on a predesigned survey questionnaire. The study was carried out in Zakho College of Medicine, Zakho city, Iraqi Kurdistan Region between February 2022 and May 2022. The questionnaire was prepared at the University of Zakho, College of medicine, and distributed among students of different medical college of Kurdistan Region-Iraq through in person interview and an online designed google form. The questionnaire was prepared by academic members of the college and has been approved by the college research committee.

The questionnaire consists of two main parts, in addition to demographic information. The first part was to evaluate the learning styles of the students, it consists of three sections based on the O'Brien (1985) modality learning channel preference questionnaire.[10] Each section consists of 10 sentences related to a specific learning style (visual, auditory, and Kinesthetic), the instruction was written for students to read each sentence carefully and consider if it applies to him or her (On the line in front of each statement, indicate how often the sentence applies to you, according to the chart below).

1	2	3
Never applies to me.	Sometimes applies to me.	Often applies to me.

The scores for each of the three sections are recorded. The maximum score in any section is 30 and the minimum score is 10 as follows:

- Section One score: _____ (Visual)
- Section Two score: _____ (Auditory)
- Section Three score: _____ (Kinesthetic)

The modality type with the highest score indicated the student's preferred learning style.

The higher the score, the stronger the preference. If the student has relatively high scores in two or more sections, the student probably has more than one strength. If the scores in the sections are roughly equal, the student probably does not have a preferred learning style; the student is a multi-sensory learner.

The second part consists of six questions that were related to their activities within the group, their preferred learning methods and tools, their preferred teaching technique, and which type of assessment they believe is/are more valid, fair, and useful. The students were also asked to express how they feel within their group based on a Likert scale of (satisfied, natural, or unsatisfied) regarding group size, environment, class design, available teaching resources, teacher or tutor role, learning objectives, and content and time for the task to be completed and reviewed within each session.[11]

The students from 1st stage to 5th stage were selected to participate in this study and the sample size was considered to be around 400 participants. Informed consent was taken from each of the participants before the study. The questionnaire was interpreted and explained to selected volunteer students to distribute it among participants, each participant had enough time to fill and answer the questionnaire's questions and they were instructed to ask for any unclear questions or any additional explanations.

In order to provide a comprehensive view of the medical students' learning experiences and preferences, we have included a detailed questionnaire in Appendix A of this paper. This questionnaire serves as a foundational tool for our research.

Statistical Analysis

In this study, various statistical analyses were employed to interpret the collected data and draw meaningful conclusions, using the Statistical Package of Social Science (SPSS)

version 26.0 (2019). Descriptive statistics were initially used to summarize the demographic characteristics of the medical students. To assess the differences in learning styles, activities, and preferences across various groups, a one-way Analysis of Variance (ANOVA) was utilized. Chi-square tests were employed to analyze the differences in students' feelings regarding various aspects of the learning environment. The statistical significance level was set at ($P < 0.05$).

Results

Demographic Characteristics of Study Participants

We aimed for a sample size of around 400 medical students to ensure robust analysis. The actual count was 398, slightly less due to factors like academic commitments and incomplete responses. Despite this, the sample size is considered sufficiently representative for the study's objectives.

The demographic characteristics of the medical students participating in the study are summarized in Table 1 and Figures 1–3. The table categorizes the data according to gender, stages of medical education, and universities. The demographic characteristics reveal some key patterns. Notably, the cohort is predominantly female, comprising 60.05% of the total students. The gender distribution may offer insights into how learning experiences and styles could differ between male and female students in small group settings. A significant concentration of students is in the 2nd stage of their medical education, making up 55.03% of the total. This suggests that the 2nd stage may be particularly relevant for evaluating the efficacy and experiences of small group-based teaching methods.

The students are primarily from the University of Duhok (42.71%) and the University of Zakho (40.95%), with a smaller but still significant representation from the University of Sulaimani (16.33%). This distribution across universities may provide a diverse range of perspectives on small group-based learning experiences.

Evaluation of Learning Styles of the Students

In Table 2, we evaluated the learning styles of medical students across three dimensions: gender, academic stage, and

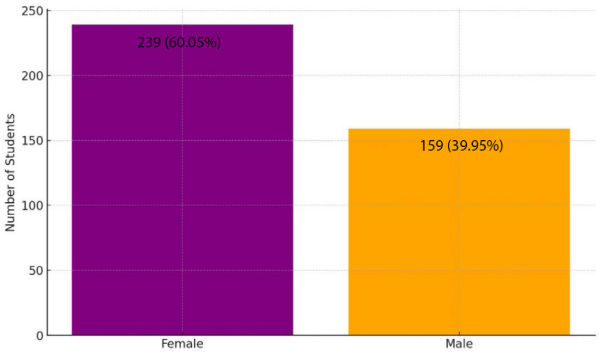

Fig. 1 **Demographic according gender.**

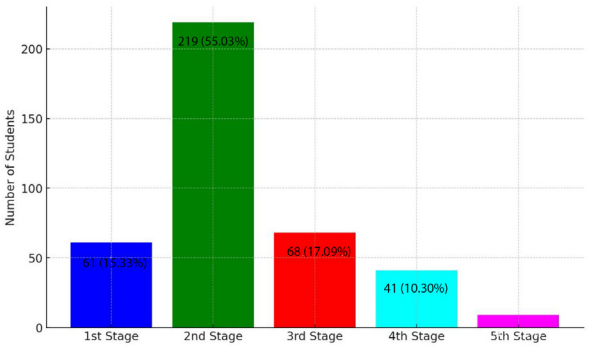

Fig. 2 **Demographic according stages.**

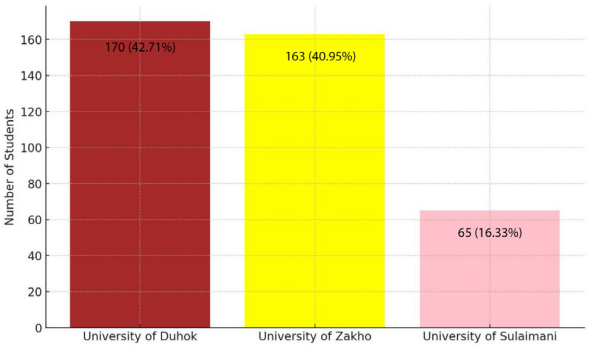

Fig. 3 **Demographic according universities.**

Table 1. **Demographic characteristics of medical students in small group-based teaching in Kurdistan Region-Iraq**

Category	Sub-category	Number of Students	Percentage (%)
Gender	Female	239	60.05
	Male	159	39.95
Stages	1st Stage	61	15.33
	2nd Stage	219	55.03
	3rd Stage	68	17.09
	4th Stage	41	10.30
	5th Stage	9	2.26
Universities	University of Duhok	170	42.71
	University of Zakho	163	40.95
	University of Sulaimani	65	16.33
Total		398	100.00

Table 2. **Summary of learning style preferences among medical students by gender, academic stage, and university**

Category	Visual learning	Kinesthetic learning	Auditory learning	Total	*P*-value
Gender - Female	127 (53%)	65 (27%)	47 (20%)	239 (60%)	0.080
Gender - Male	90 (57%)	51 (32%)	18 (11%)	159 (40%)	
Stage - 1st Stage	36 (59%)	13 (21%)	12 (20%)	61 (15%)	
Stage - 2nd Stage	104 (47%)	69 (32%)	46 (21%)	219 (55%)	0.014
Stage - 3rd Stage	46 (68%)	17 (25%)	5 (7%)	68 (17%)	
Stage - 4th Stage	26 (63%)	14 (34%)	1 (2%)	41 (10%)	
Stage - 5th Stage	5 (56%)	3 (33%)	1 (11%)	9 (2%)	
University of Duhok	81 (48%)	44 (26%)	45 (26%)	170 (43%)	
University of Sulaimani	43 (66%)	19 (29%)	3 (5%)	65 (16%)	<0.001
University of Zakho	93 (57%)	53 (33%)	17 (10%)	163 (41%)	

Table 3. **Mean, standard deviation, and statistical significance of learning styles among medical students in small group-based teaching in Kurdistan Region-Iraq**

Learning style	Mean	Standard deviation (SD)	*P*-value
Visual learning	21.59	3.25	<0.001
Auditory learning	19.38	2.91	
Kinesthetic learning	21.20	3.14	

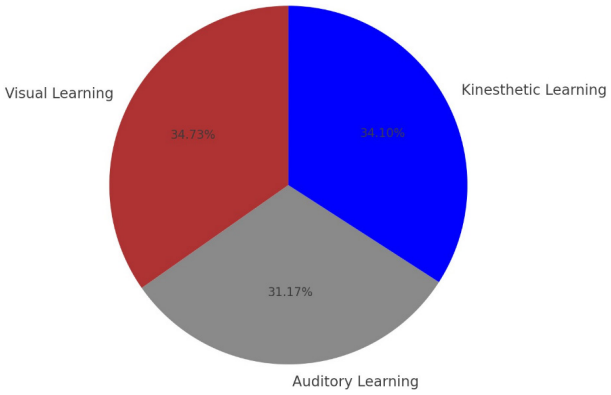

Fig. 4 **Distribution of learning style.**

university affiliation. The sample consisted of a total of 398 students, of which 239 were females (60%) and 159 were males (40%).

Our study revealed a consistent preference for Visual Learning across various demographic and educational contexts, including gender, academic stage, and university affiliation. This was followed by Kinesthetic Learning and, lastly, Auditory Learning. These findings suggest that educational strategies prioritizing visual methods could be broadly effective in this setting. Further research is needed to explore the underlying factors contributing to these preferences.

By Gender: Among female students, the majority (53.14%) displayed a preference for Visual Learning, followed by Kinesthetic Learning (27.20%) and Auditory Learning (19.67%). In contrast, male students were more evenly distributed between Visual Learning (56.60%) and Kinesthetic Learning (32.08%), with a smaller proportion (11.32%) favoring Auditory Learning. Statistical analysis confirmed that there are no significant differences in learning styles between male and female students in this sample (*P*-value >0.05).

By Academic Stage: Students in the 3rd stage exhibited the highest preference for Visual Learning at 67.65%, the highest percentage across all categories. Kinesthetic Learning was notably the second most preferred style in the 2nd and 4th stages, at 31.51% and 34.15%, respectively. Auditory Learning was least preferred, especially in the 4th stage, where it accounted for just 2.44% of preferences. Statistical analysis revealed significant differences in learning styles across various academic stages (*P*-value < 0.05).

By University: At the University of Sulaimani, a significant 66.15% of students preferred Visual Learning, the highest among the three universities studied. The University of Duhok displayed the most balanced distribution of learning styles: Visual (47.65%), Kinesthetic (25.88%), and Auditory (26.47%). The University of Zakho followed a similar trend to the overall gender distribution, with Visual Learning at 57.06% and Kinesthetic Learning at 32.52%. Statistical analysis showed significant differences in learning styles across the different universities (*P*-value < 0.001).

The analysis of learning styles among medical students revealed notable differences in preferences. As summarized in Table 3, Visual Learning emerged as the most predominant style with a mean score of 21.59 and a standard deviation of 3.25. This was closely followed by Kinesthetic Learning, which had a mean score of 21.20 and a standard deviation of 3.14. Auditory Learning had the lowest mean score of 19.38, with a standard deviation of 2.91.

The statistical analysis yielded a near-zero *P*-value (<0.001), significantly below the alpha level of 0.05, indicating statistically significant differences in learning styles among medical students.

Gender-based comparative analysis of learning styles

Our analysis revealed nuanced differences in learning styles between male and female medical students. For Visual Learning, males had a slightly higher mean score of 21.78 compared to females at 21.46, although the standard deviations (SD) were relatively close (2.97 for males and 3.42 for females) Table 4.

In Auditory Learning, females had a higher mean score (19.66) than males (18.97). Interestingly, the variability was also slightly higher among males, with an SD of 3.03, compared to an SD of 2.80 for females.

For Kinesthetic Learning, males again had a slightly higher mean score (21.43) than females (21.05), with very similar standard deviations (3.16 for males and 3.12 for females).

For Visual and Kinesthetic learning styles, the p-values are greater than the common significance level of 0.05, suggesting that there aren't statistically significant differences in the mean scores of these learning styles between genders. For Auditory learning style, the p-value is less than 0.05, indicating a statistically significant difference in the mean scores between genders.

Stage-based Comparative Analysis of Learning Styles

Our study offers intriguing insights into how learning styles evolve across different stages of medical education as shown in Table 5.

In visual learning, the mean scores ranged from a low of 20.48 in the 2nd Stage to a high of 23.89 in the 5th Stage. Notably, students in the 5th Stage exhibited the highest mean score, indicating a stronger preference for visual learning as they progress in their studies.

In auditory learning, the mean score was highest in the 1st Stage (20.52) and generally declined as students advanced, reaching the lowest in the 5th Stage (18.56). This suggests a decreasing reliance on auditory learning methods as students move through the curriculum.

In kinesthetic learning the mean scores were relatively consistent across stages, but the 5th Stage stood out with the highest mean of 22.89 and the lowest standard deviation (SD) of 1.45, indicating a strong and consistent preference for kinesthetic learning in advanced stages.

The *P*-values for all three learning styles are less than the common significance level of 0.05, suggesting that there are statistically significant differences in the mean scores of the learning styles across different stages.

University-based comparative analysis of learning styles

The analysis also sheds light on how learning styles differ across universities:

In Visual Learning, students from the University of Zakho had the highest mean score (23.04) in visual learning, followed by those from the University of Sulaimani (22.35). The University of Duhok had the lowest mean score (19.91), suggesting a lesser preference for visual learning methods among its students.

In Auditory Learning, the highest mean score was observed at the University of Zakho (19.78), whereas the University of Sulaimani had the lowest (18.42). Interestingly, the standard deviation was highest at the University of Zakho (3.14), indicating a wider range of preferences Table 6.

Table 4. **Gender-based comparative analysis of learning styles**

Learning style	Gender	Mean	Standard deviation (SD)	*P*-value
Visual learning	Female	21.46	3.42	0.3368
	Male	21.78	2.97	
Auditory learning	Female	19.66	2.80	0.0198
	Male	18.97	3.03	
Kinesthetic learning	Female	21.05	3.12	0.2399
	Male	21.43	3.16	

Table 5. **Stage-based comparative analysis of learning styles**

Learning style	Stage	Mean	Standard deviation (SD)	*P*-value
Visual learning	1st	23.34	3.40	<0.001
	2nd	20.48	3.04	
	3rd	22.59	2.58	
	4th	22.71	2.83	
	5th	23.89	3.26	
Auditory learning	1st	20.52	3.75	0.0137
	2nd	19.30	2.59	
	3rd	19.04	2.91	
	4th	18.88	2.83	
	5th	18.56	2.70	
Kinesthetic learning	1st	22.38	3.14	<0.001
	2nd	20.29	3.14	
	3rd	21.97	2.68	
	4th	22.66	2.47	
	5th	22.89	1.45	

Table 6. **University-based comparative analysis of learning styles**

Learning style	Stage	Mean	Standard deviation (SD)	*P*-value
Visual learning	University of Duhok	19.91	2.93	<0.001
	University of Sulaimani	22.35	2.67	
	University of Zakho	23.04	2.96	
Auditory learning	University of Duhok	19.38	2.69	0.0058
	University of Sulaimani	18.42	2.66	
	University of Zakho	19.78	3.14	
Kinesthetic learning	University of Duhok	19.64	3.01	<0.001
	University of Sulaimani	21.89	2.59	
	University of Zakho	22.56	2.71	

In Kinesthetic Learning, he University of Zakho led with a mean score of 22.56, followed closely by the University of Sulaimani at 21.89. In contrast, the University of Duhok had a notably lower mean score of 19.64.

The *P*-values for all three learning styles are less than the common significance level of 0.05, suggesting that there are statistically significant differences in the mean scores of the learning styles across the universities: Zakho, Sulaimani, and Duhok.

Evaluation of learning styles by stage and university

Our analysis offers critical insights into the learning styles of medical students across different stages and universities as shown in Table 7. Remarkably, a substantial proportion of 160 (40.20%) students demonstrated roughly equal scores across all three sections: Visual, Auditory, and Kinesthetic. This suggests a high prevalence of multi-sensory learners within our sample.

On the other end of the spectrum, only a small fraction of 6 (1.51%) students had high scores in two or more sections. These students excel in multiple learning styles, but they represent a minority in the study population.

The statistical analysis yielded a near-zero *P*-value (<0.001), significantly below the alpha level of 0.05, confirming a significant difference between the groups of multi-sensory learners and those excelling in multiple learning styles.

Small-Group Activities Within Stages and Universities

Active, task-oriented, reflective learning approach

Our study provides a comprehensive analysis of medical students' engagement with various aspects of small-group learning, as shown in Table 8. Most students 208 (52.26%) indicated that active involvement "sometimes applies" to them, whereas nearly a third 117 (29.40%) students felt it "often applies." Only a minority 73 students (18.34%) felt it "never applies." Over half 204 students (51.26%) felt that a well-defined task orientation "sometimes applies," while 100 students (25.13%) felt it "often applies." The majority of students either "often" 168 (42.21%) or "sometimes" 173 (43.47%) engaged in reflection based on experience and deep learning.

Statistical analysis revealed significant differences in student responses across the categories (*P*-value <0.00001). These findings suggest that different aspects of small-group activities resonate variably with students, warranting further exploration to optimize educational strategies.

Preferred learning methods

Case-based learning was the most preferred method in 215 (54.02%) of students, followed closely by free discussion 199 (50.00%) students. Statistical analysis using one-way ANOVA revealed significant differences in the preferences for different learning methods among the students (*P*-value <0.001). This underscores the variability in learning preferences, emphasizing the need for diverse educational strategies to cater to these differences.

Preferred teaching methods

Among teaching techniques, brainstorming was the most popular in 192 (48.24%) students. Statistical analysis using one-way ANOVA revealed significant differences in the preferences for different teaching techniques among the students (*P*-value = 0.019). This highlights the importance of employing a variety of teaching techniques to accommodate diverse student preferences

Beliefs in assessment types

The majority of students 210 (52.76%) favored formative or summative assessments, followed by assessment of outcomes or progress 173 (43.47%) students. Statistical analysis employing one-way ANOVA revealed significant differences in students' beliefs about different types of assessments (*P*-value <0.00001). This indicates the need for educational institutions to consider multiple assessment methods to align with the diverse beliefs and preferences of medical students.

Feelings regarding learning environment

For group size, most students were either "satisfied" 182 (45.73) students, or found it "natural" 152 (38.19%) students. However, dissatisfaction was most prominent regarding available resources for teaching, where 134 (33.67%) students were "unsatisfied." Statistical analysis using the Chi-square test revealed significant differences in students' feelings regarding various aspects of the learning environment (*P*-value <0.00001). This highlights the need for a nuanced approach to optimizing the educational setting, as student opinions vary significantly across different environment factors.

Discussion

Our study revealed a consistent preference for Visual Learning across various demographic and educational contexts, including gender, academic stage, and university affiliation. This was followed by Kinesthetic Learning and, lastly, Auditory Learning. These findings suggest that educational strategies prioritizing visual methods could be broadly effective in this setting. Further research is needed to explore the underlying factors contributing to these preferences.

Our observations confirm the findings of another study (Bakar, M. B. A., 2018), which also reported that visual learning was the most preferred style among tertiary level students, followed by kinesthetic and auditory learning styles.[12] This further supports the idea that visual learning is a dominant style across diverse educational settings.

Table 7. **Evaluation of learning styles by stage and university**

Evaluation criteria	Number of students	Percentage (%)	Section affected	*P*-value
Students with high scores in two or more sections	6	1.51	Visual, Auditory, Kinesthetic	<0.001
Students with roughly equal scores across sections	160	40.20	Visual, Auditory, Kinesthetic	

Table 8. **Evaluation of small-group activities within stages and universities**

Categories	**Often applies to me**	**Sometimes applies to me**	**Never applies to me**
Active involvement in the entire learning cycle	117 (29.40%)	208 (52.26%)	73 (18.34%)
Well-defined task orientation with aims and objectives	100 (25.13%)	204 (51.26%)	94 (23.62%)
Reflection based on experience and deep learning	168 (42.21%)	173 (43.47%)	57 (14.32%)
Preferred learning methods	**Number of students**	**Percentage (%)**	
Tutorials	168	42.21%	
Free discussion	199	50.00%	
Simulations	148	37.19%	
Case-based learning:	215	54.02%	
Problem-based learning	184	46.23%	
Team-based learning	130	32.66%	
Seminars	76	19.10%	
Preferred teaching techniques	**Number of students**	**Percentage (%)**	
Buzz group	168	42.21%	
Brainstorming or Ideas storming	192	48.24%	
Presentations	162	40.70%	
Resource-based tasks	194	48.74%	
Roleplay	158	39.70%	
Beliefs in assessment types	**Number of Students**	**Percentage (%)**	
Assessment of outcomes or progress	173	43.47%	
Formative or summative assessment	210	52.76%	
Assessment of performance and reflection	148	37.19%	
Oral or written exam	187	46.98%	
Peer/self or tutor assessed	116	29.15%	
Feelings regarding learning environment	**Satisfied**	**Natural**	**Unsatisfied**
Group size	182 (45.73%)	152 (38.19%)	64 (16.08%)
Group physical environment and climate	95 (23.87%)	221 (55.53%)	82 (20.60%)
Place of teaching and classroom design	126 (31.66%)	155 (38.94%)	117 (29.40%)
Available resources for teaching	89 (22.36%)	175 (43.97%)	134 (33.67%)
Learning objectives and contents	111 (27.89%)	187 (46.98%)	100 (25.13%)
Teacher or tutor role and class management	88 (22.11%)	211 (53.02%)	99 (24.87%)
Time for tasks to be completed and reviewed	107 (26.88%)	171 (42.96%)	120 (30.15%)

Advantages of the Visual Learning Style in medical schools include the ease of grasping complex concepts through diagrams and flowcharts, which is vital in medical studies that often involve intricate physiological processes. Visual aids can also enhance memory retention. However, the downside is that exclusive reliance on visual methods may hinder the development of hands-on skills and auditory understanding. Medical students may prefer visual learning because it simplifies complex information, making it easier to understand and remember, unlike Kinesthetic and Auditory styles that may require more cognitive effort.

Interestingly, our study is contrasting with another study that found Kinesthetic Learning to be the most preferred among medical students.[6] This divergence could be attributed to a variety of factors, including differences in educational settings or cultural influences. Interestingly, the other study also found an increase in multi-modal learning preferences as students progressed through their years of study, suggesting a potential area for further research in our context. Both studies underscore the need for curriculum adaptation based on these preferences.

In line with a recent systematic review that analyzed 34 studies from 14 countries, our findings underscore the variability in learning style preferences among medical students.[13] While the review found kinesthetic and auditory styles to be most common among unimodal preferences, our study identified a distinct preference for visual learning. These differences could be attributed to regional or cultural variations in teaching methods. Interestingly, both studies highlight the importance of multi-modal learning styles, lending further support to the need for diverse and adaptable educational strategies in medical training.

Our study provides an in-depth analysis of learning style preferences among medical students across different genders, academic stages, and universities, as summarized in Table 2. Notably, the data shows significant variations in learning styles across academic stages and universities, although no significant difference was found based on gender.

Our study and a recent cross-sectional study conducted in a Central Asian university both emphasize the dominance of visual learning preferences among medical students.[14] However, while our study did not find significant gender-based differences in learning style preferences, the Central Asian study reported that males have a higher preference for visual learning, and females for sequential styles. Furthermore, that study extended its scope to examine the impact of learning styles on academic performance in specific subjects, a direction that might be valuable for future research in our context. Both studies highlight the crucial role of understanding learning styles in enhancing educational outcomes.

Despite exhibiting some variations in learning style preferences, our results indicated no statistically significant differences between male and female medical students (*P*-value = 0.080). This aligns with (Kalbasi S, et al., 2008), suggesting that gender may not be a decisive factor in determining learning style within this academic context.[15]

While our study found no statistically significant difference between male and female students in their learning style preferences (P-value = 0.080), it contrast with previous research in that male and female students had different learning styles. The Learning Styles of Medical Students 454 mean of dominant style in female students was reading-writing style and in male students was the listening style.[16]

Our study identified significant variations in learning styles across different academic stages, a finding that aligns with previous research. A study of 338 medical students also found that learning style preferences evolved as students transitioned from pre-clinical to clinical years.[17] While we observed a dominant style in our population, the earlier study noted a shift towards multi-modal learning preferences, particularly kinesthetic and aural styles, as students advanced. These complementary findings underscore the importance of adaptable, stage-specific educational strategies in medical training.

In line with a study conducted among 600 medical students in Saudi Arabia (Almigbal TH. et al., 2015), our research also emphasizes the diversity of learning styles in medical education.[18] Interestingly, while the Saudi study found significant gender differences in learning styles, our findings did not reveal such disparities. Moreover, like the Saudi study, we found no direct correlation between learning style preferences and academic performance, suggesting that a multifaceted approach to education is essential. These parallel findings underline the importance of tailoring teaching methods to diverse learning styles for optimal educational outcomes.

Concerning small-group interactions within academic levels and university settings, the latter portion of our survey included six questions focused on student participation within these groups. Our research offers an in-depth examination of how medical students engage with different facets of small-group education. We found it particularly valuable to consider the findings from a similar study conducted at Hawler College of Medicine in Iraq. Their qualitative research, based on focus group discussions, similarly endorsed the effectiveness of small-group teaching methods, while also pointing out challenges such as inadequate infrastructure and assessment issues.[19] Incorporating their insights can provide a broader context to our quantitative findings. It allows us to confirm some of our own observations and consider their recommendations for improving assessment systems and curriculum design, thus enriching the depth and applicability of our own study.

Our findings can be further enriched by a comparative study that evaluated Case-based learning (CBL) and Team-based learning (TBL).[20] That study revealed that while TBL is effective in imparting basic scientific principles, CBL excels in honing students' clinical reasoning skills. These insights are particularly relevant to our investigation as they suggest that the efficacy of different small-group teaching methods may be contingent on the specific learning outcomes being targeted. Therefore, medical education curricula could be optimized by strategically incorporating these distinct yet complementary small-group teaching approaches.

In our study, Case-based learning emerged as the most preferred learning method, chosen by 54.02% of the student population. This was closely followed by free discussion, chosen by 50.00% of students. These findings resonate with a separate study that implemented a hybrid pedagogical model combining Team-based and Case-based learning.[21] That study not only found enhanced academic performance but also reported higher levels of student motivation and self-regulation post-intervention. Notably, the model was praised for its ability to contextualize the curriculum and foster positive social interdependence among students. Our results suggest that the high preference for Case-based learning and free discussion could be indicative of students' desire for more interactive, contextual, and socially engaging educational experiences. Such hybrid models could also serve as valuable analytical tools for personalized, data-driven student feedback, thereby helping to identify knowledge gaps and correct misconceptions."

Our study found brainstorming to be the most popular teaching technique among medical students, with 48.24% favoring this method. This aligns with a previous study conducted at the University of Alabama School of Medicine, which explored medical students' preferences for various instructional methods, including lectures, team-based learning, and simulation among others.[22] Interestingly, that study revealed a shift in preference from lecture-based instruction in the first year to more clinically-oriented teaching methods like patient presentations in the second year. This suggests that teaching techniques might need to be adapted according to the academic stage of medical students to better align with their learning preferences and educational needs. Our finding that brainstorming is popular across academic stages could imply its versatility and effectiveness in engaging students in both preclinical and clinical settings.

In our study, the majority of students 210 (52.76%) favored formative or summative assessments, followed by assessment of outcomes or progress 173 (43.47%) students. Formative assessment in medical education serves as a critical tool for both learners and educators, offering real-time feedback that guides the learning process. Unlike summative assessments, which evaluate learner competence at the end of an instructional period, formative assessments occur continuously throughout the educational journey. They can take various forms, such as quizzes, discussions, or practical exercises, and are often integrated into small-group activities

or problem-based learning scenarios. The primary aim is not grading but the enhancement of learning and instruction. By identifying gaps in knowledge and skills, formative assessments allow medical students to focus their efforts more efficiently and enable educators to tailor their teaching methods accordingly.[23]

Our study revealed nuanced student perceptions about the learning environment. While the majority felt either "satisfied" or "neutral" about the group size, indicating a general contentment with this aspect, a significant portion (33.67%) of the students expressed dissatisfaction with the available teaching resources. This disparity suggests that while students may be comfortable with the interpersonal dynamics of their learning groups, they find the material resources lacking. The Chi-square test confirmed significant differences in feelings across various elements of the learning environment (*P*-value <0.00001), emphasizing the need for educational planners to focus on improving the quality and availability of teaching resources.

Our findings indicate that a significant portion of students expressed dissatisfaction with the available resources for teaching, with 33.67% reporting being 'unsatisfied.' This facet of the learning environment warrants special attention, as previous research has demonstrated that students' perceptions of their learning environment are closely tied to their academic emotions and, potentially, their academic performance.[24] Specifically, a study using the Dundee Ready Educational Environment Measure (DREEM) and Achievement Emotions Questionnaire (AEQ) found that the perceived learning environment predicts students' academic emotions. Therefore, dissatisfaction with educational resources may not only affect the quality of education but also have broader implications on students' emotional well-being and academic success. Addressing these issues is crucial for creating a more conducive and emotionally supportive learning environment.

Conclusion

Our study provides a comprehensive overview of medical students' preferences in learning styles, teaching methods, and assessment types across different demographics, academic stages, and universities. We found that Visual Learning is the most universally preferred style, but significant variations exist in other preferences based on academic stage and institutional affiliation. Notably, there's a trend toward more multi-sensory learning, and a significant proportion of students favor small-group activities and formative assessments. Despite overall satisfaction with group sizes, dissatisfaction with available teaching resources stood out, emphasizing the need for a nuanced educational approach tailored to diverse needs.

Given the variability in student preferences, we recommend the implementation of diverse teaching methods and assessment strategies, and increased investment in educational resources to optimize the learning environment.

Ethical Approval

This study was conducted in accordance with ethical guidelines and standards for research involving human subjects. The questionnaire used for data collection was designed by academic members of the College of Medicine at the University of Zakho and received formal approval from the college research committee. Prior to their participation, all study participants were informed about the objectives, methodology, and purpose of the study. Verbal informed consent was obtained from each participant, confirming their voluntary agreement to be involved in the study. Participants were assured of the confidentiality and anonymity of their responses and were also informed that they had the right to withdraw from the study at any time without any consequences. No personal identifiers were used in the data collection or reporting processes, ensuring the privacy and anonymity of all participants.

Authorship

- Conception and design of the study: Mahmoud Abdi, Basheer Abdi.
- Acquisition of data: Dilveen Mikail, Dastan Mustafa, Sawen Ibrahim.
- Analysis and interpretation of data: Mahmoud Abdi.
- Drafting the article: Dilveen Mikail.
- Critical revising: Mahmoud Abdi.
- Final approval: Basheer Abdi.

Ethical Standards (See Statement of Human and Animal Rights)

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Informed Consent (if applicable, see Informed Consent)

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Conflict of Interest (See Conflict of Interest)

None.

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Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Appendix A

Medical Student's Learning Experience Within Small Groups-Based Teaching Questionnaire

Male ☐ Female ☐
Stage ☐ Group ☐

University/College or Faculty

☐

Learning Style and Small Group Teaching Questionnaire

The modality (learning channel preference) modified questionnaire reproduced here is by O'Brien (1985). To complete, read each sentence carefully and consider if it applies to you. On the line of each statement, indicate how often the sentence applies to you, according to the chart below. ***Please respond to all questions***.

1	2	3
Never applies to me.	Sometimes applies to me.	Often applies to me.

SECTION ONE: Visual Learner

1. _____ I remember something better if I write it down.
2. _____ When trying to remember someone's telephone number or something new like that, it helps me to get a picture of it in my mind.
3. _____ It helps me to look at the person while listening; it keeps me focused.
4. _____ Using flashcards helps me to retain material for tests.
5. _____ It is better for me to get work done in a quiet place.
6. _____ I like to read books on my own rather than have them read out loud.
7. _____ I solve problems by reading information or organizing solutions on paper.
8. _____ I like to study at a desk.
9. _____ I remember the faces of people but forget names.
10. _____ I like to use graphic organizers, graphs, mind maps, or charts.

Total _____
Please respond to all questions.

1	2	3
Never applies to me.	Sometimes applies to me.	Often applies to me.

SECTION TWO: Auditory Learner

1. _____ I understand how to do something if someone tells me, rather than having to read the same thing to myself.
2. _____ I remember things that I hear, rather than things that I see or read.
3. _____ It's hard for me to read other people's handwriting.
4. _____ If I had the choice to learn new information through a lecture or textbook, I would choose to hear it rather than read it.
5. _____ I like to listen to the books read out loud.
6. _____ I like to talk and enjoy making oral presentations.
7. _____ I remember what was said during class lectures or discussions.
8. _____ I like to participate in discussions.
9. _____ I solve problems by talking about options and asking other people.
10. _____ I remember the names of people but forget faces.

Total _____
Please respond to all questions.

1	2	3
Never applies to me.	Sometimes applies to me.	Often applies to me.

SECTION THREE: Kinesthetic Learner

1. _____ I learn best when I am shown how to do something, and I have the opportunity to do it.
2. _____ Before I follow directions, it helps me to see someone else do it first.
3. _____ I find myself needing frequent breaks while studying.
4. _____ I am not skilled in giving verbal explanations or directions.
5. _____ I think better when I have the freedom to move around.
6. _____ I have difficulty sitting still; in motion most of the time.
7. _____ I remember things I have done rather than what was seen or talked about.
8. _____ I have messy handwriting.
9. _____ I gesture with my hands when talking.
10. _____ I remember things if I write them down.

Total _____
Please respond to all questions.

1	2	3
Never applies to me.	Sometimes applies to me.	Often applies to me.

Small-Group Activities

1. _____ I have active involvement in the entire learning cycle.
2. _____ I have a well-defined task orientation with achievable specific aims and objectives in a given time.
3. _____ my reflection is based on experience and deep learning.

Which of the following learning methods (tools) do you prefer the most? Please circle/select all that apply to you.

1. Tutorials
2. Free discussion
3. Simulations
4. Case-based learning
5. Problem based learning
6. Team-based learning
7. Seminars
8. Other, specify: ☐

Which of the following teaching techniques do you prefer the most? please select all that apply to you

1. **Buzz group**: Write a question or a topic on the board and ask each student to write down any ideas/responses they have. Then ask them to share their thoughts with a colleague for a couple of minutes.
2. **Brainstorming or Ideas storming:** Write down a statement, a word, or a question on the board. Ask the students to shout out their thoughts and ideas and write them down on the board or flipchart without comment.
3. **Presentations**: individual students or groups of students present on a topic devised by the tutor or on a self or group-generated topic.
4. **Resource-based tasks:** Provide the students with a range of resources (could be articles, quotations, x-rays, tables of data, test results, photographs, printouts, etc). Ask them to solve a problem or address a question using the provided resources.
5. **Roleplay**: students take on specific roles and act out the views or actions associated with those roles. This could involve experiencing different points of view or putting into practice certain skills and approaches.

Which of the following assessment types do you believe is/are more valid, fair, and useful? Please select all that apply to you.

1. Assessment of your outcomes or progress
2. Formative or summative assessment
3. Assessment of your performance and reflection
4. Oral or written exam
5. Peer/self or tutor assessed

How do you feel within your group? Regarding the following points:

Please Check that apply to you

	Satisfied	*Natural*	*Unsatisfied*
Group Size (Number of students)			
Group physical environment and climate			
Place of teaching and classroom design			
Available resources for teaching			
Learning objectives and contents for each session about your interest			
Teacher or tutor role and class management			
Time for the task(s) to be completed and reviewed			