



Learning styles, approaches and academic performance of second and third-year medical students of a medical college of Kathmandu: a descriptive cross-sectional study

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Background: The research is based on a questionnaire to study the different learning styles among medical students, and their approach to intellectual development.

Methods: This is an observational, cross-sectional study conducted on 140 participants. Initially after the informed consent process, the second-year and third-year medical students were requested to respond to the questionnaire without consulting friends. Data were analyzed descriptively and comparison was made.

Results: In this study, the students were mostly visual learners, followed by solo learners, audio learners, verbal learners, and social learners. The majority of the students in our study (84.56%) studied less than 4 h per day beyond normal lecture hours. Similarly, 45.71% of students studied continuously for 30–60 min. During break, 63.57% of students used social media, watched television, and videos, and listened to music. Most students (75%) preferred to study in a hostel room and only 12.85% used the library as their study place. The majority of the students (65.71%) of students slept between six to eight hours. The University's suggested medical textbooks and reference materials were consulted by 94.3% of the students. The 47.85% of students favored self-directed learning with 56.42% preferring to read and write to retain the learned materials. Self-prepared notes were commonly used by the majority of students (60.7%).

Conclusions: This research evaluates the preferred learning preferences of medical students and their relationship to academic performance, which will improve the effectiveness of teaching and learning between teachers and medical students.

Keywords: academic, learning, medical, performance, students

Introduction

Medical students have a variety of learning styles that affect how they approach the acquisition of knowledge and skills. Understanding these learning preferences can have a major impact on how they learn and how well they do in school. Some medical students prefer a visual approach to learning and rely on illustrations, diagrams, and charts to understand difficult medical concepts^[1]. Others prefer auditory learning and get the most benefit from discussions, lectures, and oral explanations. Some students also prefer a kinesthetic

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HIGHLIGHTS

- The students were mostly visual learners, followed by solo learners, audio learners, verbal learners, and social learners.
- Most students studied less than four hours daily beyond normal lecture hours.
- During breaks, most of the students prefer to scroll social media.
- Most students prefer to study in a hostel room than at the library.
- The university's suggested medical textbooks and reference materials were consulted by most of the students.

learning style and participate in demonstrations and hands-on activities to enhance their understanding. Medical educators can adapt their teaching strategies and create a more inclusive and productive learning environment for all medical students by recognizing and accommodating these different learning styles^[2].

Medical students acquire the enormous amount of knowledge they need for their studies through various learning strategies. Active learning through problem-solving, self-directed learning using books and online resources, collaborative learning through group discussions and case-based learning, and experiential learning through clinical rotations and hands-on experiences are some examples of these approaches^[3]. Medical students often combine different learning strategies to improve their

understanding and memory of medical concepts and position themselves for success as competent and caring healthcare professionals. Medical students need to be acutely aware of their learning styles, preferences, and methods to maximize their academic performance^[4]. The second and third years of medical school are crucial because it is during this time that students deepen their studies, broaden their prior knowledge, and hone their clinical skills. There are not many studies of this kind in our environment. The benefits of this research in the context of Nepal include the ability to assess medical students' preferred learning preferences and their relationship to academic performance, which will improve the effectiveness of teaching and learning between teachers and medical students and help medical students achieve better examination results. The development of effective, up-to-date, knowledgeable, and ethical physicians is facilitated by medical education, which has a variety of essential effects^[5,6].

Therefore, this study was planned to determine the learning styles, learning approaches, and academic performance of second and third-year medical students.

Objectives

This study aims to classify the learning preferences of first- and second-year medical students and to compare academic performance with different learning styles and approaches.

Methods

The study was conducted from April 2023 to July 2023 after ethical approval was granted by the Institution Review Committee (registration number 818 dated 24 April 2023). Participants were over 18 years of age. Written informed consent was obtained from each participant. The written consent form is kept securely, and a digital copy of each consent form is stored.

This is an observational, cross-sectional study conducted on undergraduate students in the second and third year of MBBS. Initially, the total number of undergraduate students in the second and third-year MBBS were chosen ($N = 200$). The sample size was adjusted using the Cochran formula where $\alpha = 0.05$, $d = 0.05$, $P = 0.5$, $q = 0.5$, $Z = 1.96$, $N = 200$.

$$n = \frac{\{(1.96)^2 \times 0.5 \times 0.5\} \div (0.05)^2}{1 + \frac{1}{200} \{[(1.96)^2 \times 0.5 \times 0.5] \div (0.05)^2 - 1\}}$$

The final sample size was set at 140 people, allowing for a 5% loss. Second- and third-year medical students who had taken a university examination at least once and received their examination results were included in the study. Potential biases that may occur in the study include selection bias, non-response bias, response bias, information bias, and reporting bias. To avoid these biases, participants were selected by lot to ensure randomization and simple and understandable questions were asked.

After giving informed consent, the second and third-year medical students were asked to answer the questionnaire without consulting friends. The pre-designed questionnaires were validated with the help of two subject experts, and the questions were revised after a pilot study with 14 medical students (seven each from the second and third year of MBBS).

The questionnaire consisted of four parts. Part A contained demographic variables such as gender, age, and level of

education. Parts B and C contained questions on learning style, preferences, approaches, and statements, respectively. Part D consisted of questions on academic assessment and performance.

The data obtained from the questionnaires were analyzed descriptively using IBM SPSS 24 and MS Excel 19 and compared wherever possible. A Likert scale of 1–5 was used and the mean, standard deviation with a CI of 95 was calculated. Descriptive analysis was performed with frequency, percentage, mean, and standard deviation. The analyzed results were presented in the form of tables and diagrams. The work was reported by the STROCSS criteria^[7].

There were no missing data. Subgroups and interactions were not present.

Results

A total of 140 students took part in the study. Out of the 140, 92 (65.71%) students were male, and 48 (34.28%) students were female. Seventy students had completed their MBBS degree in the first year, and the remaining 70 students had completed their second year.

Regarding the duration of study, 43.14% of students studied 0–2 h, 41.42% of students studied 2–4 h, 11.42% of students studied 4–6 h and 5% of students studied more than 6 h beyond the normal lecture time. The subject revision was done by 6.42% of students daily, by 25.71% of students once a week, by 22.85% of students once a month and by 45% of students during examination preparation. The situation is similar with continuous reading: 23.57% of the students studied continuously for less than 30 min, 45.71% of the students for 30–60 min, 24.28% of the students for 60–90 min, and 6.42% of the students for more than 90 min.

Thirty-five percent of the students took a break for less than 20 min, 38.57% between 20 and 40 min, 12.85% between 40 and 60 min, and 13.57% longer than 60 min. Similarly, 17.14% of students took a short nap during their break, 9.28% of students preferred to exercise, 63.57% of students liked to use social media, watch TV, watch videos, and listen to music, 7.14% of students liked to gossip with a friend and 2.85% of students liked to eat a snack during their break.

Of the 140 students, 2.85% preferred to stand while studying, followed by 64.28% who preferred to sit on a chair, 14.28% who preferred to walk while studying, and 17.85% who preferred to lie on their backs while studying. In terms of study locations, 75% of students preferred to study in their dorm room, 12.85% of students preferred to study in the library, 5% of students preferred to study in class or on the ward, and 7.14% of students preferred to study at home.

The results showed that 7.14% of students slept less than four hours daily, 11.42% of students slept between 4 and 6 h, 65.71% of students slept between 6 and 8 h, and 15.71% of students slept more than 8 h daily. 3.57% of the students consulted the university syllabus daily, 39.28% of the students consulted the university syllabus once in a while, 27.85% of the students consulted the university syllabus during examination time and 29.28% of the students never consulted the university syllabus while studying.

In terms of preferred methods, 10% of students preferred role-play/demonstrations as teaching-learning approaches, 47.85% of students preferred self-directed learning, 24.28% of students

preferred problem-based learning, 15.71% of students preferred bedside/clinical learning, and 2.14% of students preferred community-based learning. In terms of retention, 12.14% of students wrote down the material to retain it, 56.42% of students read and wrote to retain it, 12.14% of students preferred making mnemonic devices and flashcards, and 19.28% of students preferred discussing it with friends.

In the academic assessment of performance, 70 students passed their first-year examination and the other 70 students passed their second-year examination. Of them, 4.28% of the students scored less than 50% in the final university examinations, 10.71% of the students scored between 50 and 59%, 37.14% of the students scored between 60 and 69%, 42.85% of the students scored between 70 and 79% and 5% of the students scored more than 80% in the final examinations. Moreover, 65% of the students were satisfied with their results while the remaining 39% of the students were dissatisfied with their results. 80.71% of the students passed their university examination on the first attempt, 18.57% of the students passed on the second attempt and 0.71% of the students passed on the fourth attempt. The majority, 75.71% of the students, never failed the internal examination, while the remaining 24.29% of the students failed the internal examination.

Among 140 participants, there were different types of learners as shown in Figure 1.

Regarding the sources that students regularly consulted for learning, 134 of them used medical textbooks and reference books recommended by the university, 60 of them consulted online resources such as journal articles and websites, and 34 of them consulted medical textbooks and reference books not recommended by the university. The majority of students preferred self-prepared notes (85), followed by lecture notes (66), question-and-answer books (28), lecture notes handed out by lecturers (22), online notes (15), notes from friends and colleagues (8), and index cards (6). The number of students preferring audio-visual learning with animations is 66, case and problem-based learning 63, interactive sessions 47, blackboard and markers 27, bedside learning 23, online 21, and one-page PowerPoint presentation 12.

The mean score with standard deviation (SD) and the lower and upper range with a 95% CI for the statements of learning styles and preferences are shown in Table 1.

The mean score with SD and the lower and upper range with a 95% confidence interval for the statements of learning approaches are tabulated in Table 2.

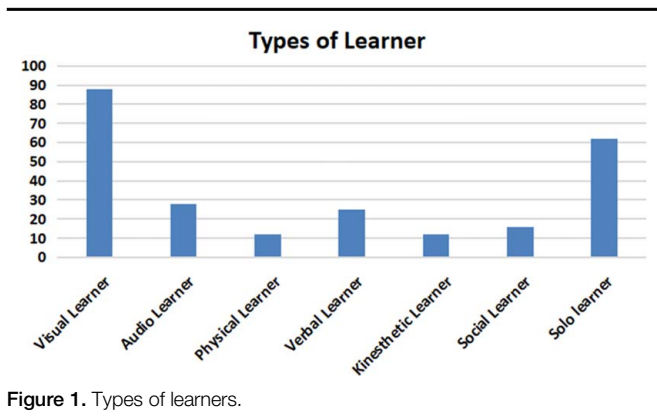


Figure 1. Types of learners.

Table 1

Statements for learning style and preference

Statements	Mean score ± SD (95% CI)	
	II nd year	III rd year
I enjoy doodling and even my notes have lots of pictures and arrows in them which helps to retain the most	4.06 ± 0.89 (3.85–4.27)	3.59 ± 0.90 (3.37–3.79)
If I am taking a test, I can “see” the textbook page and where the answer is located.	3.44 ± 0.91 (3.23–3.66)	3.46 ± 0.91 (3.24–3.67)
I should get work done in a quiet place	4.36 ± 0.89 (4.15–4.57)	4.43 ± 0.89 (4.22–4.64)
It helps to use my finger as a pointer when reading to keep my place.	3.57 ± 0.91 (3.36–3.78)	3.40 ± 0.91 (3.19–3.61)
I understand more and remember how to do something if someone tells me, rather than having to read the same thing to myself.	3.77 ± 0.89 (3.56–3.98)	3.50 ± 0.92 (3.29–3.71)
I learn more when I study with a group.	3.56 ± 0.90 (3.34–3.77)	3.23 ± 0.92 (3.01–3.44)
I learn better by reading out aloud.	3.70 ± 0.89 (3.49–3.91)	3.29 ± 0.97 (3.07–3.50)
I learn more when I can make a model of something.	3.90 ± 0.90 (3.69–4.11)	3.90 ± 0.89 (3.69–4.11)
I understand things better in class when I participate in role-playing.	3.71 ± 0.89 (3.50–3.92)	3.56 ± 0.91 (3.31–3.74)

Table 2

Statements for learning approaches

Statements	Mean score ± SD (95% CI)	
	II nd year	III rd year
It is good practice to study things till the eleventh hour.	3.3 ± 0.92 (3.08–3.51)	3.16 ± 0.92 (2.94–3.37)
The best learning strategy is to study the highest-priority topics.	4 ± 0.89 (3.79–4.21)	4.04 ± 0.89 (3.83–4.25)
Students learn better if the method of information delivery to the learner suits their particular learning habits.	4.31 ± 0.89 (4.11–4.52)	4.24 ± 0.89 (4.03–4.45)
Medical students with less intellectual flexibility will experience less academic burnout, more engrossment in learning, and better educational performance.	3.44 ± 0.90 (3.23–3.66)	3.27 ± 0.91 (3.06–3.49)
Certain teaching modalities like Problem-based learning (PBL) and case-based learning (CBL) compelled them to open textbooks to find specific answers related to clinical situations.	4.41 ± 0.89 (4.21–4.62)	4.54 ± 0.87 (4.34–4.75)
The educational environment plays a vital role in students’ learning.	4.41 ± 0.89 (4.21–4.62)	4.37 ± 0.89 (4.16–4.58)
Before the lecture, I review the topic.	3.24 ± 0.92 (3.02–3.45)	2.93 ± 0.93 (2.71–3.15)
I reviewed the topic after the lecture on the same day.	3.77 ± 0.89 (3.56–3.98)	3.07 ± 0.92 (2.85–3.29)
A break allows me to study more effectively when I return.	4 ± 0.90 (3.78–4.21)	3.96 ± 0.89 (3.75–4.17)
Assessment helps to improve my intellectual development	3.92 ± 0.89 (3.71–4.13)	3.88 ± 0.89 (3.68–4.09)
I review past questions to perform better in examinations.	4.01 ± 0.89 (3.80–4.22)	4.05 ± 0.89 (3.85–4.27)
I prefer peer discussion to better understand and retain the topic.	3.92 ± 0.89 (3.71–4.13)	3.84 ± 0.89 (3.63–4.05)
In my opinion, online video lectures are more useful than class lectures.	3.94 ± 0.89 (3.73–4.15)	4.27 ± 0.89 (4.06–4.48)

Discussion

In this study, men predominate with a ratio of 1.92 to women, which is similar to the study by Gautam and colleagues in Nepal with a ratio of 1.7 to women but differs from the study by Papanna and colleagues in India, in which women predominate with a ratio of 0.76 to men^[8,9].

The majority of students in our study (84.56%) studied less than four hours per day, which is similar to Abdulrahman and colleagues (70.8%), but Liles and colleagues reported that 49% of students studied 3–5 h per day^[10,11]. Most students (75%) preferred to study in a dormitory room, and only 12.85% used the library as a study venue. In contrast to our findings, Bickerdike *et al.*^[12] reported that 52.9% studied mainly in the library, 40.4% at home, and 7.1% divided their study time equally between the library and home. Lal and Ingle^[13] found that although 97% of undergraduate students reported visiting the library, only 41% visited it regularly. The library in our setting is not well equipped and not open 24/7 for students, which could lead them to prefer dormitory rooms over the library. This study found that 64.28% of students preferred to sit on a chair, and only 2.85% of students stood while studying.

Regarding breaks during study, 45.71% of students stated that they study continuously for 30–60 min at a time. About 74% of students take breaks of less than 40 min and 63.57% of students use online social networks and other sources of entertainment (social media, television, videos, and listening to music) during their breaks. A study by Peleias and colleagues reported that 27% of medical students were physically active during their free time, while Jameel and colleagues reported that multimedia applications such as WhatsApp and Facebook engaged medical students the most during their free time (males 55%, females 42%)^[14,15]. A study in Moscow by Reshetnikov *et al.*^[16] found that 43.9% of medical students preferred to spend their breaks actively (meetings, sports, walking, traveling), and the rest of the students rested passively (sleeping, reading, watching TV, etc.). They also found that 31.6% of students had the urge to surf the Internet even during study time.

This study found that 81.4% of students slept more than six hours each night, compared to 7.14% of students who slept less than 4 h. The studies by Brubaker and colleagues (77.2%), Ahmed and colleagues (71.5%), and Rathod and colleagues (82.15%) showed a similar rate of students sleeping more than six hours daily^[17–19]. The results contrary to ours were from Priya and colleagues^[20] who reported that 21.5% of students slept more than six hours but 9.12% of students slept less than four hours, which was similar to ours. The undeniable problem of inadequate sleep in adolescents and young adults is even worse among medical students.

The medical textbooks and reference books recommended by the university were consulted by 94.3% of the students. 47.85% of the students preferred self-directed learning. 56.42% of the students preferred to read and write to retain the learning material. Self-prepared notes were used by the majority of students (60.7%), followed by lecture notes (47.1%) and old question-and-answer banks (20%), which are not mutually exclusive. A 2019 University of New South Wales study by Wynter^[21] and colleagues reported that most students preferred face-to-face lectures (45.9%), followed by online question banks (40.9%) as their main learning tools. The study by Jameel *et al.*^[15] in Saudi Arabia showed that medical textbooks were used most frequently

(46.1%) by students as the main learning material, and 82% of them believed that problem-based learning was the best learning technique.

In this study, students were predominantly visual learners, followed by solo learners, audio learners, verbal learners, and social learners, and a few were physical and kinesthetic learners, which are not mutually exclusive. Sixty-six students preferred audio-visual learning with animations, 63 preferred case-based and problem-based learning, 47 preferred interactive sessions, 27 chose blackboard and markers, 23 preferred online learning, and 12 preferred one-page PowerPoint slide presentations. In a study conducted by Papanna *et al.*^[9] in India, it was found that problem-based learning (PBL) was the most popular teaching method with 71.4% of participants. This was closely followed by video lectures, with 67.9% of participants indicating a preference for this form of teaching. Didactic lectures were preferred by 32.8% of participants, while self-directed learning (SDL) was least preferred by only 14.1% of participants. This indicates a clear preference for active and interactive learning methods such as PBL and video lectures among the participants of the study. In the study conducted by Jana *et al.*^[22] in India in 2020, it was found that the majority of the participants preferred practical demonstration (81.3%) as the preferred teaching method. After this, the discussion was preferred by 64.2%, followed by the chalk-and-talk method with 58.5% and lectures with 35.3%. The preference for the practical demonstration was attributed to the perceived ease of understanding (69.1%), the fact that the medical curriculum is predominantly based on practical methods (43.9%), and clear elaboration (45.5%). In terms of teaching media, participants indicated a preference for computers with liquid crystal display projectors (63.8%), followed by whiteboards (52.8%) and blackboards (46.7%). This shows a clear preference for technology-based visual aids in the learning process. Gupta *et al.*^[23] (2016, India) reported that 59 (45.4%) students preferred a lecture, while 28 (21.5%) preferred a tutorial, 36 (27.7%) preferred a group discussion and seven (5.3%) students preferred a symposium. Similarly, they also observed that when the participating students were asked about their preferences regarding the best teaching and learning media, 58 (44.6%) preferred blackboard as a teaching tool, followed by 47 (36.1%) who preferred the use of PPT and 25 (19.2%) who opted for overhead projectors (OHP)^[23].

A comparison of second- and third-year medical students' attitudes towards learning style and preferences revealed that all of them like to doodle and use pictures and arrows to retain most of what they have learned. Hernandez-Torrano *et al.*^[4] reported that medical students overwhelmingly preferred the visual learning style (80.8%). Similarly, Rezigalla and colleagues (2019) observed that medical students in Saudi Arabia preferred auditory (55.9%) followed by kinesthetic (32.2%) for uni-modal learning patterns and auditory-kinesthetic (77.8%) for bi-modal learning patterns. In addition, they all agreed that they remembered the location of the answers in the textbook during the test and that they liked to work in a quiet place^[24]. The study conducted by Panambur *et al.*^[25] in Oman in 2014 provided interesting insights into the learning style preferences of preclinical medical students. Approximately 35% of the participants showed a clear preference for a single dominant learning method, which could be visual, auditory, reading/writing, or kinesthetic. The distribution across the four sensory modes was relatively even: 8% learned visually, 9% auditory, 9% reading/writing, and

9% kinesthetic. These students were categorized as uni-modal learners. In contrast, the remaining 65% of participants reported preferring two (14%), three (19%), or all four (32%) modes to absorb information, which categorized them as multi-modal learners. Within this group, the majority of learners used all four modes equally (quad-modal). Some tended to use three modes (tri-modal), while others preferred two modes (bi-modal) for their knowledge acquisition. This diversity of learning styles underlines the importance of considering different educational approaches to meet the diverse needs of students.

The study conducted by Urval *et al.*^[26] in 2014 investigated the learning styles of medical students using the VARK questionnaire. The results showed that the majority of students (68.7%) had multiple learning preferences. Among the sensory modalities identified, auditory was the most common preference, reported by 45.5% of students, followed by kinesthetic (related to physical movement and touch) at 33.1%. This highlights the diversity of learning styles among the participants, with a significant proportion preferring auditory and hands-on learning methods.

The second-year medical students agreed that they learned more when they studied in a group and also when they read aloud, but the third-year medical students were not sure about this. However, the second and third-year medical students agreed that they learned more when they made a model of something and participated in role-play. The difference in second and third-year medical students' views on their preferred learning methods may be attributed to their developing understanding of effective learning strategies and the increasing complexity of their curriculum. Second-year medical students may find group learning and reading aloud beneficial for several reasons. First, the material may be more basic and conceptually challenging in the first years, so discussing it with peers or reciting the content may improve comprehension. In addition, learning in a group encourages students to get to know each other and share different perspectives and approaches to problem-solving. On the other hand, third-year medical students may be more uncertain about the effectiveness of group study and reading aloud. This uncertainty may result from the transition to more clinically oriented learning, where independent learning and practical experience become increasingly important. At this stage, students may gain more practical experience in the clinical setting, which may not fit as seamlessly into group study.

Both second and third-year students agree that building models and role-playing are very effective. These activities provide tangible, experiential learning that can be particularly effective for medical education. Building models and participating in role-playing allows students to apply theoretical knowledge to practical situations, helping them to better understand and retain complex medical concepts. These activities can also simulate real-life clinical scenarios, promoting the critical thinking and problem-solving skills that are essential to medical practice. When comparing second- and third-year medical students' attitudes toward learning approaches, all agreed that studying the highest-priority topics was the best learning strategy and that they learned better when the method of information delivery matched their learning habits. They all agreed that using their fingers as pointers helped them to read and that they understood and remembered more when they listened to something rather than reading it themselves.

The study by Abdulrahman *et al.*^[10] investigated the study habits of medical students. The most commonly used method was an individual study (85.3%), followed by group study (34%), being taught by another student (26.4%), and discussions with course instructors (12%). When no examinations were coming up, participants relied primarily on the slides from the main lecture with personal notes (83.4%), followed by videos from platforms such as YouTube and Osmosis (76.1%) and textbooks (46.1%). Closer to the examinations, the main methods also remained the same, with most using lecture slides with personal notes (92.4%) and videos (62.1%). Interestingly, a significant proportion (74.8%) used questions from past examinations as a learning tool. In terms of study hours per day, students with higher GPAs studied on average 3–4 h per day (45.5%) compared to students with lower GPAs (38.3%), regardless of proximity to the examination. Another study found that 43% of students with high GPAs studied 10–14 h just before final examinations, compared to 50% in the low GPA group. In terms of gender, 47% of female students preferred to study 10–14 h close to final examinations, compared to 44% of male students. During examination-free periods, 75% of students with high GPAs studied 1–4 h daily, while 65% of students with low GPAs did the same. Similarly, 64% of female students preferred 1–4 h a day, compared to 78% of male students.

The study by Shah *et al.*^[27] investigated the learning approaches of health sciences students in a Nepali medical college. They identified two distinct approaches: deep and surface learning. Students adopting the deep approach are motivated by an interest in the subject and its professional relevance. They critically analyze new concepts, connecting them to existing knowledge, leading to a thorough understanding and long-term retention. Conversely, students opting for the surface approach are primarily motivated by a desire to complete the course or a fear of failure. They tend to focus on memorization for assessment rather than understanding, resulting in shallow retention of knowledge. The study found that the majority of students predominantly utilized the deep approach, indicating a strong inclination towards understanding and retention of concepts.

The study conducted by Ismail *et al.*^[28] examined the preferences and opinions of the study population about teaching methods. The majority (72%) expressed a preference for lectures. Only a small percentage preferred other methods: 10% opted for tutorials and 6% each for PBL, practical exercises, and early clinical exposure (ECE). None of the participants found computer-assisted learning (CAL) useful. In addition, 96% felt that lecturers' use of the whiteboard to draw diagrams contributed to better visualization and retention of the material than relying solely on PowerPoint presentations. Furthermore, 86% of students felt that concentration waned after 20–30 min of lecture-based teaching. A significant portion (76%) of the study population expressed a preference for 'two-way communication' in lecture classes. Additionally, 92% noted that some lecturers employ interactive teaching methods such as mnemonics, analogies, and storytelling during lectures. Moreover, 94% believed that discussions with peers were beneficial in enhancing their understanding of specific topics.

The students in both years are not sure whether it is good practice to study until the last lesson, and they are also not sure whether they have worked through the topics before the lecture. The second-year medical students agreed that academic burnout, eagerness to learn, and academic performance were related to

students' intellectual flexibility, while the third-year students were not sure about this. However, both cohorts agreed that PBL and CBL force them to open textbooks and that the learning environment plays an important role in their learning. Second-year medical students repeated topics after lectures on the same day, while third-year medical students were unsure whether they should repeat topics on the same day. Students in both years agreed that the break allowed them to study effectively and that the assessment helped them to improve their intellectual development.

Of the 140 students, 42.85% received grades between 70 and 79%, 5% received scores above 80%, and 4.28% received less than 50% on recent university examinations. Furthermore, 39% of students expressed dissatisfaction with their performance scores, while 65% expressed satisfaction. On their first attempt, 80.71 percent of students passed their university examinations, while on their fourth attempt, 0.71% of students passed. 75.71% of students never failed their internal examinations, compared to just 24.29% of students who did. According to research by Jameel *et al.*^[15], 9.5% of students admitted to having failed a subject in the past.

Ninety-five percent of students had passed every examination they had taken before. This was the vast majority. It's interesting to note that people who often passed their examinations showed a preference for online journals, pocketbooks, medical websites, and textbooks. The group that had previously failed seemed to be more inclined to use lecture handouts and class notes, on the other hand. Nearly half of the students only reviewed the material for examinations, which was discovered to be comparable to a study by Bickerdike *et al.*^[12] (47.1%). The ineffective scheduling of study time and workload to balance them evenly throughout the academic year and the number of subjects to study in a year, or roughly 7–8 subjects in a year, may be the cause of the last-minute scrambling.

According to this study, only 3.57% of students used the university curriculum daily, which is a low level of continuous use. Unbelievably, a sizable 29.28% of students said they never used it while they were in school. The information presented here highlights a significant disconnect between the intended and actual use of educational resources by students in their daily learning routines. According to a 2011 study by Zhang^[29] and colleagues at the University of Queensland School of Medicine, almost 80% of the students said they felt overburdened by the amount of work they thought it would take to finish the official program. This result highlighted the considerable stress and pressure that most students in this school setting faced. Furthermore, according to 74.3% of respondents, using informal learning strategies was crucial to their performance in passing examinations. This indicated that a large number of students used extracurricular, non-structured learning strategies to improve their comprehension and performance. This study's results are consistent with the notion that it is critical to acknowledge and encourage a variety of learning approaches in the classroom.

Conclusion

Most of the students were visual learners. To maximize the efficiency of their learning, most students blend this type of learning with other types of learning such as solitary, auditory, verbal, and social learning. Less than four hours is the amount of time most students spend studying after lectures. Students' preferred study

time is 40–60 min. During study breaks, the majority of students prefer to surf social media. The majority of students get 6–8 h of sleep per day.

This study is limited to a single medical college in Kathmandu, which may limit the generalizability of the results to other institutions or regions. The exclusion of medical students from other years could affect the completeness of the results in terms of learning styles and approaches in all years of medical education. In addition, this study was conducted during a specific period and the results may be influenced by factors unique to that time frame. Changes in educational policy, curriculum, or teaching methods after the study period are not taken into account. The study relies on specific instruments or tools to assess learning styles and approaches. The validity and reliability of these instruments are considered within the study. In addition, the study may not take into account external factors that could influence learning styles and approaches, such as personal experiences, family background, or extracurricular activities.

This research evaluates the preferred learning preferences of medical students and their relationship to academic performance, which will improve the effectiveness of teaching and learning between teachers and medical students.

Ethical approval

Ethical approval was taken from the Institutional Review Committee, Nepalese Army Institute of Health Science, Kathmandu.

Consent

Not applicable.

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Author contribution

A.K. conceived the study, recruited the research team, designed the study protocol, drafted the manuscript, and searched the existing literature. A.K., A.B., R.J., S.K., and S.S.M. collected the data and analyzed it. A.K., A.B., R.J., S.K., and S.S.M. contributed to the results and discussion section of the manuscript. A.K., A.B., R.J., S.K., and S.S.M. edited the manuscript and have read and approved the final manuscript.

Conflicts of interest disclosure

A.K. works for Nepal and A.B., R.J., S.K., and S.S.M. are medical undergraduate students. The authors report no conflicts of interest.

Research registration unique identifying number (UIN)

The research study is registered with registration number 818 at the Institutional Review Committee, Nepalese Army Institute of Health Science, Kathmandu.

Guarantor

Anuj Basnet.

Data availability statement

Data are protected under ethical guidelines and security considerations under the Institutional Review Committee. Data can be given access to the viewer or reviewer upon request. Reason for need for access to the data is required and if the reason is justified, access to data is permitted.

Provenance and peer review

Not commissioned; externally peer-reviewed.

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References

- [1] Buşan AM. Learning styles of medical students-implications in education. *Curr Health Sci J* 2014;40:104.
- [2] Kharb P, Samanta PP, Jindal M, *et al.* The learning styles and the preferred teaching—learning strategies of first year medical students. *J Clin Diagn Res JCDR* 2013;7:1089.
- [3] Lehl SS, Gupta M, D’Cruz S. Enhanced learning strategies of undergraduate medical students with a structured case presentation format. *J Educ Health Promot.* 2021;10:424.
- [4] Hernández-Torrano D, Ali S, Chan CK. First year medical students’ learning style preferences and their correlation with performance in different subjects within the medical course. *BMC Med Educ* 2017;17:1–7.
- [5] Guze PA. Using technology to meet the challenges of medical education. *Trans Am Clin Climatol Assoc* 2015;126:260.
- [6] Shrestha C, Shrestha A, Joshi J, *et al.* Does teaching medical ethics ensure good knowledge, attitude, and reported practice? An ethical vignette-based cross-sectional survey among doctors in a tertiary teaching hospital in Nepal. *BMC Med Ethics* 2021;22:1–16.
- [7] Mathew G and Agha R, for the STROCSS Group. *STROCSS* 2021.
- [8] Gautam N, Dhungana R, Gyawali S, *et al.* Perception of medical students regarding TU-IOM MBBS curriculum and teaching learning methods in Nepal. *Kathmandu Univ Med J* 2022;20:219–24.
- [9] Papanna KM, Kulkarni V, Tanvi D, *et al.* Perceptions and preferences of medical students regarding teaching methods in a Medical College, Mangalore India. *Afr Health Sci* 2013;13:808–13.
- [10] Bin Abdulrahman KA, Khalaf AM, Bin Abbas FB, *et al.* Study habits of highly effective medical students. *Adv Med Educ Pract* 2021;8:627–33.
- [11] Liles J, Vuk J, Tariq S. Study habits of medical students: an analysis of which study habits most contribute to success in the preclinical years. *MedEdPublish* 2018;7:61.
- [12] Bickerdike A, O’Deasmhunaigh C, O’Flynn S, *et al.* Learning strategies, study habits and social networking activity of undergraduate medical students. *Int J Med Educ* 2016;7:230.
- [13] Lal P, Ingle GK. Use of medical library by undergraduate medical students in a medical college of North India. *Indian J Commun Med* 1999;24:86–8.
- [14] Peleias M, Tempski P, Paro HB, *et al.* Leisure time physical activity and quality of life in medical students: results from a multicentre study. *BMJ Open Sport Exerc Med* 2017;3:e000213.
- [15] Jameel T, Gazzaz ZJ, Baig M, *et al.* Medical students’ preferences towards learning resources and their study habits at King Abdulaziz University, Jeddah, Saudi Arabia. *BMC Res Notes* 2019;12:1–6.
- [16] Reshetnikov AV, Prisyazhnaya NV, Reshetnikov VA, *et al.* Perception of healthy lifestyle among students of medical schools. *Serbian J Exp Clin Res* 2020;21:67–74.
- [17] Brubaker JR, Beverly EA. Burnout, perceived stress, sleep quality, and smartphone use: a survey of osteopathic medical students. *J Osteop Med* 2020;120:6–17.
- [18] Ahmed N, Sadat M, Cukor D. Sleep knowledge and behaviors in medical students: results of a single center survey. *Acad Psychiatry* 2017;41:674–8.
- [19] Rathod SS, Nagose VB, Annapaka E, *et al.* Sleep duration among undergraduate medical and science degree college students: a comparative study. *Natl J Physiol Pharm Pharmacol* 2018;8:536–9.
- [20] Geethika B, Priya J. Effect of meditation on sleep—a questionnaire based study among dental students. *J Pharm Sci Res* 2016;8:931.
- [21] Wynter L, Burgess A, Kalman E, *et al.* Medical students: what educational resources are they using? *BMC Med Educ* 2019;19:1–8.
- [22] Jana PK, Sarkar TK, Adhikari M, *et al.* A study on the preference of teaching methods among medical undergraduate students in a tertiary care teaching hospital, India. *J Educ Health Promot.* 2020;9:275.
- [23] Gupta SS, Rathod AD. A Study on preferences of I MBBS Students about teaching–Learning Methods. *J Educ Technol Health Sci* 2016;3:20–2.
- [24] Rezigalla AA, Ahmed OY. Learning style preferences among medical students in the College of Medicine, University of Bisha, Saudi Arabia (2018). *Adv Med Educ Pract* 2019;10:795–801.
- [25] Panambur S, Nambiar V, Heming T. Learning style preferences of pre-clinical medical students in oman. *Oman Med J* 2014;29:461–3.
- [26] Urval RP, Kamath A, Ullal S, *et al.* Assessment of learning styles of undergraduate medical students using the VARK questionnaire and the influence of sex and academic performance. *Adv Physiol Educ* 2014;38:216–20.
- [27] Shah DK, Yadav RL, Sharma D, *et al.* Learning approach among health sciences students in a medical college in Nepal: a cross-sectional study. *Adv Med Educ Pract* 2016;7:137–43.
- [28] Ismail S, Rahman NIA, Mohamad N, *et al.* Preference of teaching and learning methods in a new medical school of Malaysia. *J Appl Pharm Sci* 2014;4:048–55.
- [29] Zhang J, Peterson RF, Ozolins IZ. Student approaches for learning in medicine: what does it tell us about the informal curriculum? *BMC Med Educ* 2011;11:87.