Journal Homepage: - www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)

Article DOI: 10.21474/IJAR01/17215
DOI URL: http://dx.doi.org/10.21474/IJAR01/17215

RESEARCH ARTICLE

EXPLORING NOTE TAKING HABITS AMONG EMERGENCY MEDICINE BOARD TRAINEES, AND ITS IMPLICATION ON LEARNING IN MEDICAL EDUCATION

Dr. Rawan Eskandarani, Dr. Zainab Alahamdi, Dr. Safa Alabdaljabbar and Dr. Abdulaziz Alhamad
KFMC, Emergency Department.

Manuscript Info

Manuscript History
Received: 05 May 2023
Final Accepted: 09 June 2023
Published: July 2023

Abstract

This study investigates the impact of note-taking on academic performance and clinical practice among emergency medicine trainees. It compares paper-based and digital note-taking methods and evaluates note-taking skills and organization. The study aims to determine the need for changes in learning methods during residency and introduce a strategic note-taking approach to trainees. The findings reveal the association between note-taking and focus, retention, ability to recall in the medical learning setting and clinical practice. Paper-based note-taking is perceived as more effective for information retrieval. The study highlights the need for incorporating note-taking instruction into the medical education curriculum and developing effective note-taking skills for medical trainees.

Introduction:-

Note-taking is a widely utilized skill among individuals across various domains, especially during their academic years. Despite its importance, students rarely receive any guidance on best practices for taking notes to achieve maximum retention and long-term memory recall. Note-taking is thought to enhance information comprehension and allow for better understanding. in some studies, it is found that students taking notes during class are more likely to reach the course goals, perform better on examinations, and have an improved retention of information compared to those who did not (1). Some learners filter, organize and process the given information, adding to their previous knowledge and encoding their notes uniquely. In contrast, others perceive note-taking as recording every word said during the lecture without filtration (2). In the past, using paper notebooks was the only available method to take notes, but with the advancement of technology, more people use smartphones, tablets, and laptops to write their notes (3). Another factor affecting note-taking is the presence of handouts given in advance or after the end of a lecture (4). The process of writing notes by hand is thought to be closely associated with encoding (5-7) (Figure 1). Thus, handwritten notes are generally believed to be associated with better recall than notes taken on a computer or other device (7-10). Most research data advocate the effect of note-taking on academic performance, and little to none show their impact on practical life after the end of academic years. In this study, we will evaluate the academic and clinical practice effects of note-taking among Emergency Medicine trainees

Study Rationale

The study findings will be valuable for medical students and practitioners as very few studies have been conducted to look at note-taking behaviors and best practices to retain knowledge and information. This research focuses on medical trainees in the field of emergency medicine and note-taking effect on their academic, clinical performance, and knowledge retention.

Corresponding Author:- Dr. Rawan Eskandarani
Address:- KFMC, Emergency Department.

Research Objectives:-

1. Impact of strategic note taking on academic performance
2. Importance of note-taking impact on the clinical practice
3. Comparison between paper and digital note taking in the easiness of retrieving information when needed.
4. Testing and measuring the note-taking skills among emergency trainees
5. Type of note-taking and organization and its effect
6. To evaluate the need for change in learning methods during residency or to introduce the strategic note takings approach to trainee.

Methodology:-

Study Design

This study adopts a cross-sectional design to evaluate note-taking habits among emergency medicine board trainees and their implications on learning in medical education. The research design allows for the collection of data at a specific point in time, providing a snapshot of trainees' note-taking practices and their perceived impact.

Study Participants

The study involves emergency medicine board trainees from multiple residency programs in Saudi Arabia and the Gulf region. Trainees from different regions and cultural backgrounds are included to enhance the diversity and generalizability of the findings. Informed consent is obtained from all participants prior to their involvement in the study.

Data Collection

Data collection is carried out using self-administered questionnaires. The questionnaire includes items designed to gather information on participants' demographic characteristics (e.g., gender, residency program area, residency level), note-taking methods (e.g., paper-based, digital), note-taking skills and organization, and perceptions of the impact of note-taking on academic performance and clinical practice. The structured questionnaire provide an opportunity for an in-depth exploration of participants' note-taking strategies, challenges, and suggestions for improvement.

Instrument Development

The questionnaire is developed based on a comprehensive review of the literature on note-taking habits and their implications in medical education. Existing validated scales and items are adapted and modified to suit the specific objectives of this study. The questionnaire was reviewed after piloting by experts in medical education field to ensure content validity and clarity of items.

Data Analysis

Data was cleaned and analyzed using the SPSS program (version 22), Categorical variables was presented using number and percentages to summarize participants' characteristics and note-taking habits. Inferential analysis; to analyze association between two categorical variables we used the Chi square test. are employed to examine the relationships between variables (e.g., note-taking methods and academic performance). Alpha level was set as 0.05. P value equal to or less than 0.05 was considered statistically significant.

The qualitative data from the interviews were transcribed and analyzed thematically. Coding was performed to identify key themes and patterns related to note-taking strategies, challenges, and perceived impacts. The qualitative analysis provides a deeper understanding of trainees' experiences and perspectives regarding note-taking.

Ethical Considerations

This study adheres to ethical guidelines for research involving human subjects. Informed consent is obtained from all participants, ensuring their voluntary participation and confidentiality of their responses. Participants are informed of their right to withdraw from the study at any point without consequences. Data are securely stored and only accessible to the research team to maintain participant confidentiality.

Results:-

The results presented in Table 1 provide an overview of the characteristics of the participants included in the study, with a total sample size of 158. In terms of gender, the majority of participants were female, accounting for 60.1% (95 participants), while males accounted for 39.9% (63 participants).

Regarding the residency program area, the highest number of participants were from Riyadh, comprising 73.4% (116 participants) of the sample. Jeddah had the second highest representation with 13.3% (21 participants), followed by the Eastern province with 12% (19 participants). The Gulf area had the lowest representation, with only 1.3% (2 participants).

The participants' residency levels were distributed across different stages. PGY1 had 25.3% (40 participants), PGY2 had 25.9% (41 participants), PGY3 had 22.8% (36 participants), and PGY4 also had 25.9% (41 participants).

Regarding note-taking habits, a significant portion of the participants reported taking notes regularly, accounting for 39.2% (62 participants). Sometimes, note-taking was reported by 38% (60 participants), while 22.8% (36 participants) indicated that they rarely or never took notes.

Table 2 provides detailed information on the patterns and outcomes of note-taking among the participants, with a total sample size of 158. The table presents the frequency and percentages of participants based on various parameters related to note-taking practices and their perceived impact on learning.

In terms of reasons for taking notes, a considerable proportion of participants, 44.3% (70 participants), reported that taking notes helped them understand the material when they reviewed them later. The next most common reason for taking notes was to help focus during lectures, cited by 20.9% (33 participants). Some participants indicated that they took notes solely for exam purposes (7.6% or 12 participants), while a small number reported taking notes to remember information and reread it again (1.3% or 2 participants).

When asked about the necessity of taking notes for effective learning, the majority of participants, 56.3% (89 participants), responded affirmatively. However, a notable proportion of participants were uncertain (25.9% or 41 participants), and 17.7% (28 participants) did not consider taking notes necessary for effective learning.

Participants who perceived note-taking as time-consuming accounted for 47.5% (75 participants), while 44.9% (71 participants) reported difficulty in coordinating listening and writing simultaneously. On the other hand, a significant majority of participants did not feel less focused when taking notes (80.4% or 127 participants) and found taking notes useful (88% or 139 participants).

When asked if they wished to take notes more often, a substantial majority of participants, 74.1% (117 participants), expressed a desire to increase their note-taking frequency. In terms of the tools used for note-taking, the most commonly reported medium was a tablet (53.2% or 84 participants), followed by a notebook (36.7% or 58 participants) and a laptop (10.1% or 16 participants).

Regarding the organization of notes, the majority of participants reported organizing their notes through bullet lists of important points (43% or 68 participants) or by writing in their own words (77.8% or 123 participants). When taking notes, a significant proportion of participants did not use additional reading sources to link with their notes (17.1% or 27 participants).

Participants expressed a preference for teachers to provide lecture slides prior to class, with 73.4% (116 participants) responding positively. However, when slides were provided, a considerable number of participants still continued to take notes (57.6% or 91 participants).

The findings also revealed that a majority of participants found their note-taking interfering with their immediate understanding of the lecture (58.9% or 93 participants) and preferred having lecture materials provided to focus their attention without taking notes (52.5% or 83 participants). Furthermore, a significant proportion of participants considered their notes helpful for exam review (82.9% or 131 participants) and reported reviewing their notes either sometimes (46.8% or 74 participants) or frequently (36.1% or 57 participants).

The majority of participants had not been taught any note-taking skills previously (77.8% or 123 participants) and expressed a desire to improve their note-taking skills (67.7% or 107 participants). Moreover, a substantial number of participants believed that improving their note-taking skills would positively impact their academic performance (71.5% or 113 participants) and enhance their overall understanding of topics (92.4% or 146 participants).

When asked about the perceived effects of notes on performance, a large majority of participants believed that their notes helped them perform better during exams (89.2% or 141 participants). Furthermore, participants indicated that their notes contributed to passing exams (46.2% or 73 participants), good clinical practice (50.6% or 80 participants), and improving knowledge overall (74.7% or 118 participants).

Participants reported varying levels of retrieval and ease of note-taking during clinical practice. While 65.2% (103 participants) stated that they sometimes retrieved their previous notes during clinical practice, 53.8% (85 participants) reported that it was sometimes easy to take notes during clinical practice.

Table 3 presents the association between the participants' characteristics and their frequency of note-taking. Gender was found to have a significant association with note-taking frequency ($\chi^2 = 5.252$, $p = 0.001$) . Among female participants, 44.4% rarely or never took notes, 61.7% sometimes took notes, and 67.7% always took notes. In contrast, among male participants, 55.6% rarely or never took notes, 38.3% sometimes took notes, and 32.3% always took notes.

Residency program area also showed a significant association with note-taking frequency ($\chi^2 = 13.156$, $p = 0.041$). Participants from the Eastern province had the lowest note-taking frequency, with 16.7% rarely or never taking notes, 8.3% sometimes taking notes, and 12.9% always taking notes. Participants from Jeddah had the highest frequency, with 19.4% rarely or never taking notes, 20% sometimes taking notes, and 3.2% always taking notes. In Riyadh, the majority of participants (63.9%) rarely or never took notes, while 71.7% sometimes took notes, and 80.6% always took notes. However, note that there were no participants from the Gulf area who rarely or never took notes.

Residency level exhibited a significant association with note-taking frequency ($\chi^2 = 27.358$, $p = 0.000$). Among PGY1 participants, 8.3% rarely or never took notes, 30% sometimes took notes, and 30.6% always took notes. For PGY2 participants, 8.3% rarely or never took notes, 33.3% sometimes took notes, and 29% always took notes. The majority of PGY3 participants rarely or never took notes (50%), while 13.3% sometimes took notes, and 16.1% always took notes. Among PGY4 participants, 33.3% rarely or never took notes, 23.3% sometimes took notes, and 24.2% always took notes.

These results indicate that there are significant differences in note-taking frequency based on gender, residency program area, and residency level among the participants. Females tended to have higher note-taking frequencies compared to males. Participants from Jeddah showed higher note-taking frequencies, while those from the Eastern province had lower frequencies. In terms of residency level, PGY3 participants had the lowest note-taking frequency compared to other levels.

Table 4 presents the patterns and outcomes of note-taking in relation to the method of note-taking. Regarding gender, the table shows that a higher percentage of females (75%) take notes on laptops compared to males (25%). This difference is statistically significant ($\chi2 = 6.164$, $p = 0.046$). Similarly, in the residency program area, a significant difference is observed, with a larger proportion of participants from Riyadh (82.1%) taking notes on tablets compared to other areas ($p < 0.001$). The residency level also shows significant variations, with PGY1 residents (34.5%) more likely to take notes on laptops compared to PGY2, PGY3, and PGY4 residents ($p = 0.001$).

The table also examines the relationship between note-taking methods and their perceived benefits. Participants who find note-taking helpful for focusing during lectures show similar proportions across the three note-taking methods (laptop, notebook, and tablet). However, those who find it easier to retrieve notes in the future and have their notes available everywhere have higher percentages for notebook and tablet methods compared to the laptop method ($p < 0.001$).

Other aspects of note-taking behavior and preferences are also explored in table 4. Notable findings include participants preferring to write their own notes rather than transcribing the teacher's exact words ($p = 0.15$) and

organizing their notes using bullet lists for important points ($p = 0.029$). Additionally, participants who use other reading sources to link with their notes tend to rely more on textbooks compared to PowerPoint slides or videos ($p = 0.018$).

Furthermore, participants who prefer having lecture materials provided prior to class and those who stop taking notes when slides are provided show some variations across the three note-taking methods, although these differences are not statistically significant ($p > 0.05$). The table also reveals that a higher proportion of participants who review their notes prefer highlighting and marking them, while others prefer rereading only ($p < 0.001$).

Lastly, participants who were taught note-taking skills before, wished to have better note-taking skills, believed that improving their note-taking skills would enhance academic performance, and found their notes helpful for understanding topics better, generally exhibited higher percentages for the notebook and tablet methods compared to the laptop method ($p < 0.05$).

Table 1:- Characters of the included participants (n=158).

Parameter		**Frequency (%)**
Gender	**Female**	95 (60.1%)
	Male	63 (39.9%)
Residency program area	**Eastern province**	19 (12%)
	Gulf area	2 (1.3%)
	Jeddah	21 (13.3%)
	Riyadh	116 (73.4%)
Residency level	**PGY1**	40 (25.3%)
	PGY2	41 (25.9%)
	PGY3	36 (22.8%)
	PGY4	41 (25.9%)
Do you take notes?	**Rarely or never**	36 (22.8%)
	Sometimes	60 (38%)
	Yes, regularly	62 (39.2%)

Table 2:- Patterns and outcomes of note taking (n=158).

Parameter		**Frequency (%)**
If you take notes, why do you do so?	**I do not take notes**	41 (25.9%)
	I take notes solely for exam purposes	12 (7.6%)
	It helps me focus during the lecture	33 (20.9%)
	it helps me to understand the material when I go back to them	70 (44.3%)
	To remember that information and reread it again	2 (1.3%)
Do you feel that taking notes during lectures is necessary for effective learning?	**No**	28 (17.7%)
	Not sure	41 (25.9%)
	Yes	89 (56.3%)
It takes lots of time to write	**It takes lots of time to write**	75 (47.5%)
	No	83 (52.5%)
I am not able to coordinate listening and writing at the same time	**I am not able to coordinate listening and writing at the same time**	71 (44.9%)
	No	87 (55.1%)
I feel less focused when I take notes	**I feel less focused when I take notes**	31 (19.6%)
	No	127 (80.4%)
I don't find taking notes useful	**I don't find taking notes useful**	19 (12%)
	No	139 (88%)
Do you wish to take notes more often than your	**No**	22 (13.9%)

doing	**Not sure**	19 (12%)
	Yes	117 (74.1%)
What do you use to take notes	**laptop**	16 (10.1%)
	Notebook	58 (36.7%)
	tablet	84 (53.2%)
It helps me focus	**It helps me focus**	43 (27.2%)
	No	115 (72.8%)
Easier to retrieve when I need them in the future	**Easier to retrieve when I need them in the future**	77 (48.7%)
	No	81 (51.3%)
Available with me everywhere	**Available with me everywhere**	62 (39.2%)
	No	96 (60.8%)
faster to keep up during lecture	**faster to keep up during lecture**	54 (34.2%)
	No	104 (65.8%)
Do you try to write your own notes or copy what teacher say exactly?	**transcribe what the teacher say**	35 (22.2%)
	Write on my own words	123 (77.8%)
Do you organize your notes soon after the lecture	**No**	36 (22.8%)
	Sometimes	107 (67.7%)
	Yes	15 (9.5%)
How would you organize your notes	**Bullet list important points**	68 (43%)
	Cornell notes	20 (12.7%)
	No	36 (22.8%)
	Rephrase	34 (21.5%)
While taking notes do you use other reading sources to link with your notes?	**No**	27 (17.1%)
	PowerPoints or similar material of the lecture	33 (20.9%)
	Textbook	84 (53.2%)
	videos	14 (8.9%)
Do you prefer teachers to provide the lecture slides prior to class?	**No**	26 (16.5%)
	Not sure	16 (10.1%)
	Yes	116 (73.4%)
Do you stop taking notes if slides are provided	**No**	91 (57.6%)
	Not sure	22 (13.9%)
	Yes	45 (28.5%)
I sometimes find my note-taking interfere with my immediate understanding of the lecture	**FALSE**	65 (41.1%)
	TRUE	93 (58.9%)
I prefer to have the lecture materials provided so I'd focus my attention and not take notes	**FALSE**	75 (47.5%)
	TRUE	83 (52.5%)
I find my notes helpful when I go back to review them before exam	**FALSE**	27 (17.1%)
	TRUE	131 (82.9%)
Do you review the notes you take	**No**	27 (17.1%)
	Sometimes	74 (46.8%)
	Yes	57 (36.1%)
How do you review your notes	**highlight and mark**	47 (29.7%)
	make flash cards	5 (3.2%)
	Rereading only	81 (51.3%)
	summarize them	22 (13.9%)
	test myself	3 (1.9%)
Were you thought any note-taking skills before	**No**	123 (77.8%)
	Yes	35 (22.2%)
Do you wish you had a better note-taking skills?	**No**	25 (15.8%)
	Sometimes	26 (16.5%)
	Yes	107 (67.7%)
Do you think if you improved your note-taking	**No**	20 (12.7%)

skills, it would improve your academic performance	**Not sure**	25 (15.8%)
	Yes	113 (71.5%)
Do you think your notes help you overall to understand topics better	**No**	12 (7.6%)
	Yes	146 (92.4%)
Do you think your notes help you perform better during exams	**No**	17 (10.8%)
	Yes	141 (89.2%)
Passing exams	**No**	85 (53.8%)
	Passing exams	73 (46.2%)
good clinical practice	**good clinical practice**	80 (50.6%)
	No	78 (49.4%)
improving knowledge overall	**improving knowledge overall**	118 (74.7%)
	No	40 (25.3%)
Do you retrieve your previous notes during your clinical practice?	**Always**	31 (19.6%)
	Never	24 (15.2%)
	Sometimes	103 (65.2%)
Do you find it easy to take notes during clinical practice?	**Always**	23 (14.6%)
	Never	50 (31.6%)
	Sometimes	85 (53.8%)

Table 3:- Taking notes in association with characters of the participants (n=158).

Parameter		**Do you take notes?**			**X^2**	**P-value**
		Rarely or never	**Sometimes**	**Yes**		
Gender	**Female**	16 (44.4%)	37 (61.7%)	42 (67.7%)	5.252	0.000
	Male	20 (55.6%)	23 (38.3%)	20 (32.3%)		
Residency program area	**Eastern province**	6 (16.7%)	5 (8.3%)	8 (12.9%)	13.156	0.041
	Gulf area	0 (0%)	0 (0%)	2 (3.2%)		
	Jeddah	7 (19.4%)	12 (20%)	2 (3.2%)		
	Riyadh	23 (63.9%)	43 (71.7%)	50 (80.6%)		
Residency level	**PGY1**	3 (8.3%)	18 (30%)	19 (30.6%)	27.358	0.000
	PGY2	3 (8.3%)	20 (33.3%)	18 (29%)		
	PGY3	18 (50%)	8 (13.3%)	10 (16.1%)		
	PGY4	12 (33.3%)	14 (23.3%)	15 (24.2%)		

Table 4:- Patterns and outcomes of taking notes in association with method of note taking (n=158).

Parameter		**Where do you take notes**			**X^2**	**P-value**
		Laptop	**Notebook**	**Tablet**		
Gender	**Female**	12 (75%)	40 (69%)	43 (51.2%)	6.164	0.046
	Male	4 (25%)	18 (31%)	41 (48.8%)		
Residency program area	**eastern province**	0 (0%)	13 (22.4%)	6 (7.1%)	25.35	0.000
	gulf area	0 (0%)	0 (0%)	2 (2.4%)		
	Jeddah	7 (43.8%)	7 (12.1%)	7 (8.3%)		
	Riyadh	9 (56.3%)	38 (65.5%)	69 (82.1%)		
Residency level	**PGY1**	2 (12.5%)	9 (15.5%)	29 (34.5%)	22.304	0.001
	PGY2	10 (62.5%)	11 (19%)	20 (23.8%)		
	PGY3	2 (12.5%)	16 (27.6%)	18 (21.4%)		
	PGY4	2 (12.5%)	22 (37.9%)	17 (20.2%)		
It helps me focus	**It helps me focus**	6 (37.5%)	22 (37.9%)	15 (17.9%)	7.93	0.019
	No	10 (62.5%)	36 (62.1%)	69 (82.1%)		
Easier to retrieve when I need them in the future	**Easier to retrieve when I need them in the future**	13 (81.3%)	12 (20.7%)	52 (61.9%)	30.861	0.000
	No	3 (18.8%)	46 (79.3%)	32 (38.1%)		
Available with me	**Available with me**	2 (12.5%)	14 (24.1%)	46 (54.8%)	18.835	0.000

everywhere	**everywhere**					
	No	14 (87.5%)	44 (75.9%)	38 (45.2%)		
faster to keep up during lecture	**faster to keep up during lecture**	5 (31.3%)	19 (32.8%)	30 (35.7%)	0.201	0.904
	No	11 (68.8%)	39 (67.2%)	54 (64.3%)		
Do you try to write your own notes or copy what teacher say exactly ?	**transcribe what the teacher say**	6 (37.5%)	9 (15.5%)	20 (23.8%)	3.8	0.15
	Write on my own words	10 (62.5%)	49 (84.5%)	64 (76.2%)		
Do you organize your notes soon after the lecture	**No**	3 (18.8%)	15 (25.9%)	18 (21.4%)	0.952	0.917
	Sometimes	11 (68.8%)	37 (63.8%)	59 (70.2%)		
	Yes	2 (12.5%)	6 (10.3%)	7 (8.3%)		
How would you organize your notes	**Bullet list important points**	11 (68.8%)	21 (36.2%)	36 (42.9%)	14.055	0.029
	Cornell notes	0 (0%)	13 (22.4%)	7 (8.3%)		
	No	3 (18.8%)	15 (25.9%)	18 (21.4%)		
	Rephrase	2 (12.5%)	9 (15.5%)	23 (27.4%)		
While taking notes do you use other reading sources to link with your notes ?	**No**	5 (31.3%)	9 (15.5%)	13 (15.5%)	15.292	0.018
	PowerPoints or similar material of the lecture	6 (37.5%)	5 (8.6%)	22 (26.2%)		
	Textbook	4 (25%)	36 (62.1%)	44 (52.4%)		
	videos	1 (6.3%)	8 (13.8%)	5 (6%)		
Do you prefer teachers to provide the lecture slides prior to class ?	**No**	0 (0%)	14 (24.1%)	12 (14.3%)	13.14	0.011
	Not sure	2 (12.5%)	10 (17.2%)	4 (4.8%)		
	Yes	14 (87.5%)	34 (58.6%)	68 (81%)		
Do you stop taking notes if slides are provided	**No**	12 (75%)	33 (56.9%)	46 (54.8%)	5.139	0.273
	Not sure	0 (0%)	11 (19%)	11 (13.1%)		
	Yes	4 (25%)	14 (24.1%)	27 (32.1%)		
I sometimes find my note-taking interfere with my immediate understanding of the lecture	**FALSE**	7 (43.8%)	29 (50%)	29 (34.5%)	3.444	0.179
	TRUE	9 (56.3%)	29 (50%)	55 (65.5%)		
I prefer to have the lecture materials provided so I'd focus my attention and not take notes	**FALSE**	6 (37.5%)	39 (67.2%)	30 (35.7%)	14.386	0.001
	TRUE	10 (62.5%)	19 (32.8%)	54 (64.3%)		
I find my notes helpful when I go back to review them before exam	**FALSE**	2 (12.5%)	17 (29.3%)	8 (9.5%)	9.745	0.008
	TRUE	14 (87.5%)	41 (70.7%)	76 (90.5%)		
Do you review the notes you take	**No**	2 (12.5%)	8 (13.8%)	17 (20.2%)	16.01	0.003
	Sometimes	3 (18.8%)	37 (63.8%)	34 (40.5%)		
	Yes	11 (68.8%)	13 (22.4%)	33 (39.3%)		
How do you review your notes	**highlight and mark**	4 (25%)	7 (12.1%)	36 (42.9%)	30.592	0.000
	make flash cards	0 (0%)	5 (8.6%)	0 (0%)		
	Rereading only	12 (75%)	34 (58.6%)	35 (41.7%)		
	summarize them	0 (0%)	12 (20.7%)	10 (11.9%)		
	test myself	0 (0%)	0 (0%)	3 (3.6%)		
Were you thought any note-taking skills before	**No**	6 (37.5%)	51 (87.9%)	66 (78.6%)	18.549	0.000
	Yes	10 (62.5%)	7 (12.1%)	18 (21.4%)		
Do you wish you had a better note-taking skills ?	**No**	2 (12.5%)	7 (12.1%)	16 (19%)	7.249	0.123
	Sometimes	3 (18.8%)	15 (25.9%)	8 (9.5%)		
	Yes	11 (68.8%)	36 (62.1%)	60 (71.4%)		

Do you think if you improved your note-taking skills, it would improve your academic performance	**No**	0 (0%)	12 (20.7%)	8 (9.5%)	7.533	0.11
	Not sure	2 (12.5%)	7 (12.1%)	16 (19%)		
	Yes	14 (87.5%)	39 (67.2%)	60 (71.4%)		
Do you think your notes help you overall to understand topics better	**No**	0 (0%)	8 (13.8%)	4 (4.8%)	5.451	0.066
	Yes	16 (100%)	50 (86.2%)	80 (95.2%)		
Do you think your notes help you perform better during exams	**No**	0 (0%)	7 (12.1%)	10 (11.9%)	2.147	0.342
	Yes	16 (100%)	51 (87.9%)	74 (88.1%)		
Passing exams	**No**	7 (43.8%)	29 (50%)	49 (58.3%)	1.682	0.431
	Passing exams	9 (56.3%)	29 (50%)	35 (41.7%)		
good clinical practice	**good clinical practice**	2 (12.5%)	34 (58.6%)	44 (52.4%)	10.891	0.004
	No	14 (87.5%)	24 (41.4%)	40 (47.6%)		
improving knowledge overall	**improving knowledge overall**	7 (43.8%)	44 (75.9%)	67 (79.8%)	9.286	0.01
	No	9 (56.3%)	14 (24.1%)	17 (20.2%)		
Do you retrieve your previous notes during your clinical practice ?	**Always**	2 (12.5%)	6 (10.3%)	23 (27.4%)	7.403	0.116
	Never	2 (12.5%)	9 (15.5%)	13 (15.5%)		
	Sometimes	12 (75%)	43 (74.1%)	48 (57.1%)		
Do you find it easy to take notes during clinical practice ?	**Always**	4 (25%)	9 (15.5%)	10 (11.9%)	7.706	0.103
	Never	7 (43.8%)	22 (37.9%)	21 (25%)		
	Sometimes	5 (31.3%)	27 (46.6%)	53 (63.1%)		

Discussion:-

Note-taking is a widely recognized and essential component in the process of learning. This is especially true in the medical field, given the vast amount of knowledge and information to be learned by the learner over the years (1, 2, 4). The act of note-taking by students is an integral and underappreciated skill among students. Most students report taking some sort of notes during their study and believe in its importance but mostly report never receiving any instructions related to the best practices to improve their note-taking behaviors .

During the academic learning journey, lectures are the most common form of teaching that is used to convey information and knowledge from the lecturer to the learner to facilitate learning to ultimately retain knowledge in the long-term memory. In the medical field especially, lectures serve as a starting point for students to be introduced to a certain topic to further expand their knowledge. In most cases, it is never sufficient to depend on a lecture or a single method of learning for the students to comprehend a certain topic. More often new information is interconnected with past information and it solely depends on the learner to be able to manage, connect and recall his collected expertise and knowledge over the years. The learner experience and skill to be able to collect, take notes, and recall relevant pieces of information when needed is a personal skill that can differentiate an average from outstanding learner performance (13-14)

When a learner listens to lectures, The learner is commenced in the act of listening, interpreting, filtering, and conveying knowledge into comprehendible pieces of information, capturing new ideas and relating them to old pieces of knowledge. The act of note-taking is the process where they create knowledge and make connections between new information and prior knowledge and produce it in a format that is easy to retrieve later (7)(figure 2.)

Most of the students who take notes, do so to be able to do well on exams at the end of courses. Few students who truly excel are those who master the skill of connecting their new notes with prior notes and don‘t only treat their note-taking as a chore that is completed once done with exams. This importance starts to clearly show later for those learners continuing in the medical or academic field, where the need to collect new information and connect it with prior knowledge is a must and not a choice to advance in their careers.

The practice of note-taking in medical education has been left for the student's proficient self-produced practices, despite the presence of literature to support best practices that can lead to efficient studying, improved retention, and learning outcomes (3-7-15)

Numerous studies have explored the impact of note-taking on academic performance and clinical practice among medical trainees (4-9).

In his work, Di vesta showed that note-taking served primarily two functions: Encoding and storage. Where students encoded information by actively transcribing, selecting, and summarizing relevant information to meet the second function, where reviewing their notes helps them to store information for later retrieval 5.

It is logical to think that reviewing the notes can produce higher achievement and better recall and performance than not reviewing notes. In his work, Kiewra summarized studies findings where he listed 33 out of 56 studies to be in favor of notetaking supporting better achievement, 21 reveal no difference between taking notes and solely listening to lectures, and two studies found that note-taking impaired better performance (17)

The Fundamental idea of learning through our lives comes from Jean Piaget's learning theory of Cognitive Constructivism. Where Piaget proposed that knowledge is actively constructed by learners in a continuous dynamic process of active discovery of the world around them.

The act of note-taking has been clearly related to multiple cognitive-oriented variables such as working memory, capacity limitation, metacognition, and information processing capabilities. The cognitive process involved in effective note-taking has been proposed by van Dijk and Kintsch to occur at three levels of strategic complexity: propositional, local coherence, and macro-strategic. complex propositions expressed by sentences that convey a single idea. local coherence strategies involve combining complex propositions to establish meaningful connections. Macroproprositions are combined using macro strategies to express the theme or concept of interest. In theory, to be an effective notetaker, you would be able to join ideas and concepts to synthesize macro propositions and integrate them into a larger theme or topic of the lecturer. In reality, most learners will revert to recording verbatim and capturing every word that is being said. This type of note-taking is not only ineffective and does not lead to comprehension, but possibly detrimental to decrease the learning process, as it shifts the student's focus from important knowledge processing to be decoded in the working memory into a paraphrasing and copying word by word without much meaningful connections made cognitively (16-17)

In the Academic context, long-time learners tend to develop better practicing habits in their note-taking skills. After several years of practice, most habits conception develop to serve the specific individual purpose of note-taking such as the end of course exams, academic research, etc.

The process of taking notes in itself increases learning by fostering retention and connections of information, especially when the student engages in a deep comprehension of the source material. It is evident that the learning process is enhanced due to the generative effect. (the generative effect is the proposal of better knowledge retention when materials are generated by the learners themselves rather than having the material handed to them) (18)

The cognitive effort during the note-taking process enhances the learning effect by active encoding, making connections between the new material and past knowledge (16)

In the past few decades, technological advancement has led to major changes in note-taking habits among students. The rapid digitalization of the learning environment and rapid change in the formal lecturing methods mandates a different look on the learning theories and notetaking practice efficiencies as it continually evolves in an accelerated fashion. Initial reports stated that students who took notes using pen and paper performed better than students who took digital notes . (19-20)

Studies exploring the benefits of digital note-taking are still scarce. It is reasonable to assume the persistence of traditional note-taking benefits like encoding and storage in the digital note-taking practice (3). It is also necessary to update our perception of learning, working memory, and variable cognitive processes involved in the digital note-taking process.

In this study, we aim to investigate the impact of note-taking on academic performance and clinical practice among emergency medicine trainees. The study also compares paper-based and digital note-taking methods in terms of ease of information retrieval. Additionally, the study aims to assess and measure the note-taking skills of the trainees and evaluate the effects of note-taking type and organization. The goal is to explore note-taking habits from the learner's perspective and provide better insight for learners to improve their learning habits and gain maximum benefit. We also aim to emphasize the need to provide better-guiding instructions and implement best practices in note-taking habits in medical education to introduce a strategic note-taking approach to trainees.

The results of the study provide insights into the various aspects of note-taking and their implications in medical education. The findings related to the impact of note-taking on academic performance are particularly significant. Table (3) presents the association between gender, residency program area, residency level, and note-taking methods (laptop, notebook, tablet) with the statement "It helps me focus." It was found that a higher percentage of females reported that note-taking helped them focus compared to males (75% vs. 25%). This gender difference could be attributed to variations in learning styles or individual preferences. Furthermore, the study found a significant association between residency program area and note-taking methods. Trainees from the eastern province showed a higher preference for paper-based note-taking (notebook) compared to those from the gulf area and Riyadh. This variation might be influenced by cultural and educational background differences among trainees from different regions.

In terms of clinical practice, the study investigated the effects of note-taking on good clinical practice and knowledge improvement. The table shows the association between note-taking methods and the statement "good clinical practice." It was found that trainees who used paper-based note-taking (notebook) reported a higher percentage of good clinical practice compared to those using digital methods (tablet or laptop). This finding suggests that traditional note-taking methods may have a positive impact on the application of knowledge in clinical settings. However, further research is needed to explore the specific factors contributing to this association.

Regarding the comparison between paper and digital note-taking, the study examined the ease of retrieving information when needed. Trainees were asked whether their notes were easier to retrieve when using a laptop, notebook, or tablet. The results showed that trainees using a laptop reported the highest percentage of ease of retrieval (51.2%), followed by notebook (69%), and tablet (48.8%). This finding suggests that trainees perceive digital note-taking methods, particularly using a tablet, to be less effective in terms of information retrieval compared to paper-based methods. However, it is important to consider individual preferences, technological proficiency, and familiarity with digital tools when interpreting these findings.

Several studies have highlighted the positive association between effective note-taking strategies and improved academic performance. Research by Kiewra (1989) found that students who engaged in systematic note-taking demonstrated better performance in exams and retained information more effectively compared to those who relied solely on passive listening (11). Moreover, the choice of note-taking method has been a topic of interest in the literature. Traditional paper-based note-taking has been a longstanding approach, but the rise of digital technology has introduced new possibilities. A study by Mueller and Oppenheimer (2014) revealed that students who took notes by hand outperformed those who used laptops in terms of conceptual understanding and long-term retention (12). On the other hand, digital note-taking offers advantages in terms of organization, searchability, and accessibility (13)(figure 3).

Our study also assessed the note-taking skills of the emergency medicine trainees. Trainees were asked whether they were taught any note-taking skills before and whether they wished they had better note-taking skills. The results revealed that a significant percentage of trainees (87.9%) reported not being taught any note-taking skills before. This highlights the potential gap in medical education regarding the instruction of effective note-taking techniques. Moreover, a substantial proportion of trainees expressed a desire for better note-taking skills (68.8%), indicating the importance of incorporating note-taking strategies into the residency curriculum.

Study Strengths

One of the strengths of this study is its comprehensive evaluation of note-taking habits among emergency medicine trainees. By considering multiple variables such as gender, residency program area, residency level, and note-taking methods, the study provides a more nuanced understanding of the factors influencing note-taking practices. The inclusion of different regions and cultural backgrounds adds to the diversity and generalizability of the findings.

Additionally, the study's focus on both academic performance and clinical practice outcomes enhances its relevance and applicability to medical education. By examining the impact of note-taking on focus, good clinical practice, and knowledge improvement, the study sheds light on the multifaceted benefits of effective note-taking. Moreover, the study addresses the gap in note-taking instruction by highlighting the lack of formal training in note-taking skills among trainees. By emphasizing the need for incorporating note-taking strategies into the residency curriculum, the study provides insights into potential improvements in medical education.

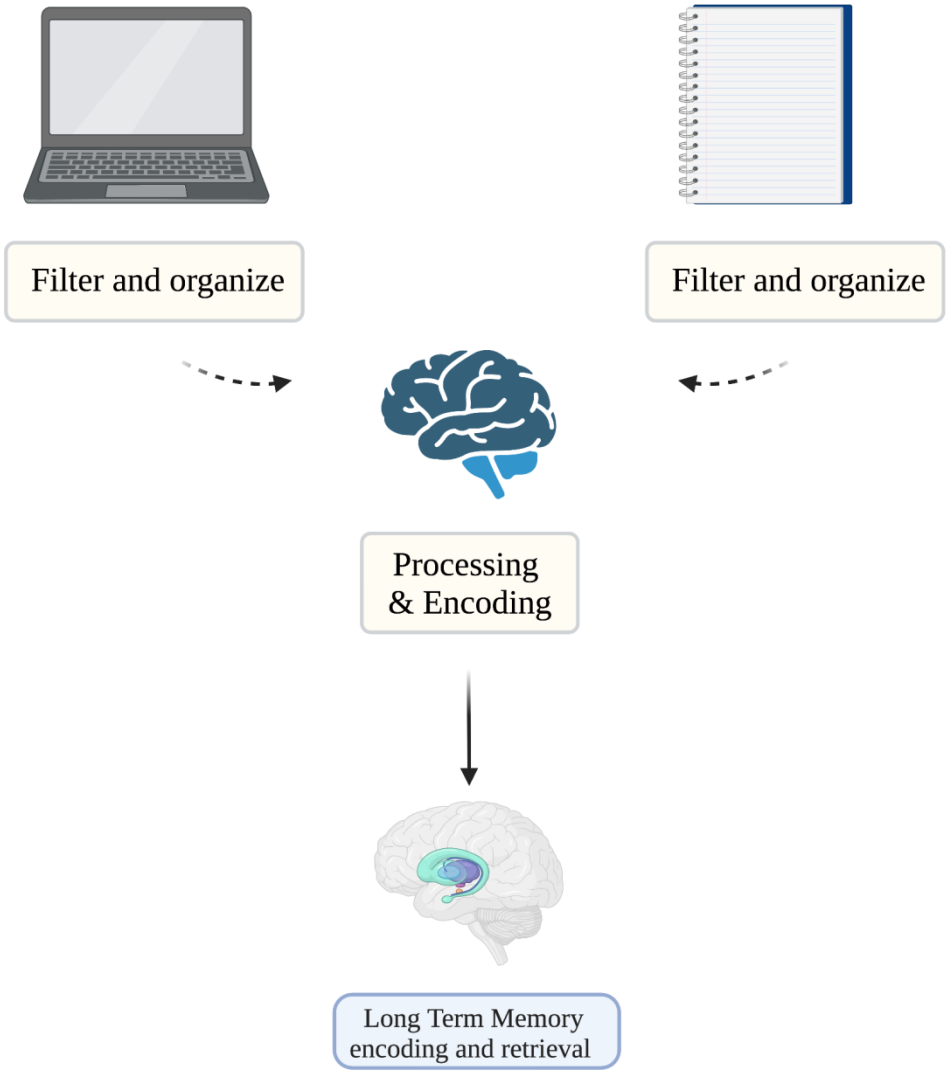

Fig 1. Information and knowledge are filtered and organized to be processed in the long term memory

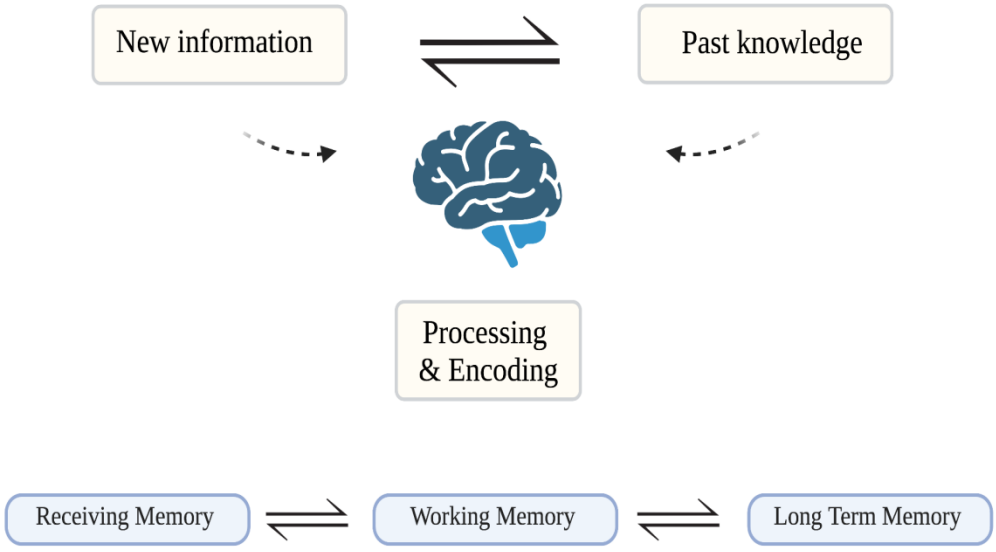

Fig 2. Managing and connecting past and new knowledge process

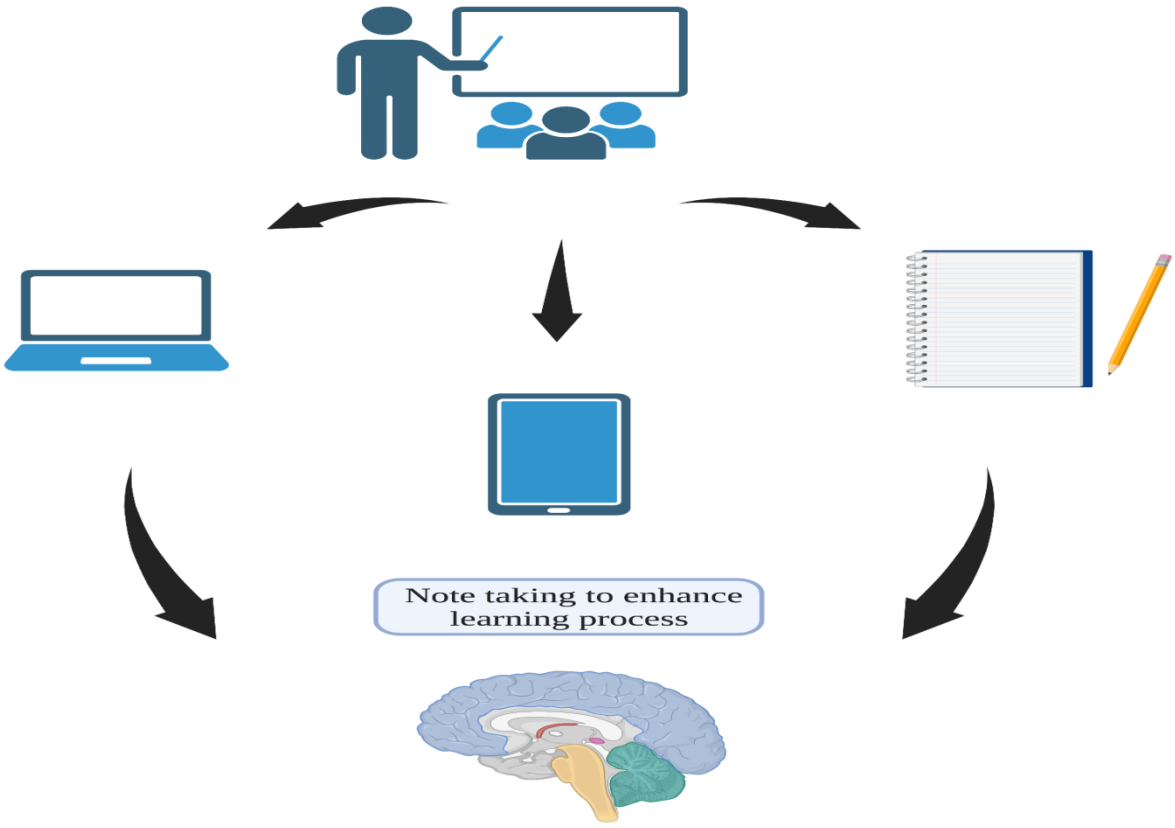

Fig 3. Cognitive effort during note taking enhance the process of learning

Study Limitations

Despite its strengths, this study has some limitations. Firstly, the reliance on self-reported data from trainees may introduce response bias. Trainees' perceptions of their note-taking habits and their impact on learning and clinical practice may be subjective and influenced by various factors such as recall bias or social desirability bias. Furthermore, the study focuses on emergency medicine trainees, limiting the generalizability of the findings to other medical specialties. Different specialties may have distinct learning and note-taking requirements, which could affect the outcomes and recommendations.

Conclusion:-

In conclusion, the results of this study provide insights into the impact of note-taking on both academic performance and clinical practice among emergency medicine trainees. The findings suggest that note-taking can have a positive effect on focus, good clinical practice, and knowledge improvement. Paper-based note-taking methods were perceived to be more effective in terms of ease of information retrieval compared to digital methods. The study also highlights the need for incorporating note-taking instruction into the residency curriculum and emphasizes the importance of developing effective note-taking skills for medical trainees. These findings contribute to the ongoing evidence on learning methods during medical training and provide a basis for introducing strategic note-taking approaches to enhance learning and clinical practice in medical education.

References:-

1. Hüseyin, Z. (2019). Impact of note taking during reading and during listening on comprehension. Educational Research and Reviews, 14(16), 580–589. https://doi.org/10.5897/err2019.3812
2. Salame, I. I., & Thompson, A. (2020). Students 'Views on Strategic Note-taking and its Impact on Performance, Achievement, and Learning. International Journal of Instruction, 13(2), 1–16. https://doi.org/10.29333/iji.2020.1321a
3. Artz, B., Johnson, M., Robson, D., & Taengnoi, S. (2020). Taking notes in the digital age: Evidence from classroom random control trials. The Journal of Economic Education, 51(2), 103–115. https://doi.org/10.1080/00220485.2020.1731386
4. Pyörälä, E., Mäenpää, S., Heinonen, L., Folger, D., Masalin, T., & Hervonen, H. (2019). The art of note taking with mobile devices in medical education. BMC Medical Education, 19(1). https://doi.org/10.1186/s12909-019-1529-7
5. Morrison EH, McLaughlin C, Rucker L. Medical students' note-taking in a medical biochemistry course: an initial exploration. Medical Education. 2002 Apr;36(4):384-6.
6. Newble DI, Entwistle NJ. Learning styles and approaches: implications for medical education. Medical education. 1986 May;20(3):162-75.
7. Abraham RR, Kamath S, Ramnarayan K. Impact of note-taking on cognition during lectures. South-East Asian Journal of Medical Education. 2010 Dec 30;4(2):44-5.
8. Isaacs G. Lecture note-taking, learning and recall. Medical Teacher. 1989 Jan 1;11(3-4):295-302.
9. Courneya CA, Cox SM. Visual note taking for medical students in the age of instagram. Health Professions Education. 2020 Jun 1;6(2):126-35.
10. Lindberg V, Jounger SL, Christidis M, Christidis N. Characteristics of dental note taking: a material based themed analysis of Swedish dental students. BMC Medical Education. 2020 Dec;20(1):1-0.
11. Kiewra KA. A review of note-taking: The encoding-storage paradigm and beyond. Educational Psychology Review. 1989 Jun;1:147-72.
12. Mueller PA, Oppenheimer DM. The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. Psychological science. 2014 Jun;25(6):1159-68.
13. Boyle JT, Nicol DJ. Using classroom communication systems to support interaction and discussion in large class settings. ALT-J. 2003 Jan 1;11(3):43-57.
14. Morehead K, Dunlosky J, Rawson KA, Blasiman R, Hollis RB. Note-taking habits of 21st Century college students: implications for student learning, memory, and achievement. Memory. 2019;27(6):807-819. doi:10/ggnc5q
15. Bohay, Blakely, Tamplin, Radvansky. Note Taking, Review, Memory, and Comprehension. Am J Psychol. 2011;124(1):63. doi:10/b9m49v
16. Di Vesta FJ, Gray GS. Listening and note taking. J Educ Psychol. 1972;63(1):8-14. doi:10/cdjjrr
17. Quintus L, Borr M, Duffield S, Napoleon L, Welch A. The Impact of the Cornell Note-Taking Method on Students 'Performance in a High School Family and Consumer Sciences Class. :12.

18. Kiewra KA. Investigating Notetaking and Review: A Depth of Processing Alternative. Educ Psychol. 1985;20(1):23-32. doi:10.1207/s15326985ep2001_4
19. Piolat A, Olive T, Kellogg RT. Cognitive effort during note taking. Appl Cogn Psychol. 2005;19(3):291-312. doi:10/cft3vc
20. Wood E, Zivcakova L, Gentile P, Archer K, De Pasquale D, Nosko A. Examining the impact of off-task multi-tasking with technology on real-time classroom learning. Comput Educ. 2012;58(1):365-374. doi:10/fvfmnh
21. Stacy EM, Cain J. Note-taking and Handouts in The Digital Age. Am J Pharm Educ. 2015;79(7):107. doi:10/f7xpqf.