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EFFECT OF SMARTPHONES AND INTERNET SERVICES ON THE SHORT TERM MEMORY OF MEDICAL STUDENTS IN A TERTIARY CARE HOSPITAL.

Community Medicine

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ABSTRACT

Background: The advent of the Internet, with sophisticated algorithmic search engines, has made accessing information as easy as lifting a finger.1 The Internet and Internet-enabled devices have transformed our everyday lives and relationships. We entrust them with our precious personal information including contacts and images and rely on them to connect us to a vast repository of knowledge, anytime, anywhere.2 People are beginning to use the internet and computers as a transactive memory system, and this use is changing the way people encounter and treat information.3

Aims and Objectives:

1. To study the effects of use of smartphones and internet on short term memory, mainly recognition and recall in medical students.
2. To suggest suitable recommendation s based on the findings.

Materials and Methods:

A cross sectional study was carried out in a tertiary healthcare center among medical students. The participants underwent three tasks in a sequential manner. These were 1) Typing task 2) Memory-recall task and 3) Recall-recognition task. The typing task consisted of typing trivial statements displayed on a computer screen using a keyboard. The memory-recall task was a pen and paper free recall task, in which the subjects were told to write down the entire statements or a part of statement they remember from the typing task. In the last recall recognition task some of the statements from the typing task were shown to the participants, of which half were slightly modified and the participants were asked to recognize which statements were changed and which were unchanged.

Results:

In memory recall task combined mean score for templates of 'will be saved' types was 4.08 ±1.83 and for templates of 'will be erased' types, it was 6.64 ±1.73. Similarly in recall recognition task combined mean score for templates of 'will be saved' types was 5.55 ± 2.66 and for templates of 'will be erased' types, it was 8.78 ± 1.4. In both memory recall task and recall recognition tasks, the mean scores for templates of 'will be erased' types for both for male and female medical students were significantly more than that for templates of 'will be saved' types.

Conclusion:

The study concludes that medical students make fewer efforts to remember the information which they expect to be stored in their digital devices. Thus smartphones and internet services have effects on the short term memory of medical students. This study further concludes that the phenomenon of directed forgetting has now extended and is applicable for digital appliances as well.

KEYWORDS

Transactive memory system, Directed forgetting, Internet , Memory-recall, Recall recognition.

INTRODUCTION

The Internet and Internet-enabled devices have transformed our everyday lives and relationships. We entrust them with our precious personal information including contacts and images and rely on them to connect us to a vast repository of knowledge, anytime, anywhere [2]. The short history of mobile phones has witnessed several stages, as phone adoption has increased rapidly across the globe. Today, several billion individuals carry these devices. Mobile technology adopt ion has widespread social implications. A recent trend is associated with the rise of the smartphone - computationally powerful computing devices available to users across an increasingly wide range of prices.[4] According to Kaspersky Labs, 44% people across United States admit that their smartphones have everything they need to recall and serves as their memory[2].

People are beginning to use the internet and computers as a Transactive Memory System and this use is changing the way people encounter and treat information.[3] A transactive memory system is a means by which people may store information externally; in such a system the task of remembering is offloaded by remembering where information is located, rather than remembering the information itself.[3] The findings of experiments carried out by Sparrow et all are in concurrence of previous work on directed forgetting, showing that when people don't believe they will need information for a later exam, they do not recall it at the same rate as when they do believe they will need it[1].

Directed forgetting is a phenomenon first studied by R. A.Bjork, LaBerge, and LeGrand (1968) whereby people appear to be able to intentionally forget information, making it less accessible to later attempts at recall and reducing interference from that information.[5,6]

Direct forgetting effect is an enhancement in the recall of to be recalled (TBR) items when other items are designated as to be forgotten (TBF).[7] Directed (or intentional) forgetting allows us to deal effectively with multiple demands on memory by prioritizing one memory set over another.[8]

Although most instances of forgetting are unintentional or incidental, there are occasions when we try to forget, either because the memory is unappealing or because the memory constitutes a source of interference in conducting routine mental operations such as memory updating. Consequently, selective forgetting has been assigned an integral role in the processing of to-be-remembered (R) information by various scholars and researchers.[9]

It has been observed that students spent significantly more time on internet and were much more comfortable with such devices than the adults.[10]

This study is an attempt to know whether the phenomena of directed forgetting is applicable with respect to digital devices and whether it is affecting some memory components viz. recall and recognition in medical students.

Aims and Objectives:

1. To study the effects of use of smartphones and internet on short term memory, mainly recognition and recall in medical students.
2. To suggest suitable recommendation s based on the findings.

Material and methods

A cross sectional study was carried out in a tertiary healthcare center in

the month of July 2017. The study population consisted of medical students who were Smartphone and internet users for a minimum period of 1 year. Previous studies report a mean of 6.00±1.93 for recall of statements in saved condition and a mean of 5.20±1.40 for recall of statements in erased condition in young adults.[11] Considering this data, at Z=95%, i.e. type I error (α) = 0.05 and power of test = 90% at an allowable error of 10%, sample size was 80.These 80 students were selected from study population by using simple random sampling.

The subjects had to undergo three tasks one after another. These were 1)Typing task 2) Memory-recall task and 3) Recall-recognition task.

1) Typing task:
The first task i.e. typing task consisted of typing trivial statements displayed on a computer screen using a keyboard. The subjects were informed to do their best to memorize these statements while typing them. Typing task was performed using the SuperLab software. The participants were notified that a template would appear on the screen before every statement. During the briefing session, instructions were given to the participants that if the template displayed 'will be saved', they would see the corresponding statement again before the further tasks, and if it displayed 'will be erased', they would not see the corresponding statement again. Thus a representative situation in which we expect digital devices to store certain information such that the device can produce it later when we need to recall it was created. After the template, a statement was displayed on the screen for 60 seconds. A provision was made for the participants to proceed further if they finished typing the statement before 60 seconds. A set of 20 such templates and statements was shown. The templates 'will be saved' and 'will be erased' had 10 statements each. The order in which these statements appeared on computer screen was randomized. Unlike told earlier, the subjects were not shown any statements before the further tasks. The main objective of doing this was to check if there was any difference in the way participants treated data which they expected to be saved in a digital device and which they knew would not be saved.

2)Memory-recall task:
The second task i.e. the memory-recall task was a pen and paper free recall task, in which the participants were told to write down the entire statements or a part of statement they remember from the typing task. An arbitrary scoring system was created for entering the responses and it was done as:

- 1 point and 0.5 points were given for a completely written and a half written statement respectively.
- Scores of the templates of 'will be saved' and 'will be erased' statements were calculated separately.
- The maximum possible score of both the templates was10 each. Thus, the total maximum possible score was 20.
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There was no time limit for this task. When the subjects could not recall any further statements, the third task i.e. recall-recognition task was conducted.

3) Recall-recognition task:
In this task, 20 statements from the typing task were shown to the participants, of which 10 were be slightly modified. Out of these 10 modified statements, 5 were of 'will be saved' template and 5 were of 'will be erased' template. The simple task here for the participants was to recognize which statements were changed and which were unchanged with respect to the statements shown to them during the typing task. An arbitrary scoring system was created for analyzing the responses and it was done as:

- 1 point was given for every correct answer and 1 point was deducted for every wrong answer.
- Scores of the templates of 'will be saved' and 'will be erased' statements were calculated separately.
- The maximum possible score for each of both the templates was10. Thus, the total maximum possible score was 20.
- The minimum possible score for each of both templates was -10. Thus, the total minimum possible score was -20.
- There was no time limit for this task either. The data was tabulated and analyzed. Appropriate statistical tests were used wherever necessary and significance was checked at $p < 0.05$.

Ethical approval was obtained from Institutional Ethical Committee. There was no conflict of interest. The data were tabulated and analyzed using Epi Info and MS Excel. The study report has been approved by ICMR New Delhi.

Results:
Total 80 medical students participated in the study and data was collected from all 80 medical students. Mean scores with respective standard deviations were calculated for memory recall task and recall memory task separately. Then the test of standard error between two means was performed to test the significance in differences between mean scores.

Out of these 80 medical students there were 41 male students and 39 female students.

Table 1: Mean scores for memory recall tasks among study population.

Study population	Parameter	For template 'will be saved'	For template 'will be erased'
Male students	Mean score	3.67	6.50
	SD	1.62	1.86
	Significance	Z = 7.33; p < 0.05	
Female students	Mean score	4.5	6.79
	SD	1.94	1.58
	Significance	Z = 5.72; p < 0.05	
Combined Scores for male and female students	Mean score	4.08	6.64
	SD	1.83	1.73

Table 1 depicts the results of Memory-recall task. It can be seen that scores of both males and females are more for the templates of 'will be erased' type (6.50 ± 1.86 and 6.79 ± 1.58 for males and females respectively) than that for templates of 'will be saved' type (3.67 ± 1.62 and 4.50 ± 1.94 for males and females respectively). These differences were tested statistically by performing test of standard error of difference between two means. It was found that the difference in the scores of templates in both the male and female students was statistically significant i.e. $p < 0.05$.

The overall scores of the memory-recall task were 6.643 ± 1.73 for the templates of 'will be erased' type and 4.075 ± 1.82 for the templates of 'will be saved' type.

Table 2: Mean scores for recall recognition tasks among study population

Study population	Parameter	For template 'will be saved'	For template 'will be erased'
Male students	Mean score	5.27	9.02
	SD	3.03	1.01
	Significance	Z = 7.54; p < 0.05	
Female students	Mean score	5.85	8.51
	SD	2.22	1.70
	Significance	Z = 5.96; p < 0.05	
Combined scores for male and female students	Mean score	5.55	8.78
	SD	2.66	1.41

Table 2 shows the results of recall recognition task performed by students. The score of templates of 'will be erased' type (9.02 ± 1.01 and 8.51 ± 1.70 for males and females respectively) was more than that for templates of 'will be saved' type (5.27 ± 3.03 and 5.85 ± 2.22 for males and females respectively). These difference were tested statistically by performing test of standard error of difference between two means and again, the difference was found statistically significant i.e. $p < 0.05$.

The overall scores of the recall-recognition task were 5.55 ± 2.66 for the templates of 'will be erased' type and 8.76 ± 1.41 for the templates of 'will be saved' type.

Gender wise difference was also studied both for memory recall task and recall recognition task. It is shown in Figure 1and 2.

Figure 1: Gender wise comparison of mean scores of the students for Memory Recall Task.

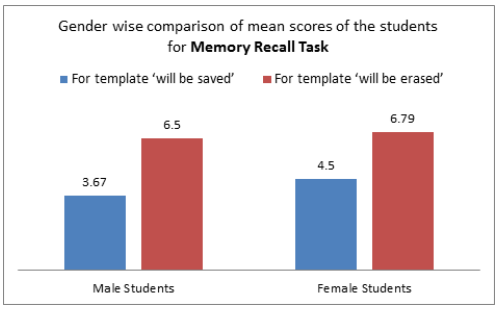

Figure 1 shows the gender wise comparison of scores of participants for memory recall task. The differences for both male and female students were tested statistically by performing test of standard error of difference between two means and it was observed that the difference between scores for male and female students was significant only for templates of "will be saved" type with $Z = 2.07$ and $p < 0.05$. It was not significant for templates of "will be erased" type with $Z = 0.76$; $p > 0.05$.

Gender wise difference was also studied for recall recognition memory. The results are shown in Figure 2.

Figure 2: Gender wise comparison of mean scores of the students for Recall Recognition Task. Zp'

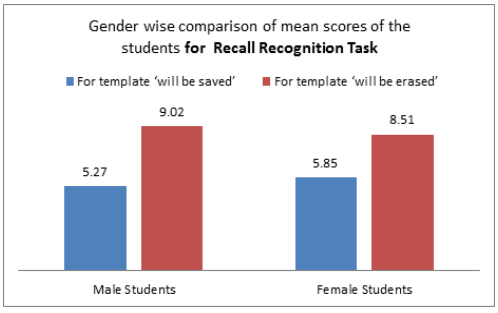

Figure 2 shows the gender wise comparison of scores of participants for recall recognition task. The differences for both male and female students were tested statistically by performing test of standard error of difference between two means and it was found that the difference between score for male and female students was not statistically significant. The Z value for templates of 'to be saved' type was 0.98 with $p > 0.05$ and Z value for templates of 'to be erased' type was 1.63 with $p > 0.05$.

Discussion:

This was a cross sectional study carried out to study the effects of digital devices on short term memory of medical students. Data was collected from 80 medical students.

In the memory-recall task, the combined overall score for the templates of 'will be erased' type (6.643 ± 1.73) was found to be much higher than that for templates of 'will be saved' type (4.075 ± 1.82). Similar findings have also been found in the experiment conducted by Sparrow et all.[1] The immediate recall of subjects suffered significantly when they believed that the information presented to them was saved in a digital device and it would be accessible to them as and when needed. This suggests that participants were substantially less attentive while reading or typing the statements which they thought would be saved. The behavior of participants in the experiment replicates their behavior in real life. However the study carried out by Elizabeth T. Friede[11] does not supports these findings. Their study showed that both younger adults and 'older adults' memory performance for saved statements were not significantly different than their memory for erased statements, in both recall and recognition memory tests.

The results of recall-recognition task also followed the same pattern. The combined overall mean score 8.76 ± 1.41 for the template 'will be erased' was much higher than combined overall mean score of 5.55 ± 2.66 for the template 'will be saved'. Similar findings have also been found in the experiment conducted by Sparrow et all.[1] Despite having a negative scoring component, the overall scores of the recall-recognition task are more than those of the memory-recall task. This suggests that participants have a broad idea of what information is stored in their devices and can detect any changes within it more effectively than they can recall the entire information. However, as mentioned earlier, the study carried out by Elizabeth T. Friede [11] does not support these findings.

There was no statistically significant difference observed in the way male students and female students treat information , except for the scores of 'will be saved' templates of the memory-recall task. This may be because both the genders undergo equal exposure to digital devices and internet.

Conclusion:

The mean scores for templates of 'to be erased' type are more than mean scores of templates of 'to be saved' types in both memory recall and recall recognition tasks. Thus this study concludes that medical students are considerably making fewer efforts to remember the information they expect to be stored in their digital devices. Smartphones and internet services have effects on the short term memory of medical students. The study suggests that participants have a broad idea of what information is stored in their devices and can detect any changes within it more effectively than they can recall the entire information This study further concludes that the phenomenon of directed forgetting has now extended and is applicable for digital appliances as well.

Recommendations:

1. Further studies need to be conducted to examine the effect of directed forgetting while using smartphones, other digital devices and internet in students of different faculties.
2. The comparative studies may be undertaken with inter-group comparisons between people from different occupations and also of different age groups.
3. Extensive studies on large population are required to be carried out for generalizing the results.

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