Review Article

Using Link and Major System of Memory to Memorise, Remember and Recall Pharmaceutical Sciences Better

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ABSTRACT

Traditional memory techniques like mnemonics, flashcards and outline have been used to memorise and recall information as rote learning is not something that can be completely avoided in education. Recently, two memory techniques that are considered superior to traditional memory techniques-link and major system of memory are being widely used to memorise a large amount of data in a very short time. The link and major system of memory are based on three basic principles: Observation, association and repetition. These techniques can be used to memorise, remember and recall information in pharmaceutical subjects like botanical names and families in pharmacognosy, drug names and classification in medicinal chemistry, dose and adverse effect of drugs in pharmacology, list of additives in pharmaceutics and interpretation of spectrum in pharmaceutical analysis. The link and major system of memory offer several advantages over traditional memory techniques like mnemonics, flashcards and outline. One of the key advantages of link and major system of memory is that these techniques need no training as they are very simple and intuitive to human beings. The other advantages are: they help students to learn, remember and retain new concepts easily; they help students to sharpen their self-learning skills; they also help students to direct their attention to key concepts and process the material deeply and save a lot of time.

Key words: Link method of memory, Major system of memory, Rote learning, Observation, association, Pharmaceutical sciences.

INTRODUCTION

Rote learning is a technique used to memorise information by repetition. Rote learning is considered as an ineffective method to achieve mastery in any field of study. Modern academicians all over the globe discourage rote learning as it does not allow comprehension of a subject and prevents one from gaining mastery. On the other side, rote learning is considered essential to create primary information and fundamentals. For instance, rote learning is frequently used to memorise formulae in any subjects, anatomy in medicine, normal and abnormal laboratory values in medicine, periodic table in chemistry, drug names, classification, side-effects, indications and contra-indications in pharmacology etc. So rote learning is considered a necessary evil in the field of pharmaceutical sciences and medical sciences.[1] The world memory championship is an event organized by World Memory Sports Council (WMSC) in which the competitors memorise and recall as much information as possible within a given period of time. The winner is the one who manages to memorise and recall the maximum amount of different forms of information. The participants memorise and recall information like: the sequence of randomly shuffled deck of 52 cards, random

Submission Date: 06-05-2020;
Revision Date: 14-07-2020;
Accepted Date: 07-09-2020

DOI: 10.5530/ijper.54.3s.142

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numbers (91560…) which are presented in rows of 20 digits with 25 rows per page, random binary numbers (01011….) which are presented in rows of 30 digits with 25 rows per page, list of hundreds of random words (cup, tree, beaker….) names of random people and faces in photographs etc. For instance, in 2017 Zou Lujian memorized the sequence of randomly shuffled deck of 52 cards in 13.96 seconds! In 2008, Ben Pridmore set the world record for memorizing a 930 digit binary number in 5 min. Memory champions achieve these impressive feats through training using two major systems of memory - Link system of memory and Major system of memory –developed by ancient Greeks.[2]

These insane feats are achieved by memory athletes not because of superior cognitive skills but through deliberate practice.[3,4] Behavioral studies have proved the superiority and efficacy of link system of memory and major system of memory techniques over traditional mnemonic techniques in learning and remembering.[5] Mastering Link and major system of memory does not demand any formal training which is the most important advantage of these techniques and these techniques also save a lot of time.[6] There are many thousands of drugs with multiple brand names and this creates a lot of confusions amongst medical professionals when trying to remember and recall generic and brand names of drugs and this leads to serious medication errors.[7,8] With the help of link system of memory, generic and brand names of drugs can memorized and recalled easily compared to traditional techniques. These two techniques can be used to effectively memorise and recall any kind of information in pharmaceutical sciences. This review article explains how the techniques of link and major system of memory can be applied to memorise, remember and recall pharmaceutical sciences better.

Principles of Link and Major System of Memory

The Link and Major system of memory are based on three principles: Observation, association and repetition.[9] Which historical monuments are printed on Indian currencies of denominations 10 and 200? One might have seen the pictures of these monuments on the currency many times but most fail to remember it because they failed to observe it. One cannot possibly remember anything that one fails to observe. To develop a good memory a keen sense of observation is required. The answers to the above questions are- Sun temple and Sanchi Stupa.

The second principles association.[10] After something is observed it must be associated in our minds with something we already know or remember. Association, as pertaining to memory, simply means the connecting or tying up of two or more things to each other. For instance, Korea was liberated from Japan on 15th August 1945 and Norway gained independence from Denmark on 17th May 1814. If an Indian had to memorise the dates of independence of Korea and Norway, he would find it easy to remember the independence day of Korea as he would simply associate Korean independence day which happened two years before but on the same date (15th August 1945) with independence day of India (15th August 1947).To give an example from pharmacology, the type of β receptors (β1 or β2) present on heart and lungs always confuses most students. To remember the location of β receptors, we can associate it with what we know already. We already know that there is/are one heart and two lungs. So we can associate β1 with 1 heart and β2 with 2 lungs. The fourth clotting factor is calcium. Milk is rich in calcium and the number of letters in milk is four. By making an association between fourth clotting factor and milk, one can remember that the fourth clotting factor is calcium. The fifth clotting factor is labile factor and the number of letters in labile is five. This association may help to remember the fifth clotting factor. The point is we can remember things better once we start associating or linking things which we want to remember with what we already know.

The third principle of good memory is repetition or revision. To remember better we have to commit the information to long term memory. To drive information from short term to long term memory, one has to revise the information at regular intervals as short term memory is very volatile.

Link Method of Memory[11]

It is also called as chain method of memory and is used to memorise a list of random items. It is based on creating mental images of the things one wants to remember and creating an association or link between the first and the second item on the list and then creating an association between the second and third item on the list and so on and so forth. The main factor that determines the effectiveness of this method is the quality of associations. One can make better associations by creating associations that are 1. Out of proportion 2. In action 3. Visual and 4. Emotional.

Major System of Memory

It was first introduced by Stanislaus Mink von Wennsshein along about the year 1648. Major system is used to memorise numbers. Not just a simple ten digit mobile number. It can be used to memorise a thousand digit number and even a thousand digit binary number.

Numbers are very difficult to memorise and recall as they are abstract and intangible. They don't have a shape, size or color and so they mean nothing to our brain. So in major system, we convert numbers into meaningful images and then use link system of memory to associate the images with each other. And when it is time to recall we convert the images back into numbers. In major system, each number from 0-9 is allotted one or more alphabets as given in Table 1.

According to major system, the word "tin" represents the number 12 since t is 1, i does not have any value and 2 is n. Similarly, moon is 32, motor is 314, pope is 99 and Amazon is 302. But what really count is the sound and not the actual letters. The letter C in the word coat (c is pronounced with a k sound) represents #7 but in the word cent(c is pronounced with an s sound) represents # 0. The letters kn in Knee and Knife represent 2 as k is silent in both the words.

The upper limit of normal laboratory value of potassium and sodium is 5 meq/l. Using major system number 5 can be converted to the word "whale" (The letters w, h, a and e have no values and l is 5). By visualizing oneself feeding potassium rich bananas to a giant whale, one can remember the laboratory value of potassium better. The rational is that the brain is good at remembering mental images better than abstract numbers. In this case, it is easy to remember and recall a giant whale eating bananas than the number 5. The above technique can be used to convert any number into words and by making interesting associations using link method of memory one can memorise any number like common laboratory values in medicine or absorption spectra values in pharmaceutical analysis.

Table 1: Major system of Memory.[12]

Digit	Sound	Memory Aid
1	T or D	The letter T and D has one down stroke.
2	n	n has two down strokes.
3	m	m has three down strokes.
4	R	Final sound of the word, "four" is R.
5	L	Roman numeral for 50 is L.
6	J, sh, ch, g	The letter J turned around is almost like the number 6.
7	K, c, g	Capital K contains two sevens
8	F or V	F or V as written f looks like eight
9	P or b	P is a mirror image of nine
0	Z or S	The first letter of zero is Z
No Value	a, e, i, o, u and w, h, y	The vowels and the letters w, h, y do not carry any value

Ayushi Quereshi *et al.* tested the effectiveness of the memory techniques in medical students by teaching the students in the test group with both didactic lectures and memory techniques on the topic "Insulin and diabetes". The control group was taught the same topic but only through didactic lectures. The results showed a highly significant increase in the performance of students in the test group. Moreover 100 % of students who received lectures through memory techniques agreed that these techniques very helpful. The authors of the study conclude that these techniques can be very effective in learning and can be adopted in other disciplines of medicine.[6]

CONCLUSION

Link system of memory and major system of memory can be used to memorise anything like a shopping list, passwords, bank account numbers and telephone numbers. The list does not end here. One can use this system to memorise drug names, classification of drugs, botanical names and families, important laboratory values and even to memorise a speech. It takes a little practice and effort to master these memory techniques but if one invests some time and practice, it can bring in a phenomenal improvement in memory.

ACKNOWLEDGEMENT

The authors would like to thank the Department of Science and Technology – Fund for Improvement of Science and Technology Infrastructure in Universities and Higher Educational Institutions (DST-FIST), New Delhi for their infrastructure support to our department. The authors would also like to express their special thanks to management of JSS College of Pharmacy, Ooty and JSS Academy of Higher Education and Research, Mysuru.

CONFLICT OF INTEREST

The authors declare that the contents in this article have no conflict of interest.

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Cite this article: Jayaram S, Ramajayam SK, Rymbai E, Sugumar D. Using Link and Major System of Memory to Memorise, Remember and Recall Pharmaceutical Sciences Better. Indian J of Pharmaceutical Education and Research. 2020;54(3s):s438-s441.