EFFECT OF EXTENSIVE ROTE LEARNING EXPERIENCE ON SUBSEQUENT ACADEMIC ACHIEVEMENT

Javed Iqbal, Amina Ahmad*

Quaid-e-Azam Medical College Bahawalpur, Pakistan *College of Physicians and Surgeons (CPSP) Pakistan

ABSTRACT

Objective: To determine the difference between academic achievements in terms of scores of students with prior extensive rote memorization experience with those without it.

Study Design: Ex-post fecto study

Place and Duration of Study: Quaid-e-Azam Medical College, Bahawalpur from Dec 2013 to Mar 2014.

Participants and Methods: After Quaid-e-Azam Medical College's ethical review board's approval, scores of medical students' first professional examination were selected by purposive sampling technique, making a total sample size of 102 students, constituting 2 comparison groups with 51 students in each. The first group comprised all the students of 3rd, 4th and 5th year MBBS who were Hafiz-e-Quran and the other one had non Hafiz-e-Quran students from the same year. Descriptive statistics such as mean and standard deviation of their scores were calculated.

Results: The overall mean score in biochemistry, physiology and anatomy was statistically different for these two groups as mean scores were 730.25±50.66 and 699.94±48.93 (p = 0.003) respectively for hafiz-e-Quran and non-hafiz-e-Quran. This was because of significant difference in achievement of score in physiology as mean score was 258.47±24.36 and 248.98±20.60 for hafiz-e-Quran and non-hafiz-e-Quran respectively (p = 0.036). The difference in the subject of anatomy and biochemistry was not statistically significant.

Conclusion: Prior training of rote learning may provide experience to learn and reproduce bigger chunks of knowledge more effectively

Keywords: Academic achievements, Medical students, Medical education, Rote learning.

INTRODUCTION

Rote learning is defined as repeated rehearsal of verbal material. This, results in small amounts of information to be transferred from short-term to long-term memory e.g. telephone numbers, e-mail addresses etc[1].

The process of rote learning fixes the information in the memory through sheer repetition. It is generally, not considered to be a favoured learning strategy. The students with such learning styles are considered to be surface learners. However, it can be argued that rote-memorization through rehearsal is the necessary step to recall important information, which paves the way to understanding and subsequent higher order cognitive skills such as analysis and problem solving[2].

Some students use rote learning as their main learning strategy. Entwistle and Peterson identified three subgroups of students with diverse learning conceptions[3]. Students who strongly equate learning with to seek understanding were labeled as constructive learner. Those who equate learning with memorizing were labeled as reproductive learners. The third group possesses mixed conception of learning. For them, the understanding and memorizing were mutually enhancing processes. The study concluded that these identified learning conceptions result in the adoption of different study strategies, which in turn lead to varied academic results.

Research on rote memorization has shown that a prolonged period of repetitive rote memorization may lead to improvements in verbal/episodic memory, which persists in the weeks following the cessation of exercise of rote learning. Furthermore, it has been demonstrated that these benefits appear to be associated with metabolic changes produced by repetitive rote memorization in the left posterior hippocampus[4]. These metabolic changes are demonstrated as increased

Correspondence: Dr Javed Iqbal, 60-A, Hashami Gardens, Bahawalpur, Pakistan
Email: surgeonjaved@hotmail.com
Received: 30 May 2014; received revised: 22 July 2014; accepted: 16 Sep 2014

NAA/(Cho+tCr)* ratio in hippocampus related to repeated activation of brain structures associated with rote learning. Another study by Valenzuela et al also supported this finding[5].

There exists a group of students in all medical colleges in Pakistan who has undergone extensive experience of rote memorization usually in their early adolescent age in the form of Hafiz-e-Quran (Memorization of whole test of Holy Quran word by word). The educational authorities grant 20 extra marks to be counted for admission in professional colleges to the students who are Hafiz-e-Quran. This might have religious, cultural and political basis, which is beyond the scope of the present study. However, there is a common understanding that such students will do better in academics as compared to their counterparts in their academic course. These students with many years exercise of rote memorization appear to be an appropriate model to statistically determine the effect of extensive prior training of rote learning on academic achievements of students in terms of their scores in exams.

There is paucity of medical education research addressing the effect of rote memorization experience on further learning and cognitive growth.

Dearth of published evidence in this context makes a case for designing an ex-post fecto study[6] at Quaid-e-Azam Medical College, Bahawalpur to ascertain whether extensive rote memorization experience can influence academic achievement in terms of scores or not by comparing the scores of Hafiz-e-Quran and non-Hafiz-e-Quran students.

PARTICIPANTS AND METHODS

This ex-post fecto study was conducted at Quid-e-Azam Medical College from December 2013 to March 2014 after formal approval from the institution's ethical review board. MBBS students of 3rd, 4th and final year were included making a total sample size of 102 students, constituting 2 comparison groups with 51 students in each. The first group comprised all the students of 3rd, 4th and 5th year MBBS who were Hafiz-e-Quran and the second group comprised randomly selected equal number of students from the same years who were not Hafiz-e-Quran, selected on the basis of non-probability purposive sampling technique with the same gender distribution as in group one by lottery method. In order to minimize confounders, the selected students of both groups were those who got admission in medical college after FSc and not after Cambridge system of education (A-levels), as these systems vary in their teaching strategies. Students who didn't pass their examinations in 1st attempt were also excluded.

1st and 2nd year students were excluded from the study due to their fewer academic scores available as their inclusion could have erroneously skewed the data.

The academic scores in the subjects of Anatomy, Physiology and Biochemistry, were obtained from the college record of the student section. Each student was allotted a code, to ensure anonymity before entering the data into the software for analysis.

SPSS v.16 (SPSS Inc., Chicago, IL) was used for data analysis. Descriptive statistics were used to describe the results. Overall scores as well as scores of the subjects were compared through independent samples t-test between both the groups as well as between the genders. A p-value < 0.05 was considered as significant.

RESULTS

Total 102 students were included in the study, 51 in each group. There were total 56(54.9%) male students while 46(45.1%) were female students with a mean age of 24.57±1.69. (Table-1). The comparison of overall mean score as well as individual subject scores in two groups are summarized in table-2. This comparison yielded statistically significant results (p-value=0.003). Statistically significant difference was noted in achievement of scores in physiology, whereas they were statistically insignificant in case of anatomy and physiology.

When mean academic scores of male students in both groups were compared with female students, the scores of female students

*NAA= N-acetylaspartate, Cho=choline and r=creatine,

were significantly more than the male ones, both in Hafiz-Quran and non- Hafiz-e-Quran groups (Table-3).

DISCUSSION

It is pertinent to understand that 'Hafiz-e-Quran" in this study is only used as a model for rote memorization. The cognitive aspect of this experience is considered here. There are social, psychological, life style, religious and spiritual aspects of Hafiz-e-Quran, which are beyond the scope of this study. The possible confounding effects of these aspects are recognized by the authors and acknowledged as limitation of the present study. The subsequent discussion must be read with this context in mind.

Rote learning, which is thought to be, not a good learning strategy, is essentially needed in some areas of learning as it provides foundation for subsequent understanding and application of knowledge[7].

However, it is argued that rote learning results in learning facts without real understanding of them. Hence the application and subsequent transfer of learning is not possible[8].

The human memory system has a taxon memory part in which facts are learned by rote rehearsal by storing the information in a sequence without attaching any imagination or concept with it. According to information processing model the effective working of this

Table-1: Showing demographics of participants.

	Hafiz-e Quran	Non Hafiz-e- Quran	
Gender			
Male	28 (50%)	28 (50%)	
Female	23 (50%)	23 (50%)	
Mean Age in years			*p*-value
Male	23.96±1.68	25.14±1.84	0.015*
Female	24.00±1.50	25.21±1.24	0.004*
Over all mean age	24.57±1.69		

*Statistically significant

Table-2: Showing comparison of scores: Hafiz-e-Quran and non-Hafiz-e-Quran students (n=102).

Variables	Hafiz-e- Quran (51)	Non Hafiz-e- Quran (51)	
	Mean (SD)	Mean (SD)	*p*-value
Overall Mean score (Biochemistry, Physiology, Anatomy)	730.25 (50.66)	699.94 (48.93)	0.003*
Score achieved in Anatomy	256.76 (22.16)	251.15(22.25)	0.205
Score achieved in Physiology	258.47 (24.36)	248.98(20.60)	0.036*
Score achieved in Biochemistry	210.54(17.98)	204.27(17.59)	0.078

*Statistically significant

Table-3: Showing comparison of scores between male and female students.

	Hafiz-e- Quran		*p*-value	Non Hafiz-e- Quran		*p*-value
	Male	Female		Male	Female	
Overall Score	713.24±40.75	741.03±51.64	0.029	680.81±51.64	733.11±48.75	0.019*
Anatomy	250.21±19.85	264.73±22.63	0.018	241.28±21.14	263.17±17.35	0.000*
Biochemistry	207.28±17.59	214.52±18.03	0.155	198.57±20.05	211.21±10.85	0.006*
Physiology	255.75±27.15	261.78±20.52	0.384	240.96±19.86	258.73±17.29	0.001*

*Statistically significant

system requires many trials resulting in easy fatigability of brain and consumption of attention. The learner needs external motivation in the form of reward and punishment rather than internal motivation generated from inherent joy of learning something meaningful[8].

In contrast to taxon memory system, the contextual learning utilizes an experience. It involves the spatial memory system. This system doesn't need rehearsal and the learning is stored as a meaningful experience almost instantaneously. The motivation is internal and long lasting[9].

Having said, that all of these aspects about rote memorization as a poor learning strategy has already been well established[10,11]. The issue here is whether the exercise of rote memorization has any effect on the cognitive abilities utilized for higher level functions like problem solving and critical thinking. The results of this study indicate a similar trend as Hafiz-e-Quran students have shown overall better performance as opposed to non Hafiz-e-Quran group with a statistically significant difference (p=0.003). In addition, this is an indirect evidence of using the ability to memorize facts for subsequent higher-level cognitive functions. Since these scores are produced as a result of assessment mainly based on MCQ and SEQs, which are meant to assess understanding and to some extent application of knowledge.

Though scarce, yet there is evidence in literature that a mere prolonged exercise of utilizing mental faculties in memorizing facts does result in enhanced cognitive ability. This was traced to an actual change in the chemistry at neuronal cellular level. An extensive study by Roche and collegues[4] and by Valenzuela et al[5] has demonstrated the favourable metabolic changes in the left posterior hippocampus after repeated activation of brain structures due to repeated rote learning exercise.

Similarly, Snowdon and colleagues have shown in a famous "Nuns study" that involvement of a group of elderly people in a continued cognitive activity results in mental health benefits including lower rate of neuronal degeneration[12].

Studies by Maguire et al[13] and Bremner[14] are also supportive of this fact. They could actually demonstrate activation of neural circuits involving left inferior prefrontal cortex, supplementary motor area, posterior parietal cortex and medial temporal lobe. The activity levels in this circuit are related to quick recall of rehearsed material.

It was expected that the scores would be higher in the subject of anatomy as it requires cramming up the facts. However, the overall difference in the average scores between Group 1 and 2 was due to significantly higher average scores in the subject of physiology alone, which requires concept building and critical thinking instead of mere memorization of facts. Thus indicating that rote memorization, as an exercise may result in enhanced cognitive capacity required for higher-level mental functions including conceptualization. Apart from this cognitive aspect of Hafiz-e-Quran, the other variables between Hafiz-e-Quran and Non-Hafiz-e-Quran have social, cultural, religious and spiritual dimensions, which are beyond the scope of the present study. We recognize them as limitation of the present study.

This study has also indicated that the mean scores of female students were more in all comparisons than their male colleagues, irrespective of being Hafiz-e-Quran or not. Literature does indicate similar trends in under and post graduate education in different societies. One of the proposed reasons was better self-discipline exhibited by female students[15-18]. This interesting aspect needs further probing through objective studies in context with our local socio-cultural background.

Our study paves the way for further studies on the subject looking into the strength of associations between Hafiz-e-Quran and their scores and those without this training in addition to gender differences with respect to the same.

CONCLUSION

Our results provide evidence that prior experience of extensive rote memorization

(Memorization of Holy Quran, used as a model) does have effect on the learning abilities as indicated by statistically significant difference between the average academic scores achieved by two groups of students indicating an edge to the Hafiz-e-Quran group. Likewise, it is also reflected that female students scored better as opposed to their male counterparts, highlighting a need to study in depth common characteristics among female students in order to ascertain the exact reasons behind this achievement. However, generalization of these results beyond the given context is not possible due to a small sample size. Further multi-center studies are recommended for this purpose.

CONFLICT OF INTEREST

Authors alone are responsible for the findings of this study and no institutional funding has been used for this study.

REFERENCES

1. Benjamin AS Bjork RA. On the relationship between recognition speed and accuracy for words rehearsed via rote versus elaborative rehearsal. J Exp Psychol. Learn Mem Cog 2000; 26: 638–48.
2. Santtrock JW. Educational Psychology. 2nd ed. New Delhi: Tata McGraw-Hill; 2006. p.251.
3. Entwistle NJ, Peterson ER. Conceptions of learning and knowledge in higher education: relationships with study behaviour and influences of learning environments. Int J Educ Res. 2004; 41(6): 407-9.
4. Roche RA, Mullally SL, McNulty JP, Hayden J, Brennan P, Doherty CP et al. Prolonged rote learning produces delayed memory facilitation and metabolic changes in the hippocampus of the ageing human brain. BMC Neurosci. 2009; 10:136.
5. Valenzuela MJ, Jones M, Wen W, Rae C, Graham S, Shnier R, et al. Memory training alters hippocampal neurochemistry in healthy elderly. Neuro Report. 2003; 14: 1333–7.
6. Creswell JW. Research Design: quantitative, qualitative, and mixed methods approaches New York:Thousand Oaks. 2003; 4-12.
7. Schunk DH. Learning theories: an educational perspective London: Prentice Hall; 2008; p108-15.
8. Just MA Carenter PA. A capacity theory of comprehension: individual difference in working memory. Psychol Rev. 1992; 99(1): 122-49.
9. Caine G, Caine RN. Making connections: teaching and the human brain. Addison Wesley: Innovative Learning Publications. 1994; 187-190.
10. AMEE Medical Education Guide No. 15: Problem-based learning: a practical guide 1999; 21(2): 130-40.
11. Nandi PL, Chan JNF, Chan CPK, Chan P, Chan LPK. Undergraduate medical education: comparison of problem-based learning and conventional teaching.Hong Kong Med J. 2000; 6: 301-6.
12. Snowdon DA. Nun study: brain infarction and expression of AD. J Am Med Assoc. 1997; 277: 813.
13. Maguire EA, Franckowiak RSJ, Frith CD. Recalling routes around London: activation of the right hippocampus in taxi-drivers. J Neurosci. 1997; 17: 7103–10.
14. Bremner JD. Does stress damage the brain? Biol Psychiatry. 1999; 45: 797–805.
15. Dougherty C. Why are the returns to schooling higher for women than for men? J Hum Resour. 2005; 4(40): 969-88.
16. Duckworth AL, Seligman MEP. Self-discipline gives girls the edge: gender in self-discipline, grades, and achievement test scores. J Educ Psychol, 2006; 1(98): 198-208.
17. Hyde JS, Linn MC. The psychology of gender: advances through Metaanalysis. Baltimore: Johns Hopkins University Press; 1986. 136-58.
18. Mettem D, Asik ST. Gender differences in academic performance in a large public university in Turkey. Higher Educ. 2007; 53(2): 255-77.