

## Long-term memory and learning through the use of Research-Centered Teaching Method

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### Abstract

The present study aims at exploring the relation between long term memory and two teaching methods: Research-Centered Teaching and customary lecturing. The promotion of exploratory thinking which is provoked in the Research-Centered Teaching Method is considered to lead to hypothetical research and analytical thinking among students.

Two separate courses in neurophysiology at Tehran University of Medical Sciences and Health services and Iran University of Medical Sciences and Health Services were selected for the study. 310 students were registered on these courses. Half the topics studied were randomly selected for Research-Centered Teaching and the other half for customary lecturing. Thus, each course, consisting of 28 hours of teaching, was split between these two methods. All the students participated in a written exam at the end of the course and filled out a questionnaire regarding which topic was more precisely remembered, the reasons behind that and also their motives for more regular class attendance.

81% of the students stated that the topics taught through the Research-Centered Method were the

ones they remembered best. This was proved in the analysis of the exam results ( $P < 0.02$ ). The students stated that the teaching methods and the desire to do well in exams were two motivating factors for regular class attendance. The analysis indicated that the teaching method, prior curiosity and further research in order to find the answer to the questions raised in the class were crucial for remembering the topics better.

Exploratory thinking which aids the storage of information in the long-term memory for a longer time motivates students to attend classes regularly and this helps successful learning. This study supports the already established belief that interest and curiosity are effective factors in learning.

**Key Words:** long-term memory, learning, Research-Centered Teaching Method, exploratory thinking, motivation

### Introduction

The present study aims at exploring the relation between long-term memory and two teaching methods: Research-Centered Teaching and customary lecturing. It is assumed that certain factors such as motivation and anxiety facilitate

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the conditions for storing the acquired information in the brain for a longer period of time. Exploratory thinking as the main vehicle in Research-Centered Teaching may provoke anxiety and increase motivation (Rassaian 1996, 1997). This may lead to more regular class attendance and promote the chances of successful learning and long-term storage of information.

According to neurophysiology, the information entered in the brain is first processed, evaluated and practised, and finally stored in the long-term memory at a cellular or molecular level for a few minutes, a few years or even permanently. This stored information is considered as acquired knowledge. There is no doubt that in the complex phenomenon of learning, both the learner (in terms of the level of curiosity, motivation and concentration) and the environmental factors (in terms of teaching methods and clear learning objectives) play essential roles in storing information in the brain. In the Research-Centered Teaching Method, the flow of information to the brain is aided by exploratory thinking. In this method, instead of lecturing the students, a question which researchers were faced with years ago is raised. Their subsequent formulation and development of the topic and the process of arriving at the answer thus become part of the learning process. The students are then asked to find out the answer to the question through hypothetical research. The students' opinions are discussed and analysed for their appropriateness, research methodology, ethics, etc. During the discussion, the students get closer to the final answer. They are then referred to the relevant books and articles to seek evidence for their proposals (Rassaian N 1995, 1997).

The following equation between cognition, as a dependant variable, and other known variables such as enthusiasm, not interested and anxiety has been reported in previous studies (Rassaian 1997a, 1997b 1995).

$$\text{Cognition} = (0.27) \text{ enthusiasm} - (0.15) \text{ not interested} + (0.08) \text{ anxiety}$$
$$F=20.59$$
$$(P<0.0001)$$

Thus according to the above equation if Research-Centered Teaching Method provokes enthusiasm and anxiety then it can lead to better understanding and hence to longer storage of information in the brain. The present study looks at such issues in order to compare the two teaching methods with regard to successful learning.

The Research-Centered Teaching Method is regarded as an active learning method in that there is a dialogue between the teacher and the students. This method can be contextualised among other methods of active learning such as the Scheme-driven search method proposed by Mandin et al who believe that the teacher should help the students to think like experts. As every clinical problem has a special deductive process relevant to its complexity and solution, thus, besides having the relevant knowledge, the teacher should be able to organise the learning in such a way as to reveal the deductive process involved. The processes involved in this method are the conceptualisation of the problem and an organised search to get to the appropriate response to the complex clinical situation or problem.

Mandlin et al believe that their method is more effective than problem based learning which is a hypothetico-deductive process. In problem based learning, all clinical problems require to be solved through outlining a hypothesis which would be the basis for organising knowledge and information. In comparison with the problem-based learning method, the Scheme-driven Search Method goes about solving a problem in a more logical and organised way, without requiring a hypothesis and deduction (Mandin, & Woloschuk 1997).

Research-Centered Teaching Method is questioning how a discovery or a finding has happened. According to Sachdeva, to enhance the cognitive abilities of students, effective questioning should be brought up during teaching sessions. The teachers need to make these questions at different levels of knowledge. Acquiring the relevant skills in making these questions require training and the active participation of teachers in educational workshops (Sachdeva 1996).

### Subjects and Methods

This investigation was carried out in 1995 with the participation of 310 students from Tehran University of Medical Sciences and Health Services (74%) and Iran University of Medical Sciences and Health Services (26%). Two separate courses in neurophysiology were selected for the study. Both courses were conducted in the same semester. Each course was made up of 28 teaching hours, and they were conducted over a 14-week period. For both courses, half the randomly selected topics on each course were taught through the Research-Centered Teaching Method and the other half through the more customary lecturing. At the end of the course, all students took a written exam,

where questions in the form of filling in the blanks were used to evaluate their understanding of the topics taught. Prior to the written exam, a questionnaire containing twelve questions was distributed. Before answering the questions, the students had to write down a subject they remembered best. The questions were aimed at finding out the reasons for remembering better the topic (7 questions) and the factors that motivated them to attend the classes (5 questions).

The statistical evaluation included t-test, factor analysis and the reliability analysis.

### Results

81% of the students stated that the topics they had learned through the Research-Centered Teaching Method were the ones they remembered best. The exam results of all students in these topics ranged between  $6.5 \pm 2.98$  out of 10. The rest of the students who remembered the topics taught through lectures attained lower grades, ranging between  $5.8 \pm 3.75$  ( $P < 0.02$ ). A factor analysis was used to verify the reasons for best remembering the topics. The results indicated that the factors related to the teaching method received the highest factor loads ( $P < 0.00001$ ) (Table 1).

**Table 1.** Reasons mentioned by the students regarding why they remembered the topics taught (factor loadings smaller than 0.53 are not presented in the table)

Reasons for best remembering the topic	Factor 1	Factor 2
Deductibility of the topic	0.788	
Using examples for better perception	0.737	
The topic being related to medical sciences	0.588	
Learning in class	0.407	
Prior curiosity		0.699
Library search (further studies)		0.623
Study of lecture notes		0.401

Factors related to the reasons for attending the classes were the method of teaching (Factor 1) and a desire to succeed in exams and the carrying

out of university requirements (Factor 2) (Table 2) ( $P < 0.0003$ ).

**Table 2.** The reasons for attending the classes (factor loadings smaller than 0.53 are not presented in the table).

Reasons for Attending Classes	Factor 1	Factor 2
Learning the exploratory thinking	0.748	
Interest	0.639	
The topics are not easily found in textbooks	0.537	
To pass exams		0.765
Carrying out a university requirement		0.762

The results of the reliability analysis of the questionnaires regarding the reasons for remembering topics taught and the students'

motives for attending the classes are shown in Table 3.

**Table 3.** Reliability analysis of the questionnaire

Questionnaire	Mean	Variance	Q	p	coefficient
Reasons for remembering the topics (7 questions)	0.307	0.015	148.6	0.00001	0.517
Reasons for attending the classes (5 questions)	0.350	0.017	94.8	0.00001	0.232

## Discussion

Research-Centered Teaching Method provokes interest and enthusiasm among students. This, in turn, facilitates the information stored in the long-term memory which then leads to a better understanding of topics. In the present study, a better understanding of topics acted as a *motivational factor for the students* to attend the classes more regularly. This contributed to better learning and exam results. In comparison, with customary lecturing, the students were less stimulated. Since the students were less motivated, the inflow of information was sluggish and their understanding of the topics was affected, resulting the lower grades.

As stated earlier, in the Research-Centered Teaching Method, the discussion concentrates on

how the information regarding a topic was developed/discovered. The students' activities are based on exploratory thinking that actively involves the brain in the learning process. By provoking interest in the topic, the level of anxiety that facilitates the learning process aids the brain to learn with enthusiasm.

The fact that students could remember better the topics taught through exploratory thinking indicates that information is better stored in the long term memory when the Research-Centered Teaching Method is used (8).

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