

# Experimental Research about Effect of Mathematics Anxiety, Working Memory Capacity on Students' Mathematical Performance With Three Different Types of Learning Methods

<sup>1</sup>Saeed Daneshamooz and Hassan Alamolhodaei, <sup>2</sup>Saeed Darvishian

<sup>1</sup>School of Mathematical Sciences-Ferdowsi University of Mashhad

<sup>2</sup>Department of Engineering-Islamic Azad University, Neyshabur Branch

## ABSTRACT

The purpose of this quasi-experimental was to investigate the effect of two predictive factors (mathematics anxiety, working memory capacity) on mathematical performance of three groups of college students with three different learning methods. Students in 1st group studied the material cooperatively; students in the 2nd group studied the material in e-learning method and students in 3th group studied the material in traditional class. Three chapter's tests were used to measure students' Mathematical achievement. The significant negative correlation between mathematics anxiety and mathematical performance and positive correlation between mathematical performance and working memory capacity were found. One of the results of this study showed that students in the cooperative learning groups had significantly higher test scores than students in the other groups. Moreover, there is a significant interaction effect of working memory capacity and mathematics anxiety on mathematical performance based on students' learning method. The most important result of this study indicated that with controlling the effect of math anxiety, WMC had significantly more effect on students' mathematical problem solving who studied their lessons in e-learning method than other groups of learning method.

**Keywords:** *Mathematics anxiety, Working memory capacity, Cooperative learning, e-learning, Mathematical performance.*

## 1. INTRODUCTION

The art of problem solving is the heart of mathematics. Mathematical problem solving is a complex cognitive activity involving a number of processes and strategies. Patton et al. [1] propose that learning to solve problems is a primary objective in learning mathematics, as problems are an inevitable fact of life. According to Effandi and Normah [2], a student needs to think and make decisions using appropriate strategies to solve mathematic problems. Many research studies and projects have pointed out the importance of learning problem solving in school mathematics courses [4-6].

The National Council of Teachers of Mathematics [5] recommendations to make problem solving the focus of school mathematics posed fundamental questions about the nature of school mathematics. Mathematics instruction should be designed so that students experience mathematics as problem solving.

Teaching mathematical problem solving is a challenge for many teachers. A teacher who believes that information can be transmitted to students' heads often employs lecture methods in the teaching of mathematics. These teachers usually stand up in front of the class, writing formulas on the board, and providing several examples for practicing the formula. Teachers then give

students many exercises for practice and expect students to memorize the formula [7]. Yet several studies have described the detrimental effects of this approach for students (e.g. [7, 8]). Because of a tendency for teachers to expect students to memorize a lot of facts that may not necessarily make sense to them, and asking students to listen and practice many exercises in preparation for a test, many students come to the conclusion that mathematics is either about right or wrong, it is unrelated to real life, or it is only appropriate for smart students [7, 9].

According the importance of math problem solving the present study was carried out by the authors to study mathematical problem solving in term of predictive factor. In this study the effect of working memory capacity and mathematics anxiety on mathematical performance according to the learning method will be discussed. It seems to be more beneficial to describe the historical background of predictive factors of mathematical performance, working memory capacity and mathematics anxiety before introducing research framework.

### a. Working memory Capacity

Alan Baddeley defines working memory (WM) as "a brain system that provides temporary storage and manipulation of the information necessary for such complex cognitive tasks as language comprehension, learning, and reasoning" [10]. Working memory refers to a complex cognitive system that is responsible for the storage and processing of information in the short term. Also working memory known as a mental workspace,