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Causal Model of Mathematical Academic Achievement based on the Creative Thinking and Critical Thinking with the Mediation of Problem Solving in Primary School Students of Tabriz City

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Purpose: Academic achievement especially in mathematics is very important and knowing the effective factors on it helps a lot in planning in the field of mathematical academic achievement. As a result, the aim of this research was to investigate the causal model of mathematical academic achievement based on the creative thinking and critical thinking with the mediation of problem solving in primary school students.

Methodology: The present study was a description from type of quantitative, which its population was all primary school students of Tabriz city in the 2023-24 academic years. The sample size of the present research was considered to be 250 people, which this number were selected by multi-step cluster random sampling method. The tools of this study were included the questionnaires of mathematical academic achievement (Shalev et al, 1993), creative thinking (Welch and Mc Dowall, 2010), critical thinking (Facione et al, 1994) and problem solving (Heppner and Petersen, 1982) and their data were analyzed with the methods of Pearson correlation coefficients and structural equation modeling in SPSS-26 and AMOS-24 software.

Findings: The findings of the present research showed that the causal model of mathematical academic achievement based on the creative thinking and critical thinking with the mediation of problem solving in primary school students had a good fit. In the mentioned model, the variables of creative thinking and critical thinking had a direct and significant effect on problem solving and mathematical academic achievement of primary school students, and the variable of problem solving had a direct and significant effect on their mathematical academic achievement. In addition, the variables of creative thinking and critical thinking with the mediation of problem solving had an indirect and significant effect on mathematical academic achievement of primary school students ($P<0.05$).

Conclusion: According to the results of this study, in order to improve the mathematical academic achievement of primary school students can promote their creative thinking, critical thinking and problem solving.

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Extended Abstract

Objective: In the third millennium the learning of mathematical concepts and skills in working with numbers is a need, which is considered the key to success in the complex world of the new era, but due to the wide application of mathematics in everyday life, there are many problems in this field and many students face fail in mathematics education. The mathematics is a symbolic language that makes people think about quantitative matters, record them and communicate quantitative thoughts to each other. Academic achievement means mastery on theoretical knowledge and information in a given field and indicates how successful the learners were in achieving academic goals. The prerequisite for the mathematical academic achievement is learning the principles and concepts of mathematics, learning cognitive and metacognitive strategies and mastery in solving mathematical problems. Therefore, educational systems seek to improve the academic status of mathematics or the mathematical academic achievement of students, which requires the identification of factors affecting it. One of the possible factors affecting on the mathematical academic achievement is creative thinking. Thinking is one of the great qualities of mind and creativity is the ability to create new, amazing and valuable ideas and artifacts. One of the main goals of educational systems is to raise thoughtful and creative students with scientific insight who can manage their daily life in the best way and provide the basis for personal and social growth and improvement. The creative thinking is a type of thinking that leads to new perspectives, emerging approaches, new perspectives and new ways to understand objects and situations. People with creative thinking have a set of abilities and special personality and cognitive characteristics and try to solve various problems by producing innovative solutions. Such people have divergent thinking, they are different from others in thinking and acting, avoid doing habitual and repetitive behaviors and always seek to use new ways for problems. Another possible factor affecting on the mathematical academic achievement is critical thinking as one of the most important skills, which is a combination of the skills of inference, identification of assumptions, inference, interpretation and commentary, evaluation and logical reasoning. This type of thinking allows people to logically and argumentatively judge the theories used, the evidence available, the criteria and standards described, or the value of the methods used. The critical thinking is a purposeful and self-regulating judgment that helps solve problems and make appropriate decisions in different situations. People with critical thinking organize information well, categorize it and judge and evaluate it in order to use it in interaction with others and issues. One of the possible mediating variables between mathematical academic achievement and thinking is problem solving, which is known as a cognitive, conscious, rational and purposeful process. Problem solving is a cognitive and behavioral process that helps people solve everyday problems through the five stages of identifying the problem, defining the problem, generating solutions, evaluating solutions and implementing the best solution and evaluating and judging the solution.

Problem solving includes a set of cognitive, behavioral and emotional responses that are done to adapt to internal and external challenges and include evaluating problems as challenges, thinking to solve problems, systematic effort and needing time to solve problems. People who lack the ability to solve problems in the face of life's obstacles and challenges show impulsive behaviors, feel weak, powerless, and failure, use ineffective strategies of aggression or withdrawal and fail to solve problems. Few researches have been conducted on the relationship between creative and critical thinking, problem solving and mathematical academic achievement, and no research was found in this field with the mediation of problem solving on mathematical academic achievement. Academic achievement especially in mathematics is very important and knowing the effective factors on it helps a lot in planning in the field of mathematical academic achievement. As a result, the aim of this research was to investigate the causal model of mathematical academic achievement based on the creative thinking and critical thinking with the mediation of problem solving in primary school students.

Methodology: The present study was a description from type of quantitative, which its population was all primary school students of Tabriz city in the 2023-24 academic years. The sample size of the present research was considered to be 250 people, which this number were selected by multi-step cluster random sampling method. For this purpose, first a list of all primary schools of Tabriz city was prepared, and then a number of schools were randomly selected from among all schools, and then a number of classes were randomly selected from among the selected primary schools, and all the students of the selected classes were selected as the sample of the present study. It should be mentioned that the importance and necessity of the research was explained and they were assured about observing ethical points. The tools of this study were included the questionnaires of mathematical academic achievement (Shalev et al, 1993), creative thinking (Welch and Mc Dowall, 2010),

critical thinking (Facione et al, 1994) and problem solving (Heppner and Petersen, 1982) and their data were analyzed with the methods of Pearson correlation coefficients and structural equation modeling in SPSS-26 and AMOS-24 software.

Findings: The findings of the present research showed that the causal model of mathematical academic achievement based on the creative thinking and critical thinking with the mediation of problem solving in primary school students had a good fit. In the mentioned model, the variables of creative thinking and critical thinking had a direct and significant effect on problem solving and mathematical academic achievement of primary school students, and the variable of problem solving had a direct and significant effect on their mathematical academic achievement. In addition, the variables of creative thinking and critical thinking with the mediation of problem solving had an indirect and significant effect on mathematical academic achievement of primary school students ($P<0.05$).

Conclusion: According to the results of this study, in order to improve the mathematical academic achievement of primary school students can promote their creative thinking, critical thinking and problem solving. Therefore, it is suggested that counselors and psychologists use strategies based on the variables of creative thinking, critical thinking and problem solving in their psychological interventions to improve mathematical academic achievement and reduce problems in this field.