

INVESTIGATING THE EFFECTS OF MULTIPLE SOLUTIONS ON STUDENTS' ATTITUDES TOWARDS MATHEMATICS

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The purpose of this study is to study the affectivity of education with an emphasis on multiple solutions on improving secondary students' attitudes towards math. In this study, 47 students participated in the experimental group and 54 students in the control group all of whom were studying in Tehran's public schools for girls in both mathematics and empirical sciences in the academic year 2016-2017. The research tool is a questionnaire which assesses students' attitudes towards math in the form of 4 components in Likert Scale. Data analysis shows that teaching by multiple solutions can improve all the attitudes components meaningfully.

Some scholars regard mathematics as the gate towards success and failure of high school graduates (NRC & Up, 2001). However, results of the TIMSS studies from 1999 till now show that in all these years, Iran's position in the 4th and the 8th grade is meaningfully lower than the average scale of TIMSS. Academic achievement is not only affected by knowledge structures, but also it is affected by motivational factors. One of the pedagogical approaches that seem to have impact on improving students' attitudes towards math and creating a sense of satisfaction in them is emphasizing on multiple solutions while teaching math. However, despite the numerous studies that encourage students to use multiple solutions to achieve the key to in-depth knowledge of math (Schukajlow & Krug, 2014), many scholars indicate that implementation of this method will bring about many challenges. Thus, the purpose of this paper is to study the affectivity of teaching based on multiple solutions on improving students' attitudes towards math. This study was conducted in two groups, to determine the effects of this methodology on the students with the higher and lower skills in math courses.

In this study, 47 students participated in the experimental group and 54 students in the control group all of whom were studying in Tehran's public schools for girls in both mathematics and empirical sciences in the 10th grade in the academic year 2016-2017. (Usually mathematics students are stronger than the empirical sciences students). In pre-test and post-test Palacios et.al questionnaire (2014) was used to assess the students' attitudes towards math. This questionnaire has 4 components, namely, perception of utility, mathematical self-concept, enjoyment of math and perception of mathematical incompetence and contains 32 questions that assess students' attitudes in a Likert scale.

Data analysis suggests that after teaching based on multiple solutions, in both groups of the experimental group the mean scores of utility, self-concept and enjoyment is increased in the post-test and the incompetence is decreased. The changes of both experimental groups are the same, but math group has more enjoyment of math rather than the empirical sciences group significantly. There were some challenges such as students' confusion especially weaker students, the sometimes fierce resistance of students in accepting this method, lack of time to have in depth assessment of the solutions proposed, etc which at the time of the presentation will be discussed more widely.

References

- National Research Council (NRC), & Up, A. I. (2001). Helping Children Learn Mathematics. Mathematics Learning Study Committee. J. Kilpatrick, J. Swafford, and B. Findell, eds. Washington, DC: National Academy Press.
- Palacios, A., Arias, V., & Arias, B. (2014). Attitudes towards mathematics: Construction and validation of a measurement instrument. *Revista de Psicodidáctica*, 19(1), 67-91.
- Schukajlow, S., & Krug, A. (2014). Do multiple solutions matter? Prompting multiple solutions, interest, competence, and autonomy. *Journal for Research in Mathematics Education*, 45(4), 497-533.