INFLUENTIAL COGNITIVE FACTORS IN STUDENTS' MATHEMATICAL ACHIEVEMENT IN GRADE 6

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Mathematics is one of the most important school subjects (Molnár & Csapó, 2018). Achievement in mathematics is influenced by a range of factors (Chamann et al., 2014), including mathematics self-concept (Wang, 2007), attitude towards mathematics (Hannula, 2002), mathematics self-efficacy (Williams & Williams, 2010), creativity (Pásztor et al., 2015) and gender (Kenney-Benson, Pomerantz, Ryan & Patrick, 2006). This study aims to determine cognitive factors in students' mathematical achievement. We focus mainly on transversal skills, such as inductive reasoning (IR), combinatorial reasoning (CR), complex problem solving (CPS), ICT literacy (ICT) and working memory (WM) as predictive factors in mathematical achievement. The mathematics test assessed three dimensions of mathematical knowledge: disciplinary content knowledge (MD), the psychological dimension (MP) and the literacy dimension (ML; Csapó & Szendrei, 2011). The sample for the study was drawn from sixth grade students (N=325). The online data collection was carried out via the eDia platform in the schools' ICT rooms. Automatic scoring was used and instant feedback was provided at the end of the tests. The internal consistencies of the tests were good: Cronbach's alpha values varied between .70 and .95. Standard deviations of Weighted Likelihood Estimation scores and correlations were used to examine the predictive power of CPS, IR, CR, ICT and WM on mathematical achievement. All measurement models were computed with Mplus. We assumed that all cognitive factors measured would predict performance in different dimensions of mathematics. Thus, we regressed mathematics on CPS, IR, CR, ICT and WM, and estimated the proportion of explained variance in three dimensions of mathematics. Results showed that all the cognitive factors measured explained performance in all three dimensions of mathematics, but with different effects. The strongest influential factor proved to be IR, followed by ICT, CPS, CR and WM. The model fit well (CFI=.988, TLI=.980, RMSEA=.051 [95% CI: .021–.079]). Within the three-dimensional model, significant latent correlations were found between the pairs of dimensions in the field of mathematics (r_{MD_ML}=.68, r_{MD_MP}=.60, r_{ML_MP}=.70, p<.001). The residuals of measures of ML, MD and MP still correlated highly (.57<r<.63), indicating common aspects of mathematics dimensions separable from the cognitive factors measured. The cognitive factors under examination predicted mathematical achievement at the highest level in the psychological dimension (.634) and at the lowest level in the disciplinary dimension, though still at a high level (.578). The values are high in each case, and a significant amount of variance is explained, thus supporting the claim that IR, CPS, CR, ICT and WM play an important role in various aspects of mathematical performance.

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