THE ROLE OF INDUCTIVE REASONING AND COMBINATORIAL REASONING IN COMPLEX PROBLEM SOLVING: A COMPARISON STUDY BETWEEN CHINA AND HUNGARY

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Problem solving has been considered as one of the most important cognitive skills for successful learning in the 21st century (Dede, 2010). This study aims to detect the developmental effect of inductive reasoning (IR; see Molnár et al., 2013) and combinatorial reasoning (CR; see Pásztor & Csapó, 2014) on complex problem solving (CPS; see Dörner & Funke, 2017) and analyze its similarities and differences in the European and Asian context. The test was implemented in China and Hungary in June and July 2017. The sample was drawn from 12-year-old Chinese and Hungarian students (China: N=187, 85 boys and 102 girls; age mean=11.93, SD=1.06; Hungary: N=835, 382 boys and 453 girls; age mean=11.86, SD=0.43). The tests were carried out via the eDia platform (Molnár, 2015), each student had one and a half hours (two class periods) to make answers. The tests were delivered in simplified Chinese in China and in Hungarian in Hungary. The internal consistencies of the tests were good in both countries (Hungary: CPS=.84, IR=.92, CR=.84; China: CPS=.90, IR=.96, CR=.74). Measurement invariance analysis indicated that CPS tasks worked differently in China and Hungary (chi-square difference testing: $\Delta\chi^2$=122.82, p<.05). Language difference was excluded as a reason for the non-invariance, because the tasks required minimal amount of reading. Two structural equation models were built to analyze the relations and influential effects of IR and CR on CPS in both China and Hungary. The model fits were acceptable: Hungary: χ^2=25.83, df=17, CFI=.997, TLI=.995, RMSEA=.03, SRMR=.02; China: χ^2=42.34, df=17, CFI=.973, TLI=.956, RMSEA=.09, SRMR=.04. The models indicated that CR and IR have significant predicting effects on CPS in both cases, that is, CR and IR are important component skills of problem solving independent of the cultural context. CR and IR proved to be highly correlated in both of the models. There were differences in the cognitive styles of Chinese and Hungarian students. For Hungarian students, the level of CR (β=.319) and IR (β=.376) had basically the same predicting power on CPS achievement; while in China CR (β=.611) played a much more important role than IR (β=.241). This indicated significant differences in the way Hungarian and Chinese students solve CPS problems, however, it highlighted the importance of IR and CR by solving complex problems independent of the given cultural context. The present analyses using structural equation modelling techniques contribute to the research findings regarding CPS in educational settings by analyzing Chinese and Hungarian students' cognitive style differences.

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