IMPROVING THE RESOLUTION OF MATHEMATICAL MODELLING TASKS THROUGH ARTIFICIAL INTELLIGENCE: FINDINGS FROM A FIELD-BASED STUDY

ROUISSA LAMYAE

Interdisciplinary Research for Innovation in Didactics and Human Capital (RIIDCH), Man–Society–Education, Faculty of Educational Sciences, Mohammed V University of Rabat, Morocco
E-mail: lamyae.rouissa742@gmail.com

Abstract - As the need to equip students with the ability to solve real-world problems becomes increasingly urgent, mathematical modelling has emerged as an essential competency in secondary education. However, research consistently shows that students face major cognitive challenges throughout the modelling process, particularly during mathematization, interpretation, and validation. This experimental study investigates the impact of an artificial intelligence (AI)-based support tool on student performance and cognitive strategies when solving complex modelling tasks.

The experiment involved 32 upper secondary school students and followed a within-subject design across two stages: one modelling task without assistance (pre-test) and a parallel task integrating an AI assistant (post-test). Statistical analysis relied on a paired-samples t-test, repeated measures ANOVA, McNemar's test, and Spearman's correlation.

Results indicate a significant improvement in overall performance following the intervention ($t(31) = 6.37$, $p < 0.001$, $d = 1.13$), with the most notable gains observed during the mathematization and interpretation phases ($p < 0.001$). Severe cognitive difficulties, identified using a detailed analysis grid, were significantly reduced—particularly in the transitions from real-world situations to mathematical models, and during model validation. A significant negative correlation ($\rho = -0.46$, $p = 0.008$) suggests a compensatory effect: students who initially performed poorly benefited the most from the tool.

These findings highlight the potential of intelligent technologies to foster more equitable and effective learning in mathematical modelling, by directly addressing cognitive barriers and offering personalized support throughout the modelling process.

Keywords - Mathematical Modelling, Artificial Intelligence, Cognitive Difficulties, Secondary Education, Educational Technologies