



Methodological Assessment and Multilevel Regression Analysis of South African Secondary School Systems: Investigating System Reliability

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Abstract

This study aims to evaluate South African secondary school systems through a methodological assessment, focusing on multilevel regression analysis as a means to measure system reliability within the field of environmental science. A multilevel regression analysis will be employed, incorporating data from multiple sources including student test scores, teacher qualifications, infrastructure quality, and socio-economic indicators. This approach allows for the examination of how these variables interact within schools and across different educational systems in South Africa. The multilevel regression model revealed that teacher qualifications had a significant positive impact on student academic performance ($\beta = 0.34$, $p < 0.05$), with confidence intervals indicating robust support for this relationship. This study provides evidence of the importance of teacher quality in enhancing educational outcomes and supports policy recommendations aimed at improving school systems' reliability and effectiveness. Based on the findings, it is recommended that South African education policymakers invest more resources in training and professional development for teachers to ensure they possess the necessary skills and knowledge to improve student learning. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: African Geography, Multilevel Modelling, Hierarchical Linear Models, Quantitative Research, Geographic Information Systems, Methodological Evaluation, System Reliability Analysis

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