



Bayesian Hierarchical Model in Evaluating Adoption Rates Across South African Secondary Schools Systems,

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Abstract

The adoption rates of new educational technologies in South African secondary schools have been observed to vary significantly across different regions and school systems. A Bayesian hierarchical model was developed and utilised to estimate adoption rates across multiple school systems. The model accounts for both fixed effects (e.g., technological infrastructure) and random effects (school-specific variability). The analysis revealed that the rate of technology adoption in rural schools was significantly lower than in urban areas, with a proportion of 40% versus 65%, respectively. The Bayesian hierarchical model provided nuanced insights into how different factors influence technology uptake across diverse school systems. Future research should consider expanding the model to include additional variables such as teacher training and community support, which could further refine adoption rate predictions. Model estimation used $\hat{\theta} = \underset{\theta}{\operatorname{argmin}} \{ \sum_{i=1}^n \ell(y_i, f_{\theta}(\xi)) + \lambda \|\theta\|_2^2 \}$, with performance evaluated using out-of-sample error.

Keywords: *Geographic, Hierarchical, Bayesian, Adoption, Models, Education, Analysis*

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