



AI-Powered Intelligent Tutoring Systems for Math Learning Among Primary School Students in South Africa: Cognitive Development Impact and Dropout Rates Reduction Evaluation

Nompumelelo Mngqibisa¹, Bongani Dlamini^{2,3}, Siphohle Mahlaba^{4,5}, Mpho Molefi⁶

¹ University of Fort Hare

² Department of Data Science, SA Medical Research Council (SAMRC)

³ Department of Artificial Intelligence, North-West University

⁴ SA Medical Research Council (SAMRC)

⁵ North-West University

⁶ Department of Artificial Intelligence, University of Fort Hare

Published: 01 January 2005 | **Received:** 29 September 2004 | **Accepted:** 17 December 2004

Correspondence: nmngqibisa@aol.com

DOI: [10.5281/zenodo.18815147](https://doi.org/10.5281/zenodo.18815147)

Author notes

Nompumelelo Mngqibisa is affiliated with University of Fort Hare and focuses on Computer Science research in Africa. Bongani Dlamini is affiliated with Department of Data Science, SA Medical Research Council (SAMRC) and focuses on Computer Science research in Africa.

Siphohle Mahlaba is affiliated with SA Medical Research Council (SAMRC) and focuses on Computer Science research in Africa.

Mpho Molefi is affiliated with Department of Artificial Intelligence, University of Fort Hare and focuses on Computer Science research in Africa.

Abstract

{ "background": "AI-powered intelligent tutoring systems have shown promise in improving educational outcomes for students globally, particularly in math learning. In South Africa, there is a pressing need to address low math proficiency and high dropout rates among primary school students.", "purposeandobjectives": "The purpose of this study is to evaluate the impact of AI-driven intelligent tutoring systems on cognitive development in math among primary school students in South Africa, with a focus on reducing dropout rates.", "methodology": "A randomized controlled trial was conducted across ten schools in South Africa. Students were randomly assigned to either an experimental group (using AI-powered tutoring) or a control group (traditional teaching methods). Cognitive assessments and dropout data were collected post-intervention.", "findings": "The findings indicate that students using the AI-powered system demonstrated statistically significant improvements in math scores compared to those in the control group ($\delta \text{ text } \{ \textit{Math Score} \} = 12.5, p < 0.001$). Dropout rates among experimental group were reduced by 30% (95% CI: -24% to -36%).", "conclusion": "This study provides evidence that AI-driven tutoring systems can enhance math learning and reduce dropout rates in South African primary schools.", "recommendations": "Schools should consider implementing AI-powered tutoring systems as part of their curriculum, alongside traditional teaching methods. Further research is needed to explore long-term impacts and scalability.", "keywords": "AI Tutoring Systems, Cognitive Development, Dropout Rates, Primary Education,

Machine Learning", "contributionstatement": "This study introduces a novel methodological approach that combines AI with cognitive assessment data to evaluate educational interventions in South African primary schools." } --- In the context of addressing low math proficiency and high dropout rates among primary school students in South Africa, this study evaluates the impact of AI-powered intelligent tutoring systems on cognitive development. A randomized controlled trial was conducted across ten schools, where students were randomly assigned to either an experimental group (using AI-powered tutoring)

Keywords: *African, Cognitive Load Theory, Educational Technology, Intelligent Tutoring Systems, Machine Learning, Neurocognitive Development, Personalized Learning*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

✉ **REQUEST FULL PAPER**

Email: info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

Are you a researcher in Africa? We welcome your submissions!

Join our community of African scholars and share your groundbreaking work.

Submit at: app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global Knowledge