link; https://ojspanel.undikma.ac.id/index.php/prismasains/article/view/19323

Epistemic Obstacles in Real Analysis: Newman's Error Analysis of Prospective Mathematics Teachers' Theorem Proving

Authors

- **Ahmad Syamsuadi**Universitas Muhammadiyah Makassar
- **Nasrun Nasrun**Universitas Muhammadiyah Makassar
- **Baharullah Baharullah**Universitas Muhammadiyah Makassar
- **Mukhlis Mukhlis**Universitas Muhammadiyah Makassar
- **Andi Kaharuddin**Universitas Lakidende Unaaha
- **Joseph Ozigis Akomodi**Long Island University

DOI:

https://doi.org/10.33394/j-ps.v14i2.19323

Keywords:

Error Analysis, Mathematics Education, Newman's Procedure, Real Analysis, Theorem Proving

ABSTRACT

Real Analysis is often a gatekeeper course in mathematics education, marking the difficult transition from computational calculus to formal axiomatic proof. Prospective mathematics teachers frequently struggle to construct rigorous proofs, even for fundamental properties. This study employs Newman's Error Analysis (NEA) to analyze the epistemological obstacles underlying these struggles. This descriptive qualitative case study involved 15 fifth-semester undergraduates at Universitas Muhammadiyah Makassar who completed a diagnostic proof test on field properties. Analysis of student work revealed that none made errors at the 'Reading' stage. Instead, errors clustered at higher cognitive stages: 3 students exhibited Comprehension errors, 5 made Transformation errors, 4 showed Process Skills errors, and 3 made Encoding errors. From this cohort, four subjects, each exemplifying one of these non-reading error types, were selected for in-depth semi-structured interviews. The findings indicate a hierarchical breakdown in proof construction specifically for the theorem: "If $a \neq 0$ and $a \in \mathbb{R}$, prove that $\neq 0$." Students either failed to translate verbal understanding into explicit premises (Comprehension), could not operationalize an indirect proof strategy (Transformation), neglected to justify algebraic steps with axioms (Process Skills), or omitted formal concluding statements (Encoding). The study concludes that errors often perceived as "carelessness" can be symptoms

of deeper epistemological obstacles, such as viewing proof as a computational ritual rather than a formal, communicative argument. These findings underscore the need for explicit instruction on proof mechanics and structure, even when students possess correct mathematical intuition.