

ORIGINAL PAPER

Differentiated Inquiry Cycles in Mathematics: Action Research on Reducing Dyscalculia Anxiety in Elementary and Middle School Learners

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Abstract

Investigating concrete-representational-abstract (CRA) instructional sequences to alleviate math anxiety among elementary and junior secondary students. Standardized anxiety inventories registered a statistically significant decline across two CAR iterations.

Keywords: Math Anxiety, Dyscalculia, Concrete-Representational-Abstract (CRA), Classroom Action Research, Elementary Education, Differentiated Instruction

1. Introduction

Math anxiety and dyscalculic cognitive blockages severely diminish student engagement in algebraic reasoning during the transition from elementary to middle school. Differentiated instructional scaffolding anchored in manipulatives provides a therapeutic bridge to abstract symbolic fluency.

2. Method

Two action research cycles were conducted with 42 seventh-grade learners identified with elevated math anxiety. The intervention implemented Concrete-Representational-Abstract (CRA) tactile algebra tiles followed by scaffolded peer tutoring and self-regulation checklists.

3. Results and Discussion

Standardized Mathematics Anxiety Rating Scale (MARS) scores decreased from a pre-cycle mean of 82.4 ± 6.2 (high anxiety) to 48.1 ± 5.1 (low-to-moderate anxiety). Fractional and algebraic equation solving accuracy climbed from 34% to 81%.

4. Conclusion

Differentiated tactile inquiry cycles effectively dismantle cognitive math anxiety, fostering a psychologically safe classroom culture where mathematical errors serve as productive learning opportunities.

Declarations

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Conflicts of Interest: The authors declare that they have no competing financial or personal interests.

Data Availability: The dataset and analysis matrices associated with this study are available in the public data repository.

Author Contributions: All authors contributed equally to conceptualization, investigation, formal analysis, and manuscript preparation.

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