

Abstract Title Page
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Title: Predicting First Graders' Development of Calculation versus Word-Problem Performance:
The Role of Dynamic Assessment

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Abstract Body

Limit 4 pages single spaced.

Background / Context:

Description of prior research and its intellectual context.

In education, the goal of forecasting development is to understand and identify risk for poor learning outcomes so that intervention may be designed effectively and initiated early. Tests of learning potential may be categorized along two dimensions. The first is domain specificity. Domain-general abilities, such as reasoning and language ability, are expected to effect performance across academic domains; by contrast, domain-specific capabilities are linked to performance in a single area of academic competence. The second dimension along which tests of learning potential may be characterized is whether a measure assesses static performance, indicating an individual's present state, or dynamic performance, reflecting the degree of scaffolding an individual needs to learn new material. Screening students for risk for math difficulty (MD) typically relies on static measures of learning potential, in which students respond without examiner assistance and demonstrate either unaided success or failure (Sternberg, 1996; Tzuriel & Haywood, 1992). Unfortunately, static measures mask differences between children who are unable to perform a task independently but can succeed with assistance. Vygotsky (e.g., 1934/1962) proposed dynamic assessment (DA) as an alternative, with which the examiner provides feedback or instruction to help a student learn a task, indexing responsiveness to that instruction as a measure of the student's learning potential. As demonstrated in prior work in mathematics (e.g., Fuchs et al., 2008; Swanson & Howard, 2005) and reading (e.g., D. Fuchs et al., in press), results suggest the potential value of dynamic measures of learning potential over and beyond domain-specific and domain-general static measures of learning potential. Findings are however complicated by the fact that the relative value of these various types of learning potential differs as a function of whether skill with procedural calculations (CA) or word problems (WP) is the predicted outcome.

Purpose / Objective / Research Question / Focus of Study:

Description of the focus of the research.

To assess the contribution of static domain-specific, static domain-general, and dynamic domain-specific measures of learning potential for predicting individual differences in the development of two important aspects of first-grade school mathematics learning: (CA) and (WP).

Setting:

Description of the research location.

63 classrooms in 17 public elementary schools (14 Title 1 and 3 non-Title 1) in a southeastern metropolitan school district.

Population / Participants / Subjects:

Description of the participants in the study: who, how many, key features, or characteristics.

184 students enrolled in first grade and for whom we have complete fall and spring data.

Intervention / Program / Practice:

*Description of the intervention, program, or practice, including details of administration and duration.
For Track 2, this may include the development and validation of a measurement instrument.*

Students were assessed on the learning potential measures at the start of 1st grade and on CA and WP at the end of 1st grade.

Research Design:

Description of the research design.

Predictive correlational design with planned multiple regression analyses.

Data Collection and Analysis:

*Description of the methods for collecting and analyzing data.
For Track 2, this may include the use of existing datasets.*

The First-Grade Test of Computational Fluency and the First-Grade Test of Concepts and Applications (Fuchs, Hamlett, & Fuchs, 1990) were administered in the fall to select a representative sample of first-grade students. Two static domain-general measures of cognitive ability (i.e., language and nonverbal reasoning), one static domain-specific measure of numerical cognition, and one dynamic measure of domain-specific mathematics learning were administered to the representative sample in the fall. To assess language, we used the Wechsler Abbreviated Scale of Intelligence (WASI) Vocabulary test (Psychological Corporation, 1999), which measures expressive vocabulary and verbal knowledge. To assess reasoning, we used WASI Matrix Reasoning (Psychological Corporation), which measures nonverbal reasoning skill with pattern completion, classification, analogy, and serial reasoning. We used Quantity Discrimination (Chard et al., 2005; Lembke & Foegen, 2009; Research Institute on Progress Monitoring, 2009) as a static domain-specific measure of numerical cognition. The domain-specific DA of domain-specific learning, Balancing Equations DA (Seethaler & Fuchs, 2010), measures the degree of scaffolding required to learn unfamiliar mathematics content, specifically, solving for missing variables in nonstandard-format addition and subtraction equations. In the spring of 1st grade, we assessed CA and WP performance with the Arithmetic subtest of the Wide Range Achievement Test-3 (Wilkinson, 1993) and Story Problems (Jordan & Hanich, 2000), respectively. Two models to predict individual differences in CA and in WP development were contrasted to determine the value of the two domain-general cognitive abilities and the two domain-specific mathematics measures. Further, a complete commonality analysis (Beaton, 1973; Capraro & Capraro, 2001; Newton & Spurell, 1967) was conducted to evaluate the unique and shared variance associated with each predictor and each combination of predictors with respect to CA and WP development.

Findings / Results:

Description of the main findings with specific details.

For CA, the static and dynamic domain-specific measures but not the domain-general learning potential measures were uniquely predictive, with a greater proportion of variance attributable to the static than the domain-specific measure. For WP, both static and dynamic domain-specific

learning potential measures were uniquely predictive; however, language was also uniquely predictive, and the DA of learning potential captured the greatest proportion of variance.

Conclusions:

Description of conclusions, recommendations, and limitations based on findings.

Results of this study suggest that development of CA and WP depend on different measures of learning potential and that DA may be useful in predicting 1st-grade mathematics development, especially WP.

Appendices

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Appendix A. References

References are to be in APA version 6 format.

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Appendix B. Tables and Figures
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