

Further development of measures of early math performance for preschoolers[☆]

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Abstract

The purpose of this study was to examine the progress monitoring and screening accuracy for a set of curriculum-based measures (CBM) of early mathematics skills. Measures included counting objects, selecting numbers, naming numbers, counting, and visual discrimination. Measures were designed to be administered with preschoolers in a short period of time using a developmentally appropriate format, and to constitute minimal disruption to the classroom routine. Previous research indicated that each of these measures produced scores with acceptable consistency across alternate forms on consecutive days. Scores yielded on the experimental probes correlated moderately, in most cases, with two commonly used standardized measures (i.e., the Brigance Screens and TEMA-2). Performance on the probes also correlated with teacher rankings and ratings of child performance. In the present study, data were collected in two phases. In the first phase, a cohort of children were administered the early math measures in spring of preschool and were followed into winter of kindergarten where they were administered kindergarten CBM probes to examine the degree to which performance in preschool (as measured by the early math probes) could predict performance on similar tasks in kindergarten. Second, risk criteria were examined and compared to identification by the Brigance Screens. These analyses provided data about the potential accuracy of the probes for screening. In the second phase, sensitivity of the probes to performance differences was examined by comparing mean performance on the probes of preschoolers and kindergartners. The lowest-

[☆] These data were collected when Amanda VanDerHeyden was working in Vail School District.

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performing children were provided with seven intervention sessions to examine the degree to which probes could detect growth resulting from intervention. Directions for future research and implications for practice are discussed.

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Prestigious panels have recognized recently the importance of revising instruction and assessment preschool practices to facilitate the development of mathematics competence in young children (US Department of Health and Human Services, 2001; US Department of Education, 2003; National Council of Teachers of Mathematics, 2000). These panels have responded to a growing body of literature indicating that children are not achieving minimal functional competence in math by the end of formal schooling, children from high poverty backgrounds are disproportionately represented in the low-achieving or high-risk group (Fuchs, Fuchs, Yazdian, & Powell, 2002; Griffin & Case, 1997; Starkey, Klein, & Wakeley, 2004), and that early intervention can remediate difficulties and alter a child's otherwise weak learning trajectory in math (Fuchs & Fuchs, 2001; Fuchs, Fuchs, & Karns, 2001; Griffin & Case, 1997; Phillips, Fuchs, Fuchs, & Hamlett, 1996; Sophian, 2004). Section 619 of the Individuals with Disabilities in Education Improvement Act of 2004 specifies that early intervention services provided by preschool programs should include "an educational component that promotes school readiness and incorporates preliteracy, language, and numeracy skills."

One key recommendation for reform in early mathematics assessment and instruction is obtaining instructionally-relevant data and assisting teachers to use those data to inform instruction and enhance child outcomes (NCTM, 2000; US Department of Education, 2003; Sophian, 2004). Achieving this goal requires that technically-adequate, sensitive, and inexpensive measures be available for teachers to use in their classrooms on a frequent basis. Curriculum-based measurement (CBM) provides a framework within which such measures could be developed.

In a previous study, VanDerHeyden et al., (2004) used a CBM framework to develop measures of early math performance that could potentially be used in preschool settings to indicate current level of child performance and to track growth over time on skills identified in the literature and nominated by preschool teachers as important for children to master. Six probes were developed in the original study. Most of the measures yielded consistent findings across alternate forms on consecutive days and were similarly scored by two independent scorers. Scores yielded on the experimental probes correlated moderately, in most cases, with two commonly used standardized measures (i.e., the Brigance Screens and Test of Early Mathematics Ability). The experimental probes were rated by teachers as representing important math skills for 4-year-old preschoolers to master and decisions based upon probe performance correlated with teacher rankings in math. Finally, the probes were capable of being administered in a short period of time, in a developmentally appropriate format, and caused minimal interference to the normal classroom routine.

One critical feature of CBM is its ability to detect performance changes that result from skill development or learning (i.e., sensitivity). Because the measures are sensitive to

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