"MU MATH STUDY"

MATHEMATICAL DEVELOPMENT IN LEARNING DISABLED CHILDREN

Project Summary for Teachers, Principals, and other Educational Professionals 2010



WHAT: The National Institute of Child Health and Human Development is sponsoring a consortium of research groups across the country to study children's mathematical learning and learning difficulties. Our mission is to explore the critical genetic, neurobiological, cognitive, linguistic, socio-cultural, and instructional factors that influence this learning. The Cognitive Development Lab in the Department of Psychological Sciences at the University of Missouri is one of a select few research centers funded under this program. We are now in the 7th year of this 10-year longitudinal study on mathematical development in learning disabled children.

WHO: Project Director: David C. Geary, PhD, Curator's Professor; Senior Research Specialists: Mary Hoard, PhD, Lara Nugent, MA; Graduate Research Assistants: Drew Bailey, Jon Thacker, Leah Thomas, Alex Wilkerson; Research Assistants: Erin Twellman, James Dent, Kristy Kuntz, Kelly Regan, Erin Willoughby.

WHY: To identify the basic cognitive systems (e.g., attentional control, memory) that underlie math learning and the core deficits that define and underlie learning disabilities in math. This research will lead to refined diagnostic techniques and the development of informed remediation tools for mathematical disabilities.

METHODS

Participants: At the end of kindergarten, about 300 children from 12 elementary schools and their parents agreed to participate in the study. Now, at the beginning of 7th grade, over 200 of these children are continuing in the study, involving all three Columbia Public middle schools.

Procedures: Students are tested individually or in groups in a quiet room in their school or in our mobile testing unit. Care is taken to coordinate testing with each participant's counselor so as not to remove the student from an important academic lesson. Even so, participants may always decline participation, on any particular day, or for the study in general. Sessions last between 30 and 45 minutes, depending on the student.

Tasks

<u>Standardized</u>: The students are administered standard achievement tests in reading and math at the end of each academic year, and were administered cognitive ability tests in kindergarten and 1st grade.

<u>Working Memory</u>: During the 1st and 5th grade year, an extensive battery of working memory tasks was administered, outside of school time, to most of the participants. This assesses their ability to focus and control their attention, and their ability to remember language-based and visuospatial information.

<u>Cognitive</u>: Each year, the students are administered a series of experimental tasks that assess their conceptual understanding of fractions, numbers and number sets, their ability to use a number line, the strategies (e.g., finger counting or fact retrieval) used to solve simple (e.g., 4+8) and more complex (e.g., 18+6) problems.

Examples of cognitive tasks include:

Fractions Comparison Task: The student is asked to compare pairs of fractions and determine which represents a bigger amount. This task assesses the students understanding of how fractions work and may be useful in predicting achievement in algebra.

Addition Strategy Assessment: The student solves addition problems (3 + 6) and the type of strategy (e.g., finger counting) used in problem solving is recorded.

Number Line Task: The student is shown a series of number lines, on which they mark their estimation of where a particular number would fall. This task allows us to track how participants understand the values of smaller and larger numbers.

Number Sets Task: The student is shown groups of items (shapes and Arabic numerals). The student's task is to circle items that add to equal a target number, which provides a measure of fluency in recognizing number combinations

RECENT FINDINGS

We have looked at 1^{st} grade to 5^{th} grade growth in math and reading achievement and identified the skills needed at the beginning of 1^{st} grade to be successful in math throughout the elementary school years. Kids who start 1^{st} grade with a good understanding of numbers (e.g., they know that ' $\bullet \bullet$ ' = 'three' = '3'), knowing a few math facts (e.g., 4+2=6'), and how to use counting to solve problems when they can't remember these facts do better through the end of 5^{th} grade than kids who are behind in these skills. These are the skills that need to be developed in kindergarten or very early in 1^{st} grade to keep kids on track.

We've also identified several of the specific problems that slow the progress of kids with a learning disability in math. We can show that this is not related to their reading skills, "intelligence," or other factors that affect learning. These kids really have difficulty with numbers and memory for math facts that slows them down.

We are working with colleagues at Vanderbilt University and Stanford University School of Medicine to develop early interventions for these children.

Be sure to keep checking the News and Publications sections of our **web site** at **mumathstudy.missouri.edu** for a list of current publications.

If you have questions please contact: Mary Hoard (HoardM@missouri.edu) or Lara Nugent (NugentL@missouri.edu) at 573-882-8529, or Dave Geary (GearyD@missouri.edu) at (573) 882-6268.

Dr. Geary would be happy to present results to a group, or answer questions by meeting with you in person.

THANK YOU!

We thank you for your help on this project and we appreciate your willingness to send your students to do math and reading activities with us three times this year. We hope to continue to learn much about the development of mathematical skills over the next few years as these students grow and learn. We couldn't do it without you! We will continue to do everything we can to minimize disruption of your teaching and the student's classroom activities.