Results from Fall 2008 DreamBox Learning K-2 Math Embedded Assessment Study:
Demonstrates 50% Increase in Student Proficiency

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Overview:

The purpose of this research was to examine the changes in learning that resulted for students who used DreamBox Learning K-2 Math. The learning metric is based on the assessments that are embedded in the DreamBox program. This instructional program is organized into lessons based on fine-grained instructional objectives called "micro-objectives." These micro-objectives represent discrete and hierarchical skills that form the building blocks of fundamental mathematics literacy in the primary grades.

This study focused on 369 students who participated in the final research phase of the product's development. These were students in pre-K through third grade who had volunteered to participate in a pilot implementation of the DreamBox instructional product, and who played at least 3 times.

The 369 students played DreamBox Learning K-2 Math between October 30th 2008 and December 15th 2008. Only students who had two or more embedded assessments (pre and post) measures on a lesson were included. If a student had more than two measures on a specific assessment only the first and last measures were analyzed for this report.

This research examined the change between the students' scores on the first score after taking a Placement Test and on their last score before the end of the research study. The scores are percent correct thus adjusting for any differences in the points available on these tests.

Students on the average improved 29.46 percentage points from their first embedded assessment to their last embedded assessment before data collection for this study was completed. Using a paired sampled (or dependent t- test), there were statistically significant increases in achievement based on a comparison of the mean by student of each pair of embedded pre and post measures.

Stated another way, students showed a 50% increase in average score on the assessments after only an average of 3.26 hours engaged in the instructional lessons of this learning tool.

Overview of the DreamBox Instructional Program:

DreamBox offers a thematically-contextualized interactive web--based instructional program with embedded assessments. A student selects the theme and adventure story they want to play. They also select their avatar, and then direct their avatar where to move as they play the adventure game they have chosen. At all times the student has a number of choices of what area of the program to explore, or what lesson to play next, but the program has dynamically selected the options available as the ones most appropriate for the student at that time.

The DreamBox curriculum is divided into 36 modules, each with a Placement Test. Each module has 8-10 lessons and these lessons focus on fine-grained mathematics objectives that are referred to in the product description as "micro-objectives".

Depending on their grade level in school, students begin their DreamBox experience with a different Placement Test aligned to commonly taught grade-level mathematics. But unlike most instructional programs, these Placement Tests do not appear to be any different from the learning activities in DreamBox. In fact, the students do not know they are "taking a test".

Failure on a placement test results in the student being presented with lessons to learn the material just failed. Passing on the placement test results in the student skipping the material just passed, and being presented with another placement test for a more advanced concept . This program is a form of adaptive instruction with student performance determining the next instructional lesson. The lessons are organized hierarchically based on content and the fit of each lesson into the Focal Points Framework http://www.nctm.org/standards/focalpoints.aspx?id=326).

Within the DreamBox instructional program lessons are organized into either the Number Sense or Operations strands consistent with the foundational mathematics requirements for primary grades. Each lesson is built around one or more "micro-objective(s)". These micro-objectives are the fine-grained building blocks of early mathematics learning. They may differ in granularity from many state content standards because they are narrowly focused. For example, a micro-objective would be "addition of numerals 1-10" whereas a state content standard might be "addition of numerals from 1-100". Within the DreamBox instructional program, students would first master addition of numerals from 1-10 and then move into addition of numerals from 1-20. For state content standards, it is implicit that students would first master addition of numerals 1-10 before moving on but not explicit. In DreamBox, the learning is monitored at this fine-grained level ensuring that every student demonstrates mastery of each component of these building blocks to mathematics proficiency.

Once a student has entered a module, they stay in that module until they have demonstrated mastery of all the micro-objectives associated with that module. Any particular lesson in that module might assess one or more of the associated micro-objectives. Once mastery of a micro-objective has been demonstrated the student moves to other, slightly more complex lessons which have that micro-objective as a prerequisite. It is very common for students to be assessed more than once on the same micro-objective, either because they played the same lesson more than once, or because they played two or more lessons that assessed the same micro-objective.

The embedded assessments are seamless from the lessons. The student experience through activities, games, and assessments are the same; the assessments are literally seamless with instruction.

Research Focus:

Because DreamBox Learning K-2 Math is completely student-driven through literally hundreds of lessons, it is not possible to compare students on identical instructional experiences. Rather, the comparisons in this study are based on performance on each student's first assessment and their final assessment on the micro-objectives he/she experienced. No student scores were included until students began lessons that were challenging to them, after failing a placement test.

All students who participated in the final product pilot between October 30, 2008 and December 15, 2008 were included in this study. All students were anonymous and no information was available on ethnicity, school performance or traditional achievement metrics. In this report only students who had played in DreamBox for 3 or more sessions and who have at least one pair of pre and post measures were included in the analysis.

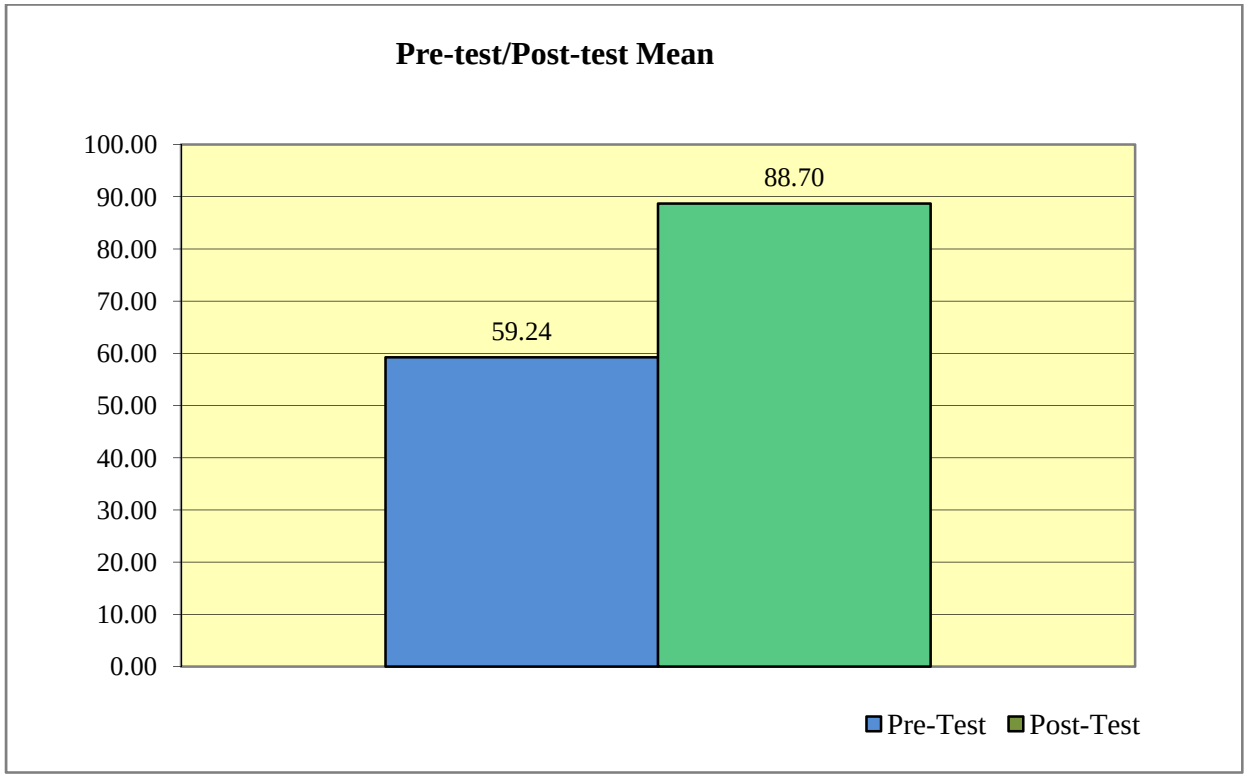
The change in performance from the embedded assessment the first time they encountered a specific micro-objective to the embedded assessment the last time they encountered that micro-objective was

evaluated. Because theses scores were already converted to percentages, differences in the number of activities (items) on each test were accounted for.

Research Findings:

The average (mean) pretest for the group was 59.24 percent correct. The mean for the post-test was 88.70 percent correct.

Using a paired-sample (or dependent) t-test, the improvement in test scores (positive difference between pre and post test performance) for this group of students was significant at the $p<.05$ level.



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Conclusion:

These results suggest that DreamBox Learning K-2 Math engages young students in meaningful mathematics and that significant learning occurs. Students who played the DreamBox instructional program demonstrated a 50% increase in their mathematics proficiency as measured on the embedded assessments.

Further research will be needed to determine whether these increases in learning continue over extended periods of time and whether or not there are optimal learning pathways through the content for individual

students. Research will need to be conducted to confirm that this increase in mathematics achievement can be transferred to more school-like measures of achievement.

About the author: Dr. Margaret Jorgensen, Harcourt Assessment (retired), SVP

Dr. Margaret Jorgensen is currently CEO of Measure2Learning, LLC, a test development and psychometric research center. She is the former Senior Vice President for Product Research and Innovation at Harcourt Assessment, and remains a leading authority on assessment for K-12 education. Dr. Jorgensen earned her Ph.D. in Measurement, Evaluation, and Statistical Analysis from the University of Chicago and holds a Master's of Science in School Psychology. She is the author of two books on innovative assessment and has developed thousands of criterion-referenced/ standards-based and three norm-referenced tests batteries for K-12 (The Stanford Achievement Test Series, 10th Edition, OLSAT 8, and the Comprehensive Testing Program, Third Edition).

Dr. Jorgensen is knowledgeable in all areas of assessment and has developed tests, conducted research, pioneered innovative item types and assessment formats, designed friendly and useful score reports, and authored books and articles — all initiatives focused on more meaningful ways to systematically capture evidence about what students know and can do. She was an elected member of the Board for the Association of Test Publishers and has participated in the American Educational Research Association, National Council for Measurement and Evaluation, and the CCSSO Large Scale Assessment Conference for decades.

At Harcourt, Dr. Jorgensen was responsible for the innovative 10th edition of the Stanford Achievement Test — the first norm-referenced test with full color content, simple navigation, and both timed and untimed norms. Dr. Jorgensen is the author of two patents pending around innovations in test and item development. Dr. Jorgensen is also an advisor to DreamBox Learning.

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