

The Research Basis for the LeapTrack[™]
Assessment & Instruction System:
Formative Assessment and Student Learning

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Our Commitment to Research

At LeapFrog SchoolHouse, our programs are based on the latest scientific research that focuses on how students learn most effectively. We work with experts and researchers at the forefront of education to ensure that our programs are pedagogically sound and reflective of current and scientifically proven instructional methodologies. We at LeapFrog SchoolHouse are committed to providing classroom programs that represent the best and most current research-based findings.

What is formative assessment?

Formative assessment describes the systematic and regular measurement of students' progress in the classroom and the process by which the results are used to inform instructional practice. Assessment results are used to adapt teaching to meet students' learning needs. The primary objective of a formative assessment system is to guide instruction rather than measure where students are at the end of an instructional period, as is the case with summative assessments. When used regularly, formative assessments provide essential information to teachers and school administrators in the planning and delivery of instruction. Formative assessment acts as a guide and early warning system to monitor the progress of individuals and groups of students toward grade-level targets.

RESEARCH FINDING:

Effective and regular use of formative assessment produces significant learning gains.

In 1998, Paul Black and Dylan Wiliam of Kings College, London, examined the international literature on assessment, asking if there was evidence that the use of formative (classroom) assessments raises student achievement, as reflected in periodic summative assessments. They uncovered more than 250 relevant research articles. They pooled the information on the estimated effects of improved formative assessment on summative test scores and they reported an unprecedented positive effect on student achievement—effect sizes of between a half and full standard deviation. That would equate to percentile score gains of 15 to 30 points, or three or more years in grade equivalents (Stiggins 2002).

Black and Wiliam (1998a) provide firm evidence that formative assessment is an essential component of classroom work and that its development can raise standards of achievement. More than twenty of the 250 studies showed that the practice of regular formative assessment, in conjunction with instruction based on individual needs, produced significant learning gains.

“We have strong evidence that high-quality classroom assessment improves learning tremendously, possibly more effectively than any other sort of teaching intervention.”

—Lorrie Shepard, Dean of Education, University of Colorado at Boulder (cited in Olson 2002)

These studies included a range of age groups from five-year-olds through university undergraduates. A scientific method was used to evaluate the results by comparing the average improvements in the test scores of the students who experienced the use of formative assessment with the range of scores found among groups of students who had not experienced the use of formative assessment. Typical effect sizes for the formative assessment experimental groups were between 0.4 and 0.7. These effect sizes are larger than most of those found for educational interventions (Black & Wiliam 1998b).

Range of Student Improvement Following Use of Formative Assessment	
Measure	Results
Ranges of Effect Sizes ¹	0.4–0.7 (large)
Range Percentile Points Gained ²	15–30 percentile points
Grade Equivalent Gain ²	3+ academic years growth in one year

¹As reported in Black & Wiliam (1998 a,b)

²As summarized in Stiggins (2002)

LeapTrack™ System Research Application:

Effective use of formative assessment helps teachers and students know what is to be learned. Learning gains are a result of targeted, individualized instruction.

The *LeapTrack* Assessment & Instruction System was designed from inception to provide continuous, formative assessment that can be used independently by teachers and students. *LeapTrack* assessments reflect the content that students are learning in their regular curriculum, and the critical skills incorporated in state content standards, on standardized achievement tests, and in widely used curriculum materials and basal textbook series. The *LeapTrack* system employs a series of formative, low-stakes classroom assessments to determine specific learning needs for each student. The assessments are delivered to students via the LeapPad® classroom learning system, and the results are immediately scored for all students, aggregated for the class as a whole, and stored in a classroom computer.

With the *LeapTrack* system, the central principle is that assessment should inform instruction by measuring what students know and providing teachers with guidelines to effectively implement an appropriate instructional plan. Individual assessment results become the basis for prescribing personalized Learning Paths for each student.

“The Kings College researchers reported that improved formative assessment ‘helps low achievers more than other students, and so reduces the range of achievement while raising achievement overall.’ The implications for those struggling with achievement gaps between subsets of their student populations are obvious. We know of no other school improvement innovation that can make this claim.”

—Rick Stiggins, President,
Assessment Training
Institute Foundation
(cited in Stiggins 2002)

RESEARCH FINDING:

Use of formative assessments closes the learning gap for low-achieving students.

One of the truly remarkable aspects of appropriate formative assessment is the broad range of students with whom it can be applied. Bergan, Sladeczek, and Schwarz, (1991), for example, found that a rigorous formative assessment routine helped kindergarten children from disadvantaged homes in six different regions of the United States achieve significantly higher scores in several core subject areas compared with a control group. Comparable results were found with middle-school students and science learning (Frederiksen & White 1997), and with college students in an introductory algebra course (Martinez & Martinez 1992).

While formative assessment can help all pupils, it yields particularly good results with low achievers by concentrating on specific problems with their work, and giving them a clear understanding of what is wrong and how to improve it. Many of the studies reported that formative assessment helps low achievers more than other students, thus closing the gap between low- and high-performing students while raising achievement overall (Black & Wiliam 1998).

Formative assessment helps support the expectation that all children can learn at high levels and counteracts the cycle in which students attribute poor performance to lack of ability, and therefore become discouraged and unwilling to invest in further learning, (Boston, 2002).

LeapTrack™ Research Application:

Use of formative assessments closes the learning gap for low-achieving students. Formative assessment also informs instruction and enrichment for higher achieving students.

Addressing the learning needs of a broad range of student performance levels was core to the development of *LeapTrack* assessment and instructional components. The assessments contain items that range in difficulty so that low-achieving students can experience some success, high-achieving students are challenged, and students of average abilities are assessed thoroughly.

LeapTrack assessments are formative and criterion-referenced, thus highlighting the instruction necessary to address what students need to know. At the completion of an assessment, teachers have the option of reviewing items with students to give them precise feedback about their learning and how it could be improved. Students are not compared with their peers. As a result, their individual learning goals become the focus for review.

“Teachers facilitate learning by providing students with important feedback on their learning progress and by helping them identify learning problems.”

—Thomas R. Guskey,
Professor of Education Policy
Studies and Evaluation,
University of Kentucky.
(cited in Guskey 2003)

RESEARCH FINDING:

Formative assessment fosters student responsibility for learning.

Perhaps the most unrecognized aspect of appropriate formative assessment is the role of students, their motivations, and self-perception (Sadler 1989). When students perceive assessment as supportive rather than punitive, they are more likely to take responsibility for their own learning and use the results of assessment to modify their own behaviors.

LeapTrack™ Research Application:

LeapTrack assessments and instructional components are designed for student independence in managing learning tasks and fostering individual responsibility for learning.

Students consider traditional summative assessment as something outside their control. In contrast, students view well-designed formative assessments positively. The *LeapTrack* system capitalizes upon this positive perception. Because of the design of the assessments and the multisensory nature of the LeapPad® unit, students are less likely to become anxious about assessment, are inclined to respond optimally, and are inclined to use teacher feedback to improve their learning.

The *LeapTrack* system organizes the assessment and learning process into a precise series of steps. Students complete *LeapTrack* assessments, and the results are summarized immediately for teachers, providing a prescribed Learning Path for each student. As a result, all students are able to follow their individualized Learning Paths, selecting and completing assignments independently. As they use the LeapPad classroom learning system to see, hear, and respond to instruction, they can listen to directions, process information, and practice as necessary to fully understand the new learning. Students can repeat any instructional activity as often as needed to master concepts and demonstrate success with important skills.

While students manage their learning, teachers continue to monitor the results of instruction and precisely identify individual strengths and weaknesses in critical content areas. Such information about student strengths and weaknesses enables teachers to establish instructional priorities and deliver targeted instruction, intervention, remediation, or enrichment to their students as necessary. With the *LeapTrack* system, students experience real opportunities and routine processes for learning. Such experiences foster and strengthen an environment for independence and responsibility for achievement.

RESEARCH FINDING:**Formative assessment is most effective when followed by instruction.**

“If assessments provide information for both students and teachers, then they cannot mark the end of learning. Instead, assessments must be followed by high-quality, corrective instruction designed to remedy whatever learning errors the assessment identified (Guskey, 1997). To charge ahead knowing that students have not learned certain concepts or skills well would be foolish. Teachers must therefore follow their assessments with instructional alternatives that present those concepts in new ways and engage students in different and more appropriate learning experiences. High quality, corrective instruction is not the same as reteaching” (Guskey, 2003).

LeapTrack™ Research Application:**Focused instruction, personalized to individual strengths and weaknesses as identified by the LeapTrack assessments, is provided for every student.**

The *LeapTrack* instructional components focus on specific concepts and skills that students have missed on the assessments. Using the LeapPad® classroom learning system with Skill Cards or instructional books, students have the opportunity to take their time and repeat the instruction as many times as it takes to fully understand the concept being taught. The interactive and engaging audio features of the LeapPad classroom learning system provide corrective feedback if a student makes an error. Lesson content is presented in creative and engaging ways—providing new opportunities to learn.

In addition, results of all student instructional activities are immediately scored and summarized for teachers. Thus the instructional activities themselves provide real-time, iterative, and formative information that helps teachers continue to adjust instruction as indicated by the evolving learning needs of individuals and for the class as a whole.

RESEARCH FINDING:**Frequent, high-quality formative assessment is effective; however, the levels of effectiveness are dependent on the quality of the test items.**

Black and Wiliam (1998a) provided extensive and detailed research to support the use of formative assessment to ensure student learning. Their summary statements provide guidance for educators with regard to the use of formative assessment and include the following:

1. Frequent short tests are better than infrequent long ones.
2. New learning should be tested within a week of first exposure.
3. The quality of the test items is essential.

“Assessments must be part of an ongoing effort to help students learn. And if teachers follow assessments with helpful instruction, then students should have a second chance to demonstrate their new level of competence and understanding...an opportunity to experience success in learning.”

—Thomas R. Guskey, Professor of Education Policy Studies and Evaluation, University of Kentucky. (cited in Guskey 2003)

1. Frequent short tests are better than infrequent long ones.

LeapTrack™ Research Application:

Concise content area assessments, and the opportunity to re-administer them, support an ongoing process of formative assessment that continues to inform teachers about student progress.

Using the *LeapTrack* system, teachers can assess each student's learning easily and often—which in turn informs classroom instruction. After students complete their individualized instructional activities, the teacher can assign ongoing assessments to measure student progress throughout the year. Results of the assessments and learning activities are updated immediately, so that teachers are always informed about the progress of individual students and the class as a whole.

2. New learning should be tested within a week of first exposure.

LeapTrack Research Application:

***LeapTrack* instructional components, while focused on providing individualized instruction, in fact provide ongoing, transparent assessment results. Teachers use this information to reinforce and measure new learning.**

The *LeapTrack* instructional components provide targeted instruction based on individual needs. Because students often exhibit different rates of learning, individuals may need extended or abbreviated time on different types of tasks. The *LeapTrack* system itself will automatically assign instructional activities to the students' Learning Paths, based on each student's performance. As a result, students will experience the necessary time on task with each concept or skill to ensure that learning occurs.

As students complete activities and upload their results, teachers can determine whether students have learned new concepts and skills, or whether additional learning needs have been uncovered. The effectiveness of this learning process is realized in two important ways:

- Results of the learning activities are reported immediately and, in effect, function as ongoing assessment—informative for teachers, yet transparent to students.
- As students continue to learn, their evolving individual needs are reported to teachers so they can adjust their focus and pace of instruction effectively.

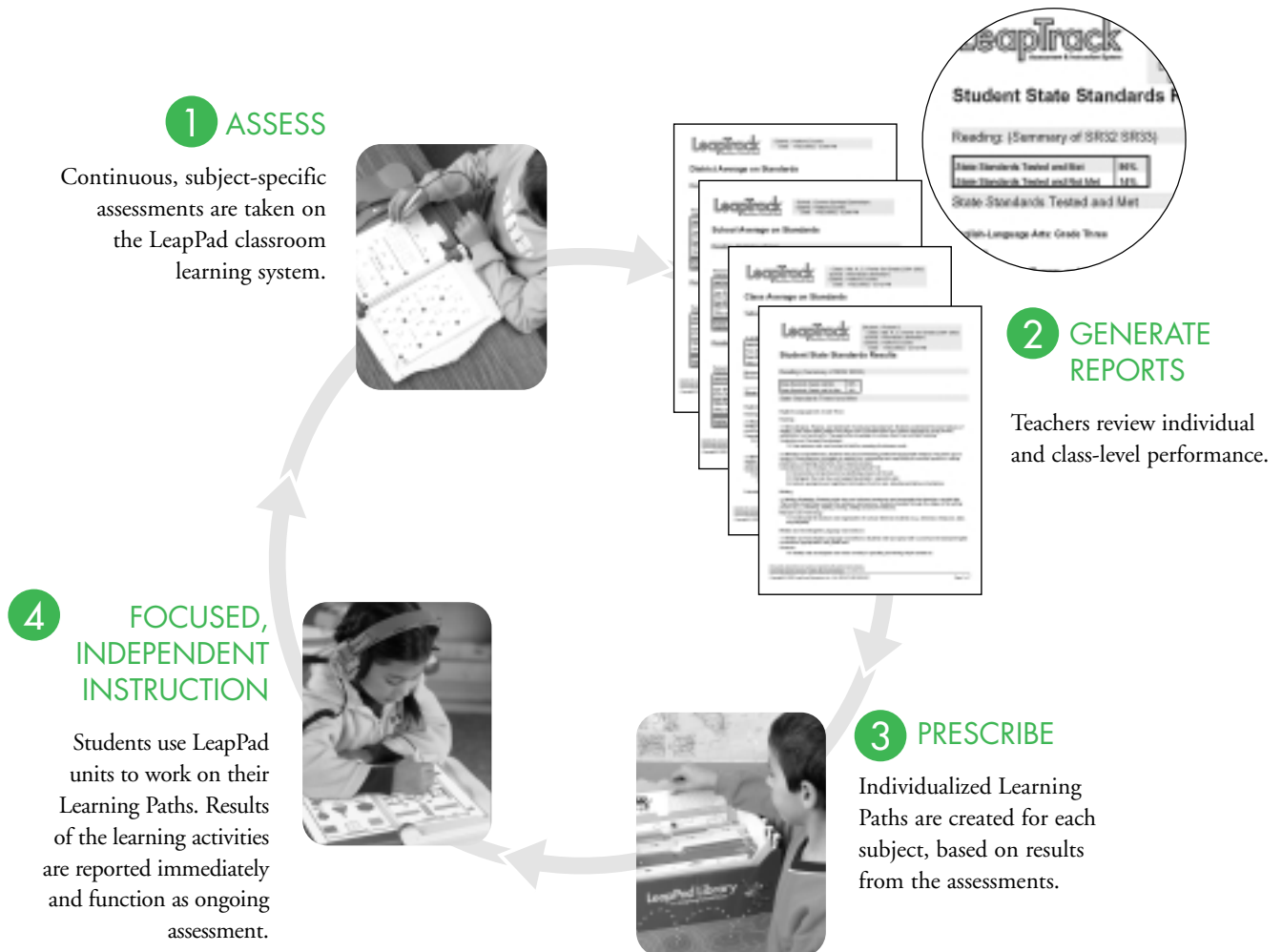
3. The quality of the test items is essential.

LeapTrack™ Research Application:

The LeapTrack System incorporates high-quality content into an ongoing cycle of assessment, instruction, and reporting of student learning.

The *LeapTrack* system was developed on research-based findings about effective formative assessment and associated individualized instruction. Development of the assessments and the companion instructional components was attentive to the principles of formative assessment in general and criterion-referenced assessments in particular. The LeapFrog SchoolHouse development priorities ensured that the high-quality test items and effective learning materials are anchored in a solid scope and sequence that is both research-based and functional in the classroom.

Using the innovative, audio-rich technology of the LeapPad® unit, combined with the ability to save and manage individual and aggregated student results, the *LeapTrack* system provides formative assessment, interactive individualized instruction, and detailed summary reports of student progress.



LeapTrack Research Application:

Development of the LeapTrack Assessment & Instruction System ensures high-quality assessment and instructional content.

The *LeapTrack* Scope & Sequence (LTSS) anchors the *LeapTrack* assessment and instructional content to key state standards, standardized tests, and classroom instructional materials.

The LTSS includes approximately 1,200 skills within five content-area domains (Reading, Language Arts, Mathematics, Science, and Social Studies). This scope and sequence of skills is aligned with key state standards that identify what teachers are expected to teach and what students are expected to learn at each given grade.

The LTSS establishes guidelines for teaching and learning. Thus, the assessments provide direction for educators in understanding what students know, and what they need to learn. The companion Skill Cards provide instruction that targets specific skills to address individual learning needs.

In-Depth Knowledge and Expertise

The LTSS was developed by Michael Milone, Ph.D, an award-winning educational writer and consultant to publishers and school districts. Dr. Milone earned his doctorate from Ohio State University and has served in various capacities at Ohio State, the University of Arizona, Gallaudet University, and New Mexico State University. For more than twenty years, Dr. Milone has been involved in a broad range of educational endeavors.

Dr. Milone has served as the editor of Skillcorp Publishers, a subsidiary of *Highlights for Children*. He was the director of research for Zaner-Bloser, Inc., a publisher of basal and supplemental educational textbooks, and was the senior research associate at Gallaudet University's Office of Demographic Studies. Dr. Milone recently coordinated the literacy skills component of *Accelerated Reader* and managed the program's successful participation in the California Language Arts Adoption.

At the University of Arizona, Dr. Milone was the director of research with a program for hearing-impaired, developmentally disabled children. He has served on the advisory boards of PSK Associates' Connection, Scholastic's Classworks!, the Educational Computer Conferences, and The Writing Notebook.

In addition to developing the LeapTrack Scope & Sequence and Critical Skills Survey assessments, Dr. Milone's credits include additional contributions in the area of assessment, including development of:

- Assessment components of the *Open Court Reading* series, *Reasoning and Writing*, *Reading for Understanding*, *Real Science*, *Corrective Reading*, and *Art Connections*
- The literacy skills component of Renaissance Learning's *Accelerated Reader* and coordinating the test-item development for STAR-Early Literacy
- Standards-based assessment for Prentice Hall's reading intervention program
- Online assessments for The Learning Company and SkillsTutor

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- The thinking skills component of the highly acclaimed Early Childhood Program from SRA
 - Selected components of the revised SRA Reading Labs
 - Test-item development for Harcourt Educational Measurement

Dr. Milone remains active in a variety of fields, including assessment and technology. He is a past chairperson of the Technology and Reading Committee of the International Reading Association, has served on the Instructional Technology Committee of the National Council of Teachers of English, and the Task Force on Technologies in Education of the American Psychological Association. Dr. Milone has also written a critical issues report on educational technology for the American Association of School Administrators.

A Thorough Process

Under the direction of Michael Milone, Ph.D, the LeapTrack Scope & Sequence was developed through an iterative process including, but not limited to, the following actions:

- Reviewing the standards from a number of states to create an initial list of critical content standards
- Cross-referencing and analyzing the initial list of content standards with those of the remaining set of states
- Considering the recommendations of several professional associations
- Examining the objectives that are featured on major standardized achievement tests
- Analyzing the content and formats of state-developed large-scale assessments

Once a baseline of content standards and critical skills was established, the *LeapTrack* Scope & Sequence was refined by

- Organizing the skills by grade and sub-skill classification
- Refining the skills' nomenclature for broad application
- Editing the master list of skills and targeting the skills that can be measured without teacher observation or evaluation (For example, skills that require dramatization, oral speaking, or open-ended responses were not included in the Scope & Sequence.)

As a result of this refining process, the skills on the *LeapTrack* Scope & Sequence are highly applicable to content standards of any given state, and are aligned with state content standards for purposes of reporting student progress toward achieving those standards.

For the most part, the skills that are included in the *LeapTrack* Scope & Sequence are those that students would encounter on a classroom-based test, a standardized achievement test, or a statewide large-scale assessment.

The LTSS is organized by Content Domain, Strand and Skill

Content Domain

There are five domains: Reading, Language Arts, Math, Science, and Social Studies. Skills within these domains are ordered and addressed according to developmentally appropriate grade-level expectations. (See table on page 13.)

Strand

There are a number of strands within each domain.

READING

Book and Print Awareness	Phonemic Awareness
Graphophonemic Awareness	Vocabulary
Literal Comprehension	Inferential Comprehension
Extending Meaning	Literary Response
Literary Analysis	

MATHEMATICS

Numeration	Computation
Data Analysis and Probability	Problem Solving
Measurement	Geometry
Algebraic Concepts	Estimation and Rounding
Language and Logic of Mathematics	

LANGUAGE ARTS

Capitalization	Punctuation
Usage	Sentences
Paragraphs	Spelling

SCIENCE

Nature of Science	Life Science
Earth Science	Physical Science

SOCIAL STUDIES

Geography	History
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Critical Skills

For each Strand there is a series of critical and foundational skills. These skills describe the actual tasks that are applied in assessment items (including test-item stems and responses) and within the Skill Cards for instructional practice.

Identification of Critical Skills to Be Assessed by the *LeapTrack*™ System

Using the approximately 1,200 skills in the *LeapTrack* Scope & Sequence, grade-level assessment blueprints were developed. In order to create assessments that could be completed in a reasonable amount of time and that could inform instruction, a subset of skills for inclusion in the *LeapTrack* assessments was derived from the master list. The items tied to these skills had to be:

- Instructionally relevant, meaning they assessed skills that teachers recognize as being important
- Included on at least one standardized achievement test
- Included on at least one statewide assessment for which specifications or released items were available
- Featured in at least one major basal series
- Consistent with the educational experiences of a typical student
- Independent of cultural background or socioeconomic status
- “Teachable” in that teachers would be able to implement intervention or remediation of skill deficits through routine instructional activities
- Presented in a format that would be familiar to most students
- Meaningful to the parents or other significant adults in a student’s life
- Measurable in a way that made sense to educators
- Valid in the sense that an informed observer would recognize the correspondence between the test item and the skill to which it refers
- Testable using the LeapPad® classroom learning system

LeapTrack™ Validity Research

The *LeapTrack* Assessments, called Critical Skills Surveys, are similar to other criterion-referenced measures (such as statewide assessments administered under the No Child Left Behind Act of 2001) in several key ways, including:

- The Critical Skills Surveys use test items that assess standards-correlated skills
- Test-item types employ many of the item formats that appear on most widely used large-scale criterion-referenced assessments, such as those administered within statewide assessment programs
- Assessment content in the Critical Skills Surveys is aligned with state content standards—thus ensuring that the *LeapTrack* assessments are measuring content and skills reflective of state assessment programs.

The content and format of the Critical Skills Surveys mirror that of many state criterion-referenced assessments, providing sufficient content validity to pursue the study of concurrent validity.

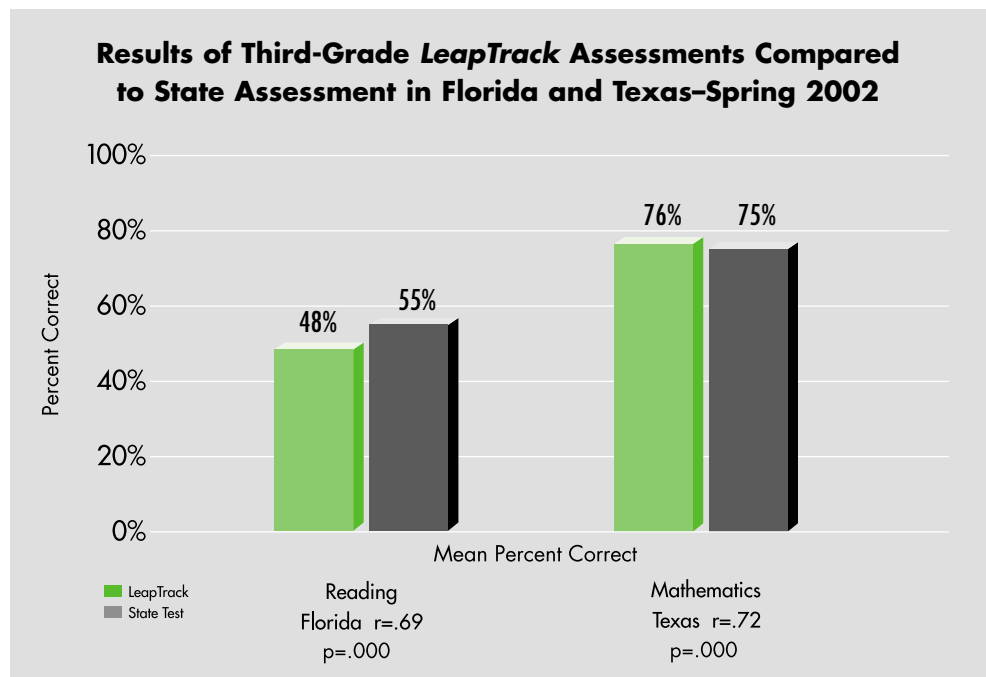
Leapfrog SchoolHouse, in cooperation with school administrators, teachers, and students, conducted research to evaluate the performance of students using the *LeapTrack* end-of-year assessments in relation to their respective performance on statewide criterion-referenced assessments.

Method

In the spring of 2002, third-grade students' assessment results in Florida and Texas were compared in reading and in mathematics as follows:

- Students in Florida took *LeapTrack*™ assessments in reading, and those test results were compared with their test results from the reading portion of the Florida Comprehensive Assessment Test (FCAT).
- Students in Texas took *LeapTrack* assessments in mathematics, and those test results were compared with their test results on the mathematics portion of the Texas Assessment of Academic Skills (TAAS).

Two correlation studies were conducted: Performance means on the *LeapTrack* assessments were compared with the associated performance means on the FCAT and on the TAAS. Correlation coefficients were calculated to determine the degree of linear relationship between the *LeapTrack* assessments and the statewide criterion-referenced assessments. The resulting correlation coefficients for the *LeapTrack* reading assessment and FCAT, and for the *LeapTrack* mathematics assessment and the TAAS, were evaluated for their levels of significance in order to determine if concurrent validity exists between the instruments.



**Summary of Data: Third-Grade Assessment
Correlations in Reading and Mathematics—Spring 2002**

	<i>LeapTrack</i> Assessment	State Assessment	Correlation Coefficient	Significant Results $\alpha = .01$
Florida	Reading FLR3	FCAT Reading Portion	.69	p = .000 Strong, Positive
Texas	Mathematics TXM3	TAAS Mathematics Portion	.72	p = .000 Strong, Positive

Results

The results of these studies reveal that the comparison of the criterion-referenced tests provides evidence of concurrent validity for the *LeapTrack* assessments with third-grade students in two states. These statistically significant and strong positive correlations demonstrate that the *LeapTrack* assessments show both concurrent validity and content validity.

It can be concluded that *LeapTrack* assessments, when used as part of a formative classroom assessment program, provide meaningful information relative to student performance toward achieving state content standards.

The *LeapTrack*™ Assessment Library

The core of the *LeapTrack* Assessment Library includes a series of comprehensive Critical Skills Surveys that cover the important skills in reading, language arts, vocabulary, mathematics, science, and social studies. Each Critical Skills Survey contains approximately 25 test items and can be completed in one session. At each targeted grade level and in each content domain, there are at least three leveled assessments, one each for the beginning, middle, and end of the school year.

At each grade level, assessments are provided for use at the beginning, middle, and end of the school year.

Library of Critical Skills Surveys

Grade Level	Reading	Language Arts	Vocabulary	Mathematics	Science	Social Studies
K	✓			✓		
1	✓	✓	✓	✓		
2	✓	✓	✓	✓	✓	✓
3	✓	✓	✓	✓	✓	✓
4	✓	✓	✓	✓	✓	✓
5	✓	✓	✓	✓	✓	✓

Summary

The *LeapTrack* Assessment & Instruction System was developed on scientifically based research findings about formative assessment and student learning. Assessment design, content, and format are anchored in a solid scope and sequence to ensure that teachers are informed about the essential learning needs of all their students. Effective use of formative assessment calls for targeted instruction based on individual learning needs.

The *LeapTrack* Critical Skills Surveys are low-stakes assessments designed for ongoing formative assessment in the classroom. These classroom-based assessments are effective as an early warning system that informs teachers about where students stand within the formal accountability process—yet the assessments themselves are not accountability measures.

The Critical Skills Surveys are built as criterion-referenced assessments designed to compare a student's test performance with clearly defined curricular objectives. Results from criterion-referenced tests compare student performance to a predefined set of standards and objectives, and assessment results point to whether individuals can demonstrate mastery of specific skills within a content domain. In this way, teachers are able to establish individual and collective instructional needs of their students, and can adjust instruction accordingly.

Conclusion

The *LeapTrack* Assessment & Instruction System employs scientific research findings as the foundation of the assessments and the companion instructional components. The system is designed to provide a comprehensive and motivational program of instruction for every student, based on each student's individual needs. The LeapPad® technology helps students develop independence and responsibility for their learning.

Thomas Guskey notes that teachers must follow the use of assessments with instructional alternatives. They must present instructional concepts in new ways and engage students in different and more appropriate learning experiences. “High quality, corrective instruction is not the same as reteaching,” (Guskey 2003).

LeapFrog SchoolHouse is proud to provide revolutionary technologies, high-quality, research-based content, and significant opportunities for students to learn—in creative, exciting, and new ways. At LeapFrog SchoolHouse, we continue to find innovative ways to engage and motivate students by combining cutting-edge technologies with assessments and curriculum that are supported by research.

LeapFrog SchoolHouse is committed to demonstrating that our programs achieve measurable learning gains in the classroom. We have conducted and continue to conduct efficacy research in order to validate these gains.

References

- Bergan, J. R., I. E. Sladeczek, and R. D. Schwarz, (1991). "Effects of a measurement and planning system on kindergartners' cognitive and educational programming." *American Educational Research Journal* 18.
- Black, P. and D. Wiliam. 1988a. "Assessment and classroom learning." *Assessment in Education* 5.
- Black, P. and D. Wiliam. 1988b. "Inside the black box: raising standards through classroom assessment." Kappan @www.pdkintl.org/kappan/kbla9810.htm
- Boston, C. 2002. "The concept of formative assessment." *Practical Assessment, Research & Evaluation* 8: 9.
- Fredericksen, J.R and. B. J. White. 1997. "Reflective assessment of students' research within an inquiry-based middle school science curriculum." Paper presented at the annual meeting of the American Education Research Association, Chicago.
- Guskey, T. R. 1997. *Implementing mastery learning*. 2d ed. Belmont, CA: Wadsworth.
- Guskey, T. R. 2003. "How classroom assessments improve learning." *Educational Leadership* 60: 6-11.
- Martinez, J.G. and N.C. Martinez. 1992. "Re-examining repeated testing and teacher effects in a remedial mathematics course." *British Journal of Educational Psychology* 62.
- Olson, L. (2002) "Up Close and Personal." *Education Week* (22 May).
- Sadler, R. 1989. "Formative assessment and the design of instructional systems." *Instructional Science* 18.
- Stiggins, R. 2002. "Assessment for learning." *Education Week* (13 March).

ABOUT US: LeapFrog SchoolHouse offers research-based programs designed specifically for the classroom. We publish PreK–Grade 8 curriculum and assessment content that is correlated to state standards and enhanced by our unique learning platforms.



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