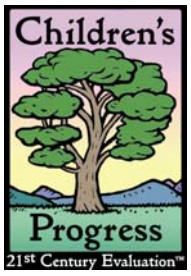

Scientific Basis of the Galanter Educational Evaluation Lattice (GEEL)

The Galanter Educational Evaluation Lattice (GEEL) a product of Children's Progress, Inc. (CPI), is a scientifically based assessment delivered over the Internet. The GEEL is currently available for children in grades Pre-K through 2. The GEEL examines and evaluates the child's understanding of concepts related to intellectual and social success. It provides teachers with immediate, actionable information in areas of concern and of promise. The GEEL screens the child for impairments in vision, hearing, and motor coordination so that a school nurse or medical practitioner can be notified if necessary for further clinical evaluation. The GEEL also examines a child's skills in language arts and mathematics, including foundational science, and identifies specific strengths and weaknesses in these areas to help teachers develop teaching strategies for each child. Moreover, the GEEL alerts teachers to potential cognitive deficits (e.g., reversal tendencies, attention/vigilance, short-term memory). And finally, the GEEL examines operationally defined adaptive social and emotional functions, such as achievement attribution, self-conception, peer acceptance, and anger/hostility attribution. CPI scientists are now working to invent a new technology to display dynamic sociometric data. This will offer teachers detailed information about each child's social environment, as well as structural knowledge about the micro-culture of the classroom.

Immediately following the assessment, the GEEL delivers a narrative report that explains, in plain language, the data generated by the child's performance. These reports provide targeted recommendations to let teachers construct learning plans for individual children. The GEEL simultaneously provides a summary report of the whole class that gives teachers a snapshot of all areas of instruction.

This instantaneous access across a range of physical, psychological, academic and social domains allows teachers to identifying problem areas early. By using the power of the Internet and CPI's patented methods of assessment, the nation can change the way assessments are performed, interpreted, and used by teachers.

The Theory and Science Behind the GEEL

The founding of CPI and the design of the GEEL was shaped by ideas drawn from the Soviet psychologist Lev Vygotsky, and captured in a United States Patent by Eugene and Michelle J. Galanter. The patent defines the central principle of the GEEL: the logical structure and software system know as the *Lattice.* Professor Galanter's work in auditory perception at Columbia University convinced CPI that assessments and diagnostics should incorporate psychophysical, as well as academic data. A CPI grant to the Massachusetts Institute of Technology underwriting the theoretical and practical computational research led by Dr. Thomas von Wiegand proved that the Lattice-based assessment technology could capture such information from children, and that the abstract data matrix would map into an instant narrative report for the teacher that detailed a child's performance.

The Nature of the Lattice

With every response emitted by the child, the system alters the child's path through the Lattice. Unlike a simple adaptive technology, when a child answers a specific question incorrectly, the technology poses a hint about the same question in a different form. The Lattice offers this hint to provide opportunities for success. Data captured continuously from the child's path through the Lattice serves to estimate the child's acquisition of specific skills and pivotal concepts. For example, the assessment can identify a child who may have a reading difficulty, and then determine if this problem is due to letter comprehension or phonemic understanding (or something else altogether). On the other hand, if a child answers a specific question correctly, the Lattice moves the child forward to examine the acquisition of more complicated conceptual structures. It is simplistic (and ultimately dangerous) to think of any child's response to a question as simply right or wrong. Each specific response emitted by a child holds special significance about that child's skills, and helps to inform and enrich the narrative report to the teacher.

Concept-based Assessment

CPI believes that there is no ordinary child—indeed, every child is unique. Teachers need an assessment that examines specific concepts and provides individualized information about each child. Unlike standardized tests, CPI's assessment is concept-based and child-centered. The domains we assess are vital to and greatly impact children's learning and are aligned with a scientifically derived developmental model of skill and concept acquisition. In addition, the GEEL assesses many areas that are out of the reach of typical assessments, yet foundational to developing unique teaching strategies for individual children. Moreover, the assessment is fun for the child. There is none of the anxiety that is often associated with other standardized tests—the children behave as though they are playing a game. The assessment is conducted on as many occasions as is deemed necessary by the teacher (every run through the Lattice provides additional information concerning the child's learning progress). We recommended that the GEEL be administered at least 3 to 5 times during the year). In this way, the GEEL measures children's progress on specific concepts from one time to another, and can give teachers a time-based evaluation of the child's educational development.

Most "high-stakes tests" are standardized tests. That is, they provide teachers and parents with a number that may represent where this particular child falls within a standardized distribution (i.e., an ordinate on a bell-curve). Such tests provide little or no information about how a teacher should go about helping a child, and all too often it is no more than a record of failure.

Technology and Security

CPI's partnership with MIT has led to the development of technologies that were never before possible. Using these technologies we evaluate aspects of children's behavior that are inaccessible to other types of assessment (e.g., response times within 1/60 sec, color vision and hearing assessed over uncontrolled channels as well as cognitive skills, and social-emotional behavior). All a teacher needs in order to administer the GEEL is a "classroom" computer connected to the Internet via a broadband connection, headphones, and a mouse. If a teacher uses email then he or she has mastered the technical skills necessary to administer the GEEL. In addition, CPI complies with regulations and practices, including COPPA (the Children's Online Privacy and Protection Act), to ensure that all information transmitted across the Internet is secure and appropriately protected. Moreover, the data collected on our servers is absolutely confidential and any information that identifies specific children will never be shared with any third-party.

Team of Researchers

CPI is based in New York City. Our Board of Scientific Advisors is composed of internationally recognized academic and scientific professionals. In addition, CPI uses researchers and educators at Harvard, Yale, Princeton, MIT, and Teacher's College. Many of our educational specialists and consultants are teachers who work in the classroom every day. CPI has helped to define the leading edge of assessment research and technology, and is constantly adapting to the world within and outside the classroom to change the nature of and attitude towards child assessment.

Chris Camacho, Cognitive Scientist
Jenny Cashin, Educational Specialist
Kit Norris, Educational Specialist
Carla Seal-Wanner, Educational Consultant
Rebecca Tatum, Educational Specialist

Research Basis for Assessment Domains

CPI is committed to applying classic and current theories and research in developmental and educational psychology to child assessment. We examine four major domains that have significant consequences on children's learning: Academic Skills (language arts, mathematics and foundational science), Visual, Auditory, and Motor Skills, Cognitive Skills, and Social-Emotional Functioning. Below are just some of the references and resources that provide the scientific basis for the GEEL.

Theoretical Overview and Methodological Approach
Our patented methodological approach builds upon the work of Lev Vygotsky, renowned Soviet child psychologist. His research identified the "zone of proximal development (ZPD)". The ZDP is the area between the actual development of a child (as determined by independent problem solving) and the level of potential development (as determined by problem solving with adult guidance). The ZPD encapsulates those concepts at the cusp of acquisition which can be nurtured to fruition through appropriate classroom instruction.

Vygotsky, L. S. (1934/1986). Thought and Language. (Ed. and revised by A. Kozoulin.) Cambridge, Mass.: MIT Press.

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Our assessment technology was designed and built by leading researchers in child development, educational psychology, psychophysics, cognitive psychology, and statistics. In addition, the applications of the GEEL has benefited greatly from the extended relations we have built with practicing teachers, special education coordinators, and administrators. CPI stresses the importance of assessing all relevant domains of a child's environment that may affect learning.

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Ginsburg, H. P. (1997). Entering the child's mind. New York: Cambridge University Press.

Miller, G. A., Galanter, E. and Pribram, K. H. (1986). *Plans and the Structure of Behavior*. New York: Holt, Rinehart, and Winston.

Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, A. W., Brody, N., Ceci, S. J., Halpern, D. F., Loehlin, J. C., Perloff, R., Sternberg, R. J., and Urbina, S. (1996). Intelligence: Knowns and unknowns. *American Psychologist, 51*, 77-101.

Piaget, J. (1929/1979). *The Child's Conception of the World*. New York: Harcourt Brace.

Sternburg, R. J. (1999). The theory of successful intelligence. *Review of General Psychology, 3*, 292-316.

Academic Assessment

The academic assessments were constructed to correlate with state and national standards. In addition, the academic assessments are molded by current findings in child development. These assessments pinpoint specific areas of learning that are necessary for academic success. Within *Language Arts*, we examine several concepts that relate to letter conception, phonemic awareness, reading and writing, inference, and comprehension. These are areas the have been proven helpful to children in reading skills and reading comprehension.

National Reading Panel (2000). Teaching Children To Read: An Evidence-based assessment of the scientific research literature on reading and its implications for reading instruction.

U. S. Department of Education (2002). No Child Left Behind: A Desk Reference.

Miller, G. A. (1988). The challenge of universal literacy. *Science, 241*, 1293-1299.

Whitehurst, G. J. and Lonigan, C. J. (1998). Child development and emergent literacy. *Child Development, 69*, 848-872.

Whitehurst, G. J., Epstein, J. N., Angell, A. L., Payne, A. C., Crone, D. A., and Fischel, J. E. (1994). Outcomes of an emergent literacy intervention in head start. *Journal of Educational Psychology, 86*, 542-555.

Within the area of *Mathematics and Foundational Science*, we have developed our assessment around national standards and current research from the fields of educational and developmental psychology. Our mathematical and foundational science assessment covers six major domains: numbers and operations, patterns and algebra, geometry, measurement, probability, and object manipulation.

National Council of Teachers of Mathematics (2000). Principles and standards in school psychology.

Ginsburg, H. P., Pappas, S., and Seo, K. (2001). Everyday mathematical knowledge: Asking young children what is developmentally appropriate. *In Psychological Perspectives on Early Childhood Education: Reframing Dilemmas in Research and Practice* (S. Goldbeck, Ed.), 181-219.

Resnick, L. B. (1989). Developing mathematical knowledge. *American Psychologist, 44*, 162-169.

Becker, J. and Varelas, M. (1993). Semiotic aspects of cognitive development: Illustrations from early mathematical cognition. *Psychological Review, 100*, 420-431.

Psychophysical (Visual-Auditory-Motor) Assessment

We screen for various visual problems including near vision, acuity, astigmatism, and color vision. These screening tools are unique to the CPI technology, and the color vision assessments are patent pending by MIT with CPI the exclusive licensee. Our screenings for auditory difficulties for the youngest children are based on signal detection paradigms first reported by the Psychophysics Laboratory, and subsequently implemented by our software engineers in New York. When children are able to count temporal sequences (assessed during the mathematical arts sequence) we then estimate hearing loss data for five critical pure tone frequencies. Motor skills are evaluated by reaction speeds and tracking ability in the various scenarios that ensure adequate mousing skills. In this way we counter-validate errors in other domains that may be attributable to motor control problems rather than academic, cognitive, or socio-emotional functions.

Brown, A. M. & Lindsey, D. T. (2001) The Color Blue: A psychophysical explanation for a linguistic phenomenon. *Vision Sciences Society Abstract,* First Annual Meeting, Sarasota, FL, May 4-8, pg 21. Abstract nr 59.

Farnsworth, D. (1943) The Farnsworth-Munsell 100-Hue and Dichotomous Tests for Color Vision. *Journal of the Optical Society of America,* Vol 33, No 10, pp 568-578.

Galanter, Eugene (2002) Psychophysics, in *Encyclopedia of Psychology*, Washington, DC: American Psychological Association & Oxford University Press.

Galanter, E. & Sachtler, W. L. (2002) Color Vision Testing on the Internet, *Society for Information Display, 33 (3)* May 2002.

Geller, A. M. & Hudnell, H. (1997) Critical issues in the use and analysis of the Lanthony Desaturate Color Vision Test. *Neurotoxicology and Teratology,* Vol. 19, No. 6, pp 455-465.

Sachtler, W. L. (2001) A color deficiency screening test robust to display calibration errors. *Invest Ophthalmol & Vis Sci. ;* 42(4): S48.

Cognitive Skills Assessment

Our Cognitive Skills Assessment evaluates important areas of cognitive processes that could pose an obstacle to learning. For example, we assess a child's memory retention. We also assess a child's predilection to generate reversal tendencies, a possible indicator of dyslexic symptoms. We also examine a child's ability to attend to a stimulus and remain vigilant during variable time intervals. The Cognitive Skills Assessment identifies children with possible cognitive difficulties, not to diagnose, but to make teachers alert for other possible symptoms that they may observe, and refer.

Miller, G. A. (1956/1994). The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review, 101, 343-352.

Cowan, N., Towse, J. N., Hamilton, Z., Saults, J. S., Elliott, E. M., Lacey, J. F., and Hitch, G. J. (2003). Children's working-memory processes: A response-timing analysis. *Journal of Experimental Psychology: General, 132*, 113-132.

Griffiths, Y. M. and Snowling, M. J. (2001). Predictors of exception word and non-word reading in dyslexic children: The severity hypothesis. *Journal of Educational Psychology, 94*, 34-43.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention, and executive functions: Constructing a unified theory of ADHD. *Psychological Bulletin, 121*, 65-94.

Social-Emotional Adaptiveness Assessment

Factors that affect children's academic achievement are not limited to psychophysical and cognitive impairments. A child's social environment can have dramatic effects on a child's performance in school. For example, a child's achievement attribution can have significant effects on how the child maintains motivation after failure. In addition, a child's tendency to make anger and hostility attributions of other's intentions can influence or shape learning as well as classroom behavior. The social structure of a classroom can help to identify children who may be socially isolated or may become "bullies." Early identification and intervention for these behaviors may dramatically improve individual children's progress and the learning environment of the classroom.

National Center for Educational Statistics (2001). Measures of socio-emotional development in middle childhood. Working Paper Series.

Mueller, M. and Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*, 33-52.

Crick, N. R. and Dodge, K. A. (1994). A review and reformulation of social information-processing mechanisms in children's social adjustment. *Psychological Bulletin, 115*, 74-101.

Eisenberg, N., Fabes, R. A., Murphy, B. Karbon, M., Smith, M. and Maszk, P. (1996). The relations of children's dispositional empathy-related responding to their emotionality, regulation, and social functioning. *Developmental Psychology, 32*, 195-209.