THE FUTURE OF A MISTAKE: WILL DISCREPANCY MEASUREMENT CONTINUE TO MAKE THE LEARNING DISABILITIES FIELD A PSEUDOSCIENCE?

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Over the past two decades I have written several articles about assessment procedures in the field of learning disabilities (LD) (Stanovich, 1986, 1988, 1991, 1993, 1996, 1999a, 2000). Many of those articles were centered around the issue of aptitude-achievement discrepancy as a defining feature of a learning disability. In dealing with this issue again here and talking about its future, I was drawn to the title of this essay. The title advertises my frustration with the field on this issue.

The persistence of the discrepancy concept in LD signals that the field is not ready to put itself on a scientific footing and that it will continue to operate on the borders of pseudoscience. It is ironic that my other research area is critical thinking, particularly the cognitive processes that lead to pseudoscientific thinking (Stanovich, 1999b, 2002, 2004). The fixation on discrepancy measurement provides a test case of things that I study in that area: confirmation bias (e.g., Nickerson, 1998) and failure to consider alternative theories (e.g., Johnson-Laird, 1999; Stanovich, 1999b, 2004).

Imagine that your current HMO covered only the procedures and diseases recognized by the medical profession in 1950. The thought is ridiculous because in such a rapidly developing field as medicine, no one would expect practice to be frozen at the level of scientific knowledge attained 50 years ago. In a less extreme fashion, though, this is what has happened in LD. The field suffers greatly from its tendency to base practice on concepts and psychometric technologies that have been superseded by subsequent scientific advance. I am referring here to the field's persistence in linking the definition of learning disability to the concept of aptitude-achievement discrepancy and identifying aptitude with intelligence test performance. In the following, I confine my comments to reading disability, the most common type of learning disability, and the one where my expertise is concentrated.

In the October 2004 issue of the *APA Monitor*, a leading figure in LD diagnosis is quoted as saying that "the intelligence test is our stethoscope, like it or not" (Kersting, 2004, p. 54), even though there is no research consensus that LD diagnosis using intelligence as a proxy for aptitude is useful or conceptually justified (Siegel, 1989, 1992). Where would one find support for treating the concept of aptitude-achievement discrepancy as foundational – as it has been in practice in the LD field? One would look for evidence supporting four different propositions: (1) that the pattern of information-processing skills that underlie the reading deficits of low-IQ poor readers is different from the information-processing skills that underlie the reading deficits of high-IQ poor readers; (2) that the neuroanatomical differences that underlie the cognitive deficits of these two groups are different; (3) that low- and high-IQ poor readers require different treatments to remediate their reading problems; and (4) that there is differential etiology in the two groups based on different heritability of the component deficits.

Why do I call reliance on discrepancy definitions in the LD field an example of pseudoscientific practice? Because there is no strong research consensus supporting any of these four propositions.

THE MISSING EVIDENCE

Regarding point #1, the preponderance of evidence indicates that the primary indicators of reading difficulty at the word-recognition level do not differentiate

poor readers with discrepancy from readers without. For example, several studies have compared the performance of poor readers with high and low IQs and have found that they display equivalent pseudoword reading deficits. Similarly, the two groups display roughly equal deficits in phonological segmentation skills. On measures of orthographic processing, where reading disabled children are generally less impaired, the groups again display no differences. Finally, the two groups appear to have identical growth curves for reading development and for component skills of word recognition. In summary, there is still no converging empirical evidence indicating that the processing mechanism accounting for the primary word-recognition problems of high-IQ poor readers is different from the processing mechanism accounting for the primary word-recognition problems of low-IQ poor readers (Aaron, 1997; Fletcher et al., 1994; Flowers, Meyer, Lovato, Wood, & Felton, 2001; O'Malley, Francis, Foorman, Fletcher, & Swank, 2002; Share, 1996; Stanovich & Siegel, 1994; Stuebing et al., 2002; see Stanovich, 2000, for at least a dozen more citations of evidence supporting this conclusion).

Whereas there is a wealth of evidence regarding proposition #1 that is largely negative, on proposition #2 there is virtually no evidence at all. A variety of neuroanatomical studies have indicated that atypical brain symmetries and other cortical anomalies are associated with reading disability (e.g., Hynd, Clinton, & Hiemenz, 1999; Shaywitz, 2003). However, to date there is no indication that these neuroanatomical correlates of reading disability show any association with degree of reading-IQ discrepancy.

On point #3 – that low- and high-IQ poor readers require different treatments to remediate their reading problems – the bulk of the research evidence is negative. A review by Aaron (1997) drew the conclusion that studies that have directly compared high- and low-IQ poor readers have provided no strong evidence for an aptitude-by-treatment interaction. Training studies conducted since the Aaron (1997) review suggest the same conclusion (see Hatcher & Hulme, 1999; Jimenez et al., 2003; Stage, Abbott, Jenkins, & Berninger, 2003; Torgesen, 2004; Vellutino, Scanlon, & Lyon, 2000; Wise, Ring, & Olson, 1999).

Only on proposition #4 – differential etiology in the two groups based on different heritability of the component deficits – do we find evidence that is the least bit inconclusive. An amalgamation of earlier studies (e.g., Fletcher, 1992; Olson, Rack, Conners, DeFries, & Fulker, 1991; Pennington, Gilger, Olson, & DeFries, 1992; Stevenson, 1991, 1992) failed to provide strong evidence that indicators of genetic etiology were correlated with degree of aptitude-achievement discrepancy. Recent studies by the Colorado group (Olson, 1999, 2002; Wadsworth, Olson, Pennington, & DeFries, 2000) have reported a trend in the expected direction (higher heritability for the group deficit of the higher IQ poor readers). However, the difference is quantitative rather than qualitative: Both high- and low-IQ poor readers display indications of partial genetic etiology and partial environmental etiology. It is just that the relative proportions of variance are quantitatively somewhat different (a heritability difference of .72 versus .43). Wadsworth et al. (2000) are careful to point out that such a finding could still mean that the same genetic influences are operative for the two groups but that the high-IQ group is characterized by a more homogeneous environment (which would occur if the high-IQ group were a relatively uniformly advantaged group). This, in turn, would result in the high-IQ group displaying higher heritability. Additionally, Olson (2002) has emphasized that

> these results do not justify withholding remedial services to poor readers with lower IQ ... The differences in genetic etiology are not particularly large between the high and low IQ groups, and there are certainly individual cases in the low IQ group that have a very strong genetic etiology for their reading problems. This would argue against any strong categorical use of IQ or IQ-reading discrepancy criteria for defining any genetic specificity in dyslexia. (p. 154)

Finally, the summary model of difficulties in reading that is generally accepted, and that is based on voluminous research, provides no support for differentiating poor readers on the basis of IQ. Consider that:

1. The primary subcomponent of reading that is problematic for children with severe reading problems is word recognition.
2. The primary psychological process underlying the word-recognition difficulties of reading disabled individuals is a problem in phonological coding due to weak segmental language skills.
3. Both the distal processing problem in the phonological domain and the proximal word-recognition problem can in part be remediated with intensive intervention.

The problem for the discrepancy assumption that is so foundational for the LD field is: *none of these facts correlate at all with IQ!*

THE FUTURE OF THE LD FIELD

What is the future of the LD field? It depends on whether the field – at least on this, its foundational issue – will finally be responsive to evidence. I cannot admit to much optimism on this score. Over a decade ago I wrote that "the LD field seems addicted to living

dangerously. Even in the context of such a history, the decision to base the definition of a reading disability on a discrepancy with measured IQ is still nothing short of astounding" (Stanovich, 1989, p. 487). I remain frustrated that somehow we cannot seem to get the hard-won research knowledge in the field to infuse practice. I remain frustrated that this is a field that sees its critics (e.g., Gordon, Lewandowski, & Keiser, 1999; Kelman & Lester, 1997; Siegel, 1989; Stanovich, 1999a) as attacking the field rather than trying to advance it.

A field that resists reform from the inside is asking for reform from those outside the profession, thereby putting its autonomy at risk. And any field that can ignore the conclusions of the superb meta-analysis of Stuebing et al. (2002) – a meta-analysis conducted by some of the most eminent psychologists in the world and analyzing experiments by some of the most rigorous educational researchers in the world – is a field that is resisting reform. We will again see if the field is resistant to reform when the response to the reauthorization of the Individuals with Disabilities Education Act (IDEA) becomes apparent. This is because the reauthorization of IDEA does not require a local educational agency to take into consideration whether a child has a severe discrepancy between achievement and intellectual ability (Council for Exceptional Children, 2004).

REFERENCES

Aaron, P. G. (1997). The impending demise of the discrepancy formula. *Review of Educational Research, 67,* 461-502.

Council for Exceptional Children. (2004, November). *The new IDEA: CEC's summary of significant issues*. Arlington, VA: CEC.

Fletcher, J. M. (1992). The validity of distinguishing children with language and learning disabilities according to discrepancies with IQ: Introduction to the special series. *Journal of Learning Disabilities, 25,* 546-548.

Fletcher, J. M., Shaywitz, S. E., Shankweiler, D., Katz, L., Liberman, I., Stuebing, K., Francis, D. J., Fowler, A., & Shaywitz, B. A. (1994). Cognitive profiles of reading disability: Comparisons of discrepancy and low achievement definitions. *Journal of Educational Psychology, 86,* 6-23.

Flowers, L., Meyer, M., Lovato, J., Wood, F. B., & Felton, R. H. (2001). Does third grade discrepancy status predict the course of reading development? *Annals of Dyslexia, 51,* 49-71.

Gordon, M., Lewandowski, L., & Keiser, S. (1999). The LD label for relatively well-functioning students: A critical analysis. *Journal of Learning Disabilities, 32,* 485-490.

Hatcher, P. J., & Hulme, C. (1999). Phonemes, rhymes, and intelligence as predictors of children's responsiveness to remedial reading instruction: Evidence from a longitudinal intervention study. *Journal of Experimental Child Psychology, 72,* 130-153.

Hynd, G. W., Clinton, A., & Hiemenz, J. R. (1999). The neuropsychological basis of learning disabilities. In R. J. Sternberg & L. Spear-Swerling (Eds.), *Perspectives on learning disabilities* (pp. 60-79). New York: Westview/HarperCollins.

Jimenez, J., Ortiz, M., Rodrigo, M., Hernandez-Valle, I., Ramirez, G., Estevez, A., O'Shanahan, I., & Trabaue, M. (2003). Do effects of computer-assisted practice differ for children with reading disabilities with and without IQ-achievement discrepancy? *Journal of Learning Disabilities, 36,* 34-47.

Johnson-Laird, P. N. (1999). Deductive reasoning. *Annual Review of Psychology, 50,* 109-135.

Kelman, M., & Lester, G. (1997). *Jumping the queue: An inquiry into the legal treatment of students with learning disabilities*. Cambridge, MA: Harvard University Press.

Kersting, K. (2004, October). Debating learning-disability identification. *APA Monitor,* 54-55.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology, 2,* 175-220.

Olson, R. K. (1999). Genes, environment, and reading disabilities. In R. J. Sternberg & L. Spear-Swerling (Eds.), *Perspectives on learning disabilities* (pp. 3-21). New York: Westview/ HarperCollins.

Olson, R. K. (2002). Dyslexia: Nature and nurture. *Dyslexia, 8,* 143-159.

Olson, R. K., Rack, J., Conners, F., DeFries, J., & Fulker, D. (1991). Genetic etiology of individual differences in reading disability. In L. Feagans, E. Short, & L. Meltzer (Eds.), *Subtypes of learning disabilities* (pp. 113-135). Hillsdale, NJ: Erlbaum.

O'Malley, K., Francis, D. J., Foorman, B. R., Fletcher, J. M., & Swank, P. R. (2002). Growth in precursor and reading-related skills: Do low-achieving and IQ-discrepant readers develop differently? *Learning Disabilities Research & Practice, 17,* 19-34.

Pennington, B. F., Gilger, J., Olson, R. K., & DeFries, J. C. (1992). The external validity of age- versus IQ-discrepancy definitions of reading disability: Lessons from a twin study. *Journal of Learning Disabilities, 25,* 562-573.

Share, D. L. (1996). Word recognition and spelling processes in specific reading disabled and garden-variety poor readers. *Dyslexia, 2,* 167-174.

Shaywitz, S. E. (2003). *Overcoming dyslexia: A new and complete science-based program for reading problems at any level*. New York: Knopf.

Siegel, L. S. (1989). IQ is irrelevant to the definition of learning disabilities. *Journal of Learning Disabilities, 22,* 469-479.

Siegel, L. S. (1992). An evaluation of the discrepancy definition of dyslexia. *Journal of Learning Disabilities, 25,* 618-629.

Stage, S. A., Abbott, R. D., Jenkins, J. R., & Berninger, V. W. (2003). Predicting response to early reading intervention from verbal IQ, reading-related language abilities, attention ratings, and verbal IQ-word reading discrepancy: Failure to validate discrepancy method. *Journal of Learning Disabilities, 36,* 24-33.

Stanovich, K. E. (1986). Cognitive processes and the reading problems of learning disabled children: Evaluating the assumption of specificity. In J. Torgesen & B. Wong (Eds.), *Psychological and educational perspectives on learning disabilities* (pp 87-131). New York: Academic Press.

Stanovich, K. E. (1988). Explaining the differences between the dyslexic and the garden-variety poor reader: The phonological-core variable-difference model. *Journal of Learning Disabilities, 21,* 590-612.

Stanovich, K.E. (1989). Has the learning disabilities field lost its intelligence? *Journal of Learning Disabilities, 22,* 487-492.

Stanovich, K. E. (1991). Discrepancy definitions of reading disability: Has intelligence led us astray? *Reading Research Quarterly, 26,* 7-29.

Stanovich, K. E. (1993). Dysrationalia: A new specific learning disability. *Journal of Learning Disabilities, 26,* 501-515.

Stanovich, K. E. (1996). Toward a more inclusive definition of dyslexia. *Dyslexia, 2,* 154-166.

Stanovich, K. E. (1999a). The sociopsychometrics of learning disabilities. *Journal of Learning Disabilities, 32,* 350-361.

Stanovich, K. E. (1999b). *Who is rational? Studies of individual differences in reasoning.* Mahweh, NJ: Erlbaum.

Stanovich, K. E. (2000). *Progress in understanding reading: Scientific foundations and new frontiers.* New York: Guilford Press.

Stanovich, K. E. (2002). Rationality, intelligence, and levels of analysis in cognitive science: Is dysrationalia possible? In R. J. Sternberg (Eds.), *Why smart people can be so stupid* (pp. 124-158). New Haven, CT: Yale University Press.

Stanovich, K. E. (2004). *The robot's rebellion: Finding meaning in the age of Darwin.* Chicago: University of Chicago Press.

Stanovich, K. E., & Siegel, L. S. (1994). The phenotypic performance profile of reading-disabled children: A regression-based test of the phonological-core variable-difference model. *Journal of Educational Psychology, 86,* 24-53.

Stevenson, J. (1991). Which aspects of processing text mediate genetic effects? *Reading and Writing: An Interdisciplinary Journal, 3,* 249-269.

Stevenson, J. (1992). Identifying sex differences in reading disability: Lessons from a twin study. *Reading and Writing: An Interdisciplinary Journal, 4,* 307-326.

Stuebing, K., Fletcher, J. M., LeDoux, J. M., Lyon, G. R., Shaywitz, S. E., & Shaywitz, B. A. (2002). Validity of IQ-discrepancy classification of reading difficulties: A meta-analysis. *American Educational Research Journal, 39,* 469-518.

Torgesen, J. K. (2004). Lessons learned from research on interventions for students who have difficulty learning to read. In P. McCardle & V. Chhabra (Eds.), *The voice of evidence in reading research* (pp. 355-382). Baltimore: Paul Brookes.

Vellutino, F. R., Scanlon, D. M., & Lyon, G. R. (2000). Differentiating between difficult-to-remediate and readily remediated poor readers: More evidence against the IQ-achievement discrepancy definition of reading disability. *Journal of Learning Disabilities, 33,* 223-238.

Wadsworth, S. J., Olson, R. K., Pennington, B. F., & DeFries, J. C. (2000). Differential genetic etiology of reading disability as a function of IQ. *Journal of Learning Disabilities, 33,* 192-199.

Wise, B. W., Ring, J., & Olson, R. K. (1999). Training phonological awareness with and without explicit attention to articulation. *Journal of Experimental Child Psychology, 72,* 271-304.

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