Accompanying Text for the Presentation: "Who are the Learning Disabled"

Lee Swanson, University of California-Riverside

Slides 2-4

The purpose of this presentation is to address the question of who are the students with specific learning disabilities (SLD) in relation to two main considerations:

1. Treatment outcomes: What works for students with SLD?
2. Cognitive processes: Are there differences in cognitive processing ability that underlie reading disability, math disability, and co-morbid (reading and math) disability?

This presentation and text are based on the following references:

Hoskyn, M., & Swanson, H.L. (2000). Cognitive processing of low achievers and children with reading disabilities: A selective meta-analytic review of the published literature, *The School Psychology Review, 29*, 102-119.

Swanson, H.L. (1999). Reading research for students with LD: A Meta-analysis of intervention outcomes, *Journal of Learning Disabilities, 32*, 504-532.

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Swanson, H.L., & Beebe-Frankenberger, M. (2004). The relationship between working memory and mathematical problem solving in children at risk and not at risk for serious math difficulties, *Journal of Educational Psychology, 96*, 471-491.

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Swanson, H.L. & Hoskyn, M. (2001). Instructing adolescents with learning disabilities: A component and composite analysis, *Learning Disabilities Research & Practice, 16*, 109-119.

Swanson, H.L., Hoskyn, M., & Lee, C. (1999). *Interventions for students with learning disabilities: A meta-analysis of treatment outcomes.* NY: Guilford.

Swanson, H.L., Jerman, O., Dukas, G., & Gregg, R. (in press) TITLE, *Review of Educational Research.*

Swanson, H.L., & Sachse-Lee, C. (2000). A meta-analysis of single-subject-design intervention research for students with LD. *Journal of Learning Disabilities, 33*, 114-136.

Swanson, H.L., & Siegel, L. (2001). Learning Disabilities as a working memory deficit, *Issues in Education, 7, 1-48.*

Swanson, H.L., Trainin, G., Necoechea, D.M., & Hammill, D.D. (2003). Rapid naming, phonological awareness, and reading: A meta-analysis of the correlation evidence. *Review of Educational Research, 73*, 407-440.

Part One: Treatment Outcomes

Slide 5

Important assumptions about the definition of SLD include:

1. SLD is not due to inadequate opportunity to learn, general intelligence, or to significant physical or emotional disorders, but to basic disorders in specific psychological processes.
2. SLD is not due to poor instruction, but to specific psychological processing problems that

have a neurological, constitutional, and/or biological base.

3. SLD is not manifested in all aspects of learning. For example, a student may experience problems in reading but not in math.

The first two assumptions speak directly to the exclusionary clause in the federal definition of SLD and suggest that part of a classification process must include provisions to rule out these explanations for low achievement. The third assumption speaks more directly to the relationship of psychological processing deficits and academic behavior, as well as to the concept of "unexpected underachievement." Research is showing that processes such as working memory and phonological awareness underlie difficulties in reading and math. In sum, these assumptions help to distinguish students with SLD from those students with general low achievement or those students with other cognitive or behavioral disabilities (e.g., mental retardation).

Slide 6-7

1. There are three subtypes that have some consensus in the research and are relevant to the school context: students with reading disabilities, students with mathematical disabilities, and a co-morbid group (students with both reading disability and math disability).
2. These subtypes are defined by standardized (norm referenced) and reliable measures of intelligence and achievement. The most commonly used intelligence tests are the Wechsler measures and common achievement tests that include measures of word recognition or arithmetic calculation.
3. In general, an IQ score equal to or above a standard score of 85 and a reading or math subtest score equal to or below the 25th percentile reflects one of two high-incidence disorders within SLD: (1) reading or (2) arithmetic.

Many researchers are drawing attention to the differences between "school identified" and "research identified" samples of students with SLD. One consistent problem with the SLD literature and research as it applies to evidence-based interventions is the variability with which the sample is defined. This variability limits the generalizations that can be made regarding effective interventions (e.g., intervention outcomes may be more robust for some samples than others, using different criteria). Reporting these criteria allows the reader to understand the target population.

Slides 8-10

Although responsiveness to intervention (RTI) is being considered as a possible alternative to current methods of SLD identification, many unanswered questions remain about its use as a classification model. These issues include (but are not limited to) the following:

1. Lack of experimental research comparing RTI with a competing model of classification.
2. Reliance on general education teachers to provide consistent, evidence-based instruction, despite recent findings that only 10 percent of reading instruction provided by general education teachers is what research shows to be the most effective grouping.
3. Lack of consensus on what "non-responsive" is (similar to the current problems in defining discrepancy).

Some initial ways to resolve these issues include:

- Identify in the research what constitutes "evidence-based" instruction. Because of the reliance on "evidence-based" instruction in an RTI model, it is important first to identify key components of effective instruction and make sure they are in place (this review identifies key components, but a system of fidelity of implementation would be required to address the system being in place).
- Determine whether sample characteristics (e.g., IQ and reading) influence outcomes – like the criteria used by researchers to define SLD (slides 5 & 6), does the research on intervention present a pattern from which clear characteristics emerge to define the SLD population?

Slides 11-16

Why do a meta-analysis?

A meta-analysis can provide evidence to test theories as well as test the evidence across studies on specific interventions. For example, is direct instruction more effective than strategy instruction? A single study might use a form of direct instruction as well as a form of strategy instruction and compare results, but a meta-analysis of studies addressing this issue can draw conclusions about many studies that may use a different form of direct instruction and strategy instruction.

A meta-analysis provides an evaluation of a pattern of findings, as opposed to a single study. If findings are consistent across studies, that provides stronger evidence of the conclusions. A meta-analysis can help control for methodological issues that limit the conclusions/generalizations that can be made from a single study.

One persistent issue with SLD determination relates to the difficulty of distinguishing a student with SLD from a student with general low-achievement. The concept of SLD would be validated if the definition was related to treatment outcomes (e.g., are students with SLD less responsive to instructional intervention—in terms of the magnitude of effect size—than are students with low achievement?). Such a relationship might also prove more valuable to practitioners in planning for service delivery options. A meta-analysis can help identify patterns in sample characteristics to see how these might play a role in the outcomes (for example, can they generalize across age groups, achievement, and aptitude criteria) and subsequently lead to more consistent definitions (based on treatment validity) of SLD.

A meta-analysis compares and combines the results of individual studies of a particular research question. In the meta-analyses conducted here, the differences between treatment and control groups across studies are combined and an effect size is computed. This effect size is the overall magnitude of the treatment outcome. For example, across studies, does an intervention yield a large (> .80) or small (< .20) outcome for students with SLD? Across studies, are there consistent characteristics of the sample (e.g., IQ > 85 and reading level < 25^{th} percentile) that are highly correlated with the magnitude of the treatment outcomes?

Despite the many advantages that a meta-analysis can bring to understanding a particular area of research more fully, there are some limitations that warrant consideration, especially when interpreting findings. As applied to the findings related to determining effective interventions for students with SLD, these include:

1. Dodo verdict and evidence-based instruction. One limitation of a meta-analysis examining instructional interventions is that studies that report positive outcomes (e.g., the intervention worked) tend to be published at a rate much, much higher than those that do not support the use of the targeted intervention. This makes it difficult to determine which instructional interventions are more effective than others.
2. Related to this, although one study may be examining "strategy instruction" and another study may be looking at "direct instruction," the two approaches as described within these studies may share many common attributes, such as the use of feedback or monitoring how information is presented. Identifying the specific components that are effective is important but difficult if the study does not provide detailed descriptions of the intervention.
3. Finally, many single studies that report on the effects of interventions cannot be included in a meta-analysis because they suffer from methodological flaws (e.g., no control group), may not clearly define the sample, may not include definitions/descriptions of the intervention, and may not report enough information to calculate effect sizes. Thus, although several thousand studies may actually be published in a particular area, many of them cannot be included to inform the results of the meta-analysis. Because this is a common finding, many leading researchers in the field of special education are calling for stricter guidelines for conducting and publishing research studies so that general conclusions on a particular topic can be made. (See, for example, *Exceptional Children, 71*(2), 2005, Special issue: Criteria for evidence-based practice in special education).

Slides 17-44

These next slides examine the question of what constitutes evidence-based instructional practices for students with SLD and whether sample characteristics influence these outcomes. The published references related to the information in these slides are the following:

Swanson, H.L. (1999). Reading research for students with LD: A meta-analysis of intervention outcomes, *Journal of Learning Disabilities, 32*, 504-32.

Swanson, H.L. & Deshler, D. (2003). Instructing adolescents with learning disabilities: Converting a meta-analysis to practice. *Journal of Learning Disabilities, 36,* 124-135.

Swanson, H.L. & Hoskyn, M. (1998). Experimental intervention research on students with learning disabilities: A meta-analysis of treatment outcomes. *Review of Educational Research, 68*, 277-321.

Swanson, H.L. & Hoskyn, M. (2001). Instructing adolescents with learning disabilities: A component and composite analysis, *Learning Disabilities Research & Practice, 16*, 109-119.

Swanson, H.L. & Sachse-Lee, C. (2000). A meta-analysis of single-subject-design intervention research for students with LD. *Journal of Learning Disabilities, 33*, 114-136.

One of the major purposes of this series of studies was to investigate what instructional models and components have been identified as effective for students with SLD. Slides 19-22 provide descriptions of how these models and components were defined.

Because the initial review of the intervention models suggested that all four were equally effective (e.g., "Dodo verdict"), a three-tiered approach to investigate the effects of various instructional approaches on treatment outcomes was used.

1. The first tier included an analysis of the instructional components (listed on slides 21 & 22) reflected in the various studies and their relationship to effect sizes.
2. The second tier of analysis focused on variations in intelligence and reading mediated treatment outcomes (for example, were results different for students with IQ > 85 as opposed to students with lower IQs?).
3. The final tier of analysis focused on potential two-way interactions related to definition (how SLD was defined) x domain (reading or math) and definition x treatment (what instructional model and components were used).

First tier of analysis (slides 23-36)

The tables in these slides present findings across meta-analyses that examine the effect of specific instructional components on outcomes; The findings are explained in detail, then summarized.

The table in slides 25-26 (original source: Swanson & Hoskyn, 1998) presents the effect sizes across studies by domain (e.g., spelling, math, cognitive processing). Studies that examined a particular domain were grouped together, and effect sizes were calculated. If a domain had more than 50 studies, the effect sizes were divided into standardized (norm-referenced measures) and experimental (researcher developed) measures. Interesting findings on this table include the following:

1. The most frequent dependent measures reflected across the studies were measures of reading (word recognition, word skills, reading comprehension, and general reading), followed by cognitive processing.
2. Effect sizes related to treatments varied across domains.
3. Small effect sizes were found for spelling, math, attitude, intelligence, social skills, perceptual processes, and language processes.
4. Near large effects were found for reading comprehension, vocabulary, creativity, and cognitive processing.
5. Effect sizes were larger for researcher-developed measures than for standardized measures.

The table in slide 27 (original source: Swanson & Hoskyn, 2001) shows the results of a regression model that predicts effect size of an intervention for students with SLD. Only a small percentage of the variance (20 percent) is accounted for based on a model that included methodology (e.g., how well the study was conducted) and age, along with nine instructional components. Two instructional components that account for variance beyond methodology and age group of the sample are advanced organizers and explicit practice. (See Swanson & Deshler, 2003, for more information about how these findings might be applied to instructional practice).

The table in slides 28-29 (original source: Swanson & Sachse-Lee, 2000) shows that four instructional components contribute independently to the variance of effect sizes:

1. Drill-repetition-feedback
2. Control-task difficulty
3. Small interactive groups
4. Strategy cuing

The table in slide 28 (original source: Swanson, Hoskyn, & Lee, 1999, p. 170) presents the mean effect sizes of instructional components comparing LD to non-LD participants across a total of 17 studies. In this table, students without disabilities acted as the comparison group but did not receive the instructional intervention. We do not know whether there is a differential effect between students with SLD and those without. One might speculate (slide 31) that if both groups of students received treatment, a differential effect based on intervention could be found (e.g., students with SLD would respond to intervention, whereas the intervention would not make a difference for students without disabilities). Much like the literature examining differential effects for the provision of accommodations on high-stakes testing, this would provide evidence for the SLD construct based on treatment validity.

The tables in slides 32-36 (original source: Swanson, 1999) synthesizes intervention research for students with SLD that includes word recognition and reading comprehension measures. Overall, the results showed that persistent word recognition and comprehension deficits can be remediated with training. For reading comprehension, the combined model (strategy instruction and direct instruction) was most effective. For word recognition skills, the direct instruction approach was most effective.

Only a few instructional components (see the list on slides 21-22) increased the predictive power of treatment effectiveness beyond what could be predicted by variations in study methodology and age. For reading comprehension, the components were:

1. Directed response/questioning
2. Control difficulty of processing demands of task
3. Elaboration
4. Modeling by the teacher
5. Group instruction
6. Strategy cues

For word recognition, the important instructional components were:

1. Sequencing
2. Segmentation
3. Advanced organizers

The importance of these findings is that only a few components from a broad array of activities enhance treatment outcomes.

There is ample evidence in the research literature that suggests certain instructional activities constitute best practice for students with SLD. Therefore, an instructional core of components that included careful sequencing of activities and materials as well as systematic feedback was examined in relation to the instructional components for word recognition. When this instructional core was considered, the influence of segmentation on word recognition was reduced. In sum, the results suggest that programs that emphasize segmenting information, such as phonics instruction, are necessary but not sufficient for bolstering real word recognition.

When this instructional core was examined in relation to reading comprehension, strategy cuing and small-group interactive instruction contributed significant variance to estimates of reading comprehension beyond the instructional core model.

Second and third tiers of analysis, slides 37-44

The second tier of analysis focused on whether variations in intelligence and reading mediated treatment outcomes (for example, were results different for students with IQ > 85 as opposed to students with lower IQs?). The third tier of analysis focused on potential two-way interactions related to definition x domain and definition x treatment.

Slides 38-42 present tables and figures from a meta-analysis that examined whether outcomes differ when various criteria for defining the sample were used (original sources: Swanson et al, 1999; Swanson & Lee, 2000).

Three comparisons related to the definition of SLD were created.

1. Were there differences in outcomes when information on IQ and reading achievement were provided compared to studies in which this information was not reported?
2. Were there differences in outcomes in studies for which students' cut-off scores in reading were computed at or below the 25th percentile and intelligence scores at or above 85 versus studies in which cut-off scores could not be computed?
3. Were there differences in outcomes when students had a discrepancy of at least a 15-point standard score difference between IQ and reading and an IQ above 90 versus when students had a discrepancy but IQs below 91?

There are three overall important findings. First, the quality of the study influenced the effect of the treatment. Those studies that suffered from methodological weaknesses had higher treatment effects than those studies with stronger methodology. Second, a focus on just IQ level as well as reading level in isolation shows minimal variation in treatment outcomes (this is slide 36 with table titled: Effect size estimates as a function of instructional outcomes and sampling variables). The subsequent figures show that when IQ and reading are considered together, clear differences in the magnitude of treatment outcomes occur. For example, studies that included samples classified by cut-off score criteria (see number 2 above) paradoxically yielded lower effect sizes than studies that included samples not meeting cut-off score criteria or studies that include low achievers (studies with IQ scores and reading scores in the same low range). For example, when studies included groups of children who had IQs above 90 and reading scores below the 25^{th} percentile, the effect sizes were lower when compared to studies that included children with both low IQ (< 90) and low reading (< 25^{th} percentile). Thus, children with a discrepancy in IQ and reading may be less responsive to treatment outcomes than children whose IQ and reading scores are in the same low range (i.e., low achievers).

What do these three findings mean?

The findings in these levels of analysis suggest that how the SLD population is defined influences treatment outcomes. Those students with average IQ and low reading ability were more resistant to treatment than those students with low IQ and low reading ability.

In terms of interventions, children most at risk for SLD would be those who yield low outcomes under optimal instructional conditions (components that significantly and positively influence effect sizes). Across domains, the use of advanced organization and explicit practice were found to be the only instructional components to account for significant variance in effect sizes of interventions. The finding that these two components enhance intervention outcomes is consistent with the existing literature. For reading, those optimal instructional components that predicted treatment outcomes include drill-repetition-practice, strategy training, and small interactive groups.

PART TWO:
The role of cognitive processing and subtypes of disability

<u>Slide 46</u>

1. Are cognitive deficits comparable between children who have reading disabilities and those who have math disabilities?
2. Does the identification of cognitive processes help in the classification?

<u>Slide 47</u>

This area of research suffers from the same issues as intervention research; poor methodology and/or incomplete inclusion of data in articles prevents the inclusion of a large number of studies. Of 800 studies selected from articles, only 28 met full inclusion criteria.

<u>Slides 48-50</u>

The tables in these slides present the results of comparing the performance of students without disabilities, students with math disabilities, and students with reading disabilities on standardized measures of IQ, math, and reading achievement.

The important results include:

1. Compared to age-matched peers without disabilities, the students with math disabilities was "outperformed" in IQ (.59 – moderate effect), in math (2.19 – large effect), and in reading (.59 – moderate effect).
2. Compared to the group with reading disabilities, the math disability group was "outperformed" in IQ (.31 – small effect) and in math (1.11 – large effect); however, the math disability group scored much higher in measures of reading (2.27 – large effect).
3. Compared to the co-morbid (i.e., students with both reading disability and math disability) group, the math disability group scored higher in IQ (.59 – moderate effect); the groups scored about the same in math, with the math disability group scoring a bit higher (.26 – small effect); and the math disability group outperformed the co-morbid group in reading (1.68 – large effect).

<u>Slides 53-57</u>

The table in these slides presents the contrasts and significant findings in performance on a variety of cognitive processing skills among various groups:

1. Math disability versus non math-disability (average achiever). The group without disability outperformed the math disability group on all measures.
2. Math disability versus reading disability. Differences in speed-naming and working memory favoring the reading disability group (math disability group performed worse on these measures).
3. Math disability versus co-morbid group. Differences in literacy, visual spatial problem

solving, long-term memory, short-term memory, and working memory favoring the math disability group; differences in speed-naming, favoring the co-morbid group.

When these domains were entered into a regression model to predict effect sizes comparing students with math disabilities and average achievers, verbal working memory was a significant predictor of differences in performance.

Slides 60-72

The original source for this section is Swanson & Beebe-Frankenberger, 2004.

Questions:

1. Does working memory predict problem solving after various measures of phonological processing have been partialed from the analysis?
2. Does the relationship between problem solving and working memory vary as a function of age and risk for SLD?
3. What cognitive processes and skills mediate the relationship between working memory and problem solving?

Criteria similar to the reading studies were used to define the math disability group: IQ > 85 and math performance below the 25th percentile. However, instead of using or relying on written calculation to determine risk as in other studies, the study relied on word problem presented orally (WISC-IV arithmetic subtest).

Results suggest that the influence of working memory across grades is stable. More importantly, the figures show that the criteria for determining risk in math disabilities was stable across all three years. Children identified as at risk in math problem solving not only suffered working memory problems across all three years, but also difficulties on several other measures, such as reading, vocabulary, and naming speed.

Two models of working memory and its influence on math word-problem solving were tested. One model tested whether phonological processes play a major role in predicting performance in problem solving and whether the phonological system mediates the influence of executive processing on problem solving. The second model suggests that problem-solving performance relates to executive processing, independent of the influence of the phonological system.

There is clear evidence that the executive system of working memory does contribute important variance to problem-solving performance beyond processes that relate to the phonological system. Thus, the results do not support the first model. Second, working memory captures unique variance in predicting solution accuracy beyond measures of long-term memory and inhibition.

There are three implications of these findings for current literature.

1. Bottom-up processes are not the primary mediators between age-related and individual differences in working memory and problem solving. Of course, these results apply only to the age and ability groups represented in this sample. However, similar results have occurred with older children.
2. The findings further suggest that although skills associated with phonological process are important to age-related changes in children in calculation and problem solving, they are no more important than working memory.
3. Such a finding qualifies bottom-up models of problem solving of children by suggesting that if low-order processes, such as phonological processes, moderate the influence of executive processing on problem-solving performance, their effects may be indirect or minimal for children who have perhaps met a minimum threshold in math and reading skills.

Slides 73-80

Source: Swanson, Training, Necoechea, & Hammill, 2003.

The study sought to investigate the correlational evidence on the relationships between phonological awareness, rapid naming speed, and sight recognition of real words. The study also investigated whether potential competing processes play an important role in predicting word reading.

Three primary purposes of the meta-analysis were to determine:

1. What is the correlational evidence on the relationships between phonological awareness, rapid naming speed, and sight-word recognition?
2. Do other processes play an important role?
3. Are the correlations between rapid naming speed and phonological awareness independent (e.g., are they sensitive to age)?

A five-factor model emerged from an explanatory factor analysis:

Factor 1 – pseudo word reading
Factor 2 – real word reading
Factor 3 – IQ
Factor 4 – comprehension
Factor 5 – spelling, vocabulary, orthography

Three important findings were identified related to the factor analysis:

1. Rapid naming and phonological awareness measures were related to different factors. Rapid naming was connected to comprehension, whereas phonological awareness was related to reading pseudo words. This lends support to the double-deficit hypothesis of Wolf and Bowers (1999).
2. Neither rapid naming nor phonological awareness measures related meaningfully to real word reading measures.
3. Spelling is meaningfully related to three factors: pseudo word reading, real word reading, and vocabulary/orthography.

When examined in consideration of the research on reading disability, these results suggest that:

1. There are no clear advantages for phonological awareness and rapid naming speed when compared with other variables. This is important because the role of these two processes in accounting for differences in reading have been stressed in the literature. The findings of this meta-analysis suggest that although they do play important roles, these roles are limited to two aspects of reading (pseudo word reading and comprehension), and that their overall contribution to understanding differences in reading performance is not different from other variables, such as IQ, vocabulary, orthography, and memory.
2. Rapid naming speed shares a moderate relationship to pseudo word reading and spelling.
3. Age does not appear to play a significant role in moderating the correlations between phonological awareness and rapid naming speed, which suggests that these variables continue to play a role in explaining differences in reading ability. This contradicts theories that phonological awareness /rapid naming speed vary as a function of age.
4. When the findings were examined for poor vs. skilled readers, the correlations in the data differed. Thus, models of normal reading based on correlations may not apply to poor readers.
5. Reading comprehension and spelling were the only measures that loaded meaningfully on the real-word reading factor.

The findings in this study show that measures of phonological awareness and rapid naming speed are not directly relevant to understanding real-word reading performance. The results do show that phonological awareness shares a similar construct with pseudo word reading, though not as strong as does spelling. An interesting finding is that phonological awareness measures do load highly on reading comprehension. The only variable found to be meaningful across several factors was spelling. Thus, it appears from the results of this meta-analysis that less emphasis should be placed on phonological awareness and rapid naming speed measures in attempts to classify children as at risk for reading and more emphasis should be placed on spelling.

<u>Slides 81-89</u>

Source: Hoskyn & Swanson, 2000, in *School Psychology Review*

The purpose of this synthesis is to test the hypothesis:

1. Children with reading disability and children who are low achievers share a common problem in phonological processing, and
2. Children with reading disability exhibit an advantage in cognitive processing for measures other than phonological processing when compared to children who are low achievers.

The results of this synthesis support the hypothesis that reading disability and low achievement groups are alike on phonological processing measures. But the findings qualify the phonological core model two ways:

1. Although there is a general trend that performance between the two groups is closer on the majority of phonological than on general verbal and spatial processing variables, it appears that only a few of these variables remain robust in the regression analysis. The important finding is that when all cognitive domains are considered simultaneously in the analysis, the only processing advantage that emerged for the reading disability samples when compared to children who are low achievers across studies was related to syntactical knowledge.

2. The effects of specific processing categories are completely washed out in the full model. These findings suggest that both groups may share a general processing deficit. This finding is important because it accounts for much of the contradictory findings in the literature. What the results indicate is that when the analysis of phonological processing categories and non-phonological processing categories is done in isolation, support is found for a phonological core model

Other important findings include the following:

- Age is important. Cognitive differences among the two ability groups are more distinguishable at the younger than older age. The implication of this finding is that older children with RD may be different from younger children with RD.
- Verbal IQ is relevant. Another important finding of this study is that verbal IQ mediates the overall level of cognitive performance. The findings also show that although reading disability/low achievement differences on specific cognitive variables yield unstable results, the differences between groups on composite scores of verbal ability are robust for all comparisons.

In summary, the idea that some specific cognitive processes of children with reading disability is distinguishable from that of low achievers is tentatively supported by this review. This is tentative because the deficits in cognitive processing shared between the two groups are much broader than a phonological core. It was found that verbal intelligence and chronological age play a key role in defining the magnitude of reading disability/low achievement group differences on cognitive measures.

Overall Summary

Slides 90-92

Who are the SLD?

The data support that they are children with average IQs (>84) with reading and/or math scores below the 25th percentile whose academic performance outcomes remain below an effect size of .70 relative to average achievers after intense exposure to optimal instructional conditions.

1. There is evidence to suggest that IQ (at least verbal IQ) should not be thrown out of the SLD definition.
2. Two processes are worth investigating further (i.e., phonological awareness and working memory) when determining the subtype of disabilities.
3. Children at great risk for SLD are those exposed to optimal instructional conditions (e.g., non-responders).

There are caveats and concerns:

1. The role of phonological awareness and rapid naming speed has been overstated relative to other constructs.
2. A great deal of variance in outcome measures is unaccounted for as a function of treatment.
3. Some differences do exist between discrepancy and non-discrepancy groups.
4. Math disability and reading disability children are hard to differentiate on cognitive measures independent of the classification measures.

References

Wolf, M., & Bowers, P. (1999). The "Double-Deficit Hypothesis" for the developmental dyslexias. *Journal of Educational Psychology, 91*, 1-24.