Screening Briefs Series

Brief #3: Predicting Students at Risk for Reading and Mathematics Difficulties

This brief provides suggestions for appropriate screening measures for predicting which students are at risk for reading difficulties and mathematics difficulties.

Schools that are just beginning RTI implementation, as well as schools that are experienced with the processes, will benefit from pairing the information in this brief with the NCRTI Screening Tools Chart, which can be found at www.rti4success.org/screeningTools. Although the chart does not recommend specific products, it can help schools become informed about the screening tools available.

Schools can also learn more about the role of screening in NCRTI's *Essential Components* document (National Center on Response to Intervention, 2010), http://www.rti4success.org/pdf/rtiessentialcomponents_042710.pdf, and from Module 1 (Screening) of the NCRTI Implementer Series http://www.rti4success.org/resourcetype/rti-implementer-series-modules.

All of the Screening Briefs in this series are available for download from NCRTI's website, www.rti4success.org.

Schools teams rely on their screening measures to consistently and accurately predict which students are at risk for poor academic outcomes. Among the many important attributes to consider when selecting screening measures is age appropriateness. Reading and mathematics skills that are used at the kindergarten level are different from those used at the first-grade level. The same is true for reading and mathematics skills in second grade, third grade, and so on. When selecting a screening measure, practitioners should make sure that the skills assessed on the screener are appropriate for the grade level that is being assessed.

Screening Measures to Predict Students at Risk for Reading Difficulties

Understanding the importance of grade-appropriate screening measures for reading, researchers have made the following suggestions and recommendations:

Kindergarten

- Screening batteries should include assessments for phonological awareness, letter and sound knowledge, print concepts, and vocabulary (Fletcher et al., 2002; Jenkins, Hudson, & Johnson, 2007; Torgesen, 2002).
- Letter identification, sentence imitation, phonological awareness, and rapid naming skills in kindergarten predict students at risk for poor reading outcomes in second grade (Catts, Fey, Zhang, & Tomblin, 2001).

First Grade

- Screens should target the ability to read words fluently and accurately in addition to assessing mastery of typical kindergarten skills (Torgesen, 2002).
- For better predictions about which first graders might have reading difficulties, screening batteries should assess word identification skills (Fuchs, Fuchs, & Compton, 2004). Oral reading fluency may also be used late in first grade.

Second Grade

- Screening assessments should assess word and passage reading, oral reading fluency, and reading comprehension (Torgesen, 2002; Jenkins et al., 2007).

Third Grade

- Screening assessments should assess word and passage reading, oral reading fluency, and reading comprehension (Torgesen, 2002; Jenkins et al., 2007).

Fourth Grade and Beyond

- Screening should involve the use of more than one measure and should assess for reading comprehension, word reading, and fluency (Speece et al., 2010).
- Performance on prior state assessments (Vaughn et al., 2010).

Screening Measures to Predict Students at Risk for Mathematics Difficulties

When schools first began implementing an RTI framework, they typically began at the lower grades and targeted reading. As a result, screening practices were developed and researched within the context of reading. It is now becoming more and more common for schools to also screen for mathematics. Although the study of reading screening measures is still ahead of similar studies in mathematics, research findings suggest indicators to predict potential mathematics difficulties in the early grades.

What do we mean by the term 'mathematics difficulties'?

- Gersten, Jordan, and Flojo (2005) defined mathematics difficulties as those exhibited by students performing in the low average range (performance at or below the 35th percentile for a given screening measure).
- Fuchs, Fuchs, and Prentice (2004) characterized students performing in the well-below-average range (performance below the 25th percentile for a given screening measure) as having mathematics difficulties.

What are some advantages and disadvantages of high versus low cut points?

- Higher, more stringent cut points (e.g., the 35th percentile instead of the 25th percentile) reduce the possibility that students with true mathematics difficulties will be missed. At the same time, it increases the chance of making false positive identifications (i.e., incorrectly identifying students as struggling in mathematics when they are not).
- Over-identifying students as at risk and providing extra mathematics instruction to those who do not require it to can be costly in terms of the use of available time and resources. (See Screening Brief 2, *Examining Assessment Classification Accuracy.*)
- On the other hand, under-identifying students means that students who are at risk may not be detected by the screening tool. This is problematic because these students will likely miss the opportunity to receive necessary supplemental instruction in a timely fashion.
- Multi-stage screening may help reduce inaccurate classification (both under and over-dentification) because students identified as at risk with an initial screening instrument are tested again to: (1) verify the student's poor performance, and (b) potentially identify strengths and weaknesses to facilitate instructional planning (Fuchs, Fuchs, & Compton, 2012)

Determining the Usefulness of Screening Assessments in Predicting Students at Risk for Mathematics Difficulties in Kindergarten and First Grade

- Baker et al. (2002) found that assessment of skills related to counting items, magnitude comparison, and simple word problems were the best predictors of future arithmetic performance in kindergarten students.
- Seethaler and Fuchs (2010) found a one-minute quantity discrimination (i.e., a task where students are asked to identify the larger of two numbers) assessment to be a robust single-skill screening instrument for identifying kindergarteners at risk for mathematics difficulties. They further noted that for students identified as at risk, a longer, second-stage screening instrument assessing multiple skills related to computation and number sense may provide useful information about these students' strengths and weaknesses, thereby facilitating teachers' instructional planning.
- In addition to the skills noted above by Baker et al. (2002), Gersten et al. (2005) found the following three brief, timed assessments were reliable predictors of first graders at risk for mathematics difficulty: (1) quantity discrimination, (2) missing number identification, and (3) number identification fluency.

Suggestions for Practice

- Given the potentially wide range of test items in outcome measures in mathematics, identify students scoring below the 35th percentile as at risk for mathematics difficulties to help ensure that few students in need will be missed.
- For kindergarten students, consider using an individually administered, single-skill, one-minute screen such as quantity discrimination.
- Consider using assessments that measure number sense skills with kindergarten and first-grade students to predict which students might have mathematics difficulties.
- Consider rapid, automatic naming of numbers and reverse digit span (a measure of working memory) as valid predictors of mathematics difficulties for first-grade students.
- Be aware that an efficient single-skill screening assessment may not provide information about students' numerical strengths and weaknesses in the way that multiple screening assessments can. Furthermore, a multi-stage screening can increase accurate identification of students at risk for academic difficulty.

References

Baker, S., Gersten, R., Flojo, J., Katz, R., Chard, D., & Clarke, B. (2002). *Preventing mathematics difficulties in young children: Focus on effective screening of early number sense delays* (Tech. Rep. No. 0305). Eugene, OR: Pacific Institutes for Research.

Catts, H. W., Fey, M. E., Zhang, X., & Tomblin, J. B. (2001). Estimating the risk of future reading difficulties in kindergarten children: A research-based model and its clinical implementation. *Language, Speech, and Hearing Services in Schools, 32,* 38–50.

Chard, D. J., Clarke, B., Baker, S., Otterstedt, J., Braun, D., & Katz, R. (2005). Using measures of number sense to screen for difficulties in mathematics: Preliminary findings. *Assessment for Effective Intervention, 30,* 3–14.

Clarke, B., & Shinn, M. R. (2004). A preliminary investigation into the identification and development of early mathematics curriculum-based measurement. *The School Psychology Review, 33,* 234–248.

Fletcher, J. M., Foorman, B. R., Boudousquie, A., Barnes, M. A., Schatschneider, C., & Francis, D. J. (2002). Assessment of reading and learning disabilities: A research-based intervention-oriented approach. *Journal of School Psychology, 40,* 27–63.

Fuchs, L. S., Fuchs, D., & Compton, D. L. (2004). Monitoring early reading development in first grade: Word identification fluency versus nonsense word fluency. *Exceptional Children, 71,* 7–21.

Fuchs, L. S., Fuchs, D., & Prentice, K. (2004). Responsiveness to mathematical problem-solving instruction. *Journal of Learning Disabilities, 37,* 293–306.

Gersten, R., Jordan, N. C., & Flojo, J. R. (2005). Early identification and interventions for students with mathematics difficulties. *Journal of Learning Disabilities, 38*(4), 293–304.

Jenkins, J. R., Hudson, R. F., & Johnson, E. S. (2007). Screening for at-risk readers in a response to intervention framework. *School Psychology Review, 36,* 582–600.

MacGinitie, W. H., MacGinitie, R. K., Maria, K., & Dreyer, L. G. (2000). *Gates-MacGinitie Reading Tests, Fourth Edition, Forms S and T.* Itasca, IL: Riverside Publishing.

Mather, N., Hammill, D. D., Allen, E. A., & Roberts, R. (2004). *Test of Silent Word Reading Fluency: Examiner's manual.* Austin, TX: Pro-Ed.

Seethaler, P. M., & Fuchs, L. S. (2010). The predictive utility of kindergarten screening for math difficulty. *Exceptional Children, 77,* 37–59.

Speece, D. L., Ritchey, K. D., Silverman, R., Schatschneider, C., Walker, C. Y., & Andrusik, K. N. (2010). Identifying children in middle childhood who are at risk for reading problems. *School Psychology Review, 39,* 258–276.

The Psychological Corporation. (1995). *Stanford achievement test* (9th ed.). San Antonio, TX: Author.

Torgesen, J. K. (2002). The prevention of reading difficulties. J*ournal of School Psychology, 40(1),* 7–26.

Vaughn, Sharon, Cirino, Paul T., Wanzek, Jeanne, Wexler, Jade, Fletcher, Jack M., Denton, Carolyn D., Barth, et al. (2010). Response to Intervention for Middle School Students With Reading Difficulties: Effects of a Primary and Secondary Intervention. *School Psychology Review, 39*(1), 3–21.

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