



Predicting reading outcomes with progress monitoring slopes among middle grade students[☆]



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ABSTRACT

Effective implementation of response-to-intervention (RTI) frameworks depends on efficient tools for monitoring progress. Evaluations of growth (i.e., slope) may be less efficient than evaluations of status at a single time point, especially if slopes do not add to predictions of outcomes over status. We examined progress monitoring slope validity for predicting reading outcomes among middle school students by evaluating latent growth models for different progress monitoring measure–outcome combinations. We used multi-group modeling to evaluate the effects of reading ability, reading intervention, and progress monitoring administration condition on slope validity. Slope validity was greatest when progress monitoring was aligned with the outcome (i.e., word reading fluency slope was used to predict fluency outcomes in contrast to comprehension outcomes), but effects varied across administration conditions (viz., repeated reading of familiar vs. novel passages). Unless the progress monitoring measure is highly aligned with outcome, slope may be an inefficient method for evaluating progress in an RTI context.

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1. Introduction

1.1. Predicting reading outcomes with progress monitoring slopes among middle grade students

1.1.1. Assessing response to intervention

Response to intervention (RTI) is an instructional framework that integrates assessment with instruction to “identify students at risk for poor learning outcomes, monitor student progress, provide evidence-based interventions, and adjust the intensity and nature of those interventions based on a student’s responsiveness” (National Center on Response to Intervention, 2010). Successful operationalization of RTI frameworks hinges on the effective use of progress monitoring measures to evaluate intervention response (Vaughn & Fuchs, 2003).

These evaluations are typically conducted by repeatedly assessing achievement with criterion- or norm-referenced progress monitoring measures (Stecker, Fuchs, & Fuchs, 2005).

For reading outcomes, progress monitoring measures may involve timed reading of words or passages, or a Maze procedure in which students provide a missing word to reflect their understanding of a passage. Student progress is typically evaluated relative to grade appropriate standards. Methods frequently used to measure instructional response include: (a) final status; (b) slope-discrepancy; and (c) dual discrepancy (Fuchs & Fuchs, 1998). Using a final status method, instructional response is determined by comparing the student’s observed final status score — that is, the post-intervention progress monitoring score, to an established criterion (e.g., performing below the 25th percentile on a norm-referenced test or below a cut-point on an empirically derived reading benchmark; Good, Simmons, & Kame’enui, 2001; Torgesen et al., 2001). With the slope-discrepancy method, rate of growth (i.e., slope) for an individual student is compared to the rate of growth for a referent group, e.g., of same age peers or classroom. The “dual discrepancy” method considers both slopes as well as final status to determine a student’s response to instruction (Fuchs, 2004; Fuchs & Fuchs, 1998).

Although final progress monitoring status is often used to evaluate instructional response at the end of an intervention period, evaluating initial progress monitoring status may be used at the beginning of the school year to predict how well students are likely to perform by the

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end of the year. This may inform teachers' plans for instruction or specific interventions. If information about slope adds value to either initial or final status or both, then slope may be used in specific ways to make decisions about instruction or response to intervention. However, the utility of these methods depends on how well initial status, final status and/or slope predict outcomes. In particular, the value added of using slope to monitor progress should be critically examined because greater resources (e.g., number and timing of assessments, added teacher training for evaluating slope) are required to use slope in evaluating response. If slope does not add to prediction about student outcomes beyond initial or final progress monitoring status, then initial or final status methods may be preferred over slope-discrepancy and dual-discrepancy methods.

1.2. Predictive validity of slope for reading outcomes

Group level studies of progress monitoring slope have typically focused on psychometric properties of slope or sensitivity of slope for measuring group level differences (Ardoin, Christ, Morena, Cormier, & Klingbeil, 2013). One study evaluated agreement between classifications of students based on progress monitoring slopes and performance on a standardized reading outcome (i.e., Iowa Test of Basic Skills, VanDerHeyden, Witt, & Barnett, 2005). None of these studies evaluated the relation between slope and reading outcomes using a model-based approach. We identified three studies that evaluated the relation between slope and reading outcomes, controlling for status and using model-based approaches (Kim, Petscher, Schatschneider, & Foorman, 2010; Schatschneider, Wagner, & Crawford, 2008; Wanzek et al., 2010). Using passage reading fluency measures, Schatschneider et al. (2008) found that within year slope did not explain unique variance in end-of-year reading achievement when controlling for final progress monitoring status among first grade students. However, Kim et al. (2010) found that within year slope explained unique variance in end-of-year reading achievement when controlling for initial progress monitoring status during first grade, but not during second or third grade among the same cohort of students. In addition, grade 1 but not grade 2 slope predicted grade 3 reading when controlling for initial status. Similarly, Wanzek et al. (2010) found that across year slope from grade 1 through grade 3 predicted likelihood of passing state- and nationally-normed reading tests when controlling for initial (i.e., grade 1) progress monitoring status.

These studies were similar in several ways. All three focused on elementary-age students; the progress monitoring measure (oral reading fluency of connected text) was the same across all three studies; the reading outcomes were measures of reading comprehension in all three studies (i.e., the same measure in Schatschneider et al. and Kim et al., different but state- and nationally-normed tests in Wanzek et al.); initial and final status measures as well as growth were estimated from growth models then entered separately into regression models; and initial/final status and slope were evaluated as predictors of end-of-year reading achievement without controlling for beginning-of-year reading achievement. The primary difference between the studies was whether slope was compared to initial or final progress monitoring status; and the difference in results suggests that the validity of slope as a predictor of reading outcome is influenced by its comparison to *initial versus final progress monitoring status* and by *student age or reading experience level*. These may not be the only factors that influence the predictive validity of slope on reading outcomes. Factors related to the progress monitoring measure may also influence the predictive validity of slope.

1.3. Psychometric issues in progress monitoring: validity and reliability

1.3.1. Validity

If the progress monitoring measure is not a valid predictor of the intended outcome, it is unlikely that progress monitoring slope would be a valid predictor of the outcome. *Alignment between the progress*

monitoring measure and the outcome may be a factor in the predictive validity of the slope. For example, Tolar et al. (2012) found that initial status and final status on a Maze progress monitoring measure (a measure of comprehension and connected text reading fluency) generally correlated more highly with an outcome measure of reading comprehension than one of word list fluency; similarly, Maze slope also correlated more highly with reading comprehension than word list fluency. These results are descriptive because it was not the goal of the study to evaluate the predictive validity of progress monitoring slope on outcomes. However, these findings suggest that, for example, if the reading outcome is reading comprehension, then the slope of a progress monitoring measure of reading comprehension is likely a more valid predictor than the slope of a progress monitoring measure of word list fluency.

A factor that may uniquely influence the predictive validity of slope (as compared to the predictive validity of initial or final status), is the *alignment between method of measuring progress and the method of measuring outcome* (i.e., progress monitoring growth may be a better predictor of outcome gains than final outcome alone). None of the three studies described above (Kim et al., 2010; Schatschneider et al., 2008; Wanzek et al., 2010) controlled for beginning-of-year reading in evaluating the effect of progress monitoring slope on end-of-year reading.

1.3.2. Reliability

Statistically, the validity of a measure is no better than its reliability. Slope reliability is likely to be lower than intercept (e.g., initial or final status) reliability. For example, in Schatschneider et al. (2008), final status reliability was .97 whereas slope reliabilities were .81 (linear model) and .57 (quadratic model). However, even with low reliability, slope may be a better predictor than initial or final status if there are factors affecting the predictive power of progress monitoring status. Schatschneider et al. (2008), Kim et al. (2010), and Wanzek et al. (2010) used a measure of oral reading fluency to index growth (DIBELS ORF; Good, Kaminski, Smith, Laimon, & Dill, 2001). At the beginning of the school year, there are large floor effects in DIBELS ORF performance among first grade students, but these floor effects diminish substantially by the end of first grade and are minimal at the beginning of second grade (Catts, Petscher, Schatschneider, Bridges, & Mendoza, 2009). Floor effects diminish the ability of initial progress monitoring status to predict reading outcomes. Floor effects in initial status but highly reliable final status (especially relative to slope reliability) may be why DIBELS ORF slope was a significant predictor of reading outcomes when controlling for initial status (Kim et al., 2010; Wanzek et al., 2010) but not when controlling for final status (Schatschneider et al., 2008).

The same phenomenon may occur if there are ceiling effects in final progress monitoring status. Although the presence of floor or ceiling effects may be an indicator of the quality of the progress monitoring measure, it is also possible that as students are beginning to learn a skill (e.g., initial status among younger students) or plateauing in a well-developed skill (e.g., final status among older students), slope may be a more valid predictor of reading outcome than progress monitoring status. As described before (see Section 1.2), *age or reading experience level* may be a factor in the predictive validity of slope on reading outcomes. Regardless of the context (initial/final status is a good or poor predictor of outcome), the more reliable the measure of slope, the more likely it will be a good predictor of outcome.

A key factor that affects slope reliability is form effects. Alternate forms (e.g., different passages or word lists) are frequently used across assessments in progress monitoring. Differences in difficulty level across forms significantly alter the shape of students' growth trajectories and influence growth rate estimates (Betts, Pickart, & Heistad, 2009; Christ & Ardoin, 2009; Francis et al., 2008). As a consequence of these form effects, measurement error may exceed observed rates of change in observed oral reading fluency performance (Christ, 2006). The simplest way to control for form effects is by using the same form

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