



# Accurate reading comprehension rate as an indicator of broad reading in students in first, second, and third grades<sup>☆</sup>

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## ABSTRACT

The relationship between reading comprehension rate measures and broad reading skill development was examined using data from approximately 1425 students (grades 1–3). Students read 3 passages, from a pool of 30, and answered open-ended comprehension questions. Accurate reading comprehension rate (ARCR) was calculated by dividing the percentage of questions answered correctly (%QC) by seconds required to read the passage. Across all 30 passages, ARCR and its two components, %QC correct and time spent reading (1/seconds spent reading the passage), were significantly correlated with broad reading scores, with %QC resulting in the lowest correlations. Two sequential regressions supported previous findings which suggest that ARCR measures consistently produced meaningful incremental increases beyond %QC in the amount of variance explained in broad reading skill; however, ARCR produced small or no incremental increases beyond reading time. Discussion focuses on the importance of the measure of reading time embedded in brief accurate reading rate measures and directions for future research.

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## 1. Introduction

To establish norms and determine eligibility for remedial reading services, numerous response-to-intervention (RtI) models include administrations of brief reading rate measures to almost every elementary student (Hughes & Dexter, 2011). More frequent administrations of brief reading rate measures may be used to evaluate remedial procedures and assist with making decisions such as whether to (a) return the student to the standard curricula; (b) maintain, adapt, or cease specific remedial procedures; and/or (c) provide access to more intensive educational services, including special education services (Deno, 1985; Shapiro, 2011). Given these decisions that educators may make based on brief reading rate measures, researchers have attempted to evaluate and improve these measures (Christ & Ardoin, 2009; Christ & Silbergliitt, 2007; Poncy, Skinner, & Axtell, 2005).

Although researchers have developed and evaluated a variety of brief reading rate assessment procedures (Neddenriep, Poncy, & Skinner, 2011; Parker, Hasbrouck, & Tindal, 1992; Skinner, 1998; Tichá, Espin, & Wayman, 2009), oral reading fluency measures, also referred to as accurate reading rate (ARR) measures, have been the focus of numerous psychometric studies (Marston, 1989; Reschly, Busch, Betts, Deno, & Long, 2009). During ARR assessments, students read passages aloud, often for 1 min, as the assessor provides prompts when necessary (e.g., providing the word after a 3 s pause) and scores errors (e.g., words skipped or read incorrectly). When

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time spent reading is not held constant (e.g., students read an entire passage), data used to calculate an ARR measure ( $ARR = \text{words read correctly} / \text{time spent reading}$ ), can be converted to a common metric of words read correctly per minute (WCPM). Numerous concurrent validity studies conducted across measures suggest that WCPM is an acceptable indicator of broad reading skill development (Fuchs & Deno, 1992; Fuchs, Fuchs, Hosp, & Jenkins, 2001; Hintze, Shapiro, Conte, & Baasile, 1997; Jenkins & Jewell, 1993; Marston, 1989; Reschly et al., 2009; Shinn, Good, Knutson, Tilly, & Collins, 1992). The association between ARR, broad reading skill development, and reading comprehension is also supported by theory. Empirically-supported theories regarding attention and working memory limitations suggest a causal link between reading fluency and comprehension (LaBerge & Samuels, 1974; Perfetti, 1977; Topping, 2006). Research on choice, schedules of reinforcement, effort, and practice support a different causal mechanism that suggests more fluent readers are more likely to choose to read, which should enhance their broad reading skills and comprehension (Skinner, 1998; Stanovich, 1986).

The support for ARR measures must be considered in light of limitations associated with these measures. Researchers have found evidence that WCPM scores may be very sensitive to: (a) differences in probes or passages (Christ & Ardoin, 2009; Francis et al., 2008; Poncy et al., 2005); (b) students' perception of how they are supposed to read (Christ, White, Ardoin, & Eckert, 2013; Colón & Kranzler, 2006; Derr-Minneci & Shapiro, 1992; Forbes et al., in press); and (c) minor inconsistencies in administration and scoring (Christ & Silbergliitt, 2007). These factors may introduce both systematic and random error, which can hinder educators' ability to make decisions based on these data (Forbes et al., in press). In particular, these limitations that introduce error can make it difficult to evaluate within student growth or responsiveness to interventions (Christ & Ardoin, 2009). Also, researchers have raised concerns with the indirect nature of ARR (Paris, Carpenter, Paris, & Hamilton, 2005; Skinner et al., 2009). Some have suggested that ARR does not directly measure functional reading skills, in part, because it does not include a measure of comprehension (Chall, 1983; Samuels, 2007; Skinner, 1998). Finally, ARR scores may be a less sensitive measure of broad reading skill development in more advanced readers (Jenkins & Jewell, 1993).

To some degree, alternative brief reading rate measures such as MAZE, CLOZE, and accurate reading comprehension rate (ARCR; see Table 1 for a description of these measures) may address concerns related to measuring comprehension (Parker et al., 1992; Skinner, 1998; Tichá et al., 2009). MAZE and CLOZE assessments are similar in that students read passages where they must either supply (CLOZE) or select (MAZE) the correct word at predetermined intervals. With MAZE, every *n*th word (e.g., every seventh word) is replaced with three options, the deleted word and two distracter words. With CLOZE, every *n*th word is replaced with a blank space for students to write or supply the missing word. MAZE and CLOZE rate measures are calculated by dividing the number of words correctly supplied (CLOZE) or selected (MAZE) by time spent reading (e.g., reading speed), which can be converted to a measure of words correct (i.e., correctly selected or inserted) per minute. These assessments can be administered in a group format (e.g., class wide) as students read silently for a fixed period of time, and researchers have found evidence that they are acceptable indicators of global reading (e.g., Jenkins & Jewell, 1993; Parker et al., 1992; Tichá et al., 2009).

Although a student's ability to supply or select missing words would appear to be more related to comprehension than to their ability to read words aloud (Wayman, Wallace, Wiley, Tichá, & Espin, 2007), accurate responding to MAZE or CLOZE assessments may not require high levels of passage comprehension (January & Ardoin, 2012). ARCR measures may provide a more direct measure of passage comprehension than MAZE, CLOZE, or ARR (Skinner, 1998; Skinner et al., 2009). To assess ARCR, students read passages aloud and if the student pauses too long or loses his or her place in the passage, ARR procedures are applied and the assessor prompts them along. When the student finishes the completed passage, the assessor records the seconds required to read the entire passage. The student then answers a set of comprehension questions related to the passage. Because it would be difficult to assess passage comprehension unless the student read the entire passage, students must read the entire passage before comprehension questions are administered (Skinner et al., 2009).

An ARCR measure is calculated by dividing the percentage of comprehension questions answered correctly (%QC) by the seconds spent reading the passage. This rate measure can then be converted to a per minute measure (i.e., 60 s in denominator) which provides an estimate of how much of the passage was comprehended for each minute spent reading (Skinner, 1998; Skinner, Neddenriep, Bradley-Klug, & Ziemann, 2002). Researchers have found that ARCR correlates with global reading skill development (Hale et al., 2011; Neddenriep, Skinner, Hale, Oliver, & Winn, 2007) and, at least in some instances, is sensitive enough to detect intervention effects (Freeland, Skinner, Jackson, McDaniel, & Smith, 2000; Hale et al., 2005; McDaniel et al., 2001; Ridge & Skinner, 2011).

**Table 1**  
Description of Brief Reading Rate Measures.

|                                                            | Numerator<br>Accuracy measure                           | Denominator<br>Reading time measure | Rate Measure<br>Accuracy/reading time |
|------------------------------------------------------------|---------------------------------------------------------|-------------------------------------|---------------------------------------|
| Accurate reading rate (ARR)                                | Word read correctly (WRC)                               | Seconds to read                     | $\frac{WRC}{\text{Seconds to read}}$  |
| MAZE                                                       | Correctly selected words (CSW)                          | Seconds to read                     | $\frac{CSW}{\text{Seconds to read}}$  |
| CLOZE                                                      | Correctly inserted words (CIS)                          | Seconds to read                     | $\frac{CIS}{\text{Seconds to read}}$  |
| Accurate reading comprehension rate (ARCR) – select answer | % comprehension questions correct (%QC) – select answer | Seconds to read                     | $\frac{\%QC}{\text{Seconds to read}}$ |
| Accurate reading comprehension rate (ARCR) – supply answer | % comprehension questions correct (%QC) – supply answer | Seconds to read                     | $\frac{\%QC}{\text{Seconds to read}}$ |

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