

Construct Identification to Support Early Literacy Measurement

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Response to Intervention (RTI) is a model of educational assessment and intervention that is increasingly being implemented in U.S. schools (Berkeley, Bender, Peaster, & Saunders, 2009; Walker & Shinn, 2010). The approach is a paradigm shift from the traditional model of waiting for students to perform so poorly that they qualify for special education services, to a model in which student performance is monitored frequently and intervention is provided immediately – upon demonstration of need - to prevent early delays from becoming disabilities (Greenwood, et al, in press).

Within the RTI framework, instructional interventions are differentiated to match individual student need (Gersten et al., 2008). Instructional decision making is based upon a measurement framework that begins with universal screenings of all children on multiple occasions throughout the school year. These screenings allow teachers to identify children not making expected rates of short-term progress who may likely require more intensive intervention. Children receiving more intensive levels of intervention are then monitored more frequently to determine the effect of the intervention on their rate of progress (DEC, 2007; Fuchs & Fuchs, 2007).

Measures appropriate for instructional decision making in RTI need to be able to accurately differentiate between children who are performing at an adequate level in a given skill area versus children who are not and could benefit from more intensive intervention. To be used for monitoring progress, these measures also need to be sensitive to changes in children's skill growth over relatively short periods of time, so educators can evaluate the effect of an implemented intervention and make decisions about the appropriateness of a given level of intervention (Greenwood, Carta, et al., 2008). The Individual Growth and Development Indicators (IGDIs) are measurement tools appropriate for early childhood RTI applications specific to the domain of early literacy (Carta, Greenwood, Walker, & Buzhardt, 2010; Greenwood, Carta, et al., 2008; McConnell & Missall, 2008).

The Early Language and Literacy Individual Growth and Development Indicators (or IGDIs) are a widely implemented and broadly supported set of measures that have demonstrated utility in language and early literacy assessment, evaluation, and intervention studies (Greenwood et al., 2008; McConnell & Missall, 2008; Cadigan & Missall, 2007; Hojnoski & Missall, 2006; Hojnoski & Missall, 2009; Missall, Carta, McConnell, Walker, & Greenwood, 2008; Missall, McConnell, & Cadigan, 2006; Missall et al., 2007). The IGDIs were originally developed as General Outcome Measures (GOMs; Deno, 1997; Fuchs & Deno, 1991; McConnell, Priest, Davis, & McEvoy, 2002), a specific category of measurement tools that are: 1) brief and easy to collect, 2) easily interpretable, 3) inexpensive, 4) related to important long-term outcomes and 5) repeatable. K-12 RTI models typical use GOMs to inform identification and progress monitoring decisions (e.g. *DIBELS*, Curriculum-based Measurement; Deno, 1997; Fuchs & Deno, 1991; Fuchs & Fuchs, 2007).

The first generation of IGDIs demonstrated adequate psychometric properties as well as high feasibility and utility (McConnell, Missall, Rodriguez & Wackerle-Hollman, 2010), however, existing design flaws limit their use in EC RTI models. Standardized administration instructions for IGDIs 1.0 specify that, for a given measure, the entire set of items be randomly shuffled prior to each administration, without knowledge of the difficulty or discrimination of any given item. This randomization process limits one's ability to make valid inferences as to the level of ability a child has based on the raw score obtained from these measures. Further, the design of test formats,

procedures and scoring were not based on a specific measurement model, further limiting the psychometric evidence of score quality for this first generation of IGDIs.

Under the auspices of the Center for Response to Intervention in Early Childhood (CRtIEC), targeted work has been done to build upon the strengths of the first generation of IGDIs to produce more empirically robust and precise tools that can be used to support an EC RtI model. This work presented a unique challenge: to develop test formats that are both brief, easy, and repeatable but are also full realizations of the identified constructs.

To accomplish this task, the measure development team adopted Wilson's (2005) model, which is based on four building blocks, including the construct map, item design, outcome space, and measurement model. The construct map defines both the construct and its form. Wilson promotes simple measurement forms that allow immediate inference to the amount of the trait an individual possesses. To arrive at a fully developed map of our intended construct, an extensive literature review process was initiated.

It is well agreed upon within the literature that the four essential domains of language and early literacy development are: (a) oral language; (b) alphabetic knowledge and print awareness; (c) phonological awareness and skill; and (d) comprehension (NELP, 2008; Snow et al., 1998; Whitehurst & Lonigan, 1998; Adams, 1990; Sénéchal, et al., 2001). While some degree of overlap may exist across these domains, they are distinct enough that each domain is best represented as a unique construct within the broader construct of early literacy development.

In concordance, four separate literature reviews were conducted, to allow for in-depth examination of each key construct. The reviews were conducted in a two-step process, the first an examination of the literature to result in an operation definition of the construct, and the second an examination of existing standardized, norm-referenced measures of these domains, to explore how other test developers had realized the forms of these constructs.

Method

Literature Review to Inform Operational Definition of Constructs

General review methods included the following criteria: articles were published in a peer-reviewed journal; written between 2006 and 2008; had a target sample of children ages 3-6 years and used English as the primary language. Articles including samples composed of primarily children with special needs were not included.

Oral language. A keyword search using, "oral language", "vocabulary", "expressive language", and "receptive language" was completed using Academic Search Primer, EBSCO Host, and Psych Info. Four articles were selected based on the review criteria previously described. The articles varied in their precise definition of oral language, but common elements emerged including a distinction between expressive language and receptive language and a distinction between vocabulary and grammar (Morgan & Meier, 2008; Mol, Bus, De Jong, & Smeets, 2008; Coyne, McCoach, and Kapp, 2007). Synthesis of the articles revealed oral language may be best defined as the ability to use words to communicate ideas and thoughts and to use language as a tool to communicate to others (Roskos, Tabors, & Lenhart, 2004). Specific definitions for expressive language and receptive language were also selected from the literature reviewed. Expressive language can be defined as the use of words to express meaning and receptive language can be defined as ability to listen, process, and understand the meaning of spoken words (Morgan and Meier, 2008).

Phonological awareness. A keyword search using, "phonological awareness" and "phonemic awareness" was completed using Education Full Text and Psych Info. Nine articles

were selected based on the review criteria previously described. Articles reviewed contained a variety of definitions of phonological awareness, with common elements including an understanding that words are made up of individual and the ability to recognize and manipulate sounds. Synthesis of the articles revealed phonological awareness may be best defined as the ability to detect and manipulate the sounds structure of words independent from their meanings (Phillips, Clancy-Menchetti, & Lonigan, 2008).

Alphabet knowledge. A keyword search using, “alphabet knowledge”, “letter knowledge”, “print awareness” and “print concepts” was completed using Psych Info. Forty-nine articles were selected based on the review criteria previously described. In addition, works of well-established literacy researchers (e.g., Susan Neuman, Monique Sénéchal, Grover Whitehurst) were examined for theoretical models of the development of alphabet and print knowledge from preschool to early and later elementary school. Articles reviewed demonstrated general concordance among researchers regarding how to define or measure alphabet knowledge. A common definition was chosen: knowledge about the names and sounds of the 26 letters of the alphabet (McBride-Chang, 1999).

Comprehension. Operationally defining the construct of comprehension in preschool age children is a tremendous challenge. Because of its overlap with oral language development in children of this young age, researchers are hard pressed to define, much less determine appropriate formats with which to measure comprehension prior to the age at which children acquire fluent narrative capacity. For instance, children need to have sufficient vocabulary knowledge in order to understand spoken phrases and to glean meaning from stories and interactions (Whitehurst & Lonigan, 1998). Thus, when designing a measure, it is difficult to determine the point at which the skill transitions from being primarily one of oral language development to pure comprehension ability. To address this challenge, our team determined that the best recourse was to conduct an extensive literature review and use convergence of evidence to arrive at a preliminary operational definition of comprehension which could be later verified through measure development and field testing.

To conduct the review, a keyword search using, “reading comprehension”, “discourse”, “listening”, “narrative comprehension”, “text comprehension”, “passage comprehension” and “story comprehension” was completed using Psych Info. Thirty-three articles were selected based on the review criteria previously described. In addition, works of well-established early literacy researchers were examined for theoretical models of the development of reading comprehension from preschool to early and later elementary school. Articles reviewed contained a variety of definitions of comprehension, with common elements including comprehension of written text and comprehension of spoken language. Synthesis of the articles suggested that comprehension appears to be comprised of two distinct skills: text comprehension and listening comprehension.

Text comprehension is defined as the ability to understand and interpret text as a whole (Storch & Whitehurst, 2002). Listening Comprehension is defined as the ability to understand and interpret spoken phonemes, words, phrases, sentences, narratives, and stories (Dickinson & Smith, 1994; Skarakis-Doyle, Dempsey, & Lee, 2008). However, these definitions do not encompass the full construct of comprehension in preschoolers. To fully comprehend, one not only understands the presented information, but also uses the information to make an inference. Inferencing is defined as a child’s capacity to use his accumulation of knowledge to fill in information that is left out (Kendeou, Bohn-Gettler, White, & Van den Broek, 2008; Van Kleeck, 2008). As such the most valid definition of text comprehension for preschool aged children is: the recognition of pictures and symbols and the ability to interpret and infer meaning from what is seen (Dunst, Trivette,

Masiello, Roper, & Robyak, 2006). Similarly, listening comprehension is defined as: the ability to understand and interpret what is spoken aloud and infer meaning from what is heard (Skarakis-Doyle, Dempsey, & Lee, 2008)

Literature Review to Investigate Construct Forms

In order to fully specify the form of each construct, it is important to determine aspects of the construct that are measurable for preschool children. This includes not only identifying construct relevant tasks or behaviors that are observable and measurable, but which are also appropriate for preschoolers, meaning brief, engaging, and within a preschoolers ability range. In addition, to ensure that the measure has high utility within an EC RtI model, the form also needs to be easy to administer, score, and interpret; standardized; repeatable; and related to important long-term outcomes. With these criteria in hand, a second literature review was conducted to examine how these constructs had been realized by other test developers and then compare those forms against our own development criteria to arrive at a robust form for each of our constructs.

Oral language. A review of current oral language measures yielded 11 measures targeting tasks associated with oral language, expressive and receptive language. Tests included: *The Test of Preschool Early Literacy* (TOPEL; Lonigan, Wagner, Torgensen, & Rashotte, 2007); *Hundred Pictures Naming Test* (Fisher & Glenister, 1997); *IGDIs 1.0* (Early Childhood Research Institute-Measuring Growth and Development, 1998); *Clinical Evaluation of Language Fundamentals – Preschool, second edition* (CELF-Preschool 2; Wiig, Secord & Semel, 1992); *Receptive One-Word Picture Vocabulary Test* (ROWPVT; Gardener, 2000); *Expressive One-Word Picture Vocabulary Tests - III* (EOWPVT-III; Gardener, 2000); *Peabody Picture Vocabulary Test - IV* (PPVT-IV; Dunn & Dunn, 2007), *Preschool Language Scale-IV* (PLS-IV; Zimmerman, Steiner, & Pond, 2002); *Oral Written and Language Scales* (Carrow-Woolfolk, 1995); *Test of Language Development - Primary: 3rd Edition* (TOLD- Primary III; Hammil & Newcomer, 1997); and *Preschool Comprehensive Test of Phonological and Print Processing* (Pre-CTOPP; Lonigan, Wagner, Torgensen, & Rashotte, 2002).

Based on this review, it was determined that a child's knowledge of vocabulary is a central aspect of oral language development that meets our specified criteria for defining the form of the construct. Vocabulary knowledge ability can be captured in a number of ways, including formats that tap both a child's receptive and expressive vocabulary. The next paper in this series will further describe the task and item development process that moves this construct form into actual test materials and procedures (Wackerle-Hollman, et al., 2011).

Phonological awareness. A review of current phonological awareness measures yielded seven measures including: *DIBELS* (Good, Kaminski, Moats, Laimon, Smith & Dill, 2003); *IGDIs 1.0* (ECRI-MGD, 1998; Cadigan, 2008); *Phonological Awareness Test 2* (PAT-2; Robertson & Salter, 1995), *Pre-Reading Inventory of Phonological Awareness* (PIPA; Dodd, Crosbie, McIntosh, Teitzel & Ozanne, 2003); *Test of Phonological Awareness 2nd Edition* (TOPA 2+; Torgesen & Bryant, 2004); *TOPEL* (Lonigan et al., 2007); *Woodcock-Johnson III(R) Test of Achievement* (WJ-ACH-III-R; Woodcock, McGrew & Mather, 2001).

Based on this review, several aspects of phonological awareness emerged as potential forms of the construct: rhyming, alliteration, syllable segmenting, and sound blending. The next paper in this series will further describe the task and item development process which considers the different methods by which children's ability of these forms of the construct can be captured.

Alphabet knowledge. A review of current alphabet knowledge measures yielded three standardized measures, including: *DIBELS- Letter Naming Fluency*, *DIBELS Letter Sound Fluency*

(Good et al., 2003), and the *WJ-ACH-III-R Word Identification Subtest* (Woodcock et al., 2000). It is important to note that few standardized measures of alphabet knowledge could be located, potentially because of the ease of assessment using curriculum based materials rather than standardized assessment materials. However, the review indicated that the most valid form of the alphabet knowledge construct is a child's ability to demonstrate knowledge of the names and corresponding sounds of the 26 letters of the alphabet. The next paper in this series will further describe the task and item development process which considers the different methods by which this ability can be captured.

Comprehension. Theoretically, listening comprehension is demonstrated when children answer and ask questions, follow directions, predict story events, interpret the meaning of a story, and relate information to their life experiences (Dunst et al., 2006). However, few have managed to develop methods to reliably and validly assess these skills in preschool age children. A review of current comprehension measures yielded three measures, including: *Test for Auditory Comprehension of Language – Third Edition* (TACL-3; Carrow-Woolfolk, 1999), *The Renfrew Bus Story* (Cowley & Glasgow, 1994) and the expectancy violation detection task developed by Skarakis-Doyle and colleagues (2008).

Across these three measures, similar tasks were used in an attempt to capture children's comprehension ability. These included: asking children to choose the picture associated with verbally presented stimuli, story retell with and without verbal cloze prompts, and asking a child questions about a story after it had been read to him (Cornell, Sénéchal, & Broda; Skarakis-Doyle et al., 2008). As such, these tasks were all considered as potential forms of the comprehension construct. The next paper in this series will further describe the task and item development process by which these specific tasks were further developed and refined to meet our original development criteria.

Based on Wilson's model of measure development, we developed construct maps for the four essential domains of early literacy development: oral language, alphabet knowledge, phonological awareness and comprehension. These construct maps contain both the operational definition of the construct and indicate the essential form of the construct. The next paper in this series will discuss how these building blocks contributed to further task development and item creation.

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