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Construct and incremental validity of dynamic assessment of decoding within and across domains☆

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ABSTRACT

In contrast to conventional static assessments measuring what students *have* learned, dynamic assessments (DAs) measure how well students *can* learn; that is, their learning potential. The purpose of this study was two-fold: (a) to test whether DA of decoding measures learning potential for early reading that is distinct from what can be assessed from static intelligence and decoding assessments (construct validity); and (b) to examine the additive value of DA of decoding for explaining word reading and arithmetic performance beyond that which can be explained with static measures (incremental validity). First grade students ($N = 112$) were assessed on DA of decoding and various measures from reading- to math-related predictors as well as domain-general learning indicators. Confirmatory factor analyses supported that DA of decoding measures early reading learning potential different from general intelligence and actual decoding skill. Structural equation models showed that DA of decoding was necessary in explaining concurrent decoding skill beyond domain general learning measures and predictors of reading. DA was not a significant predictor of word recognition and arithmetic performance suggesting that early reading learning potential measured by DA of decoding was not generalizable across domains.

We often encounter children who perform similarly on an assessment but require different amounts of support to reach the desired competence level. Children's cognitive abilities can be fully understood by recognizing the two developmental levels (Vygotsky, 1934/1962): the *actualized* and the *actualizing*. The actualized abilities are seen as those that are complete and fully developed, reflecting what children have learned in the past, whereas the actualizing abilities are those that are not yet fully developed but can become actualized in the future via interaction with more advanced individuals. The gap between the two is referred to as the zone of proximal development (ZPD).

Conventional assessments measure children's independent performance. This method is suited for assessing phenomena that are static in nature, such as the zone of actual development. An alternative approach is to use dynamic assessment (DA). DA is an umbrella term for assessment procedures that embed interaction between the examiner and examinee within the test (Lidz & Elliott, 2000). Interaction is embedded either in a form of instruction or in a sequence of progressively explicit prompts. How children respond to such instruction then serves as a measure of their learning potential (i.e., ZPD). Thus, whereas static assessments measure what has already been learned, DA estimates learning potential, which is how well an individual can learn given assistance. Because DA was developed as a tool to measure learning potential, a distinct construct from what is measured in static assessments, it is believed to provide an additional information about academic achievement beyond what can be gathered from static assessments alone (for a comprehensive DA review, see Elliott, 2003; Grigorenko & Sternberg, 1998; Guthke, 1992). In this study, we incorporated decoding instruction into DA to measure early reading learning potential with a hope that DA of decoding could aid early identification of students who may later develop reading difficulties. As a first step, we examined whether decoding DA measures early reading learning potential that is distinct from statically measured general intelligence and actual decoding skill (construct validity). We also evaluated DA of decoding's additive value in explaining concurrent word reading and arithmetic outcomes (incremental validity within and across domains).

1. The validity of DA

Several different approaches to DA exist, some of which includes learning potential assessment device (Feuerstein, 1979), graduated

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prompts (Campione & Brown, 1987), testing the limits (Carlson & Wiedl, 1979), learning potential assessment (Budoff, 1967), and learning tests (Guthke, 1992). These approaches differ in various dimensions such as the format and the nature of interaction, and the materials being used in DA. The test-teach-retest format typically incorporates individualized interaction with a blocked scheduling of instruction between pre- and posttest to index the improvement on the posttest. Alternatively, the graduated prompts approach uses progressive scheduling of a predetermined hierarchy of prompts and assesses the amount of help students require to master the skill. With the ease associated with using standardized prompts, the graduated prompts approach has been widely accepted by researchers in school settings interested in academic achievement for screening and identification of students with special needs (Daniel, 1997; Laughon, 1990). In terms of test materials, traditional approach used items adopted from traditional intelligence tests whereas recently developed DA studies tend to focus on domain- and curriculum-specific procedures (Guthke, 1992).

Although the diversity in the field of DA allows a flexible application of DA to education and psychology, it also brings challenges because there is no single definition for what DA measures (Caffrey, Fuchs, & Fuchs, 2008; Grigorenko, 2009; Jitendra & Kameenui, 1993). Conceptual similarity between learning potential and intelligence adds to the confusion as well (Elliott, 2003; Murphy, 2011). They are both commonly defined as an ability to learn from instruction/experience or efficiency in learning. Then, it is possible that the two constructs, learning potential and intelligence, may not be qualitatively different (Grigorenko & Sternberg, 1998). If they are, in fact, similar, we might be using two terms to refer to a single construct and traditional static intelligence tests may be under-representing the construct of ability to learn. They only measure the product of learning (Beckmann, 2006). Thus, for a DA to prove its utility in educational setting, it first needs to show that learning potential measured by DA is qualitatively different from information gathered from static assessments including traditional intelligence test. Secondly, DA needs to show incremental validity for explaining academic achievement by showing its value above and beyond currently used predictors. This would establish the degree to which DA might be practically useful. Because DA has been criticized for being labor intensive in administration (Jitendra & Kameenui, 1993), if it does not add a significant amount of information to the existing measures in explaining students' academic performance, the benefits of DA may not outweigh its costs.

2. Prior DA studies examining the construct and incremental validity

To contextualize the present study, two lines of DA research that utilize the graduated prompts format using academic tasks are reviewed. First, prior research examining the construct validity of DA in relation to intelligence and/or to the same ability measured statically using factor analytic methods is reviewed. Second, results from previous studies that have explored the incremental validity of DA for explaining basic word reading are reviewed.

2.1. Empirical evidence of the construct validity

Three studies were identified that used factor analytic methods to validate DA as a distinct construct from constructs measured with static assessments, including intelligence (i.e., Fuchs et al., 2008; Fuchs, Compton, Fuchs, Bouton, & Caffrey, 2011; Swanson & Howard, 2005). In Fuchs et al.'s (2011) study, students were asked to master three common decoding patterns and provided with instructional prompts that gradually became explicit. Using exploratory factor analysis the authors found that DA and static intelligence and language assessments measure similar cognitive processes. However, because of its exploratory approach, it did not allow us to empirically test the hypothesis as to whether DA measures a unique construct of learning potential. Others have used confirmatory approach but not in the area of reading. Swanson and Howard (2005) provided support for DA of phonological and semantic working memory as a tool for measuring learning potential distinct from static working memory and verbal IQ. However, the authors did not compare their hypothesized factor model with other competing models. Fuchs et al. (2008) used DA of math and tested several competing measurement models using structural equation modeling thus adding stronger empirical support to the construct validity of DA. Overall, given the small number of studies that differ in various dimensions, limited empirical evidence exists to suggest that DA of academic tasks measures learning potential as a construct that is distinguishable from what can be measured by static assessments, including intelligence.

2.2. Empirical evidence of the incremental validity

The prior studies suggest that DA of early reading measures have incremental validity in explaining or predicting word reading and its growth. DA of phonological awareness (PA) predicted later word reading; controlling for only one other static PA measure (Bridges & Catts, 2011) or language and three other PA measures (Spector, 1992). DA of decoding predicted later word reading and word reading growth in response to phonics-based reading instruction controlling for a wide range of competing predictors including PA, rapid automatized naming (RAN), and IQ (Cho, Compton, Fuchs, Fuchs, & Bouton, 2014; Fuchs et al., 2011). Although the consistent findings across these studies are that DA was a significant predictor of word reading skills, the amount of variance uniquely explained by DA was small, particularly when DA's incremental validity was tested against multiple competing predictors (2–3%). Similarly, except for the studies that used DA of decoding, the majority of these studies have mainly focused on comparing DA to its static version or to a small set of competing predictors, which may overstate the utility of DA.

3. Research questions

Research question 1. Does DA of decoding measure early reading learning potential distinct from static measures of intelligence and decoding?

Research question 2. Does DA of decoding have incremental validity in explaining word reading skills beyond what can be explained by the known predictors of reading and domain-general learning indicators?

Research question 3. Does DA of decoding have incremental validity across domains?

4. Method

4.1. Participants

A convenience sample of 112 native English speaking first grade students from 6 schools and 20 classrooms participated in this study. Standardized reading and math assessment scores suggest that the sample was representative in terms of reading and math performance (Table 1). Demographic information of the participants is summarized in Table 1.

4.2. Measures

4.2.1. Dynamic assessment of decoding

Three essential skills required for decoding development were assessed in the DA: learning novel symbol-sound correspondence, blending sounds, and inferring decoding rule. We used the novel symbols instead of alphabet to measure the process of learning to read, which is less impacted by their prior reading level. Also, pairing of new orthography with sounds is a type of paired associative learning

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