Dynamic Indicators of Basic Early Literacy Skills: An Effective Tool to Assess Adult Literacy Students?

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ABSTRACT

This study examined the reliability and validity of administering Dynamic Indicators of Basic Early Literacy Skills (DIBELS) to adult basic education (ABE) students. Ninety ABE participants were administered DIBELS measures, the Woodcock-Johnson III Broad Reading (WJ III BR) measures, and four orthographic ability tests. Since ABE students are a heterogeneous group with respect to language background, all analyses were performed on the entire sample and then repeated using only native English speakers and again on all non-native English speakers. The measures were found to be reliable for all participant groups. In a regression analysis, a significant portion of the variance in the reading ability of adults on the WJ III BR was explained by the DIBELS and orthographic predictors. Results of this study indicate that DIBELS measures have the potential to be effective tests to measure adult learners' reading achievement; however, additional measures of orthographic knowledge may be required to account for compensatory strategies adults might employ.

INTRODUCTION

According to the National Assessment of Adult Literacy, approximately 130 million Americans (43%) are unable to perform basic reading tasks (Kutner et al., 2007). Research demonstrates that adult basic education (ABE) programs can improve employment and earnings prospects for adults with low literacy and can decrease the percentage of participants receiving welfare benefits (Beder, 1999; Kutner et al., 2007; Reder & Bynner, 2009). These programs foster a better self-image and can help ABE students reach their personal and educational goals, including acquiring a General Educational Development (GED®) credential (Beder, 1999; Lipnevich & Beder, 2007). Additionally, ABE programs improve parents' participation in their children's education, indicating that intergenerational effects on education are also possible (Beder, 1999; Kutner et al., 2007).

LITERATURE REVIEW

While a large body of literature exists on the best ways to instruct children, much less information is available regarding how best to instruct adults in literacy (Kruidenier, 2002; National Institutes of Child Health and Human Development, 2004). As a result, many of the assessment and intervention materials used in ABE programs are based upon what is known about children. However, adult and child learners may not acquire literacy skills in the same way (Greenberg, Ehri, & Perrin, 1997, 2002; Nanda, Greenberg, & Morris, 2010; Thompkins & Binder, 2003). In fact, several studies indicate that they differ in critical aspects of word recognition (Greenberg et al., 1997, 2002; Thompkins & Binder, 2003). Thus, more research is necessary to address the unique learning needs and reading behavior of adult learners.

Recent analyses and critiques of ABE instruction and evaluation have pinpointed the need to tailor instruction

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A table of summary data including means, standard deviations, and range of scores is available from the first author at kbinder@mtholyoke.edu

to adult needs by means of assessment (Comings, Beder, Bingman, Reder, & Smith, 2003; Comings, Garner, & Smith, 2000). Through frequent testing, adult literacy students' progress can be tracked and the curriculum modified accordingly (Strucker, Yamamoto, & Kirsch, 2007). Greater student gains are found in children's classrooms where teachers use assessment for instructional purposes, compared to classrooms where no assessments of student progress are used (Dochy, Segers, & Buehl, 1999). Teachers who use assessment have a greater understanding of their students' needs and can focus instruction accordingly (Dochy et al., 1999). Therefore, an optimal assessment tool for ABE students would track their progress and guide instruction.

Current assessments from the National Reporting System's list of federally approved tests for adult learners are problematic. These tests provide program evaluations but are not intended to guide instruction, and they are ineffective intervention tools. One such widely used assessment is the Tests of Adult Basic Education (TABE) (CTB McGraw Hill, 1994). In Massachusetts, the Department of Education mandates administration of the TABE three times per year at all ABE sites.

The TABE provides a general indication of individual performance through the assignment of grade level, percentile, and standardized scores. It does not provide information regarding students' strengths and weaknesses in basic word-decoding skills, and it fails to account for compensatory strategies such as use of context or orthographic cues (i.e., the spelling patterns of the language) that adults might employ (Stanovich, 1980). The TABE, therefore, cannot provide meaningful information to guide instruction in early literacy skills (Shepard, 1991; Wiggins, 1992) despite a total administration time of 90 minutes for reading, language, and spelling assessments. Results from the TABE provide few benefits beyond grade-level assignments, which are of limited utility; adults and children who are matched for grade level perform significantly differently on critical aspects of word recognition. Several studies suggest that ABE students tend to outperform children on tests of orthographic knowledge while demonstrating deficits in the application of phonological analysis (Greenberg et al., 1997; Thompkins & Binder, 2003). In a study of adult and child word-reading processes, participants were given a variety of phonologically- and orthographically-based tasks. Phonological tasks included reading nonwords (to test sound blending) and performing phoneme deletion (to test students' ability to manipulate phonemes). Orthographic tasks included reading atypically spelled words (to test students' knowledge of individual word spellings) and a word-likeness choice task (to test students' knowledge of spelling patterns). Although matched for grade level, adults outperformed children on orthographic tasks, and children outperformed adults on phonological decoding tasks (Greenberg et al., 1997).

Thompkins and Binder (2003) extended these findings by examining the relationships between phonological awareness, memory, orthographic ability, and context in both ABE students and children matched on reading-grade level. Adults outperformed children on orthographic tasks, use of context, and memory ability; children again outperformed adults on phonological tasks. Using grade-equivalent scores to direct instruction is inadequate to fully understand an ABE student's reading proficiency. A more appropriate measure could pinpoint the component skills in which an ABE student was struggling and direct instruction to meet those needs.

Several recent studies have documented the importance of component skills assessment for ABE students (MacArthur, Konold, Glutting, & Alamprese, 2010; Nanda et al., 2010; Sabatini, Sawaki, Shore, & Scarborough, 2010). This type of assessment is needed to understand the strengths and weaknesses of the reading behavior of ABE students. One type of assessment that has the potential to meet the needs of ABE sites is Curriculum-Based Measurement (CBM). Extensively tested over the last 25 years on elementary-aged students with support from the Office of Special Education, CBM has proven to be a valid and reliable assessment tool that can be used to direct instruction and monitor student progress (Fuchs, Fuchs, & Maxwell, 1988; Marston, 1989; Reschly, Busch, Betts, Deno, & Long, 2009; Shin, Deno, & Espin, 2000). CBM is used to assess students' competency and progress in basic skill areas including reading fluency, written language, and spelling, using aspects of the students' own curriculum. Its popularity as an assessment continues to grow, and it has been used for screening, progress monitoring, and directing student instruction (Wayman, Wallace, Wiley, Ticha, & Espin, 2007). Research demonstrates that student achievement is higher when instructors evaluate the CBM results of

their students and make pedagogical changes accordingly (Fuchs, Fuchs, & Hamlett, 1989).

The most commonly used and studied CBM measure is Oral Reading Rate (CBM–R). CBM–R is, according to some research, the most valid assessment of reading performance (Madelaine & Wheldall, 2004; Marston, 1989). In this test, a student is asked to read a passage aloud for one minute while the examiner records student errors. The total number of errors is subtracted from the total number of words read, resulting in a calculation of words read correctly per minute (wrcm). This test requires very little time to administer, and allows for frequent measurement due to the availability of multiple probes. Focusing on long-term rather than short-term instructional goals, CBM–R measures a student's reading rate plus accuracy, rather than assessing accuracy alone. Fluency is important because those who demonstrate fluency are more likely to remember what they have learned and apply their knowledge in new situations (Binder, 1996). CBM–R also correlates significantly with standardized measures of comprehension (Fuchs et al., 1988; Shinn & Good, 1992) and predicts overall reading achievement and comprehension as well as some group norm-referenced achievement tests do (Ardoin et al., 2004). Fluency is a particular weakness for ABE students (e.g., Baer, Kutner, & Sabatini, 2009; Greenberg et al., 2011). Baer et al. (2009) reported that participants who scored at the Below Basic level on the NAAL Prose Literacy measure read at an average rate of 60 wrcm or slower. Shapiro (2004) determined that a rate of less than 70 wrcm in third-grade materials is a frustration level for children. However, a few recent studies have shown promising increases in fluency after interventions for adult learners (Sabatini, Shore, Holtzman, & Scarborough, 2011; Winn, Skinner, Oliver, Hale, & Ziegler, 2006).

The Dynamic Indicators of Basic Early Literacy Skills (DIBELS) is one set of CBM materials that emphasizes a components approach to literacy assessment and utilizes CBM–R. Substantial evidence for its use as an effective set of progress monitoring tools for elementary school children exists (Good & Kaminski, 2002). In addition to CBM–R, the DIBELS Pre-Reading Measures (PRMs) include assessments of initial sound fluency (ISF), phoneme segmentation fluency (PSF), and nonsense word fluency (NWF). DIBELS measures can be used to evaluate essential early literacy skills, as outlined by the National Reading Panel (2000) and the National Research Council (1998). The DIBELS PRMs assess students' phonological awareness and alphabetic understanding. Competence on these pre-reading measures relates directly to and facilitates reading competence. Phonemic awareness, sound-symbol relationships, and knowledge of letter names have been identified as predictors of later literacy (Stahl & Murray, 1994; Torgesen, Morgan, & Davis, 1992).

THE STUDY

The purpose of this study was to evaluate the potential utility of DIBELS measures in an adult education context. Because we recognize that ABE students and elementary students differ in their strengths and weaknesses, we compared DIBELS measures to the Woodcock-Johnson III Broad Reading measures normed on individuals aged 2 to 90. After the third grade, only CBM–R is typically administered to children because at this point students have mastered the skills that are assessed by the DIBELS PRMs. However, considering evidence that adults in ABE programs have persistent decoding problems (Greenberg et al., 1997; Thompkins & Binder, 2003), the DIBELS PRMs were administered in addition to CBM–R as part of this study. Additionally, previous research suggests that ABE students outperform grade-level-matched children on tests of orthography (Greenberg et al., 1997, 2002; Thompkins & Binder, 2003). Therefore, we added four measures of orthographic ability to the DIBELS measures to account for any outside variance in reading ability that might come from the use of orthographically-based compensatory strategies.

We addressed four questions in this study: (a) Are the WJ III BR scale, the DIBELS, and our orthographic tasks reliable for this population? (b) For adults, would DIBELS be an effective measure of reading ability as assessed by the WJ III Broad Reading [WJ III BR] scale? (c) Could the predictive power of DIBELS be increased for adults if orthographic measures were added to it? (d) Would identified relationships be maintained across groups of ABE readers with different language experiences (i.e., native versus non-native speakers of English)?

METHOD

Participants

Participants included 90 ABE students selected from nonprofit, community-based literacy programs in western Massachusetts. The mean age of the participants was 34 years old (range: 18 to 64). Participants were selected from ABE classes in which 51% of the students were non-native

speakers of English. Twenty-four percent of the non-native participants indicated that they could not read a newspaper in their native language. The racial background of the sample was varied: 49% had an Hispanic background, 32% were African American, 14.5% were Caucasian, and 4.5% were Asian. Sixty-four percent of the participants in the study were unemployed. Table 1 contains additional demographic information. This sample was representative of the population of ABE students in Massachusetts from which it was drawn. All participants received $5 as compensation.

Materials

Woodcock-Johnson III Broad Reading (WJ III BR). The WJ III achievement test (Woodcock, McGrew, & Mather, 2001) is comprised of 22 subtests measuring five curricular areas that have been normed for individuals from ages 2 through 90. The four subtests that make up the WJ III BR score include Letter-Word Identification, Reading Fluency, Passage Comprehension, and Word Attack. We used the BR measures to establish the construct validity of DIBELS for ABE participants. Standard scoring and administration procedures were used in the administration of the four subtests.

WJ III BR Letter-Word Identification (LWI). We asked students to read letters and words of increasing difficulty from flash cards. Testing was discontinued after six errors. Students' scores were the total number of correctly read letters and words.

WJ III BR Reading Fluency (RF). We asked students to read three pages of sentences and decide whether the statements were true or false by circling *Y* or *N*. Testing was discontinued after three minutes. A student's score was the total number of correctly identified sentences.

WJ III BR Passage Comprehension (PC). We asked students to read a series of sentences of increasing difficulty (each with one word missing) and to supply the missing word. Testing was discontinued after a student provided six words incorrectly. The student's score was the total number of correctly supplied words.

WJ III BR Word Attack (WA). We asked students to pronounce a series of nonwords of increasing difficulty. Testing was discontinued after a student pronounced six

Table 1
Participant Demographic Information

	All participants	Native speakers	Non-native speakers
N	90	44	46
Mean age in years	34	35	32.6
Reported learning disability	12.2%	22.3%	2.2%
Mean years of formal education	9.7	9.3	10.1
Some high school	77%	74.4%	79.5%
Some middle school	17.3%	18.6%	16%
Less than 6 years of education	5.8%	7%	4.5%
Educational goals			
GED credential or further education	72.4%	73.8%	71.1%
Job training	19.5%	16.6%	22.2%
Help children	8%	9.5%	6.7%
Length in program			
Less than 1 month	14.2%	14%	14.6%
1–3 months	34.5%	32.5%	36.6%
4–6 months	15.5%	14%	17.1%
6–12 months	19%	16.3%	22%
More than 1 year	16.6%	23.3%	9.7%

total words incorrectly. The student's score was the total number of correctly pronounced words.

DIBELS Initial Sound Fluency (ISF).

The ISF measures an individual's ability to recognize the initial sound of a word presented orally. The test examiner showed each participant four sets of four pictures. For each set, the examiner read the name of each picture. Then the examiner pronounced a letter-sound and asked the student to identify which of the four pictures began with that sound. The examiner recorded the number of correctly identified pictures and sounds. This number was then converted into the number of initial sounds given correctly per minute. Total administration time for ISF was approximately three minutes.

DIBELS Phoneme Segmentation Fluency (PSF).

The examiner asked each student to fragment words of two to five phonemes into their component phonemes. For example, a student might be asked to break the word "mop" into its individual phonemes, /m/ /o/ /p/. After the student completed one word, the examiner read another. This process continued for one minute. The number of correct phonemes provided per minute was the dependent measure.

DIBELS Nonsense Word Fluency (NWF).

We evaluated each student on his or her understanding of letter-sound correspondence and blending. The examiner presented pronounceable vowel-consonant and consonant-vowel-consonant nonsense words on paper to students. The student read as many of the individual sounds or nonsense words as he or she could in one minute. The dependent measure was the number of correct letter sounds produced per minute.

DIBELS CBM Oral Reading Fluency (CBM–R).

We asked students to read a passage aloud for one minute while the examiner recorded the words read correctly per minute (wrcm). Correctly read words were defined as words read correctly the first time or self-corrected. Words read incorrectly were words mispronounced, skipped, substituted, or hesitated on for three seconds. If a student hesitated for three seconds, the examiner provided the word. The dependent measure was wrcm. We calibrated passages used in this study at a third-grade level of difficulty based upon Spache readability measures (Good & Kaminski, 2002).

Nonword task (NW).

Developed by Siegal, Share, and Geva (1995), this test evaluated each student's ability to identify which nonwords looked more word-like in English. A student was shown two nonwords—one that contained a bigram that could occur in the English language at the end of a word and one that contained a bigram that could not occur in the English language at the end of a word—and was asked to identify which "looked more like it could be a word." The number of correctly identified nonwords was the dependent measure.

Nonword Consonant Doublet task (NWCD).

Developed by Cassar and Treiman (1997), this test evaluated each student's ability to identify which nonwords looked more word-like in English. The examiner showed the student two nonwords, one that contained a consonant doublet (such as bb) that could occur in the English language, and one that contained a doublet that could not occur (such as jj). Then the examiner asked the student to identify which "looked more like it could be a word." The number of nonwords correctly identified was the dependent measure.

Nonword Vowel Doublet task (NWVD).

Developed by Cassar and Treiman (1997), this test was used to evaluate students' ability to identify which nonwords looked more word-like in English. The examiner showed each student two nonwords, one that contained a vowel doublet (such as ee) that could occur in English, and one that contained a doublet (such as aa) that could not occur or occurs infrequently. Then the examiner asked the student to identify which "looked more like it could be a word." The number of nonwords correctly identified was the dependent measure.

Irregular Word Reading (IWR).

Adapted from Adams and Huggins (1985), this test evaluated each student's ability to read irregularly spelled words (e.g., *ocean*, *deaf*, and *yacht*). The examiner gave each student a list of 50 irregularly spelled words, ordered from least to most difficult, and asked the student to read them aloud. Testing was discontinued if the student read 10 consecutive words incorrectly. The number of words read correctly out of the total number of words was the dependent measure.

Procedure

We administered tests in two 15–20 minute time blocks. On the first test administration day, the examiner read

consent forms to the adult participants, and those who wished to participate in the study signed the forms. Each participant completed a demographic survey and then was given the four WJ III BR measures.

On the second day, we asked participants to complete the four DIBELS measures and the three orthographic nonword tasks. In addition, we asked them to read the irregular word list. After they completed all tasks, we thanked participants and read them a debriefing statement.

RESULTS

In order to assess the reliability of the measures when applied to ABE students, we conducted analyses for each measure using the entire sample (n = 90). We then separated the sample into two main groups: native speakers of English (n = 44) and non-native participants (n = 46). Our non-native sample was comprised of participants who were (n = 35) and were not (n = 11) literate in their primary language. Thus, we repeated all analyses on the non-native but literate in their primary language group. Those analyses mirrored reports for the entire non-native group.

WJ BR III

As Table 2 shows, the Cronbach alpha values for all four subtests of the WJ BR scale are quite high and consistent across groups of participants. Thus, it appears that these measures were reliable for the ABE sample.

DIBELS

With the exception of ISF, the DIBELS measures also produced strong Cronbach alpha values across participant groups. For ISF, the alphas ranged from .567 to .636. The lower reliability associated with ISF is consistent with that reported for children.

Orthographic Measures

The orthographic measures were the most variable in terms of reliability. IWR had high, consistent alpha values across groups. The NWVD task had respectable levels of reliability across groups, and the NWCD task had reasonable reliability coefficients for the entire sample. Values decreased when only native speakers were included in the analysis. The nonword task produced the lowest reliability values (alphas ranged from .388 to .576). Interestingly, this task was used in a previous study conducted with this population, and the reliability of the measure there was .752 (Thompkins & Binder, 2003).

Before we conducted the regression analyses, we correlated all predictors (DIBELS and the orthographic measures) with the WJ BR composite score. For the entire

Table 2

Reliability Measures Across Participant Groups (Cronbach alpha)

	All participants	Native speakers	Non-native speakers
Woodcock Johnson Broad Reading Measures (WJ BR III)			
Letter Word Identification (LWI)	.954	.936	.967
Word Attack (WA)	.935	.930	.941
Reading Fluency (RF)	.968	.968	.967
Comprehension (PC)	.920	.915	.919
DIBELS Measures			
Initial Sound Fluency (ISF)	.613	.636	.567
Phoneme Segmentation Fluency (PSF)	.870	.866	.875
Nonsense Word Fluency (NWF)	.909	.917	.897
Oral Reading Fluency (CBM–R)	.989	.991	.985
Orthographic Measures			
Nonwords (NW)	.486	.388	.576
Nonwords – Consonants (NWCD)	.619	.480	.707
Nonwords – Vowels (NWVD)	.804	.788	.882
Irregular Word Reading (IWR)	.968	.971	.954

sample, all but one of the DIBELS measures (PSF) and IWR shared a significant positive relationship with the WJ BR scale (see Table 3). Surprisingly, the two doublet tasks shared a significant negative correlation with the WJ BR measure. When the data set was separated into native and non-native groups, ISF, NWF, CBM–R, and IWR were all significantly positively related to the WJ BR scale.

We conducted a three-step multiple regression analysis to: (1) determine whether the DIBELS measures accounted for variance in the composite WJ III BR measure, (2) assess the possibility that adding the orthographic measures would increase the amount of variance explained in the composite WJ III BR score, and (3) determine if these relationships were maintained across participant groups. Thus, the first step included the DIBELS PRM (ISF, PSF, and NWF), the second step included CBM–R, and the third step included the orthographic measures. Based upon the analyses in which we correlated the predictor variables with the criterion variable, the first step included ISF and NWF and the second step included CBM–R. For the third step, IWR and the two orthographic doublet tasks (NWVD and NWCD) were entered, but only IWR was entered in the third step for the other analyses since these two tasks were not correlated with WJ III BR for the subsamples.

When we included all the participants in the analyses, the two DIBELS PRMs accounted for 55% of the variance in the WJ III BR score, $F(2, 87) = 52.4$, $p < .001$, indicating that they are strong predictors of reading ability in an adult population (see Table 4). When CBM–R was added to the equation, the R^2 increased to 69%, $F(3, 86) = 63.5$, $p < .001$. The change in R^2 was significant, $F(1, 86) = 39.4$, $p < .001$. When the orthographic measures were added to the regression equation, 81% of the variance in the WJ III BR score was explained, $F(6, 83) = 57.0$, $p < .001$, indicating that adults do use orthographic strategies to decode words. The change in R^2 was again significant, $F(3,83) = 16.4$, $p < .05$. These results indicate that including orthographic predictors with DIBELS measures has the potential to add significantly to predictive power for adults. For the final model that includes the DIBELS, CBM–R and orthographic tasks, ISF, NWF, CBM–R, and IWR all were significant independent contributors to the regression model (see Table 4 for Beta weights).

We conducted two parallel regression analyses using each of the subgroups. For the native speakers, the DIBELS PRMs accounted for 61% of the variance in the WJ III BR score, $F(2, 41) = 31.4$, $p < .001$. When CBM–R was added to the regression model, the R^2 increased to .75, $F(3, 40) = 39.5$, $p < .001$. The change in R^2 was significant, $F(1, 40) = 22.6$, $p<.001$. When the orthographic measure was added to the regression equation, 86% of the variance in the WJ III BR score was explained, $F(4, 39) = 57.1$, $p < .001$. Again, the change in R^2 was significant, $F(1, 39) = 28.5$, $p < .001$. And again, ISF, NWF, CBM–R, and IWR were all significant and unique predictors in this model.

The regression analysis of data from non-native speakers produced similar results. The DIBELS PRMs accounted for 49% of the variance in the WJ III BR score, $F(2, 43) = 20.6$, $p < .001$. When CBM–R was added to the regression model, the R^2 increased to .64, $F(3, 42) = 24.4$, $p < .001$. The change in R^2 was significant, $F(1, 42) = 16.8$, $p < .001$. When the orthographic measure was added to the regression equation, 76% of the variance in the WJ III BR score was explained,

Table 3

Correlations Between WJ BR Scale and Individual Predictor Variables

	All participants (n = 90)	Native speakers (n = 44)	Non-native speakers (n = 46)
Initial Sound Fluency (ISF)	.490**	.593**	.403**
Phoneme Segmentation Fluency (PSF)	.177	.134	.223
Non-Word Fluency (NWF)	.597**	.617**	.613**
Oral Reading Fluency(CBM–R)	.783**	.802**	.767**
Nonwords (NW)	.116	.093	.138
Nonwords– Vowels (NWVD)	–.213*	–.242	–.191
Nonwords– Consonants (NWCD)	–.216*	–.268	–.170
Irregular Word Reading (IWR)	.799**	.859**	.711**

*Note: *p < .05 ; **p < .01.*

$F(4, 41) = 31.8$, $p < .001$. The change in R^2 was significant, $F(1, 41) = 20.3$, $p < .001$. In the final step of this model, only CBM–R and IWR were significant and unique predictors.

According to our reported regression analyses, the DIBELS measures and orthographic measures (as assessed by the WJ III BR score) are predictive of reading ability for our adult readers, regardless of prior language experience.

DISCUSSION

The purpose of this study was to examine a set of measures of component skills in an ABE context. Specifically, we examined DIBELS pre-reading measures and CBM–R as possible predictors of reading ability based on the WJ III BR subscale. Previous research supports the validity of DIBELS with children in kindergarten through third grade, but the measures had never been examined for an ABE population. Additionally, since adults have previously demonstrated both proficiency on orthographic tests and limitations on tests of phonology when matched on reading ability with children, we tested several orthographic measures as predictors of reading ability (Greenberg et al., 1997, 2002; Thompkins & Binder, 2003). The main findings were: (a) measures that assess various literacy abilities in children are reliable in ABE populations, (b) the reliabilities are consistent across language experience groups in ABE populations, (c) DIBELS and orthographic tasks do predict reading ability in ABE students, and (d) these relationships are largely maintained across language experience groups.

The majority of the reliability coefficients were high and consistent across groups. Thus we feel confident that these are good measures to use in the ABE population. Two of the orthographic tasks did have lower reliability scores (Nonword choice and Nonword Consonant Doublet). We have, however, used the Nonword choice task in a previous study (Thompkins & Binder, 2003), and the reliability was good in that sample. Interestingly, other studies have reported low reliabilities for the orthographic measures. For example, Cunningham, Perry, & Stanovich (2001) reported alphas of .02, .26, .51, and .62 for four of their orthographic measures. However, the tasks with the lowest reliability coefficients in our study were reported to have much higher reliability in previous studies. The reliability of these measures is certainly deserving of further research.

As expected, the DIBELS measures accounted for a significant portion of the variance in reading ability for the adults. These results are consistent with previous research conducted with children (Elliott, Lee, & Tollefson, 2001). It is possible that DIBELS measures may actually have greater application in an adult literacy population than they currently have in an elementary school population. The DIBELS prereading measures of ISF, PSF, and NWF were originally designed to monitor progress and direct instruction for third-grade children and below. Once children pass third grade, they hit ceilings on the pre-reading measures. For adults, a ceiling effect did not occur: These measures predicted the reading ability of adults from second- through eighth-grade

Table 4
Regression Results

	All participants (n = 90)	Native speakers (n = 44)	Non-native speakers (n = 46)
Regression analyses R^2			
Step 1 (Pre-Reading Measures)	.547**	.605	.490**
Step 2 (+ CBM–R)	.689**	.748**	.636**
Step 3 (+ IWR)	.805**	.854**	.756**
Betas for final step			
Initial Sound Fluency (ISF)	.173**	.188**	.150
Nonword Fluency (NWF)	.198*	.203**	.139
Oral Reading Fluency (CBM–R)	.328**	.240**	.417**
Irregular Word Reading (IWR)	.433*	.494**	.409**
Nonwords – Vowels (NWVD)	.023*	---	---
Nonwords – Consonants (NWCD)	–.072**	---	---

*Note: *p < .05 ; **p < .01.*

levels. Thus, we can infer that adult literacy students have not fully mastered phonological decoding, since the DIBELS PRMs are phonologically-based tests.

Phonological ability has been shown to correlate with reading ability in individuals through the twelfth grade (Adams, 1990). Phonemic awareness also has been identified as a predictor of later literacy (Stahl & Murray, 1994; Torgesen et al., 1992). Therefore, it is important not to ignore ABE participants' deficits in phonological ability. This study indicates a direct correlation between reading ability and performance on phonological measures. If students are trained in phonological decoding, it is likely that their reading scores will improve. Research with adult students suggests that literacy training emphasizing phonological decoding can significantly boost performance on word recognition, spelling, phonological awareness, and reading comprehension (Durgunoglu & Oney, 2002).

Orthographic ability also accounted for a significant portion of the variance in adult reading ability. These findings are consistent with past research in which adults demonstrated proficiency with tests of orthography (Greenberg et al., 1997, 2002; Thompkins & Binder, 2003). It also supports the hypothesis that adults use orthographic cues to compensate for deficits in word-decoding ability (Stanovich, 1980). The current findings indicate that it may be beneficial to include tests of orthography in assessments of adults' reading ability.

The heterogeneity of the sample included in this study may be considered a strength or weakness. We set out to determine the efficacy of using an assessment tool that was developed for children in an adult education setting. Our sample reflects the heterogeneity of that population; thus, the effectiveness of DIBELS to predict reading behavior is quite promising. By including non-native speakers of English, we may have introduced other sources of variance. However, our analyses indicate that these measures explain variance in ABE reading behavior for participants with different language backgrounds. This suggests that any assessment used in the future should be able to maintain its integrity across language groups.

CBM measures have unique characteristics that make them particularly appropriate for ABE environments. First, because they are quick and easy to administer, CBM procedures are ideal for ABE programs with limited student availability. Furthermore, the ease of administration allows ABE programs to train volunteers to conduct assessments. Second, CBMs emphasize fluency as opposed to focusing assessment strictly on students' response accuracy. Thus, they can help teachers differentiate between students who have simply acquired a skill and those who have mastered it (Ardoin, Roof, Klubnik, & Carfolite, 2008). Finally, because the measurement properties of CBM integrate traditional standardized assessment procedures with those from behavioral assessment, student performance can be assessed frequently and graphed (Deno, Fuchs, Marston, & Shin, 2001). With short administration times and multiple probes, teachers can assess student performance weekly. Thus, they can evaluate instructional effects continuously as opposed to waiting three to six months to see how instruction is impacting student performance.

Continual evaluation of instructional effects ensures that ineffective interventions are not implemented for extended periods of time (Eckert, Ardoin, Daly, & Martens, 2002; Eckert, Dunn, & Ardoin, 2006). Feedback about growth can also serve as a mechanism for motivating students. Whereas substantial changes in student achievement are required to demonstrate growth with most norm-referenced achievement measures, smaller gains are noticeable when CBM measures are employed to evaluate progress (Deno, Marston, & Tindal, 1985; Deno, Mirkin, & Chiang, 1982).

Research in adult literacy is important and could be beneficial to millions of people. The social consequences of inadequate literacy training are huge: unemployment, poor health, and civic disengagement (Kutner et al., 2007). It is vital that adult education be directed and efficient, since adults have many limits on available instruction time. This study demonstrates that using a component skills approach reveals information about ABE participants' unique skill sets that is essential for building effective instructional plans. CBM provides an assessment style that fits the constraints of the ABE learning environment. But the component skills assessment needs to be modified to best assess this population. Specifically, DIBELS pre-reading measures have strong informative value in ABE settings over a much broader range of grade levels than they do with children. In addition, tasks that assess orthographic skills are crucial for this group.

REFERENCES

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print* (1st ed.). Cambridge, MA: MIT Press.

Adams, M. J., & Huggins, A. W. F. (1985). The growth of children's sight vocabulary: A quick test with educational and theoretical implications. *Reading Research Quarterly, 20,* 262–281.

Ardoin, S. P., Roof, C. M., Klubnik, C., & Carfolite, J. (2008). Evaluating curriculum-based measurement from a behavioral assessment perspective. *The Behavior Analyst Today, 9,* 36–48.

Ardoin, S. P., Witt, J. C., Suldo, S. M., Connell, J. E., Koenig, J. L., Resetar, J. L., Slider, N. J., & Williams, K. L. (2004). Examining the incremental benefits of administering a maze and three versus one Curriculum-Based Measurement reading probes when conducting universal screening. *School Psychology Review, 33,* 218–233.

Baer, J., Kutner, M., & Sabatini, J. (2009). *Basic reading skills and the literacy of America's least literate adults: Results from the 2003 National Assessment of Adult Literacy (NAAL) supplemental studies* (NCES 2009-481). Washington, DC: U.S. Department of Education, Institute for Education Sciences, National Center for Education Statistics.

Beder, H. (1999). *The outcomes and impacts of adult literacy education in the United States* (NCSALL Report No. 6). Boston, MA: National Center for the Study of Adult Learning and Literacy.

Binder, C. (1996). Behavioral fluency: Evolution of a new paradigm. *The Behavior Analyst, 19,* 163–197.

Cassar, M., & Treiman, R. (1997). The beginnings of orthographic knowledge: Children's knowledge of double letters in words. *Journal of Educational Psychology, 89,* 631–644.

Comings, J., Beder, H., Bingman, B., Reder, S., & Smith, C. (2003). *Establishing an evidence-based adult education system* (NCSALL Occasional Paper). Cambridge, MA: National Center for the Study of Adult Learning and Literacy.

Comings, J., Garner, B., & Smith, C. (2000). *Annual review of adult learning and literacy* (Vol. 1). San Francisco, CA: Jossey-Bass.

CTB McGraw Hill. (1994). Tests of Adult Basic Education. Monterey, CA: Author.

Cunningham, A. E., Perry, K. E., & Stanovich, K. E. (2001). Converging evidence for the concept of orthographic processing. *Reading and Writing: An Interdisciplinary Journal, 14,* 549–568.

Deno, S. L., Fuchs, L. S., Marston, D., & Shin, J. (2001). Using curriculum-based measurement to establish growth standards for students with learning disabilities. *School Psychology Review, 30*(4), 507–524.

Deno, S. L., Marston, D., & Tindal, G. (1985). Direct and frequent curriculum-based measurement: An alternative for educational decision making. *Special Services in the Schools, 2*(2), 5–27.

Deno, S. L., Mirkin, P. K., & Chiang, B. (1982). Identifying valid measures of reading. *Exceptional Children, 49,* 36–45.

Dochy, F., Segers, M., & Buehl, M. M. (1999). The relation between assessment practices and outcomes of studies: The case of research on prior knowledge. *Review of Educational Research, 69,* 145–186.

Durgunoglu, A. Y., & Oney, B. (2002). Phonological awareness in literacy acquisition: It's not only for children. *Scientific Studies of Reading, 6,* 245–266.

Eckert, T. L., Ardoin, S. P., Daly, E. J., III, & Martens, B. K. (2002). Improving oral reading fluency: A brief experimental analysis of combining an antecedent intervention with consequences. *Journal of Applied Behavior Analysis, 35,* 271–281.

Eckert, T. L., Dunn, E. K., & Ardoin, S. P. (2006). The effects of alternate forms of performance feedback on elementary-aged students' oral reading fluency. *Journal of Behavioral Education, 15*(3), 148–161.

Elliott, J., Lee, S. W., & Tollefson, N. (2001). A reliability and validity study of the Dynamic Indicators of Basic Early Literacy Skills—Modified. *School Psychology Review, 30,* 33–49.

Fuchs, L. S., Fuchs, D., & Hamlett, C. L. (1989). Effects of instrumental use of curriculum-based measurement to enhance instructional programs. *Remedial and Special Education, 10*(2), 43–52.

Fuchs, L. S., Fuchs, D., & Maxwell, L. (1988). The validity of informal reading comprehension measures. *Remedial and Special Education, 9*(2), 20–28.

Good, R. H., & Kaminski, R. A. (Eds.). (2002). Dynamic Indicators of Basic Early Literacy Skills (6th ed.). Eugene, OR: Institute for the Development of Educational Achievement. Retrieved from http://dibels.uoregon.edu/

Greenberg, D., Ehri, L. C., & Perrin, D. (1997). Are word-reading processes the same or different in adult literacy students and third–fifth graders matched for reading level? *Journal of Educational Psychology, 89,* 262–275.

Greenberg, D., Ehri, L. C., & Perrin, D. (2002). Do adult literacy students make the same word-reading and spelling errors as children matched for word-reading age? *Scientific Studies of Reading, 6,* 221–243.

Greenberg, D., Wise, J. C., Morris, R., Fredrick, L. D., Rodrigo, V., Nanda, A. O., & Pae, H. K. (2011). A randomized control study of instructional approaches for struggling adult readers. *Journal of Research on Educational Effectiveness, 4,* 101–117.

Kruidenier, J. (2002). *Research-based principles for adult basic education reading instruction.* Washington, DC: National Institute for Literacy.

Kutner, M., Greenberg, D., Jin, Y., Boyle, B., Hsu, Y., & Dunleavy, E. (2007). *Literacy in everyday life: Results from the 2003 National Assessment of Adult Literacy* (NCES 2007–480). Washington, DC: U. S. Department of Education, National Center for Education Statistics.

Lipnevich, A., & Beder, H. (2007). Self-esteem among adult literacy learners. *Adult Basic Education and Literacy Journal, 1,* 73–82.

MacArthur, C. A., Konold, T. R., Glutting, J. J., & Alamprese, J. A. (2010). Reading component skills of learners in adult basic education. *Journal of Learning Disabilities, 43,* 108–121.

Madelaine, A., & Wheldall, K. (2004). Curriculum-based measurement of reading: Recent advances. *International Journal of Disability, Development and Education, 51,* 57–82.

Marston, D. B. (1989). A curriculum-based measurement approach to assessing academic performance: What it is and why do it? In M. R. Shinn (Ed.), *Curriculum-based measurement: Assessing special children* (pp. 18–78). New York, NY: Guilford.

Nanda, A. O., Greenberg, D., Morris, R. (2010). Modeling child-based theoretical reading constructs with struggling adult readers. *Journal of Learning Disabilities, 43*, 138–153.

National Institutes of Child Health and Human Development. (2004). *Adult and family literacy: Current research and future directions—A workshop summary* (Informal survey report). Bethesda, MD: Author. Retrieved from http://www.nichd.nih.gov/publications/pubs/upload/afl_workshop.pdf

National Reading Panel. (2000). *Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction* (NIH Publication No. 00-4754). Washington, DC: National Institutes of Health, Public Health Service, U.S. Department of Health and Human Services.

National Research Council. (1998). *Preventing reading difficulties in young children*. Washington, DC: National Academy Press.

Reder, S., & Bynner, J. (2009). *Tracking adult literacy and numeracy skills*. New York, NY: Routledge.

Reschly, A. L., Busch, T. W., Betts, J., Deno, S. L., & Long, J. D. (2009). Curriculum-based measurement oral reading as an indicator of reading achievement: A meta-analysis of the correlational evidence. *Journal of School Psychology, 47*, 427–469.

Sabatini, J. P., Sawaki, Y., Shore, J. R., & Scarborough, H. S. (2010). Relationships among reading skills of adults with low literacy. *Journal of Learning Disabilities, 43*, 138–153.

Sabatini, J. P., Shore, J. R., Holtzman, S., & Scarborough, H. S. (2011). Relative effectiveness of reading intervention programs for adults with low literacy. *Journal of Research on Educational Effectiveness, 4*, 118–133.

Shapiro, E. S. (2004). *Academic skills problems: Direct assessment and intervention* (3rd ed.). New York, NY: Guilford.

Shepard, L. (1991). Interview on assessment issues with Lorrie Shepard. *Educational Researcher, 20*, 21–23, 27.

Shin, J., Deno, S. L., & Espin, C. (2000). Technical adequacy of the maze task for curriculum-based measurement of reading growth. *The Journal of Special Education, 34*, 164–172.

Shinn, M. R., & Good, R. H., III (1992). Curriculum-based measurement of oral reading fluency: A confirmatory analysis of its relation to reading. *School Psychology Review, 21*, 459–479.

Siegal, L. S., Share, D., & Geva, E. (1995). Evidence for superior orthographic skills in dyslexics. *American Psychological Society, 6*, 250–254.

Stahl, S. A., & Murray, B. A. (1994). Defining phonological awareness and its relationship to early reading. *Journal of Educational Psychology, 86*, 221–34.

Stanovich, K. E. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16*, 32–71.

Strucker, J., Yamamoto, K., & Kirsch, I. (2007). *The relationship of the component skills of reading to IALS performance: Tipping points and five classes of adult literacy learners* (NCSALL Research Brief). Cambridge, MA: National Center for the Study of Adult Learning and Literacy.

Thompkins, A. C., & Binder, K. S. (2003). A comparison of the factors affecting reading performance of functionally illiterate adults and children matched by reading level. *Reading Research Quarterly, 38*, 236–258.

Torgesen, J. K., Morgan, S. T., & Davis, C. (1992). Effects of two types of phonological awareness training on word learning in kindergarten children. *Journal of Educational Psychology, 84*, 364–370.

Wayman, M. M., Wallace, T., Wiley, H. I., Ticha, R., & Espin, C. A. (2007). Literature synthesis on curriculum-based measurement in reading. *The Journal of Special Education, 41*(2), 85–120.

Wiggins, G. (1992). Creating tests worth taking. *Educational Leadership, 49*(8), 26–34.

Winn, B. D., Skinner, C. H., Oliver, R., Hale, A. D., & Ziegler, M. (2006). The effects of listening while reading and repeated reading on the reading fluency of adult learners. *Journal of Adolescent & Adult Literacy, 50*, 196–205.

Woodcock, R. W., McGrew, K. S., & Mather, N. (2001). Woodcock-Johnson III Test of Achievement. Itasca, IL: Riverside.