The Role of Unitization & Accuracy on Later Reading Outcomes

Kelli D. Cummings, Ph.D., NCSP
Elizabeth Dewey, MS
Rachael Latimer
Dynamic Measurement Group

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Overview

- Review *characteristics and features* of DIBELS® Nonsense Word Fluency (NWF).
- Discuss the *role of NWF in 1st grade* (i.e., initial status and growth). Present research that examines the additional role of NWF *strategy* on later reading outcomes
- Illustrate current research on DIBELS® Next-7th Ed. NWF
  - Replicate findings for initial status and growth,
  - Document stability of the relationship between NWF-CLS (DN7) score and later reading outcomes,
  - Replicate findings demonstrating the impact of NWF *unitization* on later reading outcomes.

Why this type of Assessment? Why NWF?

- We have an unprecedented need for *school-wide assessment data* and *prevention-oriented reform* in public education. (Fien, et al., 2008).
- Within the domain of learning to read, the *alphabetic principle* represents a powerful area of opportunity for early intervention *instruction* and *assessment*.
- The *alphabetic principle has two parts*: (a) alphabetic understanding and (b) phonological recoding (National Research Council, 1998).
- DIBELS® NWF has the *capacity* to assess both of these AP component skills. Current (i.e., 6th edition) scores: NWF-CLS *and* NWF-WRC

Validity of NWF

- In two, large and representative samples, Good, Baker, & Peyton (2009) report that *NWF initial skills in fall of 1st* grade explain between 50 and 58% of the overall variance in 1st grade, spring, outcomes (i.e., DIBELS® ORF).
- *Improvement on NWF* from the beginning to the middle of the year *added substantially to this prediction*, especially for students at-risk.
- The results of this study support the use of NWF to monitor progress in learning the alphabetic principle.

Validity of NWF

- The utility of NWF is not limited only to students who are English-speaking.
- Vanderwood et al. (2008) reports that NWF in 1st grade predicted significant portions of additional variance in 3rd grade outcomes (ORF, 32%; Maze, 9%, CAT6, 8%); *even after controlling for EL status*.
- In fact, after NWF, neither growth on NWF nor another predictor (SAT9) added significant explanation to these outcomes.
- In general, NWF is a good predictor and can be used in 1st grade to identify EL students who need additional reading instruction, regardless of EL proficiency.

NWF-CLS, 1st Grade Psychometric Characteristics

- Reliability of 6th edition (Dynamic Measurement Group, 2008)
  - Coefficients of .83 and .94 are reported (alternate-form).
  - Coefficients of .94 and .98 are *estimated* from the aggregate of three probes (alternate-form).
  - Fien et al. (2008) report test-retest reliability coefficients ranging between .84 - .90 in a 1st grade sample.
- Validity (as summarized in Fien, et al., 2008)
  - Range = .50 - .82 with tests such as the Terra Nova (Reading Subtest), the Test of Early Reading Ability--3rd edition (Reading Quotient), and the DRA (Instructional Reading Score)
  - Median = .61

Harn, Stoolmiller, & Chard (2008)

- Published an article in the *Journal of Learning Disabilities* documenting the following:
  - Slope on NWF from fall to spring of 1st grade was an important predictor of end of first grade reading outcomes…*above and beyond* NWF start point.
  - Beyond these two NWF metrics, NWF strategy type added explanatory power to the spring ORF score.

Harn, Stoolmiller, & Chard (2008)

- Beyond these two NWF metrics, *NWF strategy type added explanatory power to the spring ORF score*.
  - Students who *read nonsense words as whole words* had significantly higher ORF scores in the winter (11 points higher) and in the spring (29 points higher).
  - Students who *partially blended* when producing correct letter sounds (i.e. read "fek" as /f/ /ek/) had higher ORF scores, but not until the spring.
  - Students who predominantly sounded out the nonsense words and then recoded them (i.e., read "fek" as /f/ /e/ /k/ --> /fek/) had the *lowest spring ORF score of all groups*.

Relationship to Ehri's Theory of Word Reading Development

- Students master *multiple word reading phases* on the path to proficient reading. The phase is determined by the *predominant approach* the reader uses at a given time.
  - Pre- alphabetic. Just beginning to link oral language and print
  - Partial alphabetic. Learning to focus on salient parts of a word (e.g., using intial, then final, letters as *clues* to a printed word's pronunciation).
  - Full alphabetic. Reading short words through a learned strategy of using the common letter sounds and blending.

Ehri's Theory of Word Reading Development

- Unitization. Identifying simple word types without attending to the individual letter-sound associations.
  - Word reading is much more efficient in this stage.
  - Unitization establishes connections across increasingly larger units of mastery
- Consolidated alphabetic. Recognizing whole words instantly. Unitization is the common approach to reading unknown words.

Ehri's Theory of Word Reading Development

- Automaticity *may be* a separate phase that follows consolidation. It characterizes mature readers who recognize most words by sight and who are facile, if not automatic, in decoding unfamiliar words.

Theory --> Research --> Practice

- It may be possible that NWF has a *variable relationship* with other measures (e.g., ORF) *depending on the skill level of the students* (e.g., high versus low performers).
  - This relationship may be impacted by time of year (middle of K versus beginning of 2nd grade).
  - There may be *data* that are present from NWF probe administrations *that are not captured* in the traditional data bases.
  - There may be data that are presented from NWF probe administrations that could *make the measure more relevant across skill levels and stages of development*.

The current study

- Our goal was to replicate Harn, Stoolmiller, and Chard (2008) using a different variant of NWF (i.e., new stratification of items, new directions).
- Three primary research questions:
  - *What is the relationship between initial (fall) NWF-CLS and growth (slope) on NWF-CLS to ORF at the end of 1st grade?*
  - *Does the change in directions (i.e. NWF 6th ed --> NWF 7th ed) impact the relationship between NWF-CLS and ORF outcomes?*
  - *What is the impact of NWF strategy type on end-of-year (EOY) ORF outcomes?*

Method

Participants & Setting

Scoring

Measures

Data Analysis

But First...The Acronyms!!!

Acronym	Meaning
NWF-CLS • WRC • WWR	Nonsense Word Fluency-Correct Letter Sounds • Words Recoded Correctly • Whole Words Read (without sounding out)
BOY, MOY, EOY	Beginning-of-year, middle-of-year, end-of-year
DORF/ORF	DIBELS-Oral Reading Fluency

Procedures-Participants & Setting

- Two samples.
  - To examine the effect of NWF(fall) and NWF gain (fall to spring) on ORF, we utilized a large sample ($N = 3150$) that was part of a larger project used to evaluate an updated version of DIBELS® 6th Edition (see Cummings, et al., 2009).
  - To examine the relationship between NWF(MOY) strategy type and ORF, we collected data from a sub-sample of these students ($n = 66$). This information was gathered using revised NWF directions (DIBELS® Next-7th Edition).

Procedures-Scoring

- Student responses were scored according to standard, NWF scoring rules and then were coded for "strategy type" following the data collection session.
- Similar coding strategies (as Harn et al., 2008) were used, but an additional strategy was added, the "errors" strategy.
- Student responses were coded as errors if *any part of the response* contained an error (as indicated by a " / ").
- *The errors strategy was added as a result of the differences in the two samples.* The correlation between "attempts" and NWF-CLS score in the Harn study was .99. In our sample, this correlation was .84.

Procedures--Scoring

- Categories were mutually exclusive
  - Sound only (/f/ /e/ /k/)
  - Recode (/f/ /e/ /k/ --> /fek/ OR /f/ /ek/ --> /fek …)
  - Partial Blend (/f/ /ek/)
  - Unit (/fek/)
  - Error (any response, regardless of inferred strategy type, that contained a " / ")
- Categories were exhaustive. That is, there was no response type that was not captured by these five categories.
- Reponses to non-words with errors were the predominant strategy type (mean = 50%). Correlation between attempts and CLS was much lower than in the Harn study.

$$r_{NWFattempts,NWFscore} = .70$$

Measures

- NWF (7th ed.) - new directions
- NWF (7th ed.) - scoring protocol (sample)
- ORF (Beta 2) - *new passage ordering*, same directions and scoring rules as 6th edition.

Procedures-Data Analysis

- Relation between NWF(BOY) and NWF(slope) to ORF outcomes
  - Descriptives and Correlations
  - Hierarchical Regression
- Added value of NWF(strategy type) to the prediction of ORF outcomes
  - Descriptives and Correlations
  - Hierarchical (Weighted) Regression
  - Cluster Analysis

Results

Question 1: In 1st grade, do initial NWF scores and growth on NWF predict spring ORF scores?

Table 1

Correlations and Descriptive Statistics for First Grade DIBELS Measures

Variable	Fall NWF	Winter NWF	Spring NWF	Winter ORF	Spring ORF
M (*SD*)	37.67 (25.86)	59.7 (30.72)	79 (33.75)	44.2 (34.53)	68.31 (38.37)
Fall NWF	--	.74	.64	.82	.73
Winter NWF		--	.69	.73	.68
Spring NWF			--	.68	.73
Winter ORF				--	.90
Spring ORF					--

Note. Correlations and descriptive statistics are for the large data set with a sample size of 3150 students. NWF = Nonsense Word Fluency; ORF = Oral Reading Fluency. All correlations are significant at $p < .001$.

Question 1: In 1st grade, do initial NWF scores *and* growth on NWF predict spring ORF scores?

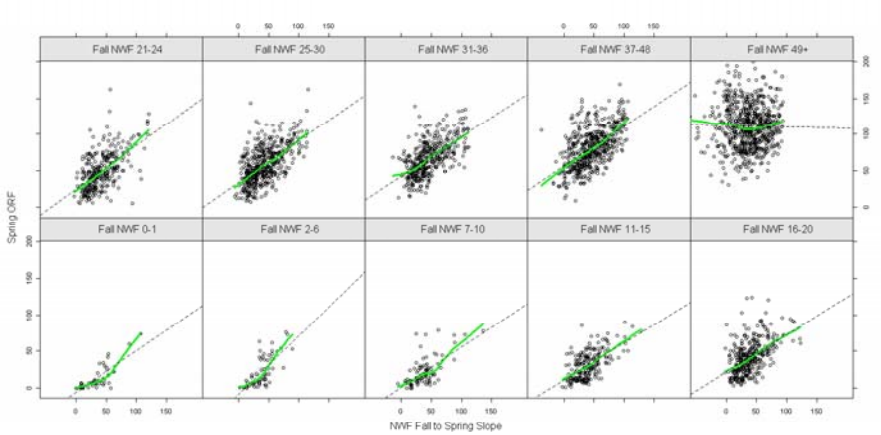


Figure 2. Fall to Spring NWF change by Spring ORF based on $N = 3150$.

Question 1: In 1st grade, do initial NWF scores *and* growth on NWF predict spring ORF scores?

Table 2

Effect of Fall and Fall to Spring Gain NWF on Spring ORF

Effect on Spring ORF	Value	SE	t	p
Intercept	-6.16	5.84	-1.05	.29
NWF slope	0.57	0.15	3.88	.00
Fall NWF = 2 to 6	-2.60	8.86	-0.29	.77
Fall NWF = 7 to 10	7.05	7.59	0.93	.35
Fall NWF = 11 to 15	16.80	6.73	2.50	.01
Fall NWF = 16 to 20	28.31	6.36	4.45	.00
Fall NWF = 21 to 24	30.38	6.39	4.75	.00
Fall NWF = 25 to 30	39.72	6.19	6.42	.00
Fall NWF = 31 to 36	48.16	6.27	7.69	.00
Fall NWF = 37 to 48	62.08	6.15	10.09	.00
Fall NWF = 49+	118.45	6.01	19.72	.00
NWF slope by fall NWF = 2 to 6	0.23	0.22	1.08	.28
NWF slope by fall NWF = 7 to 10	-0.02	0.18	-0.10	.92
NWF slope by fall NWF = 11 to 15	-0.06	0.16	-0.35	.73
NWF slope by fall NWF = 16 to 20	-0.05	0.16	-0.35	.73
NWF slope by fall NWF = 21 to 24	0.03	0.16	0.20	.84
NWF slope by fall NWF = 25 to 30	0.01	0.15	0.05	.96
NWF slope by fall NWF = 31 to 36	-0.02	0.15	-0.15	.88
NWF slope by fall NWF = 37 to 48	-0.01	0.15	-0.07	.94
NWF slope by fall NWF = 49+	-0.59	0.15	-3.95	.00

Note. $N = 3150$. Model intercept is Fall NWF = 0 to 1. R-Squared = .65. Coef of Var = 33.18.

Question 2: In 1st grade, does NWF strategy type further predict spring ORF scores?

Table 3

Descriptive Statistics and Correlations for NWF and ORF with Winter NWF Strategies

	Fall NWF	Winter Attempts	Winter NWF	Winter ORF	Unit	Partial blends	Recode	Sound only	Errors	Spring NWF	Spring ORF
M (SD)	29.95 (21.29)	19.65 (8.12)	45.42 (19.83)	30.29 (26.11)	.31 (.29)	.04 (.09)	.13 (.23)	.16 (.21)	.36 (.22)	66.92 (26.81)	50.97 (30.36)
M (SD) (Proportions)					6.68 (7.23)	0.80 (1.53)	2.04 (4.08)	3.05 (4.38)	7.08 (5.78)		
Fall NWF	--	.44***	.66***	.76***	.32**	.07	-.08	.04	-.39**	.57***	.67***
Attempts		--	--	--	.26*	-.03	-.27*	-.06	.01	.57***	.52***
Winter NWF_S			--	.73***	.40***	-.02	-.14	-.03	-.34**	.60***	.66***
Winter NWF_R			.	.67***	.32**	.02	-.15	.07	-.45**	.68***	.68***
Winter ORF				--	.33**	-.02	-.00	-.02	-.39**	.64***	.89***
Unit					--	-.14	-.35**	-.46***	-.44***	.39**	.39**
Partial blends						--	-.20	.07	-.07	-.03	-.01
Recode							--	-.23	-.28*	-.04	.05
Sound only								--	-.12	-.07	-.08
Errors									--	-.39**	-.47***
Spring NWF										--	.72***
Spring ORF											--

Note. $n = 66$. NWF strategy statistics are based on proportion of attempt type; the total number of nonwords using a particular strategy divided by the total number of nonwords attempted. Correlations that are statistically significant are denoted as follows: $*p < .05$, $**p < .01$, $***p < .001$. The correlation between Attempts and NWF_R is .84 ***.

Question 2: In 1st grade, does NWF strategy type further predict *winter* ORF scores?

Table 4

Prediction of Winter ORF with NWF and NWF Strategy Variables

Effect on Winter ORF	Value	SE	*p*
Intercept (Sounds)	27.86	5.52	.00
Fall to winter NWF gain	0.37	0.16	.02
Fall NWF	0.73	0.16	.00
Unit	0.35	7.26	.96
Partial blends	2.46	14.07	.86
Recodes	-2.81	7.63	.71
Errors	-4.27	7.07	.55
Fall to winter NWF gain by fall NWF	-0.01	0.01	.27

Note. $n = 66$. Fall and fall to winter NWF gain centered about their respective means. Model intercept is the Sound strategy. R-Square = .61.

Question 2: In 1st grade, does NWF strategy type further predict spring ORF scores?

Table 5

Prediction of Spring ORF with NWF and NWF Strategy Variables

Effect on Spring ORF	Value	SE	*p*
Intercept	44.28	9.48	.00
Fall to winter NWF gain	0.48	0.19	.01
Fall NWF	0.94	0.19	.00
Unit	24.46	12.39	.05
Partial blends	8.76	27.80	.75
Recodes	6.84	15.08	.65
Errors	-9.50	11.71	.42
Fall to winter NWF gain by fall NWF	-0.01	0.01	.51

Note. $n = 66$. Fall and fall to winter NWF gain centered about their respective means. Model intercept is the Sound strategy. R Square = .75. Coef of Var = 4.73

Question 2: In 1st grade, does NWF strategy type further predict spring ORF scores?

Table 6

Prediction of Spring ORF with Winter ORF, NWF, and NWF Strategy Variables

	Model 1			Model 2		
Effect on Spring ORF	Value	SE	p	Value	SE	p
Intercept	46.07	5.63	.00	46.51	3.15	.00
Fall to winter NWF gain	0.13	0.10	.20	0.11	0.10	.30
Fall NWF	0.26	0.15	.08	0.24	0.14	.09
Winter ORF	1.17	0.15	.00	1.19	0.15	.00
Unit	13.34	7.05	.06	12.93	5.85	.03
Partial blends	13.59	16.38	.41	12.87	15.80	.42
Recodes	17.15	7.92	.04	16.69	6.32	.01
Errors	0.54	7.29	.94			
Fall to winter NWF gain by fall NWF	0.00	0.01	.51	0.00	0.01	.52

Note. $n = 66$. Fall NWF, fall to winter NWF gain, and winter ORF centered about their respective means. Model 1 intercept is the Sound strategy; R Square = .86; Coef of Var = 1.42. Model 2 Intercept is the Sound and Errors Strategies combined; R-Square = .85; Coef of Var = 1.35.

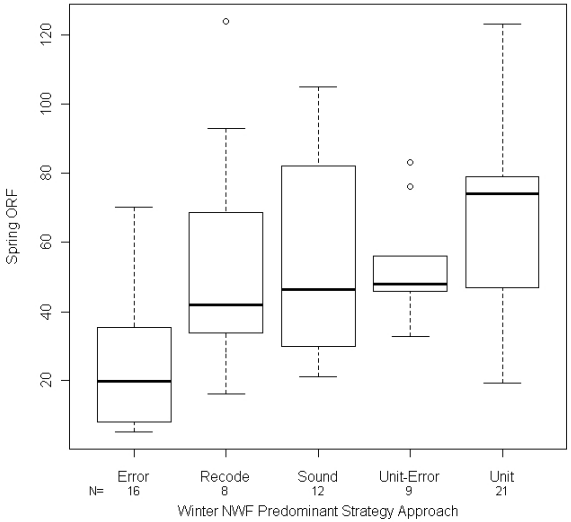
Follow-up Analysis: How do spring ORF scores vary as a function of winter strategy type?

Table 7
Means of Strategy Variables by Cluster and Cluster Sizes

		Strategy Variable					
Cluster	Cluster label	Sounds	Recodes	Partial Blends	Units	Errors	*n*
1	Unit	.05	.05	.02	.69	.20	21
2	Recode	.04	.67	.00	.08	.21	8
3	Sound	.52	.05	.07	.12	.25	12
4	Unit-Error	.06	.01	.11	.33	.50	9
5	Error	.16	.09	.04	.06	.64	16

Note. $n = 66$. Clusters are formed by predominant strategy approach to fall NWF.

Results of the Cluster Analysis by Strategy Type



Results of the Cluster Analysis by Strategy Type

Table 9
Cluster membership Effects on Spring Oral Reading Fluency (ORF)

	Model 1			Model 2		
Effect on Spring ORF	Value	SE	*p*	Value	SE	*p*
Intercept	44.93	2.96	.00	44.94	2.93	.00
Fall to winter NWF gain	0.15	0.09	.10	0.16	0.09	.10
Fall NWF	0.19	0.14	.17	0.19	0.13	.17
Winter ORF	1.15	0.15	.00	1.15	0.14	.00
Unit Cluster	11.31	4.03	.01			
Recode Cluster	*12.76*	*4.13*	*.00*	*12.76*	*4.09*	*.00*
Sound Cluster	6.58	3.80	.09	6.57	3.77	.09
Unit-Error Cluster	11.26	4.80	.02			
Unit + Unit Error Clusters				11.28	3.49	.00
Fall to winter NWF gain by fall NWF	0.00	0.01	.59	0.00	0.01	.58

Note. $n = 66$. Fall NWF, fall to winter NWF gain, and winter ORF centered about their respective means. Model 1 and 2 intercept is the Errors Cluster. Model 1: R-Square = .88. Coef of Var = 1.06. Model 2: R-Square = .88, Coef of Var = 1.05

Summary & Conclusions

Conclusions - Questions 1 & 2

- In a different sample (lower-achieving, different instructional context), and with different NWF directions we found evidence to support the findings of Harn, Stoolmiller, & Chard (2008).
- The effect of growth on NWF-CLS was moderated by initial skill status, but well-approximated by a linear relation. *Growth on NWF-CLS was strongly related to ORF for students beginning first grade with scores below 49*.
- The new directions and scoring procedures for NWF have not affected its relationship to later reading outcomes.

Conclusions

- Student errors on NWF impact its relationship to ORF. *Students who are making a significant number of errors* on NWF in the middle of 1st grade *are at-risk* for detrimental reading outcomes.
- Students who used a *unitization strategy* saw significant improvements on their Spring ORF scores.
- The future reading performance of students who used a recoding or a partial blending strategy was not clear from this study.

Recommendations for Practice

- Is it imperative that *both* components of the alphabetic principle are *clearly and explicitly taught to mastery* in 1st grade.
- Use both goals when interpreting student NWF performance (CLS and WWR), particularly in the upper grades.
- Use a unitization goal based on *whole words read* (WWR) rather than words recoded correctly (WRC).
- Students who are still making errors on basic letter sounds in the middle of 1st grade are at high-risk for not meeting later reading outcomes. Perhaps even irrespective of NWF score.
- It is very important to *open up the NWF booklets* for *instructional planning* purposes.

Limitations & Future Research

- We agree with other researchers in stating that a *difference in the focus of instruction could cause a difference in the relationship between NWF and later outcomes* (Vanderwood et al., 2008).
- Findings may not generalize to other samples, or to other times of the year (e.g., end of 1st grade).
- Our findings, particularly with regard to errors, need to be replicated in another sample.
- Further clarification of the impact of both the *partial blend* and *recoding* strategies on later reading is needed.

Questions?

Contact Information:

Kelli D. Cummings, Ph.D., NCSP
Senior Research Scientist/Director of Data Analysis, Dynamic Measurement Group
Courtesy Research Associate, University of Oregon

kcummings@dibels.org

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