A decade of research validates EPACC as an effective intervention

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Background

Promulgation and implementation of the No Child Left Behind Act of 2001 initiated a nationwide effort to help all students become readers by third grade. More recent initiatives such as response to intervention (RTI) and the emphasis on using evidence-based reading practices in the classroom have maintained this momentum in a prevention-oriented framework for beginning reading instruction (Denton et al., 2010; Gersten et al., 2009; Gersten & Dimino, 2006; Torgesen, 2007, 2009).

Prior to these initiatives, more than two decades of research investigated questions related to phonological and alphabetic awareness and successful acquisition of beginning reading skills (e.g., Adams, 1990; Bull & Blachman, 1988, 1991; Lewkowicz, 1980; Liberman & Shankweiler, 1985; National Reading Panel, 2000; Stanovich, 1986; Torgesen & Davis, 1996; Wagner, 1988; Wagner & Torgesen, 1987). Several "big ideas" (Kameenui & Carnine, 1998) have emerged from this research base.

First, in beginning reading, phonological awareness is critical, especially at the kindergarten level of instruction, because it forms the foundation for developing alphabetic understanding, a skill that requires children to map the individual sounds in words onto the letters of the alphabet in order to be able to read words (e.g., Adams, 1990; Ball & Blachman, 1991; Foorman, Francis, Beeler, Winikates, & Fletcher, 1997; National Reading Panel, 2000).

Second, converging evidence suggests that specific phonological tasks, especially phonemic segmentation, are strong predictors of beginning reading ability (Muter, Hulme, Snowling, & Taylor, 1997; Kaminski & Good, 1996; 0'Connor &: Jenkins, 1999; Snider, 1997; Spector, 1992; Wagner, Torgesen, Rashotte, Hecht, Barker et al., 1997; Yopp, 1988), and that the phonological awareness skills of phonemic segmentation and phonemic blending are necessary prerequisites for success in learning to read (Ball & Blachman, 1988, 1991; Davidson & Jenkins, 1994; Fox & Routh, 1984; O'Connor, Jenkins, & Slocum, 1995; Torgesen, Morgan, & Davis, 1992).

Third, phonological awareness skills are teachable (e.g., Adams, 1990; Ball & Blachman, 1988, 1991; Brady, Fowler, Stone, & Winbury, 1994; Cunningham, 1990; O'Connor et al., 1995; National Reading Panel, 2000). Thus, instruction often results in significant gains in phonological awareness skills for most children. Those who received phonological awareness instruction, and subsequently demonstrated increases in these skills, had higher scores on measures of reading achievement than children who did not receive phonological awareness instruction (Ball & Blachman, 1991; Cunningham, 1990; Fox & Routh, 1984; Davidson & Jenkins, 1994; O'Connor et al., 1995; O'Connor, Notari, Syverson, & Vadasy, 1996; Torgesen et al., 1992).

Finally, although phonological awareness is necessary, it is not sufficient for beginning reading acquisition. Phonological awareness instruction is most advantageous for learning to read words when combined with alphabetic skills, specifically letter-sound correspondences, to establish

explicit links between letters and sounds in spoken word (e.g., Ball & Blachman, 1991; Byrne & Fielding-Barnsley, 1989, 1991; Ehri & McCormick, 1998; Foorman et al., 1997; National Reading Panel, 2000; Simmons & Kameenui, 1998; Vandervelden & Siegel, 1997).

Five studies across a decade

Explicit Phonemic Alphabetic Connections Curriculum (EPACC) has been validated both for classroom-wide instruction, and as an effective Tier 1 and Tier 2 RTI intervention for teaching critical beginning reading skills as a complement to the core reading curriculum. The intervention was determined to be effective in 5 separate studies in 12 different classrooms across a decade of research effort.

Study 1

At the time of Study 1, a review of kindergarten intervention studies revealed that the optimal sequence for integrating letter sounds with phonemic blending and segmenting had not been investigated empirically to examine its effect on word reading and phonological awareness performance and rates of growth in word reading for kindergarten children with low phonological awareness. The research, however, clearly indicated that integration of these two component skills was critical for acquisition of beginning reading (Oudeans, 2003).

Study 1 used a parallel integrated (PI) instructional sequence, which is the prototype for EPACC. The study systematically and explicitly linked and integrated the alphabetic skills of letter-sound correspondences with the phonological skills of phonemic blending and segmenting during instruction involving print (i.e., letters). The result was higher word reading and phonological awareness performance for kindergartners with low phonemic awareness.

Purpose

Study 1 compared two instructional sequences—parallel integrated (PI) and parallel non-integrated (PN-I)—to determine which sequence resulted in higher performance and rates of growth in word reading and phonological awareness for kindergarten children with low phonemic awareness.

Method

Setting and participants. Participants in the study were from five kindergarten classrooms in three elementary schools. The Word Identification subtest of the Woodcock Reading Mastery Test–Revised (WRMT–R, 1987) was administered in late November to identify nonreaders for participation in the study, which began in mid-January and was completed at the end of March. Pretests that assessed phonological awareness skills, language ability, and alphabetic skills were administered in mid-December. Of the 55 participants, 36 (65%) demonstrated low phonemic segmentation skills at pretest. That is, they produced 10 or fewer phoneme segments per minute on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Phonemic Segmentation Fluency (PSF). According to Good, Simmons, and Smith (1998), scores in these ranges on the PSF in the winter of kindergarten could signal difficulties in reading acquisition if not remediated. The remainder of the eligible children's pretest scores (n = 19) indicated that phonemic skills were emerging (i.e., between 11 and 34 segments per minute) and were considered adequate at this time of the year. There were no significant differences between groups at pretest.

Research design. Study 1 used a pretest-posttest comparison group design with random assignment of participants to the groups. Students were assigned to groups using this process:

- Students' pretest scores on the DIBELS Letter Naming Fluency (LNF) measure were ranked and ordered from the highest to the lowest score.
- Students were paired using the LNF rank order.
- Pairs of children were assigned randomly—one member of the pair to the PI sequence and other to the PN-I sequence.

Independent variable. The two instructional sequences, PI and PN-I, were used as the independent variable. The lessons for the two instructional sequences were taught for 10 weeks, 15 minutes per day, 4 days a week, to small groups of students (3–4) in addition to the classroom early literacy curriculum. This curriculum included the SMART reading program, with additional early literacy activities such as story reading, letter-sound instruction, predictable and big books, and writing instruction.

Both instructional sequences provided clear, unambiguous strategies for teaching letter names and sounds, and phonemic blending and segmenting skills. Both the PI and PN-I sequences provided lessons with carefully sequenced examples, practice, corrective feedback, and review. The sequences differed on a single variable—the presence or absence of explicit connections between letter-sound correspondences and phonemic blending and segmenting. In the PI sequence, the lessons incorporated an integration strategy that explicitly connected the letter-sounds with the words taught during phonemic blending and segmenting.

The PN-I sequence taught the alphabetic and phonemic skills as separate activities in all lessons. No explicit connections were made between the letter sounds and words used for phonemic blending and segmenting.

Dependent variables. The dependent variables included measures of alphabetic knowledge, phonological awareness, language ability, and rapid retrieval of information. Four measures were used to assess alphabetic skills and two measures were used to provide an index of group comparability on rapid retrieval of information and language ability. See Oudeans (2003) for details.

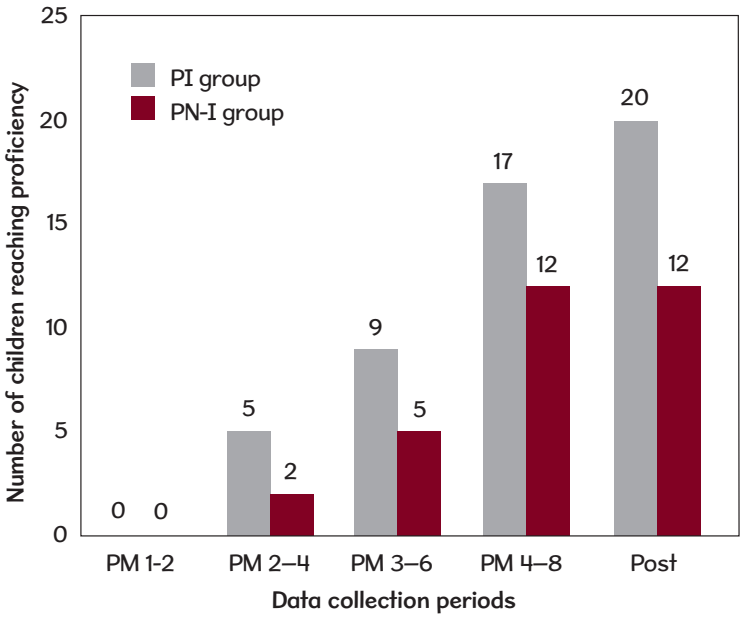
Two subtests from DIBELS were used to assess students' phonological awareness, specifically the ability to segment words. Onset Recognition Fluency (OnRF) assessed fluency in identifying and producing the onset in words (i.e., the sounds in a word preceding the vowel). Phonemic Segmentation Fluency (PSF) assessed students' ability to break a spoken word into its individual phonemes.

Study 1 results

Effect of instructional sequence on phonological awareness. There was a statistically significant interaction between instructional group and initial PSF. Initial (pretest) PSF skills were a significant predictor of posttest performance on the PSF measure for the PN-I sequence. Children in the PI sequence with initially low PSF demonstrated posttest skills comparable to children with emerging PSF at pretest.

The number of children who reached proficiency by posttest was significantly higher for the PI group than for the PN-I group (see Figure 1).

FIGURE 1
Comparison of Phonemic Segmentation Fluency Between Groups



Note. PM 1–2 = Progress monitoring #1 (Week 2), PM 2–4 = Progress monitoring #2 (Week 4), PM 3–6 = Progress monitoring #3 (Week 6), PM 4–8 = Progress monitoring #4 (Week 8), Post = Posttest.

Study 1 summary of results

Effects of instructional sequence on phonological awareness. It was a benefit for kindergarten children with low phonemic awareness in January to be in the PI sequence. In essence, the PI sequence was effective in closing the gap in phonemic segmentation between children with low segmentation skills and children with adequate skills by posttest.

More children in the PI sequence reached proficiency on the PSF measure (i.e., attained 35–45 phoneme segments per minute for two consecutive progress monitoring sessions) than in the PN-I sequence at posttest. According to Good and Kaminski (1998), children who are proficient on PSF in the winter of kindergarten (i.e., can produce 35–45 phoneme segments per minute) have a better chance of becoming successful readers in first grade.

PI sequence was more effective for increasing PSF skills, and the effects of the PI sequence were strong enough for children to maintain the gains in segmentation skills even after the intervention was discontinued.

Effects of instructional sequence on word reading performance. The PI and PN-I sequences were equally effective in teaching children the letter names and sounds in isolation. However, the PI sequence was reliably more effective in helping children apply their letter-sound knowledge to word reading regardless of initial phonemic segmentation skills. Children in the PI sequence read significantly more words per minute at posttest than children in the PN-I sequences.

The results of this study suggest that the PI sequence provided two important advantages to kindergarten children as they started to make sense of the alphabetic writing system when

learning to read. First, the PI sequence made explicit those processes that are essential to beginning reading acquisition but that are not typically attended to by kindergarten children with low phonological awareness—the connections between letter-sounds and phonemic blending and segmenting. Second, the PI sequence made explicit the implicit strategies that good readers use to recognize sounds in words, relate sounds to letters, and blend sounds into words. Additional word reading performance scores for this study can be found in Oudeans (2003) and the EPACC Implementation Guide, Appendix C.

Studies 2–4: EPACC as a Tier 1 RTI

Studies 2–4 used EPACC as a Tier 1 RTI framework with intact kindergarten classrooms and teachers with 10–17 students. In all three studies, EPACC was used to complement the core kindergarten curriculum, which was teacher-designed instruction grounded in developmentally appropriate practice. These studies compared two programs that taught beginning reading skills in kindergarten. EPACC, taught in addition to the core kindergarten curriculum (CKC) as a Tier 1 intervention, was compared with the CKC alone to determine which program resulted in higher performance in word reading and phonological awareness skills.

In each study, two kindergarten teachers self-selected to participate in the study. Each teacher provided instruction to her own classroom of children. Whole group reading instruction was delivered with approximately the same amount of time spent on early literacy skills each day.

Method

EPACC intervention group. EPACC was taught 15 minutes, 4 times per week, October through mid-May to the whole group of kindergarten students as a complement to the CKC, which included teacher-designed instruction grounded in developmentally appropriate practice in conjunction with a basal reading series.

Control group. The CKC alone was taught to the whole group of kindergarten students and included teacher-designed instruction grounded in developmentally appropriate practice in conjunction with the same basal reading series used for the intervention group.

Dependent variables. Study 2 used subtests of DIBELS—Initial Sound Fluency (ISF), Phonemic Segmentation Fluency (PSF), and Nonsense Word Fluency (NWF)—as dependent variables administered at fall (pretest), winter (mid/end-January) and spring (end-May). No significant differences were found for ISF or NWF at pretest. However, there were significant differences between groups on PSF. Students in the control group performed significantly higher than those in the intervention group, indicating that it would be possible for the control group to outperform the intervention group at winter and/or spring benchmarks on PSF.

In addition, Studies 2–4 used the Woodcock Reading Mastery Test-Revised subtest Word Attack, and a researcher-designed timed Word Reading Generalization Test to assess word reading performance (EPACC Implementation Guide, Appendix C; Oudeans, in progress).

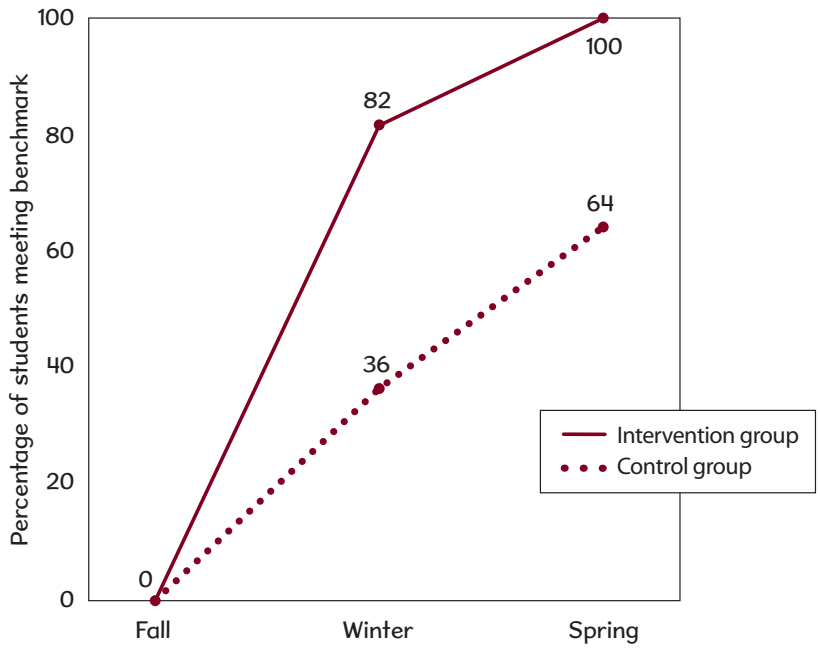
Table 1: Percentage of students meeting benchmark

	Study 2		Study 3		Study 4	
Group	EPACC	non-EPACC	EPACC	non-EPACC	EPACC	non-EPACC
Group size	N = 17	N = 14	N = 12	N = 10	N = 17	N = 17
Pretest PSF % students meeting benchmark	0% (*N* = 0)	0% (*N* = 0)	0% (*N* = 0)	0% (*N* = 0)	0% (*N* = 0)	0% (*N* = 0)
Mid PSF % students meeting benchmark	82% (*N* = 14)	36% (*N* = 5)	58% (*N* = 7)	0% (*N* = 0)	59% (*N* = 12)	35% (*N* = 6)
Posttest PSF % students meeting benchmark	100% (*N* = 17)	64% (*N* = 9)	92% (*N* = 11)	20% (*N* = 8)	76% (*N* = 13)	59% (*N* = 10)

Study 2 results

Winter benchmark—mid PSF. At winter benchmark, PSF results revealed significant differences (< .05) between groups. Even though the significant differences in PSF at pretest favored the control group, the students in the intervention group performed significantly higher on PSF in mid-January. The expected criterion of performance range for PSF is 35–45 phoneme segments per minute by the end of kindergarten. However, 82 percent of the students in the intervention group met the end-of-kindergarten criterion for PSF by mid-January, compared with 36 percent of the students in the control group (see Figure 2).

FIGURE 2
Study 2: PSF Percent of Students Meeting Benchmark



Spring benchmark—posttest PSF. At spring benchmark, statistically significant differences (< .05) favored the intervention group on PSF. Spring data show that 100 percent of the students in the intervention group had scores on PSF within the expected criterion of performance range for the end of kindergarten, compared with 64 percent of students in the control group (see Figure 2). Studies 3 and 4 demonstrated consistent results (see Figures 3 and 4).

FIGURE 3
Study 3: PSF Percent of Students Meeting Benchmark

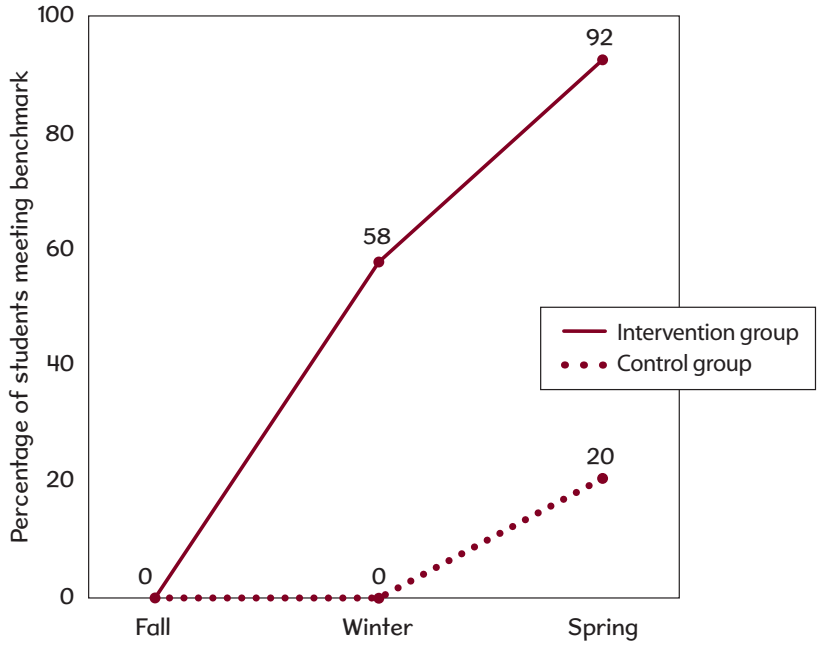
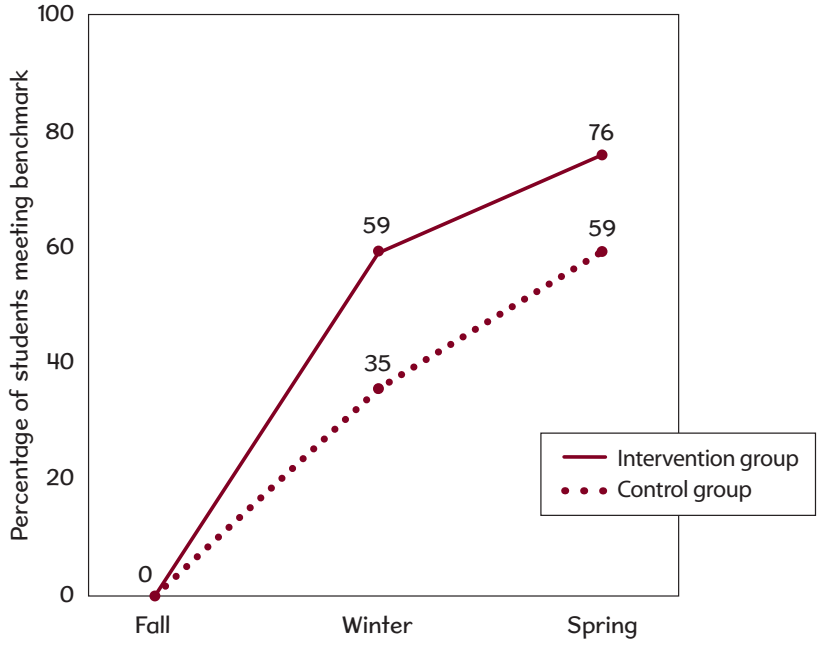


FIGURE 4
Study 4: PSF Percent of Students Meeting Benchmark



Study 2 summary of results

Students in the intervention group outperformed the control group on three critical beginning reading skills: Phonemic Segmentation Fluency, Word Attack, and Word Reading (EPACC Implementation Guide, Appendix C Study 2; Oudeans, in progress). EPACC resulted in higher performance in word reading and phonological awareness skills than using the core kindergarten curriculum alone to teach critical beginning reading skills. EPACC made explicit the connections between print and the sounds of spoken language helping students to break the code in an alphabetic writing system and acquire beginning word reading skills.

Study 5: EPACC as a Tier 2 RTI

Study 5 used EPACC as a Tier 2 RTI framework with an intact kindergarten classroom. Tier 2 RTI intervention was conducted with five students. The classroom teacher taught EPACC approximately 15 minutes per day 4 times per week from mid-September through the end of February, when student assessments indicated that students could return to core curriculum instruction only or move into another Tier 2 intervention group.

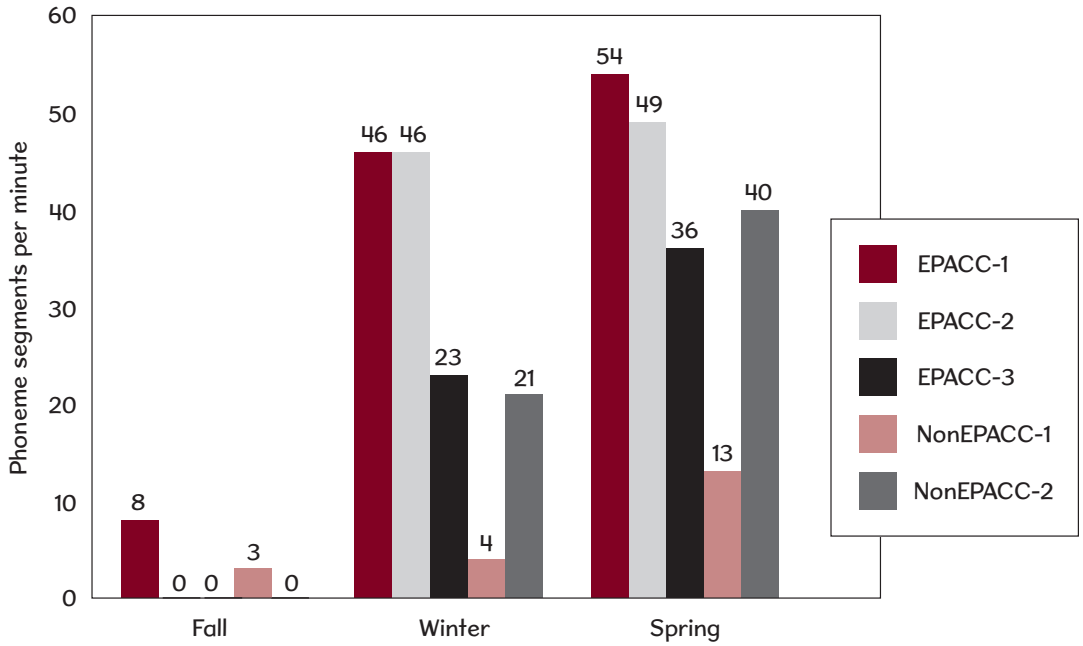
Method

Participants. For Study 5, five kindergarten students participated. Eligibility for Tier 2 intervention was low or low/average in Academic Skills on the Dominie Literacy Assessment and 5 or fewer initial phonemes per minute on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS). Three students were assigned to Tier 2 EPACC group. Two students were assigned to Tier 2 non-EPACC group.

Study 5 results

Phonemic segmentation fluency is the ability to quickly break words into individual phonemes, a critical predictor of future reading success. According to Good and Kaminski (1998), children who are proficient on PSF by the end of kindergarten (i.e., can produce 35–45 phoneme segments per minute) have a better chance of becoming successful readers in first grade.

FIGURE 5
Study 5: Phonemic Segmentation Fluency (PSF)



Study 5 summary of results

The results of this study indicate that two of the three students receiving EPACC in a Tier 2 intervention met end-of-kindergarten benchmark in February (35–45 phoneme segments per minute), and all three students receiving instruction in EPACC met benchmark by end of kindergarten. Posttest (June) scores on PSF show that the students maintained the phonemic segmentation skills even after they returned to Tier I-only instruction in the core kindergarten curriculum.

Additional pretest and posttest measures were recorded for these five students evaluating word reading performance where EPACC participants outscored non-EPACC participants (Oudeans, in progress).

EPACC implications for practice from a decade of research

It is critical for kindergarten reading instruction to make explicit those processes that are essential to beginning reading—the connections between print and the sounds of spoken language. The greater effectiveness of the EPACC sequence in strengthening the word reading ability of children with low phonological awareness skills suggests that **how** we teach the two component skills of letter-sounds and phonological blending and segmenting is as important to children's progress in becoming readers as **what** we teach. EPACC teaches the two skills in a parallel integrated approach. As a result, students taught using EPACC achieve higher scores on phonemic segmentation fluency and have a greater chance of becoming successful readers in a core reading program.

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