PROMOTING TEACHERS' USE OF SCIENTIFICALLY BASED INSTRUCTION

A Comparison of University versus District Support

ABSTRACT

In this study, a school district adopted Kindergarten Peer-Assisted Learning Strategies (K-PALS), a scientifically based, class-wide peer-tutoring program for reading. Sixteen new K-PALS teachers were assigned randomly to receive ongoing support from a university expert or from experienced K-PALS teachers within the district. K-PALS teachers who received university support implemented K-PALS with somewhat higher (d = .41), but not reliably different, fidelity compared to those who received district support. K-PALS teachers' student reading outcomes did not differ significantly based on whether they received university or district support. However, K-PALS teachers' students reliably outperformed historical controls on beginning reading measures (d = .24 to 1.29). Implications for further research and for schools' adoption of K-PALS are discussed.

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CURRENT educational policies emphasize that all students must meet rigorous academic standards, and that teachers must be held accountable for academic outcomes of students with and without disabilities (Individuals with Disabilities Education Improvement Act, 2004; No Child Left Behind Act, 2002). To ensure that all students achieve at high levels, teachers are expected to implement scientifically based instructional practices—that is, practices that have been empirically demonstrated to promote student achievement.

The charge to infuse scientifically based instruction into all classrooms is challenging for several reasons. First, relatively few instructional approaches have been

validated for classroom use through rigorous experimental or quasi-experimental research (Seethaler & Fuchs, 2005; Slavin, 2003). Thus, teachers have limited choices of scientifically based practices to implement. Second, teachers do not always tap instructional approaches that do have empirical support, creating a gap between research and practice (e.g., Espin & Deno, 2000; Fuchs & Fuchs, 1998; Klingner, 2004). Third, adopting scientifically based instruction is only "one part of the recipe for improvement" (Chard, 2004, p. 214). Whether these practices have a positive, long-term impact on student outcomes likely depends on school-wide practices that include ongoing professional development (PD) and support for teachers (Chard, 2004).

Closing the Research-Practice Gap: Peer-Assisted Learning Strategies

To close the research-practice gap, it is important for researchers and practitioners to find ways to work together to identify educational problems and create solutions (Chard, 2004; Fogelman, Fishman, & Krajcik, 2006; Greenwood & Abbott, 2001; Klingner, 2004). One example of such a collaborative effort is the development of Peer-Assisted Learning Strategies (PALS)[1], a class-wide peer-tutoring approach designed to help teachers meet the needs of an increasingly diverse student population (Fuchs, Fuchs, Mathes, & Simmons, 1997). For more than 15 years, PALS researchers have worked closely with classroom teachers to develop a peer-mediated program to address students' diverse academic needs that is feasible for classroom use (Fuchs & Fuchs, 1998, 2005; Fuchs, Fuchs, & Burish, 2000).

Kindergarten PALS (K-PALS), which was designed to promote reading readiness in at-risk kindergartners, is one product of this collaboration. Across several years, researchers worked with teachers to design and evaluate K-PALS, resulting in a program that is feasible and compatible with a range of teaching philosophies (Fuchs, Fuchs, Al Otaiba, et al., 2001), and that has improved the beginning reading skills of a wide range of learners (Fuchs, Fuchs, Thompson, et al., 2001), including students with disabilities (e.g., Fuchs et al., 2002; Rafdal, McMaster, McConnell, Fuchs, & Fuchs, 2011) and English learners (McMaster, Kung, Han, & Cao, 2008).

Despite their success in collaborating with classroom teachers, PALS researchers expressed concern about schools' adoption and successful use of PALS outside the research context (Fuchs et al., 2000). This concern arose from the fact that, throughout PALS research, teachers received weekly classroom assistance from graduate students. What remained unclear was whether or not, without such support, teachers would be able to implement PALS with fidelity and obtain similar student achievement gains to those observed in research.

Importance of Professional Development and Support

The question of what type of teacher support is needed to ensure fidelity and lead to improved student outcomes is not unique to PALS. A growing body of literature has addressed how to best support and sustain teachers' adoption of a variety of scientifically based practices. This research reflects general agreement that traditional approaches to PD, which have typically entailed brief, one-time-only workshops with little or no follow-up support, are insufficient for effecting

meaningful, long-term changes in practice (Birman, Desimone, Porter, & Garet, 2000; Garet, Porter, Andrews, & Desimone, 2001; Klingner 2004). Rather, more comprehensive and supportive PD systems are likely necessary to ensure that teachers can successfully use scientifically based practices in "real world" conditions (Chard, 2004; Odom, 2009).

Such comprehensive and supportive systems include (*a*) support provided from outside experts, such as coaching and consultation either face to face (e.g., Powell, Diamond, Burchinal, & Koehler, 2010; Sailors & Price, 2010) or via web-based technology (e.g., Pianta, Mashburn, Downer, Hamre, & Justice, 2008; Powell et al., 2010), or (*b*) support provided from within schools or districts, such as communities of practice or teacher study groups (e.g., Gersten, Dimino, Jayanthi, Kim, & Santoro, 2010; Vaughn & Coleman, 2004). Whereas these models have varied in their specific approaches, those that have successfully changed teacher knowledge, skills, and attitudes toward new practices share several essential features (Desimone, 2009): (*a*) a focus on content; (*b*) active learning opportunities; (*c*) extended duration; (*d*) coherence, such that it is clear how new practices align with standards and curricula; and (*e*) collective participation and collaboration among teachers. Studies of PD models that include these features have revealed positive effects on teacher knowledge of, implementation of, and satisfaction with newly learned practices (e.g., Gersten et al., 2010; Pianta et al., 2008; Vaughn & Coleman, 2004) and have begun to show promise to improve student outcomes (e.g., Powell et al., 2010; Sailors & Price, 2010).

Despite general consensus that teachers' successful adoption of scientifically based practices depends on strong, ongoing PD efforts, further research is needed to better understand the extent to which PD practices lead to improved student outcomes (Desimone, 2009; Gersten et al., 2010). Further, ongoing PD and support tend to be time and resource intensive (Vaughn & Coleman, 2004). Important questions remain regarding whether and how ongoing PD can support teachers' use of scientifically based practices in ways that promote student achievement and are feasible given limited resources in schools. Below, we describe the context for the current study and how we have begun to explore these questions.

Scaling Up K-PALS

Multisite Study

The present study was an offshoot of a large, multisite study in which Fuchs et al. (2008; see also Kearns et al., 2010; Stein et al., 2008) examined the effects of K-PALS when scaled up to geographically and demographically diverse locations (Tennessee, Minnesota, and Texas). One goal of the multisite study was to determine what types of PD were needed to promote teachers' K-PALS fidelity and improve student reading outcomes. Across 2 years, 224 kindergarten teachers from 71 schools in the three states were assigned randomly to a business-as-usual control, K-PALS Workshop (1-day workshop followed by 20 weeks of K-PALS implementation), or K-PALS Workshop + Boosters (one-day workshop followed by 20 weeks of K-PALS and two to three small-group problem-solving sessions across the school year). In the first year, a fourth group of teachers also received weekly technical support from research staff. This condition was dropped after one year as it did not appear to add value to

student achievement (for more discussion about this level of support, see Kearns et al., 2010).

The K-PALS Workshop + Boosters condition incorporated features of effective PD described by Desimone (2009). A focus on content was incorporated into the workshop, in which teachers learned the rationale for and specific procedures to implement the K-PALS beginning reading activities; and during boosters, in which they reviewed critical K-PALS components. Active learning was built into both the workshop and boosters, in which teachers were provided with modeling and extensive opportunities to practice, ask questions, and receive feedback about K-PALS implementation. Coherence was addressed in that the workshop and boosters emphasized how K-PALS activities align with kindergarten literacy curricula and standards, and encouraged teachers to make explicit connections between K-PALS and other aspects of their instruction. K-PALS teachers received support over an extended duration, in that booster sessions were held two to three times across the school year. Collective participation was incorporated into boosters, in that small groups of K-PALS teachers had opportunities to share experiences and ideas and engage in problem solving with each other.

Across the three states, K-PALS students outperformed controls on phonological awareness tasks. K-PALS students in Tennessee and Minnesota outperformed controls on word-reading tasks, and K-PALS students in Tennessee outperformed controls on oral reading. Workshop + Booster teachers implemented K-PALS with greater fidelity than did Workshop teachers (with, on average, 87% vs. 81% fidelity, respectively; Stein et al., 2008), and students in Workshop + Booster classrooms outperformed those in Workshop classrooms on some reading tasks. Further, teachers' fidelity to K-PALS substantially mediated the impact of K-PALS on student outcomes (Stein et al., 2008). These findings illustrate the promise of ongoing support for promoting fidelity of teacher implementation and, in turn, student outcomes.

One Minnesota School District

Because participation in the multisite study was voluntary, it was often the case that only one or two kindergarten teachers within a school, and only several schools within a district, participated. After participating in the multisite study, one of the school districts in Minnesota decided to adopt K-PALS as part of its literacy curriculum. As part of this adoption, the district's literacy leadership team revised the scope and sequence of letter sounds taught in their curriculum to align with the K-PALS scope and sequence. The district also agreed to continue participating in K-PALS research, presenting a unique opportunity to extend this research to an entire school district.

Because booster support appeared to add value to providing a 1-day K-PALS workshop, we decided to continue to explore this level of support. We were particularly interested in whether ongoing support could be provided by experienced district personnel. Thus far, K-PALS "experts"—university staff experienced in providing K-PALS training and technical assistance—have provided PD and ongoing support to K-PALS teachers. To further scale up K-PALS for implementation in schools and districts, it would be valuable to know whether experienced K-PALS teachers within a district could provide such support.

Both university and district support have potential advantages for new K-PALS teachers. University support is provided by K-PALS experts who have spent many hours observing and providing support to K-PALS teachers across a wide range of classrooms. Thus, university experts have strong knowledge about how to implement K-PALS with fidelity, and also can bring their experiences from a multitude of different classrooms to bear on solving the problems that K-PALS teachers often encounter (such as how to create successful partnerships between students, how to appropriately individualize K-PALS lessons, how to manage behaviors during K-PALS, and how to keep students motivated). Also, ongoing support provided by K-PALS experts creates the opportunity to develop and maintain strong university-school partnerships, which has been identified as critical to closing the gap between research and practice (e.g., Greenwood & Abbott, 2001; Klingner, 2004; Sailors & Price, 2010).

Support provided by experienced K-PALS teachers also has potential advantages. Opportunities for peer networking and support have been found to facilitate teacher buy-in, satisfaction with, and implementation of new practices (Gersten et al., 2010; Klingner, 2004; Vaughn & Coleman, 2004), which in turn can facilitate scaling up of those practices to schools or districts (e.g., Klingner, Ahwee, Pilonieta, & Menendez, 2003). Experienced K-PALS teachers could share not only their knowledge of K-PALS but also a deeper understanding of day-to-day classroom dynamics and how K-PALS fits into the broader curriculum. Also, support from experienced teachers would likely be less costly and more accessible in the long term, especially for districts not in close proximity to outside expertise (Vaughn & Coleman, 2004). What is not known is whether support provided by experienced K-PALS teachers would lead to similar levels of K-PALS fidelity found to be important to student outcomes in previous research, in which support was always provided by university researchers.

Purpose

The purpose of this study was to compare effects of support provided to new K-PALS teachers by experienced K-PALS teachers within the district to support provided by a K-PALS expert from the university on teachers' fidelity of K-PALS implementation and student reading achievement. We did not have an a priori hypothesis regarding which approach would be more effective, given possible advantages of both as described above. Our primary research question was, what is the effect of district-based support compared to university-based support on (*a*) new K-PALS teachers' fidelity of implementation and (*b*) student reading outcomes?

Because the entire district adopted K-PALS, we were able to assign teachers randomly to district or university support groups; however, it was not possible to include a randomized control. Yet, we believed it was important to determine whether K-PALS continued to be effective compared to business-as-usual instruction. Thus, we used data from the business-as-usual control teachers from the 2 prior years of the multisite scaling-up K-PALS study as a historical comparison group. Our secondary question was, what is the effect of K-PALS compared to a historical business-as-usual control on student reading outcomes?

Method

Setting and Participants

District. After participating in the multisite scaling-up study, a large, suburban district in Minnesota decided to adopt K-PALS as part of its core kindergarten literacy curriculum. The decision to adopt K-PALS was made with the input of district and school administrators who were familiar with the multisite study, as well as kindergarten teachers who had participated in the study and were members of the district's literacy leadership team. The district purchased K-PALS manuals and scheduled workshops for new K-PALS teachers. Principals agreed to provide teachers with time to participate in boosters during the school year.

At the time of this study, the district served 10,669 students; 28% received free/reduced-price lunches, 9% were English learners, and 13% received special education services. Sixty-eight percent of the students were White, 14% African American, 8% Hispanic, 9% Asian/Pacific Islander, and 1% American Indian. Nine of the 10 district elementary schools participated in this study.

Experienced teachers. Teachers who had implemented K-PALS for at least 1 year during the multisite study were invited to provide the district-based support to new K-PALS teachers. Six of nine eligible teachers participated; the other three were on maternity leave or had moved to a different grade level. All six teachers were White females, ranging in age from late 20s to mid-40s. All had bachelor's degrees in elementary education; two had master's degrees. Years of teaching experience ranged from 3 to 22 ($M = 10$ years). The mean fidelity with which the six teachers had implemented K-PALS during the multisite study was 87.5% (range = 66%–96%). Five teachers' scores were 89% or higher. The least experienced teacher had the lowest fidelity and was teamed with two veteran teachers to support new K-PALS teachers.

University expert. University support was provided by the study project coordinator, an advanced doctoral student in school psychology with an educational specialist degree. She had worked on the research team as part of the multisite scaling-up PALS study, and had worked in public schools as a school psychologist. Thus, she had in-depth knowledge of K-PALS as well as professional experience consulting with teachers about academic issues.

New K-PALS teachers. The researchers presented study information to the district's kindergarten teachers during a staff development day prior to the start of the school year. Teachers who had not yet participated in K-PALS research, or who had served as controls in the multisite study, were invited to participate as new K-PALS teachers. Sixteen of 21 eligible teachers agreed to participate. Of the remaining teachers, one was on maternity leave, one did not teach reading, and three had a new principal who decided not to participate.

A matched-pairs, random-assignment design was used to place teachers in one of two groups: one that received district support and one that received university support. To achieve similar groups, each new teacher was matched to another new teacher from the same school when possible, and otherwise from another building, according to length of instructional day (half- vs. full-day kindergarten), time of session for half-day classrooms (morning vs. afternoon), and percentage of students receiving free or reduced-price lunch in the school (0%–30% vs. 30%–50%). For

teachers who taught two half-day sessions, only one of their sessions was used, such that a roughly equal number of morning and afternoon kindergarten classes were represented in each group. Pairs were then assigned randomly to the two support groups. This process yielded two groups of eight teachers. Demographic information comparing new K-PALS teachers who received district versus university support is presented in the left half of Table 1. Chi-square analyses on categorical data, and *t*-tests on continuous data, revealed no statistically significant differences between the two groups on any demographic variable.

Historical comparison group. Because all kindergarten teachers in the district were asked to conduct K-PALS, it was not possible to include a randomized control group. Thus, we used a historical control group, consisting of teachers who had served as controls in the multisite study ($n = 16$). These teachers did not receive any K-PALS training and conducted business-as-usual instruction. Demographic data for all new K-PALS teachers (district and university support groups combined) and the historical control group are presented in the right half of Table 1. Chi-square analyses and *t*-tests revealed no statistically significant differences between groups.

Students. In each new K-PALS classroom and in historical control classrooms, all consented students were screened using Rapid Letter Naming (RLN) and Rapid Letter Sound (RLS) tasks, both strong predictors of later reading success (Kaminski & Good, 1996). Each teacher was asked to identify students as high,

Table 1. Teacher Demographics (District- vs. University-Supported Groups, and New K-PALS Teachers vs. Historical Control Group)

	New K-PALS Teachers							
	District Support ($n = 8$)	University Support ($n = 8$)			Total New K-PALS Teachers ($n = 16$)	Historical Control ($n = 16$)		
	n (%)	*n* (%)	χ^2	*p*-value	*n* (%)	*n* (%)	χ^2	*p*-value
Sex: female	8 (100)	8 (100)	0	1.00	16 (100)	15 (94)	1.03	.31
Race: Caucasian	8 (100)	8 (100)	0	1.00	16 (100)	15 (94)	1.03	.31
Age			3.81	.43			3.47	.48
21–29	4 (50)	3 (38)			7 (38)	3 (19)		
30–39	2 (25)	1 (13)			3 (13)	2 (13)		
40–49	1 (13)	2 (25)			3 (25)	6 (38)		
50–59	0	2 (25)			2 (25)	4 (25)		
60+	1 (13)	0			1 (6)	1 (6)		
Highest degree			1.33	.72			2.76	.60
B.A./B.S.	5 (63)	5 (63)			10 (63)	8 (50)		
B.A./B.S. + 30	0	0			0	2 (13)		
M.A.	1 (13)	1 (13)			2 (13)	2 (13)		
M.A. + 15	1 (13)	0			1 (6)	2 (13)		
M.A. + 45	1 (13)	2 (25)			3 (25)	4 (25)		
	M (*SD*)	*M* (*SD*)	*t*	*p*-value	*M* (*SD*)	*M* (*SD*)	*t*	*p*-value
Years of teaching	9.9 (12.6)	12.4 (14.5)	−.37	.72	11.1 (13.2)	14.4 (8.1)	−.85	.40
No. of SE students[a]	2.1 (1.0)	2.2 (1.2)	1.28	.22	1.4 (1.7)	1.3 (1.3)	.19	.85
Reading credits[b]	2.7 (1.4)	2.7 (1.0)	.00	1.00	2.7 (1.1)	3.1 (1.2)	−.98	.33
SE credits[c]	2.3 (1.6)	2.0 (.6)	.44	.67	2.1 (1.2)	2.1 (1.4)	.00	1.00

[a] Number of special education students in class.
[b] Number of credits of college or graduate coursework in reading instruction.
[c] Number of credits of college or graduate coursework in special education instruction.

average, or low performing in reading (relative to all of the students in the classroom). Following screening, students in each class were rank ordered based on RLN and RLS scores. A combination of screening scores and teacher judgment was used to determine high, average, or low target status. Specifically, when the RLN ranking matched the teacher's judgment of a student's reading performance, the student was selected as a target student. If the RLN ranking and teacher judgment did not match, the RLS scores were examined. If the RLN and RLS rankings were consistent, this information was used to determine high, average, or low target status, overriding the teacher's judgment. Using this process, we identified four high-, four average-, and four low-performing target students per class to ensure that our sample represented students with a range of reading skills. At posttest, if any of the target students had moved or had not participated in K-PALS for other reasons, they were replaced with a nontarget student who had similar RLN, RLS, and teacher ratings. When a similar student was not available, they were not replaced. The final sample included 64 high-, 63 average-, and 62 low-performing students ($N = 189$).

Student demographic data by study group are presented in Table 2. Demographic information comparing students who received district versus university support is presented in the left half of Table 2. Chi-square analyses and *t*-tests indicated few statistically significant differences between students of district- and university-supported teachers. District-supported teachers had more English learners (27% vs. 22%) and students receiving special education services (14% vs. 4%). Demographic data for students in new K-PALS teachers (university and district-supported groups combined) and the historical control group are presented in the right half of Table 2. Chi-square analyses and *t*-tests revealed no statistically significant differences between groups, except on race: there were more Caucasian students in the historical control group than in the PALS group.

Table 2. Student Demographics (District- vs. University-Supported Groups, and New K-PALS vs. Historical Control Group)

	New K-PALS Teachers							
	District Support ($n = 96$)	University Support ($n = 93$)			Total New KPALS Teachers ($n = 189$)	Historic Control ($n = 179$)		
	n (%)	*n*	χ^2	*p*-value	*n* (%)	*n* (%)	χ^2	*p*-value
Sex: male	56 (58)	44 (47)	2.37	.31	100 (53)	87 (49)	2.92	.23
Race			1.54	.82			37.46	.00
African American	31 (33)	24 (27)			55 (29)	56 (31)		
Caucasian	25 (27)	27 (30)			52 (28)	63 (35)		
Hispanic	25 (27)	24 (27)			49 (26)	7 (4)		
Asian	9 (10)	9 (10)			18 (10)	34 (19)		
Other	6 (6)	9 (10)			15 (8)	18 (10)		
ELL services	26 (27)	20 (22)	18.27	.00	46 (24)	42 (23)	.04	.84
Special education	13 (14)	4 (4)	4.93	.03	17 (9)	10 (6)	1.50	.22
	M (*SD*)	*M* (*SD*)	*t*	*p*-value		*M* (*SD*)	*t*	*p*-value
Age in years	5.77 (.35)	5.70 (.33)	1.37	.17	5.74 (.34)	5.75 (.31)	−.43	.67

Measures

K-PALS implementation fidelity. A checklist of teacher and student behaviors essential to K-PALS implementation was developed as part of the multisite K-PALS study and used to assess fidelity of implementation in this study. The checklist included 68 teacher behaviors and 122 student behaviors (see sample in Fig. 1). Most items reflected teachers' and students' adherence to K-PALS procedures. Several items also reflected whether teachers followed prescribed organizational, transition, and monitoring procedures, and whether students followed K-PALS rules. During fidelity observations, the observer first recorded fidelity of the whole-group teacher-directed lesson. Then, the observer watched at least one pair for each K-PALS activ-

+	—	NA		Teacher-Directed Sound Boxes Checklist
				Time Started:
			1	Completes entire Sound Boxes activity with class at least one time.
			2	Uses appropriate prompt, "Read it slowly."
			3	The Reader(s) read the word slowly.
			4	The Reader(s) points while reading the word slowly. If the entire class is acting as Reader, then at least half of the students should be pointing. This rule also applies to items 7 & 9.
			5	Coach(es) uses appropriate prompt, "Sing it and Read it." (acceptable to break into two parts, "Sing it." then "Read it.")
			6	The Reader(s) sings the word.
			7	The Reader(s) points at the sounds in the word while singing the word.
			8	The Reader says the word.
			9	The Reader points to the word while reading the word.
			10	If demonstrates correction procedure, uses exact/consistent wording on bolded portions and incorporates all 5 steps of the correction procedure.
			a	*The Coach says, "Stop.* ***That is word is mmmaaat****."*
			b	*The Coach says,* ***"What word?"*** *or "Read it slowly," then "Sing it and Read it."*
			c	*The Reader* ***repeats the word****.*
			d	*The Coach* ***asks*** *the Reader* ***to repeat the line*** *(e.g., "Good. Go back and read that line again.")*
			e	*The Reader* ***reads the line again.***
			11	Teacher calls on students to respond (i.e., individual or whole class responses are both acceptable).
			a	Calls on whole class to respond for some items.
			b	Calls on groups of students to respond for some items (i.e., all girls, all boys.)
			c	Calls on individual students to respond for some items.
			12	Students respond with appropriate response.
			13	Most students are responding during choral responses.
			14	Most students are paying attention while others make individual responses. Includes when an individual student is the Coach.
			15	Most students are on-task during the Sound Boxes activity.
			16	Teacher provides students with help when needed. Includes assistance with prompts, procedures, etc., as well as helping students with the correction procedure.
			17	Students listen to correction and repeat correct response. Does not include accepting help on prompts and procedures. This item only applies to the correction procedure.
				How many times did the teacher go through the Sound Boxes activity?
				Time Ended:
A = Total (+)	B= Total (-)	C = Total (+) and (-)	A/C * 100 = % accuracy	Comments:
Teacher-Directed Sound Boxes Fidelity				

Figure 1. Sample page from K-PALS fidelity checklist: teacher-directed sound boxes.

ity. Items on the checklist were recorded as observed (+), not observed (−), or not applicable (NA). The number of observed behaviors were added and divided by the total observed plus not-observed behaviors, then multiplied by 100 to yield a percentage.

The project coordinator and two research assistants conducted two fidelity checks in each new K-PALS classroom in February and March. Teachers were given advance notice of the observation. No feedback was provided to teachers following the observations. The observers conducted 20% to 40% of their observations with the project coordinator. Percent interrater agreement on the fidelity checklist was established by dividing the number of agreements by agreements plus disagreements and multiplying by 100. Mean interrater agreement was 92%.

In addition to the fidelity observations, each new K-PALS teacher completed a monthly calendar showing the days on which they implemented K-PALS. On these calendars, teachers were asked to write the number of minutes they spent each day on the following activities: reading the K-PALS manual, preparing materials, and implementing K-PALS. They were also asked to record the number of the lesson they implemented (from Lesson 1 to Lesson 72). Days they did not complete any K-PALS-related activities were left blank.

Student reading measures. Students were administered beginning reading measures prior to and immediately following K-PALS implementation (in October–November and April–May of the study year in which they participated). Measures assessed phonemic awareness (blending and segmenting), alphabetic knowledge (letter naming, letter-sound recognition, word reading, and spelling), and oral reading of connected text. These tests were given on a pre- and posttest basis except for spelling and oral reading, which were administered at posttest only.

Phonemic awareness. We administered a segmentation test, which was based on the Yopp-Singer test (Yopp, 1988) and developed for use in previous PALS research (Fuchs, Fuchs, Thompson, et al., 2001). The examiner says a word and prompts the student to say the sounds in the word. One point is recorded for each phoneme said correctly. The score is recorded as the number of correct phonemes expressed in 1 minute. A blending task, also used by Fuchs and colleagues, assessed students' ability to blend phonemes into words. For example, s-oa-p is blended into *soap*. The score is recorded as the number of words blended correctly in one minute. Correlations between phonemic awareness measures for this sample fell in the range $r = .69–.76$.

Alphabetic knowledge. Rapid Letter Naming (RLN), developed for a previous PALS study (Fuchs, Fuchs, Thompson, et al., 2001), consists of upper- and lowercase letters presented randomly in black type on a sheet of paper. Students are asked to name the letters as quickly as they can. The score is the number of letters named correctly in 1 minute. Correlations with other alphabetic measures for this sample fell in the range $r = .42–.76$.

The Rapid Letter Sound (RLS) test is based on a measure used by Levy and Lysunchuk (1997) and was developed for a previous PALS study (Fuchs, Fuchs, Thompson, et al., 2001). All 26 letters are presented randomly in black type on a sheet of paper. Students are instructed to say the sounds as quickly as they can. The score is the number of sounds produced correctly in 1 minute. Correlations with other alphabetic measures for this sample fell in the range $r = .51–.61$.

We administered the Word Identification (Word ID) and Word Attack subtests of the Woodcock Reading Mastery Test—Revised (WRMT-R; Woodcock, 1987) to

measure word-recognition and decoding skills. Scores on these subtests are reported to correlate with other standardized tests of reading, with *r*'s = .83–.92. Internal consistency has exceeded .90. Scores for these measures are the number of words read correctly.

The Wechsler Individual Achievement Test (WIAT; Psychological Corp., 1992) spelling subtest was administered at posttest only. Students are instructed to write letters and words on a sheet of paper. The score is the number of letters and words written correctly. The WIAT has correlated strongly with other achievement tests (*r*'s = .70–.80), and the manual reports a test-retest reliability coefficient of .94.

Oral reading. At posttest only, students read from two passages (Oral Reading A and B) that incorporate sight words and decodable words introduced in K-PALS lessons. Both stories have a Flesch-Kincaid beginning kindergarten readability level. Before reading each story, students are instructed to read aloud and to try their best. As the student reads, the examiner marks omissions, substitutions, and mispronunciations not caused by speech problems or dialects. Omissions and additions of endings are considered errors; self-corrections are not. Errors are not corrected and no decoding assistance is given. The score is the number of words read correctly in 1 minute. Alternate-form reliability for this sample was $r = .96$.

Reading Instruction

Core instruction. All teachers were asked to report the types of activities and materials that comprised their core language arts instruction. Language arts instruction was generally implemented between 90 and 120 minutes per day. Teachers consistently reported implementing "balanced" literacy instruction that incorporated letter and letter-sound recognition and pronunciation; phonemic awareness; building words using onsets and rimes (word families); shared and guided reading; whole-class writing and journal writing; comprehension activities such as making predictions, identifying main ideas, and sequencing; and vocabulary development. Most reading instruction was implemented in a whole-class format followed by individual seatwork. Teachers reported using guided reading books, trade books, decodable and pattern books downloaded from the Web, teacher-made materials, and letter charts.

K-PALS. K-PALS was designed by researchers at Vanderbilt University (Fuchs, Fuchs, Thompson, et al., 2001) to be a supplement to beginning reading instruction in the general education classroom. Teachers were asked to implement K-PALS three to four times per week, for 20–30 minutes each session, for 18–20 weeks.

K-PALS is a manualized reading program that comprises 72 lessons, including eight training lessons that follow a prescribed scope and sequence of phonemic awareness activities, letter sounds, sight words, decodable words, and sentences (described in more detail below). The scope and sequence follow best practices in introducing letter sounds to beginning readers, focusing on the most common sounds of the most commonly encountered letters first, and separating visually and auditorially similar sounds (e.g., Carnine, Silbert, Kame'enui, & Tarver, 2010). Emphasis is placed on pronouncing sounds without distortion, and in blending sounds together without stopping between them when decoding words.

The teacher pairs higher-performing readers with lower-performing readers following procedures outlined in the manual (students are ranked from highest to lowest skilled in reading, the list is split in half, the top student from the top half of the

list is paired with the top student from the lower half of the list, and so on, until all students are paired). The higher-performing reader in each pair acts as the Coach (tutor) first, and the lower-performing reader acts as the Reader first. The roles are reciprocal such that during each activity students take turns being Coach and Reader. Pairs change approximately every 4 weeks.

Teachers prepare their students for K-PALS by modeling the activities during eight scripted lessons, which are presented in a whole-class format. Following this training, K-PALS always begins with a brief, teacher-led "Sound Play" game focusing on first- and last-sound identification, rhyming, blending, and segmenting, using lesson materials provided in the manual. The games increase in difficulty as the class advances through the lessons. The Sound Play games are aligned with the decoding part of the lesson ("Sounds and Words") such that the printed letter sounds and words students encounter during Sounds and Words are first introduced orally during the Sound Play game. The teacher previews the Sounds and Words portion of the lesson, which the students then practice with their partners for about 15 minutes. The teacher circulates among the pairs, monitoring their progress and providing corrective feedback.

Sounds and Words consists of four activities presented on a one-page lesson sheet. In the first activity, "What sound?" students practice saying letter sounds. In the second activity, "What word?" students practice reading high-frequency sight words. In the third "Sound Boxes" activity, students blend sounds into words and read them. Fourth, students read sentences and stories made up of the words they have practiced. About 10 weeks into K-PALS, students begin reading brief decodable books in a partner-reading format. Students earn happy faces and points for conducting the K-PALS activities and for working cooperatively.

Procedures

Project staff. Four research assistants assisted with materials development and distribution, data collection and entry, and fidelity observations. All research assistants were educational psychology graduate students with experience working with school-age children.

Test administration training. In fall and spring of the study year, the project coordinator trained research assistants to administer pre- and posttests in 2-hour sessions, followed by mock testing sessions, during which each research assistant administered the measures to the project coordinator. The research assistant scored each test, and a point-by-point procedure was used to compare the research assistant's scores with the project coordinator's scores. Interrater agreement was established by dividing the number of agreements by the number of agreements plus disagreements, and multiplying by 100. If interrater agreement was less than 90%, or the research assistant did not accurately administer a test, the research assistant was required to practice and then redo the interrater agreement session. On average, pre- and posttests were administered with 98% and 99% agreement, respectively.

Pre- and posttesting. Pretesting was conducted in October and November, 2006. Research assistants met individually with each consented student. The research assistant spent several minutes establishing rapport with the child, and then administered the RLN test, followed by the remaining measures in random order. Similar

procedures were followed to administer posttests in April and May, 2007. However, posttests were administered only to target students.

K-PALS workshop. All teachers in the district attended a half-day workshop conducted by the first author and the project coordinator in Spring 2006. First, participants discussed the purpose of K-PALS, the importance of phonemic awareness and alphabetic knowledge to later reading success, and the importance of early intervention. Second, we described K-PALS research and presented recent findings, and answered participants' questions about the research. Third, we showed a video of teachers and students conducting each of the K-PALS activities. Fourth, we presented each activity, including a rationale for the activity, a demonstration, and guided practice with feedback, emphasizing the importance of correct letter-sound pronunciation and blending sounds into words. Fifth, we conducted an entire lesson with teachers acting as students, so that they could envision a complete K-PALS session. Sixth, we conducted a manual walk-through. Throughout the workshop, teachers were given opportunities to ask questions about K-PALS procedures and activities.

In the Fall of the 2006–2007 school year, a 1-hour refresher training was provided to all kindergarten teachers who wished to review the K-PALS activities. Teachers who agreed to be in the study received all materials needed to conduct K-PALS, including presentation materials and student folders with lesson packets and point sheets. Most teachers began K-PALS implementation in October or November; two teachers did not start until January.

Teacher support. Experienced teachers were assigned to support new teachers who taught in similar schools with similar student populations. One district-supported group comprised three experienced K-PALS teachers and five new K-PALS teachers. A second district-supported group comprised three experienced K-PALS teachers and three new K-PALS teachers. The university expert also supported new teachers in two groups—one group comprised three new K-PALS teachers and another comprised five new K-PALS teachers.

Support activities included the following: (*a*) two booster sessions; (*b*) classroom observations and feedback (during which the experienced teacher or university expert observed the teacher-directed lesson, answered any questions the teacher had, provided assistance to students during the peer-mediated activities, and provided verbal feedback and suggestions to emphasize the teachers' strengths in implementing K-PALS and address any problems that had arisen); and (*c*) the experienced teacher or university expert was available to answer specific questions via e-mail or phone calls (although this rarely occurred). Table 3 shows the extent to which each type of support was accessed by teachers in each group.

After completing approximately 15 K-PALS lessons, teachers attended the first Booster session (Booster 1). All groups used the same handout listing talking points as a basis for discussion. Talking points included review of critical K-PALS components, addressing typical problems encountered by K-PALS teachers such as pairing challenges and managing student behaviors, answering specific questions, problem solving, and sharing ideas for how to run K-PALS successfully. Group leaders were asked to cover all the points in the handout and to run sessions for approximately 50 minutes. As shown in Table 3, the actual duration of Booster 1 ranged from 30 to 45 minutes in the district-supported group and from 45 to 60 minutes in the university-supported group.

Booster 2 was held approximately 8 weeks after Booster 1. During Booster 2, teachers were asked to identify specific areas in which they would like to improve

Table 3. Support Received by Teachers in District- and University-Supported Groups

Group	K-PALS Workshop *n* (%)	Booster 1 Minutes	Booster 2 Minutes	Observation with Feedback *n* (%)
District:				
Group A ($n = 5$)	5 (100)	30–45	30	3 (60)
Group B ($n = 3$)	3 (100)	30–45	30	0
University:				
Group A ($n = 3$)	3 (100)	45–60	45–60	3 (100)
Group B ($n = 5$)	5 (100)	45–60	45–60	5 (100)

K-PALS in their classrooms, and then set personal goals in these areas. The group brainstormed strategies for meeting these goals. A written copy of each group member's goals and strategies was provided to all members following the booster. Again, group leaders were asked to run sessions for approximately 50 minutes. As shown in Table 3, the actual duration of Booster 2 ranged from 30 minutes in the district-supported group and 45 to 60 minutes in the university-supported group.

Teachers were also given the option of meeting with their groups for a final booster session to discuss progress toward their goals or to touch base with their assigned support person via e-mail or phone to discuss progress. All teachers opted to touch base via e-mail or phone. This check-in occurred approximately 1 month after Booster 2.

Each booster session was audio recorded and transcribed. The first author and project coordinator read the transcripts and completed a checklist of elements from the booster handouts that were covered in the session. The percentage of items covered was calculated for each session. For the university group, percentages ranged 61%–95% ($M = 80\%$). For the district group, percentages ranged 5%–90% ($M = 32\%$).

When possible, the university expert or experienced teachers also observed new teachers' K-PALS implementation and gave feedback once between Boosters 1 and 2. All university-supported teachers were observed, but only three of the eight district-supported teachers were observed because experienced K-PALS teachers had difficulty obtaining release time from their own classrooms to conduct observations in other classrooms or buildings.

Teacher feedback. At the end of the project, new K-PALS teachers were asked to complete a brief questionnaire using both a Likert-type rating format and open-ended questions regarding their perceptions of the support provided. Teachers were asked to rate the helpfulness of the boosters, the observations with feedback, and the overall support received either from the university or district (scale of 1–5 with 1 meaning *not at all helpful* and 5 meaning *very helpful*). In addition, teachers were asked whether support should be provided by a university or experienced district teacher in the future, and why.

Design and Data Analysis

We addressed the primary research question (comparing district vs. university support on new K-PALS teachers' fidelity of implementation and student reading outcomes) with a pretest-posttest comparison group design with randomized block

assignment (Trochim & Donnelly, 2008). Teacher was the unit of assignment and the unit of analysis for the main results. The preferred method of analysis for this type of design would involve multilevel modeling (e.g., hierarchical linear modeling; see What Works Clearinghouse [WWC], 2008). However, the reading domains that served as the dependent variables in the study (phonemic awareness, alphabetic knowledge, and oral reading) all included multiple measures, requiring multivariate analysis. Given the multivariate nature of the data, along with the low number of classrooms in the study, we aggregated student data at the teacher level and conducted multivariate analyses of covariance (MANCOVAs) instead. Because pretest mean group differences (at the teacher level) were greater than .05 *SD*, we used teacher-level pretest means as covariates (as recommended by WWC, 2008; see also Hedges & Rhoads, 2009). Post hoc ANCOVAs for each measure within the three reading domains were automatically generated within the MANCOVA output and are reported to help interpret effect sizes.

Effect sizes, reported for all posttest outcome measures, were computed using Hedges's *g*, dividing the covariate adjusted mean difference by the unadjusted pooled within-group *SD* (WWC, 2008). Because the unit of assignment and analysis was at the teacher level, effect sizes were calculated using teacher-level data. As recommended by WWC (2008), we also calculated effect sizes using student-level data, and included these in Appendix A. The confidence intervals for effect sizes were calculated based on the formula provided by Howell (2012) using the Exploratory Software for Confidence Intervals (ESCI) software (Cumming, 2012).

To address the secondary research question (comparing the effect of K-PALS to the historical control on student reading outcomes), we used a quasi-experimental design. If the two groups compared in the primary question (district vs. university support) were not reliably different from each other, we planned to collapse the two groups into one K-PALS group and compare it to the historical control group. The analytical methods for the secondary question were the same as those used for the primary question.

Results

University versus District Support

K-PALS implementation. Fidelity was observed at two time points. Independent-samples *t*-tests revealed no statistically significant difference between groups. Specifically, at Time 1, mean fidelity was 88.5% ($SD = 14.9$) for the district-supported group, and 92.4% ($SD = 6.1$) for the university-supported group, $t = -.55$, $p > .05$. At Time 2, mean fidelity was 91.3% ($SD = 9.3$) for the district-supported group and 96.7% ($SD = 3.9$) for the university-supported group, $t = -.1.48$, $p > .05$. Mean fidelity across the two time points was 89.4% ($SD = 10.7$) for the district-supported group and 93.0% ($SD = 6.2$) for the university-supported group, $t = -0.83$, $p > .05$. The effect size comparing university to district support groups was $d = .41$.

Data from the K-PALS calendars indicated that teachers in both groups implemented K-PALS, on average, 2.6 times per week ($SD = 0.9$), for 27.5 minutes ($SD = 10.0$) per session, and for 28.3 ($SD = 4.8$) weeks. This implementation did not differ across the two K-PALS groups: For numbers of sessions per week, district $M = 2.89$

($SD = 1.1$), university $M = 2.31$ ($SD = 0.6$), $t = 1.31$, $p > .05$. For number of minutes per session, district $M = 31.7$ minutes ($SD = 8.5$), university $M = 23.3$ minutes ($SD = 10.1$), $t = 1.80$, $p > .05$. For number of weeks, district $M = 27.3$ weeks ($SD = 6.1$), university $M = 29.4$ weeks ($SD = 2.7$), $t = 0.87$, $p > .05$.

Teacher feedback. Teachers reported moderate to high levels of satisfaction with the support they received, whether from the district or the university. Both groups reported the support they received from the booster session as moderately helpful (district $M = 3.00$, $SD = 1.63$; university $M = 3.33$, $SD = 1.37$) and feedback from being observed as moderately to very helpful (district $M = 4.33$, $SD = 1.16$; university $M = 3.5$, $SD = 1.05$). Independent t-tests revealed no statistically significant differences between groups on these ratings (p's $> .05$). Teachers rated overall support from their respective mentors as moderately to very helpful (district $M = 3.5$, $SD = 1.76$; university $M = 4.0$, $SD = .89$). An independent samples t-test revealed a statistically significant difference between groups on these ratings ($t = 6.25$, $p = .031$).

Responses to whether support should be provided by the district or university were mixed. In the university group, three teachers indicated a preference for university support, noting that they liked the connection with the university and that parents also valued this connection. One teacher suggested that university support was essential for new teachers, but that support could be provided by district staff beyond the first year. One teacher indicated a preference for district support, noting that sharing common experiences was important for effective problem solving. The remaining three teachers did not respond to this question.

In the district group, four teachers indicated a preference for district support, noting that they enjoyed working with colleagues and dialoging with other teachers, they benefited from collaborating with others familiar with how K-PALS fits within the district curriculum, and other teachers understood classroom problems and had ideas to address them. Two teachers noted that they preferred university support, noting that they thought university experts would have been more professional, would have more expertise about K-PALS, and would be better able to solve problems with unique groups of students.

Student reading outcomes. Because the unit of assignment was at the classroom level, MANCOVAs were conducted on reading scores aggregated at the teacher level. Classroom-level pretest, posttest, and adjusted means, *SD*s, and MANCOVA/ANCOVA results are presented in Table 4. There were no statistically significant main effects of condition (district vs. university support) on any of the posttest measures controlling for pretest performance. Effect sizes are also presented in Table 4. Effect sizes for all reading measures were small or negligible. Effect sizes calculated using student-level data are in Appendix A.

University/District Support versus Historical Control Group

Student reading outcomes. MANCOVAs were conducted on reading scores aggregated at the classroom level; classroom-level pretest, posttest, and adjusted means and *SD*s, and MANCOVA/ANCOVA results for combined university/district support groups and the historical control group, are presented in Table 5. Statistically significant main effects were found, with K-PALS classrooms outperforming the historical control group across domains. Follow-up analyses showed large effects on phonemic awareness (ES = .89 for segmentation and ES = 0.78 for blending) and

Table 4. Means, Standard Deviations, MANCOVAs/ANCOVAs, and Effect Sizes for District- and University-Supported Groups

	District Support ($n = 8$)		University Support ($n = 8$)					
Measure	*M*	(*SD*)	*M*	(*SD*)	*F*	*p*	ES[a]	CI for ES[b]
Phonemic awareness					.30[c]	.75		
Segmentation:								
Pre	5.97	(4.04)	7.73	(2.32)				
Post	26.09	(7.12)	26.95	(6.70)				
Adjusted[d]	27.52		25.53		.41[e]	.54	.29	−.51, 1.49
Blending:								
Pre	1.82	(1.18)	1.95	(.79)				
Post	9.66	(2.53)	10.34	(1.88)				
Adjusted	9.96		10.04		.01[e]	.94	−.04	−1.02, .94
Alphabetic measures					.60[c]	.70		
RLN:								
Pre	28.73	(6.97)	28.48	(5.58)				
Post	40.18	(7.75)	42.16	(6.43)				
Adjusted	40.40		41.94		.27[e]	.62	−.22	−1.20, .77
RLS:								
Pre	13.70	(5.96)	14.55	(4.35)				
Post	42.97	(6.18)	43.00	(6.99)				
Adjusted	42.82		43.15		.02[e]	.89	−.05	−1.03, .93
Word identification:								
Pre	3.71	(2.70)	3.71	(2.17)				
Post	18.77	(5.37)	16.98	(2.71)				
Adjusted	18.94		16.81		2.61[e]	.14	.50	−.51, 1.49
Word attack:								
Pre	1.09	(1.23)	1.13	(1.03)				
Post	5.97	(2.22)	6.23	(1.26)				
Adjusted	6.07		6.13		.00[e]	.95	−.03	−1.01, .95
Spelling:								
Post	11.03	(1.95)	11.21	(1.39)				
Adjusted	11.09		11.16		.01[e]	.93	−.04	−1.02, .94
Oral Reading[f]					.66[c]	.53		
Oral Reading A:[f]								
Post	33.05	(6.90)	31.10	(5.26)				
Adjusted	32.97		31.18		.52[e]	.48	.29	−.70, 1.27
Oral Reading B:[f]								
Post	34.13	(7.46)	31.13	(6.23)				
Adjusted	34.05		31.21		1.00[e]	.34	.41	−.59, 1.39

Note.—RLN = Rapid Letter Naming; RLS = Rapid Letter Sound.

[a] Effect Sizes (ES) were calculated using Hedge's *g* as covariate adjusted posttest mean differences divided by unadjusted posttest pooled *SD* (WWC, 2008).

[b] The 95% confidence intervals (CI) on noncentrality parameters for effect sizes were calculated (Cumming, 2012; Howell, 2012).

[c] MANCOVA results; Wilks' lambda was used.

[d] Postscores were adjusted using pretest scores as the covariate.

[e] ANCOVA results as post-hoc.

[f] Pretest RLN was used as a covariate.

oral reading measures (1.27 for oral reading A and 1.29 for oral reading B) and moderate effects for alphabetic knowledge (ES = .62 for RLS, ES = .67 for Word ID, and ES = .62 for spelling), but small effects for Word Attack (ES = 24), and negative effects for RLN (ES = −0.63). Effect sizes calculated using student-level data are in Appendix B.

Table 5. Means, Standard Deviations, MANCOVAs/ANCOVAs, and Effect Sizes for New versus Historical Control Groups

	New K-PALS Teachers ($n = 16$)		Historic Control ($n = 16$)					
Measure	*M*	(*SD*)	*M*	(*SD*)	*F*	*p*-value	ES[a]	CI for ES[b]
Phonemic awareness					4.05[c]	.03		
Segmentation:								
Pre	6.85	(3.31)	4.74	(3.65)				
Post	26.52	(6.69)	17.04	(7.84)				
Adjusted[d]	24.63		18.12		6.75[e]	.02	.89	.16, 1.61
Blending:								
Pre	1.88	(.97)	1.93	(1.35)				
Post	9.99	(2.18)	7.34	(3.19)				
Adjusted	9.69		7.57		6.99[e]	.01	.78	.00, 1.49
Alphabetic measures					4.28[c]	.01		
RLN:								
Pre	28.60	(6.10)	24.86	(6.81)				
Post	41.17	(6.95)	42.72	(7.10)				
Adjusted	38.42		42.86		2.31[e]	.14	−.63	−1.34, .09
RLS:								
Pre	14.13	(5.06)	11.45	(7.11)				
Post	42.98	(6.37)	34.99	(9.72)				
Adjusted	40.73		35.64		5.47[e]	.03	.62	.00, 1.33
Word identification:								
Pre	3.71	(2.36)	2.37	(2.26)				
Post	17.87	(4.21)	11.40	(6.20)				
Adjusted	16.15		12.59		13.6[e]	.00	.67	.00, 1.38
Word attack:								
Pre	1.11	(1.09)	.72	(1.14)				
Post	6.10	(1.75)	4.29	(3.20)				
Adjusted	5.67		5.05		1.61[e]	.22	.24	−.46, .93
Spelling:								
Post	11.12	(1.63)	9.21	(1.97)				
Adjusted	10.56		9.43		8.66[e]	.01	.62	.00, 1.33
Oral Reading[f]					15.3[c]	.00		
Oral Reading A:[f]								
Post	32.08	(6.01)	17.90	(8.80)				
Adjusted	27.77		18.18		30.5[e]	.00	1.27	.50, 2.03
Oral Reading B:[f]								
Post	32.63	(6.82)	18.12	(8.21)				
Adjusted	28.16		18.41		31.1[e]	.00	1.29	.52, 2.05

Note.—RLN = Rapid Letter Naming; RLS = Rapid Letter Sound.

[a] Effect Sizes (ES) were calculated using Hedge's *g* as covariate adjusted posttest mean differences divided by unadjusted posttest pooled *SD* (WWC, 2008).

[b] The 95% confidence intervals (CI) on noncentrality parameters for effect sizes were calculated (Cumming, 2012; Howell, 2012).

[c] MANCOVA results; Wilks' lambda was used.

[d] Postscores were adjusted using pretest scores as the covariate.

[e] ANCOVA results as post-hoc.

[f] Pretest RLN was used as a covariate.

Discussion

The primary purpose of this study was to compare the effects of university versus district support on new K-PALS teachers' fidelity of K-PALS implementation and their students' early reading outcomes. A secondary purpose was to determine whether K-PALS was beneficial for beginning readers, as has been demonstrated in

previous research (e.g., Fuchs, Fuchs, Thompson, et al., 2001). Below, we discuss current findings as well as implications for research and practice.

Effect of Support on Teachers' K-PALS Fidelity

Overall fidelity was 89.3% for district-supported teachers and 93.0% for university-supported teachers, and the difference between groups was not statistically significant. In other words, whether teachers received district or university support, K-PALS fidelity was generally high. These fidelity levels are consistent with (or slightly higher than) those observed in previous K-PALS research, which has indicated that booster support improves fidelity compared to workshop-only conditions (87% vs. 81% fidelity, respectively; Stein et al., 2008).

These findings are encouraging, as they suggest that support provided by either district or university personnel is sufficient to obtain similar fidelity levels to previous research. However, it is important to note that an effect size of .41 favored the university-supported group in comparison to the districted-supported group. Whereas this effect size is not reliable, given the lack of a statistically significant difference, this finding suggests that the university group may have, in fact, achieved higher fidelity levels than did the district group, but the effect was not detected due to low power. Alternatively, not all of the fidelity observers were blind to the teachers' study groups, so there may have been some systematic bias in favor of the university group, although observers attempted to be as objective as possible.

It is plausible that receiving university support could lead to somewhat higher fidelity, because the university expert appeared to have conveyed a stricter adherence to K-PALS than the experienced teachers did (recall that the university expert covered a mean of 80% of the booster items compared to experienced teachers, who covered a mean of 32% of the items). Also, more new K-PALS teachers in the university group were observed by their assigned "expert" than were those in the district group, because several of the experienced teachers were not granted release time from their own classrooms to observe new K-PALS teachers. Further research with larger samples is needed to better understand whether length and adherence to booster protocols, as well as opportunities to be observed and receive feedback, influence K-PALS fidelity. If observation and feedback are important, then further exploration of ways to facilitate these activities within districts is needed (we discuss this need in more depth below).

Even if fidelity was higher in the university-supported classrooms, another important question is whether this higher level of fidelity was important with respect to student outcomes. Previous research suggests that fidelity mediates student outcomes (Stein et al., 2008), but too much emphasis on fidelity could lead to "a kind of 'KPALS fatigue,' where teachers [feel] confined to continue the program as designed" (Kearns et al., 2010, p. 336). Given that fidelity levels for both groups in this study were at least as high as those in other studies in which student outcomes were positively impacted by K-PALS, it is reasonable to conclude that the district-supported teachers were implementing K-PALS with sufficient fidelity. The next set of findings shed light on whether student outcomes were affected by the support teachers received.

Effect of Support on Student Achievement Outcomes

In this study, results revealed no statistically reliable group differences in student achievement (aggregated at the teacher level) between district- and university-supported K-PALS groups. Given that effect sizes were also small, it appears that the district support offered in this study was just as beneficial as university support with respect to student achievement. One interpretation of this finding, alluded to above, is that, regardless of who provided support, K-PALS was implemented with sufficient levels of fidelity for students to experience academic benefits (Stein et al., 2008). That district and university support were associated with similar student achievement levels is important, because district support is likely more feasible given limited time and resources for PD (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009), especially for districts that are not in close proximity to outside experts. Of course, the question remains, if district-supported teachers had implemented K-PALS with higher fidelity, would student outcomes have been greater? As mentioned, further research is needed to better understand the relation between fidelity and student outcomes.

It is also important to note that, in the absence of a randomized control group, we cannot say conclusively that K-PALS was more effective than business-as-usual instruction. However, K-PALS effects on student achievement have been well documented in previous research (Fuchs, Fuchs, Thompson, et al., 2001; Fuchs et al., 2002; McMaster et al., 2008; Rafdal et al., 2011; Stein et al., 2008) and are also supported by the historical control comparison in this study. K-PALS classrooms in this study outperformed historical controls on measures of phonemic awareness, alphabetic knowledge, and oral reading, giving us some confidence that K-PALS continued to be an effective instructional approach. The current findings (including negative effects on letter naming) are consistent with those of previous research (Fuchs, Fuchs, Thompson, et al., 2001) and are not surprising given that K-PALS provides extensive practice in phonemic awareness, letter-sound and word identification, and oral reading of decodable, connected text, and does not include instruction on letter naming.

Teacher Perceptions of Support

Teachers' responses about the perceived helpfulness of the two types of support revealed that they generally found both types of support to be helpful, and that they had mixed preferences regarding the source of support (district vs. university). Their preferences reflected the types of benefits we anticipated for each type of support as described in the introduction; namely, that university support was focused on K-PALS implementation and problem solving, and fostered a feeling of school-university partnership, whereas district support provided opportunities for peer networking and helped new teachers understand how K-PALS fit within the larger curriculum and day-to-day classroom life. Future research could include examinations of what specific aspects of support influence such perceptions, and how these perceptions are related to teachers' buy-in and sustained use of new practices.

Limitations and Implications for Future Research

Several limitations of this study preclude firm conclusions; we review those here and identify directions for future research. First, the small sample ($n = 8$ teachers per

group) may have limited our capacity to detect statistically significant group differences. For future research, an important question is, how many classrooms should be included? In multilevel studies (e.g., in which students are nested in classrooms), it is essential to include an adequate number of units at all levels of analysis so that all parameter estimates are accurate, but consensus has yet to be reached on adequate sample sizes (Hox, 2002). One general rule of thumb is that the sample should include at least 30 participants at each level (Kreft, 1996), which presents challenges for school-based research, given difficulties associated with recruiting high numbers of classrooms and that many classrooms have fewer than 30 students. Larger samples will likely require the inclusion of larger districts or more than one district that is willing to adopt and examine effects of instructional innovations.

Second, there were small but statistically reliable demographic differences between students in district- versus university-supported groups and K-PALS versus historical control groups. Specifically, more ELLs and students in special education were in the district-supported group than were in the university-supported group, and a higher proportion of Caucasian students were in the historical control group than were in the K-PALS group. Given that our primary analyses were at the teacher level, we matched district- and university-supported teachers on classroom-level demographics rather than on student-level demographics. Also, given that reading outcomes were of primary interest in this study, we used pretest reading scores as covariates, which we assumed would control for the most relevant pretreatment between-group differences. Nevertheless, it is possible that student-level demographics influenced our findings.

Third, the district-supported boosters were implemented, on average, with low fidelity, both in terms of the percentage of discussion points covered as well as the overall time spent in booster sessions. This low fidelity may reflect the experienced teachers' lack of extensive training in providing support to their peers. Or, perhaps there was not sufficient accountability for experienced teachers to follow the specific booster discussion points, or they did not completely "buy into" the necessity of those specific points. District support would likely be enhanced by more explicit training of experienced teachers in how to provide support, as well as involving these teachers in identifying what should be covered as part of ongoing support (Klingner, 2004). Also, we included all experienced K-PALS teachers who were available to provide support, to ensure sufficient numbers of teachers to support the new K-PALS teachers. Selecting only those teachers who demonstrated high fidelity may have improved the quality of the district support (Klingner, 2004). Future research could examine factors related to the fidelity with which experienced teachers provide support to their peers.

Fourth, our study did not include a randomized control group. Future replications of this work should include randomized business-as-usual classrooms, as well as comparisons to more traditional PD (e.g., workshop without follow-up support) to provide further insight into the added value of scientifically based practices with or without supports. This work could be extended by including systematic cost-benefit analyses. Similar investigations with other scientifically based practices are also needed, because we do not know whether the types of PD and support used for K-PALS would be appropriate with other types of instructional programs.

Fifth, this study was conducted in a suburban district in which schools had strong administrators, cohesive faculties, and relatively stable student enrollments. There

was a clear message at the district level that K-PALS was being integrated into the literacy curriculum and that teachers would be supported in its implementation. Our results may have been different in a less functional, supportive district. Current findings would be strengthened if they could be replicated in other districts with varying teacher and student demographics, as well as varying school and district structures.

Sixth, in this study, we assumed that the ongoing support provided by university or district personnel incorporated Desimone's (2009) essential elements of effective PD (content focus, active learning, coherence, duration, and collective participation) and that some of these elements might be enhanced in the district-support condition. However, we did not explicitly measure the degree to which these elements were in place in the university- and the district-supported conditions. To more fully understand the relative effectiveness of university versus district support, a comprehensive examination of these elements is needed. For example, future research could incorporate pre- and posttest surveys of teachers' knowledge of K-PALS components and how they fit within the district curriculum, as well as in-depth interviews with teachers to determine whether and how support influenced their attitudes about incorporating K-PALS procedures into their instruction.

Finally, this study examined the effects of support given to teachers in their first year of K-PALS adoption. The extent to which ongoing supports lead to sustained implementation over time is a critical question. Longitudinal research is needed to document the relations among types of supports received, sustained K-PALS implementation, and student outcomes.

Implications for Practice

Despite the many questions that remain, outcomes of this study can inform schools' or districts' adoption of K-PALS as part of their literacy curricula. Previous experimental and quasi-experimental research (Fuchs, Fuchs, Thompson, et al., 2001; Fuchs et al., 2002; McMaster et al., 2008; Rafdal et al., 2011; Stein et al., 2008) indicates that K-PALS can have a meaningful impact on students' beginning reading achievement when implemented with fidelity. Whereas our comparison of K-PALS effects on student achievement to historical controls does not permit firm causal inferences, it does provide evidence that is consistent with previous experimental research. Thus, it seems reasonable to encourage schools and districts to consider adopting K-PALS as a scientifically based, supplementary instructional practice that can support students' development of important reading readiness skills.

In this study, whether teachers received ongoing support from the university or district did not appear to make a difference in terms of student achievement. In addition, teachers reported similar levels of satisfaction with the support they received from both sources. Given general consensus in the literature that some form of ongoing support is critical to successful adoption of scientifically based practices (e.g., Chard, 2004; Desimone, 2009; Klingner, 2004; Odom, 2009), we encourage schools and districts to consider finding ways to ensure that new teachers receive ongoing support as they begin to implement K-PALS, whether from outside "experts" or from within the district. This support may simply include two or three booster sessions across the year with the opportunity for new K-PALS teachers to access additional support as needed. This support should focus, at least in part, on promoting imple-

mentation fidelity. Schools or districts may wish to collect teacher-fidelity and student-achievement data to make decisions about whether K-PALS and supports do indeed fulfill their intended purposes.

Conclusions

Findings of this study add to substantial research that supports the use of K-PALS as a supplementary approach to improving kindergartners' reading readiness. However, access to a scientifically based instructional practice does not necessarily translate to teachers' successful adoption and use of that practice. Recent research suggests that ongoing support leads to improved teacher implementation of and satisfaction with scientifically based practices (e.g., Gersten et al., 2010; Stein et al., 2008; Vaughn & Coleman, 2004). Our findings uphold this idea, in that ongoing support did appear to enhance teacher implementation whether it was provided by experts or peers, which is encouraging at a time when resources are scarce.

Appendix A

Table A1. Means, Standard Deviations, and Effect Sizes for District- and University-Supported Groups: Student-Level Data

Measures	District Support ($n = 96$)		University Support ($n = 93$)		ES[a]	CI for ES[b]
	M	(*SD*)	*M*	(*SD*)		
Phonemic awareness:						
Segmentation:						
Pre	6.05	(8.98)	7.90	(9.27)		
Post	26.18	(12.68)	27.11	(10.81)		
Adjusted[c]	26.70		26.57		.01	−.28, .30
Blending:						
Pre	1.83	(3.10)	1.99	(3.27)		
Post	9.64	(6.28)	10.38	(6.09)		
Adjusted	9.88		10.12		−.04	−.33, .25
Alphabetic measures:						
RLN:						
Pre	28.58	(18.00)	28.68	(15.44)		
Post	40.01	(18.42)	43.07	(18.17)		
Adjusted	40.24		42.83		−.14	−.43, .15
RLS:						
Pre	13.57	(13.29)	14.91	(12.51)		
Post	42.75	(17.62)	43.36	(16.76)		
Adjusted	43.02		43.08		.00	−.29, .29
Word identification:						
Pre	1.10	(3.57)	3.80	(9.20)		
Post	18.67	(14.36)	17.42	(14.23)		
Adjusted	18.97		17.10		.13	−.16, .42
Word attack:						
Pre	3.82	(9.22)	1.17	(4.19)		
Post	5.96	(6.06)	6.45	(6.12)		
Adjusted	6.11		6.29		−.03	−.32, .26
Spelling:						
Post	10.96	(4.62)	11.44	(3.71)		
Adjusted	11.06		11.34		−.07	−.36, .22
Oral Reading:[d]						
Oral Reading A:[d]						
Post	33.23	(27.00)	31.57	(28.55)		
Adjusted	33.28		31.52		.06	−.23, .35
Oral Reading B:[d]						
Post	34.36	(30.06)	31.62	(29.83)		
Adjusted	34.42		31.56		.10	−.19, .39

Note.—RLN = Rapid Letter Naming; RLS = Rapid Letter Sound.

[a] Effect sizes (ES) were calculated using Hedge's *g* as covariate adjusted posttest mean differences divided by unadjusted posttest pooled *SD* (WWC, 2008).

[b] The 95% confidence intervals (CI) on noncentrality parameters for effect sizes were calculated (Cumming, 2012; Howell, 2012).

[c] Postscores were adjusted using pretest scores as the covariate.

[d] Pretest RLN was used as a covariate.

Appendix B

Table B1. Means, Standard Deviations, and Effect Sizes for K-PALS and Historical Control Groups: Student-Level Data

Measure	New K-PALS Teachers (n = 189)		Historical Control (n = 179)		ES[a]	CI for ES[b]
	M	(SD)	M	(SD)		
Phonemic awareness:						
Segmentation:						
Pre	6.96	(9.15)	4.72	(6.60)		
Post	26.63	(11.77)	17.24	(12.55)		
Adjusted[c]	25.92		17.79		.67	.38, .95
Blending:						
Pre	1.91	(3.17)	1.93	(3.22)		
Post	10.00	(6.18)	7.41	(6.32)		
Adjusted	9.77		7.68		.33	.05, .61
Alphabetic measures:						
RLN:						
Pre	28.63	(16.75)	24.94	(16.15)		
Post	41.51	(18.31)	42.71	(14.67)		
Adjusted	39.09		43.06		−.24	−.52, .04
RLS:						
Pre	14.23	(12.90)	11.45	(11.44)		
Post	43.05	(17.16)	34.85	(17.64)		
Adjusted	40.69		35.53		.30	.02, .58
Word identification:						
Pre	3.81	(9.19)	2.33	(6.26)		
Post	18.06	(14.27)	11.20	(12.69)		
Adjusted	16.38		12.43		.29	.00, .57
Word attack:						
Pre	1.14	(3.88)	.74	(2.46)		
Post	6.20	(6.08)	4.22	(6.38)		
Adjusted	5.57		4.78		.13	−.15, .41
Spelling:						
Post	11.19	(4.20)	9.26	(3.74)		
Adjusted	10.70		9.49		.30	.02, .58
Oral Reading:[d]						
Oral Reading A:[d]						
Post	32.41	(27.71)	17.53	(20.44)		
Adjusted	28.43		17.86		.43	.15, .71
Oral Reading B:[d]						
Post	33.02	(29.90)	17.88	(19.93)		
Adjusted	28.92		18.23		.42	.14, .70

Note.—RLN = Rapid Letter Naming; RLS = Rapid Letter Sound.

[a] Effect sizes (ES) were calculated using Hedge's g as covariate adjusted posttest mean differences divided by unadjusted posttest pooled SD (WWC, 2008).

[b] The 95% confidence intervals (CI) on noncentrality parameters for effect sizes were calculated (Cumming, 2012; Howell 2012).

[c] Postscores were adjusted using pretest scores as the covariate.

[d] Pretest RLN was used as a covariate.

Notes

This research was supported by grant no. R305G040104 from the Institute for Education Sciences in the U.S. Department of Education to Vanderbilt University, the University of Minnesota, and the University of Texas–Pan American. The article does not necessarily reflect the position or policy of the funding agency, and no official endorsement should be inferred. The authors wish to thank Andrew Zieffler, University of Minnesota, for his technical advice on several drafts of this article. Address all correspondence to Kristen L. McMaster, University of Minnesota, 250 Education Sciences Building, 56 East River Rd., Minneapolis, MN 55455; e-mail: mcmas004@umn.edu.

1. Two of the authors have professional associations with the Peer-Assisted Learning Strategies (PALS) program. Douglas Fuchs was one of the developers of PALS, and the PALS manuals are available for purchase through Vanderbilt University. Kristen McMaster provides professional development for some schools and districts that have adopted PALS as part of their curriculum.

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