

Relations among preschool teachers' self-efficacy, classroom quality, and children's language and literacy gains

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ARTICLE INFO

Article history:

Received 24 February 2009

Received in revised form

1 October 2009

Accepted 4 November 2009

Keywords:

Teacher self-efficacy

Classroom quality

Literacy and language development

ABSTRACT

This study examined the relations among preschool teachers' self-efficacy ($n = 67$), classroom quality (instructional and emotional support), and children's ($n = 328$) gains in print awareness and vocabulary knowledge over an academic year in the US. Results indicated that teachers' self-efficacy and classroom quality served as significant and positive predictors of children's gains in print awareness but not vocabulary knowledge. However, results also showed a significant interaction among teachers' self-efficacy, classroom quality, and vocabulary gains: for children of teachers with higher levels of self-efficacy, higher levels of classroom quality (emotional support) were associated with higher vocabulary gains.

Published by Elsevier Ltd.

1. Introduction

Currently, there is a great deal of attention focused on ensuring the quality of preschool programmes within the United States (US), particularly in light of recent reports suggesting that as much as one-third of preschool programmes are of very low quality (LoCasale-Crouch et al., 2007). Initiatives designed to increase the quality of early education occurring within the US are similar to those taking place internationally, many of which emphasise the importance of promoting specific aspects of teacher performance and knowledge as a means for improving the overall quality of preschool programmes (e.g., Burgess & Fleet, 2009; Ho, 2009). For instance, in Hong Kong, researchers have suggested that teacher retention activities (e.g., staff appraisals for the purpose of handling staff reductions) should be directly linked to observations of the quality of teaching within classrooms (Ho, 2009).

Educational theory suggests that teachers themselves are one of the most important determinants of whether a classroom exhibits higher versus lower quality of instruction (Desimone, Smith, & Frisvold, 2007; Mashburn et al., 2008). However, empirical efforts focused on linking specific characteristics of teachers (e.g., years of experience, level of educational attainment) to measures of classroom quality have often failed to link such characteristics to what teachers actually do in

the classroom (Justice, Mashburn, Hamre, & Pianta, 2008; LoCasale-Crouch et al., 2007). One preschool teacher characteristic that has, however, been associated with higher quality classroom instruction is teachers' sense of self-efficacy (Justice et al., 2008). Specifically, teachers' self-efficacy was recently shown to be a positive and unique predictor of the quality of literacy instruction within the preschool classroom setting in a study of 135 classrooms within the U.S. (Justice et al., 2008). Such findings mirror previous reports based on samples of primary school teachers, such as those presented by deLaat and Watter and Ginns (1995). In a study conducted in an Australian primary school, these researchers reported that science teachers who had a high sense of efficacy with respect to science teaching provided more effective instructional practises to their pupils.

Such findings are important because researchers contend that higher levels of teacher self-efficacy may have a positive effect on pupil outcomes, potentially through its association with higher levels of classroom quality. To date, however, the relations among teacher self-efficacy, classroom quality, and child outcomes have yet to be explored in relation to the preschool classroom context; of particular interest is exploring the possibility that the relations between teacher self-efficacy and child outcomes may be moderated by classroom quality, as suggested by research findings concerning primary and secondary schooling (Goddard & Goddard, 2001). The present study examined teacher self-efficacy as reported by a sample of 67 preschool teachers working in targeted enrolment programmes serving disadvantaged children in the US. Specifically, we sought to (a) identify potential predictors of teacher self-efficacy from among a set of variables suggested by the literature from

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primary and secondary schooling, including teacher education, credentials and years of experience, (b) examine the relations among teacher self-efficacy, classroom quality, and children's language and literacy gains over the academic year, and (c) determine whether any observed relations between teacher self-efficacy and children's language and literacy gains were moderated by (dependent upon) classroom quality.

1.1. Teacher self-efficacy as a construct

The construct of self-efficacy has evolved from Bandura's social cognitive theory. Bandura (1977) defined self-efficacy as the "belief in one's capabilities to organise and execute the courses of action required to produce given attainments" (p. 3). These perceived capabilities are believed to influence behaviour (Czerniak & Chiar-elott, 1990) in that, when a person holds a belief that his or her behaviour can lead to a desired outcome, he or she executes the behaviour required to achieve that outcome. As the concept of self-efficacy is applied to the profession of teaching and the role of teachers in the classroom, self-efficacy is defined as the belief that one's capabilities can bring about desirable changes in students' behaviours and achievement (Gibson & Dembo, 1984). Teachers who do not have a strong sense of self-efficacy, such that they do not believe that they are able to positively affect student performance, may not accept responsibility for motivating students or take the necessary steps to do so (Dembo & Gibson, 1985).

Some evidence suggests that teacher self-efficacy is positively associated with individual differences among primary and secondary teachers (Hoy & Woolfolk, 1993) and schools (Hipp & Bredeson, 1995; Rosenholtz, 1987; Webb & Ashton, 1987). For instance, such teacher characteristics as educational credentials and years of experience have been linked with teachers' reports of self-efficacy within US research; specifically, Hoy and Woolfolk (1993) found that teachers with higher levels of education and more years of teaching experience reported higher levels of personal teaching efficacy. Participation in professional development and aspects of teacher preparation have also been associated with the self-efficacy of primary and secondary teachers (Housego, 1992; Hoy & Woolfolk, 1990; Ross, 1994; Ross, McKeiver, & Hogaboam-Gray, 1995; Watter & Ginns, 1995), to include teachers within both Taiwan (Liaw, 2009) and Australia (Mulholland & Wallace, 2001).

Characteristics of schools, such as organisational structure, general climate, principal leadership, and decision-making structures have too been linked to teacher self-efficacy (Hipp & Bredeson, 1995; Hoy & Woolfolk, 1993; Moore & Esselman, 1992). For example, Moore and Esselman (1992) found that teachers who perceived a positive school climate and felt that they had a greater influence in school-based decision-making had relatively higher self-efficacy levels compared to teachers with less positive perceptions.

1.2. Teacher self-efficacy, student achievement, and classroom quality

A number of research studies have established a positive relation between teachers' self-efficacy and students' academic performance (Anderson, Greene, & Loewen, 1988; Armor et al., 1976; Bandura, 1993; Gibson & Dembo, 1984; Goddard, Hoy, & Woolfolk, 2000; Ross, 1992). These associations have been observed for pupil reading, math, and social studies' outcomes. Armor et al. (1976), for instance, found that teacher self-efficacy was related to reading achievement among minority six-grade students attending public schools in urban settings within the US. Ashton and Webb (1986) found that teacher self-efficacy explained, respectively, 24% and 46% of the variance in elementary students' math and reading outcomes as measured on the Metropolitan Achievement Test. Goddard et al.

(2000) found that teacher self-efficacy was strongly related to second, third, and fourth grade pupils' math and reading outcomes as also measured on the Metropolitan Achievement Test; research findings showed that teacher self-efficacy explained 53% and 70% of the between-school variance in pupils' math and reading outcomes. In Canada, Ross (1992) showed that teacher self-efficacy positively contributed to seventh and eight graders' social studies achievement, explaining 16% of the variance in student outcomes.

Researchers have proposed that the mechanism by which teacher self-efficacy exerts an influence on student achievement relates to the influence of teacher self-efficacy on classroom quality and practises (Goddard & Goddard, 2001). By way of illustration, consider a case in which a given student is exhibiting difficulty developing skills in certain areas of instruction. In such instances, teachers with higher levels of self-efficacy attribute this difficulty to their teaching methods instead of students' faults, and adjust instruction accordingly. Based on this belief, teachers with high self-efficacy are more likely to make continuous efforts to improve their teaching methods until success is reached. Therefore, the mechanism through which self-efficacy exerts its effect on pupil achievement is through enhanced classroom quality. To date, however, very few studies have directly explored the hypothesised relations between self-efficacy and student achievement with respect to the potential moderating role of classroom quality. This is an important focus of research, given evidence showing direct relations between-classroom quality and pupil achievement, particularly in the preschool sector (Connor, Son, Hindman, & Morrison, 2005; Hamre & Pianta, 2007; Howes et al., 2008; Mashburn et al., 2008).

Classroom quality is a multi-dimensional construct that encompasses both emotional support and instructional support (see Mashburn et al., 2008). This term describes the extent to which teachers are sensitive and responsive to children's needs (emotional support) and the extent to which teachers promote children's higher-order thinking skills and content-area learning, as well as scaffold children's participation in and learning from academic activities (instructional support) (Mashburn et al., 2008; Pianta, La Paro, & Hamre, 2008). These features of classroom instruction have been associated with student outcomes within a number of studies conducted within the US (NICHD-ECCRN, 2002a, 2002b; Pianta, La Paro, Payne, Cox, & Bradley, 2002). For example, research has demonstrated positive relations between student achievement and such classroom practises as teachers' abilities to manage students' learning and behaviour (Brophy & Good, 1986); the quantity and pacing of instruction (Fraser, 1987); and teacher warmth and responsiveness to their students (Connor et al., 2005). When considering preschool children's achievement outcomes, particularly in the domains of language and literacy, measures of how teachers interact with students is a critically important factor for characterizing children's growth over time (Meisels, 2006; NICHD-ECCRN, 2000; Rivik, Hanushek, & Kain, 2000).

The links between teacher self-efficacy and classroom quality have been suggested by the findings of several studies (Ashton & Webb, 1986; Gibson & Dembo, 1984). For instance, Justice et al. (2008) recently reported that teacher report of self-efficacy was positively correlated ($r = .2$) with measures of the quality of literacy instruction in 135 preschool classrooms serving high-risk pupils in the US. By contrast, other available measures of teacher attributes, including educational major, years of teaching experience, and recent experiences in professional development, were not correlated with quality of literacy instruction. Interestingly, in this study, teacher report of self-efficacy was also positively associated with teacher years of education ($r = .2$), suggesting that teachers with advanced degrees have higher levels of self-efficacy relative to those without advanced degrees.

The documented relation between teacher self-efficacy and higher levels of instructional quality within preschool settings is not unexpected. In a review of the literature, Tschannen-Moran,

Woolfolk Hoy, and Hoy (1998) proposed that teacher self-efficacy influences the amount of effort teachers direct towards their teaching as well as their persistence when they meet with obstacles; teachers with higher level of self-efficacy are more likely to “employ a pattern of strategies that minimised negative effect, promoted an expectation of classroom situation characterised by warm interpersonal relationships and academic work” (p. 125). Goddard and Goddard (2001) concluded that teacher self-efficacy was related to improved planning and organisation (Allinder, 1994), the use of activity-based learning (Enochs, Scharmann, & Riggs, 1995), student-centred learning (Czerniak & Schriver, 1994; deLaat & Watters, 1995), a more humanistic approach to student control (Woolfolk & Hoy, 1990), and a preference for using small group rather than large group instruction (Gibson & Dembo, 1984). However, with the exception of Justice et al. (2008), none of these previous studies have studied relations between teachers' self-efficacy and global or specific indices of classroom quality within the preschool setting.

1.3. Goals of the present study

In the present paper, we tested the hypothesis that the relation between teacher self-efficacy and student achievement may be moderated by classroom quality, and we focused our attention specifically on the preschool classroom context. Within the US, preschool classrooms are known to vary widely in the level of quality provided to students (LoCasale-Crouch et al., 2007), and classroom quality exerts direct effects on the language and literacy gains children experience within the classroom setting (Mashburn et al., 2008). In the present study, we tested the relations among teacher self-efficacy, classroom quality, and children's language and literacy gains as measured by indices of vocabulary knowledge and print awareness. Both vocabulary knowledge and print awareness represent consistent and positive predictors of children's later reading achievement in word recognition and reading comprehension (Hammill, 2004; National Early Literacy Panel, 2008), and have prominent placement in learning standards that specify specific developmental domains to be targeted within preschool settings across the US.

This study addressed three specific questions: (1) To what extent do preschool teachers' credentials (viz., level of educational attainment, certification, years of teaching experience) relate to their teaching self-efficacy? (2) What are the relations among preschool teachers' self-efficacy, classroom quality, and preschoolers' language and literacy gains over an academic year? (3) To what extent are the relations between preschool teachers' self-efficacy and preschoolers' language and literacy gains over an academic year dependent upon classroom quality?

2. Method

2.1. Participants

Participants were 67 preschool teachers who represented a subset of those enrolled in a larger multi-state study of language and literacy instructional practises in preschool classrooms. The participants in the present study comprised those teachers who had datasets containing all relevant variables needed to address the primary research questions. Teachers were affiliated with Head Start ($n = 25$), state-funded pre-K/Title I ($n = 32$), and independent ($n = 10$) preschool programmes. In terms of race and ethnicity, the teachers were White (62.7%), African-American/Black (31.3%), Hispanic/Spanish/Latino (1.5%), Native American/Indian (1.5%) and multi-racial (3%). Teachers' highest level of education varied: 23% had a Master's Degree, 40% had a four-year Bachelor Degree, 22% had two-year Associate's degree, and 15% had a high-school diploma. On average, teachers had 15 years of teaching experience ($SD = 10$, range 0–40 years). Among

them, 30 teachers had certification from their state education agency qualifying them to teach in elementary programmes.

As part of the larger study, all teachers implemented a 30-week book-reading programme in their classrooms in which they read a new target storybook to their children as a whole-class activity several times each week. Teachers were randomly assigned to one of three conditions that represented minor variations in how often or in what manner teachers were requested to read each weekly target storybook. The preliminary results of the larger study are reported in Justice, Kaderavek, Fan, Sofka, and Hunt (2009). In the current study, our interest was to examine the potential relations among teachers' self-efficacy, classroom quality, and children's language and literacy gains above and beyond any effects attributable to treatment variations. Therefore, we included all the teachers irrespective of condition, expecting that these relations would not differ across three conditions. However, given the main effect of the treatments (see Justice et al., 2009), our analyses include the three conditions as covariates to control for any influence on child outcomes that may be attributable to condition assignment of teachers.

A total of 328 children, representing four to six children from each of the 67 teachers' classrooms, were randomly selected in the fall of the year to participate in ongoing assessments of their language and literacy achievement. The exact number of children randomly sampled from a given classroom varied slightly in relation to how many consents to participate were received from children's primary caregivers (e.g., if consents for only six children were received, four were selected; if consents for eight children were received, six were selected). At the beginning of the academic year, children's average age was 4 years ($SD = 4.5$ months, range 41–64 months). Approximately half of the children were female (49%) and 42% of children were White. Other race and ethnicities were also represented, with 40% of children African-American/Black, 6% Hispanic/Spanish/Latino, 1% Asian, and 11% multi-racial.

2.2. Measures

Teachers and children participated in a series of activities that spanned the entire academic year to achieve the purposes of the larger study. We describe here those procedures directly relevant to this research. In the fall of the year, teachers completed a portfolio of questionnaires to provide information about themselves. Relevant to the current study were questionnaire items tapping teachers' total years of teaching experience, whether they held an elementary or preschool teaching certification, whether they had attained a bachelors degree, and their sense of self-efficacy. In the fall and spring of the year, a systematic observation was conducted within each classroom to assess classroom quality. Also in the fall and spring of the year, the child participants were individually tested in a 40-min session by trained research assistants to assess their language and literacy skills. Children were tested in quiet locations in their schools. The test sessions included administration of both vocabulary knowledge and print awareness measures, as discussed further below.

2.2.1. Teacher self-efficacy questionnaire

An abbreviated 11-item version of the Teacher Self-Efficacy Scale (TSES; Bandura, 1997) was used to examine teachers' sense of efficacy regarding management and motivation of children in their classrooms. The present items were selected from a larger set of 21 items used by the NICHD ECCRN's longitudinal study of day care quality (see <http://secc.rti.org> for a copy of this measure); the larger questionnaire studies self-efficacy across five dimensions, whereas the 11-item version used in this study looked specifically at teachers' instructional self-efficacy and efficacy towards creating a positive school climate. The response scale ranged from “Nothing” (score of 1) to “A great deal” (score of 5), and items included

questions such as “How much can you do to get through to the most difficult students?” and “How much can you do to keep students on task on difficult assignments?” The internal consistency reliability (α) for the 11-item scale was .88, which is comparable to the reliability of the tool as a whole (NICHD-ECCRN, 2006). Teachers' responses to each item were summed to create a total self-efficacy score for analyses (see Table 1). The scores of the Teacher Self-Efficacy Scale were normally distributed.

2.2.2. Classroom quality

Classroom quality, specifically the level of instructional and emotional support present within the 67 classrooms, was assessed using the Classroom Assessment Scoring System-PreK (CLASS; Pianta et al., 2008). Assessment of classrooms using the CLASS focuses exclusively on dynamic aspects of the classroom, particularly the interactions between teachers and students. The CLASS comprises a total of nine scales designed to measure three global domains of quality: instructional support, emotional support, and classroom organisation. For each scale, trained and reliable observers assign a single score from 1 to 7 to the classroom, spanning a continuum of quality that encompasses low (1, 2 points), mid (3, 4, 5 points), and high (6, 7 points) levels of quality. The validity of the coding scheme itself is well-supported in prior research (e.g., LoCasale-Crouch et al., 2007). For the present purposes, we used composite scores to represent the domains of instructional support (consisting of the scales measuring concept development, quality of feedback, and language modelling) and emotional support (consisting of the scales measuring positive climate, teacher sensitivity, and regard for student perspectives). These two domains are empirically supported as consistent and reliable predictors of children's growth in the constructs of interest in this study (language and literacy; see Mashburn et al., 2008).

For the present study, CLASS was scored in both the fall and spring of the year from videotapes collected during an approximately two-hour standardised classroom observation. Scoring from videotapes was conducted in a lab-based setting by research assistants who had completed CLASS training at the University of Virginia (the CLASS development site) to a reliability criterion established by the tool's authors (see Pianta et al., 2008). Specifically, research assistants who were all reliable coders had attended a two-day training workshop conducted by a certified CLASS master coder and passed a reliability test (i.e., achieving 80% agreement with six gold standard cases). The gold standard cases (i.e., classrooms) used to establish coders' reliability were similar to those classrooms participating in this study, in that these are largely publicly funded preschool classrooms that exhibit similar teacher-child ratios and pupil demographic characteristics. For the present purposes, we averaged CLASS scores for each domain across the two observation points (fall, spring). For the CLASS instructional support scores, the difference between the mean spring score ($M = 3.40$) and the mean fall score ($M = 3.49$) was not different from zero ($p = .48$). There was a slightly larger difference on CLASS emotional support scores between spring ($M = 4.76$) and fall ($M = 4.62$), but the difference was not significant ($p = .25$). The internal consistencies for the instructional and emotional support domains in our sample were .91 and .89.

Table 1
Descriptive statistics for teacher and classroom measures.

Measure	<i>M</i>	<i>SD</i>	Range
Teacher Self-Efficacy	40.66	5.16	28–50
Emotional Support	4.69	1.07	2.5–6.5
Instructional Support	3.45	.97	2–6.17

Note. Emotional support and instructional support scores from classroom assessment scoring system (Pianta et al., 2008).

Table 1 presents mean scores for the classroom quality ratings. The scores for emotional support are normally distributed; in contrast, the curve of instructional support scores is skewed to the right, indicating that more teachers in this sample provided low levels of instructional support, although skewness (.396) and kurtosis (−.169) values were within the acceptable ranges.

2.2.3. Children's language and literacy measures

Children were administered four assessments of language and literacy skills in the fall (Time 1) and spring (Time 2) of the year: one measure of language (vocabulary knowledge), *The Peabody Picture Vocabulary Test-III* (PPVT-III; Dunn & Dunn, 1997), and three measures of literacy (print awareness): the *Preschool Word and Print Awareness* (PWPA; Justice & Ezell, 2001), the Alphabet Knowledge subtest of the *Phonological Awareness and Literacy Screening-PreK* (PALS; Invernizzi, Meier, & Sullivan, 2004), and the Name-Writing Subtest of the PALS. For the present purposes, individuals who administered tests in the field completed a multi-step reliability assessment prior to implementing any measures. This involved didactic training on each measure, completion of written quizzes, and observations of one's administration as compared against step-by-step administration procedures (>95% accuracy) for each measure within the lab (i.e., giving the assessment to a peer) and in the field (i.e., giving the assessment to a study pupil). Because the assessments are procedurally well defined and exhibit high inter-rater reliability based on extant reports, inter-rater reliability of assessment procedures was not assessed in the larger study. However, all assessment intakes were double-scored and a randomly selected 10% were double-entered into the database to ensure accuracy of scoring and data entry practises. Any assessment found to have <90% inter-rater agreement for data entry practises were completely rescored and re-entered.

As the sole measure of language used in this study, the PPVT-III is a measure of single word receptive vocabulary that requires participants to select a picture that best depicts the verbal stimulus given by the examiner. When the examiner reads aloud the stimulus word, the participants choose from picture alternatives. Stimulus items are presented in increasing difficulty. Dunn and Dunn (1997) reported internal consistency reliability of .93 in a sample whose age ranged from 2 to 6 years. Table 2 presents children's mean standard and raw scores on this measure at the two time points; for analyses, however, raw scores were used.

Three separate measures were used in this study to represent children's literacy skills specific to the area of print awareness (see Table 2). The PWPA is a measure of children's knowledge of 14 print concepts; it is administered during a shared storybook-reading interaction between examiner and child in which the examiner embeds a series of print-related tasks (e.g., “Show me just one letter on this page.”). Justice, Bowles, and Skibbe (2006) reported that the inter-rater reliability (point-by-point agreement) for this measure is .94. The PALS Alphabet Knowledge subtest is a measure of children's knowledge of the 26 upper-case letters of the alphabet. The child is asked to name each individual letter within a randomly-ordered array; Invernizzi et al. (2004) reported that the inter-rater reliability for this subtest is .99. The PALS Name-Writing subtest is a measure of children's emergent writing skills; the child is asked to draw a portrait of him/herself and then sign it. The child's signature is scored on a 7-point scale. Invernizzi et al. (2004) reported that the inter-rater reliability for name-writing subtest is .99. For the purposes of data reduction, we derived a composite score of print awareness from the PWPA and two PALS measures following procedures in McGinty and Justice (2009). Z-scores were first computed for each measure using means and standard deviations across time points. Z-scores for the three observed measures were then summed within time points, resulting in Time 1 and Time 2 print awareness composite scores based on the same standardised scale.

Table 2
Descriptive statistics for child participants.

Variable	Time 1			Time 2		
	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>	Range
RW: Vocabulary (PPVT)	46.93	17.36	2–96	58.31	17.24	6–115
SS: Vocabulary (PPVT)	91.61	14.90	31–135	95.22	13.82	40–134
RW: Print Concepts (PWPA)	6.25	3.38	0–16	9.35	3.95	1–17
SS: Print Concepts (PWPA)	95.2	16.43	46–145	108.77	19.46	11–161
RW: Upper-case alphabet recognition (PALS)	9.49	9.42	0–26	17.66	8.96	0–26
RW: Name Writing (PALS)	3.97	2.12	0–7	5.75	1.58	0–7
Print Awareness Composite Score	.06	.89	–1.43–1.97	.04	.84	–2.76–1.30

Note. RW = Raw Score; SS = Standard Score; PPVT = Peabody Picture Vocabulary Test; PWPA = Preschool Word and Print Awareness; PALS = Phonological Awareness Literacy Screening (preschool or prekindergarten).

2.3. Analytic strategy

Hierarchical linear modelling (HLM; Raudenbush & Bryk, 2002) was used for the present analyses to account for the nested nature of the data. The two-level HLMs nested children within classrooms, and predicted their residualized gain (i.e., Time 2 scores with Time 1 scores as covariates) from the classroom-level measures of teacher self-efficacy and classroom quality (emotional and instructional support). We did not include the children's age and ethnicity in the level-1 model, as inclusion of children's Time 1 scores represents the effects of these variables as well as the pretest difference across the treatment conditions. Models were built separately for each child outcome, namely vocabulary knowledge and print awareness. First, an unconditional model without any predictor variables was tested to compute the intraclass correlation coefficients (ICCs). Then, we entered child variables at level 1 and teacher and classroom variables at level 2.

For all HLMs, level-1 (Equation (1)) predicted the Time 2 score (*Y*) of child (*i*) in classroom (*j*) as a function of Time 1 scores centred at the grand mean (β_{0j}). In this model, β_{0j} is the classroom mean of Time 2 scores and (r_{ij}) refers to the child-level error.

$$Y_{ij} = \beta_{0j} + \beta_{1j}(\text{T1 score}) + r_{ij} \quad (1)$$

Level-2 modelled changes in children's scores (Time 1 to Time 2) as a function of teacher self-efficacy, instructional support, and/or emotional support. All continuous predictors were centred at their grand means. Two dummy-coded variables indicating treatment status (Treatment 1, Treatment 2, with Treatment 3 as the reference group) were entered to test the effects of teacher self-efficacy and classroom quality above and beyond any effects attributable to the three treatment conditions to which classrooms were assigned. Treatment status was modelled to control its effect on children outcomes. As we anticipated, effects of teacher self-efficacy and classroom quality were seen above and beyond the treatment, and effects were similar, because we did not find any significant two- or three-way interactions involving treatment conditions. Equation (2) presents the level-2 model used to assess the direct effects of teacher self-efficacy. In this model, the mean classroom time 2 scores (β_{0j}) are a function of the grand mean (γ_{00}) plus the effects of teachers' self-efficacy (γ_{01}), treatment status (γ_{02} and γ_{03}), and classroom-level error (u_{0j}). Based on preliminary analyses showing Time 1 scores (β_{01}) as fixed effects, these were modelled simply as a function of the classroom mean (γ_{10}).

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{Self-Efficacy}) + \gamma_{02}(\text{Treatment 1}) \\ &\quad + \gamma_{03}(\text{Treatment 2}) + u_{0j} \\ \beta_{1j} &= \gamma_{10} \end{aligned} \quad (2)$$

Models testing the direct effects of teacher instructional support (IS) and emotional support (ES) added the variable of interest (IS or ES) to the classroom level. Equation (3) presents the IS model;

emotional support results simply replaced the IS variable with ES. In this model, (γ_{02}) represents the direct effect of instructional support above and beyond the effect of treatment status.

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{IS}) + \gamma_{02}(\text{Treatment 1}) \\ &\quad + \gamma_{03}(\text{Treatment 2}) + u_{0j} \\ \beta_{1j} &= \gamma_{10} \end{aligned} \quad (3)$$

Final models included the interactions between teachers' self-efficacy and classroom support, as in Equation (4).

$$\begin{aligned} \beta_{0j} &= \gamma_{00} + \gamma_{01}(\text{Self-Efficacy}) + \gamma_{02}(\text{IS}) + \gamma_{03}(\text{Treatment 1}) \\ &\quad + \gamma_{04}(\text{Treatment 2}) + \gamma_{05}(\text{Self-Efficacy} \times \text{IS}) + u_{0j} \\ \beta_{1j} &= \gamma_{10} + u_{1j} \end{aligned} \quad (4)$$

In this model, the main direct effects of self-efficacy (γ_{01}) and IS (γ_{02}) are modified by the interaction between these variables (γ_{05}). An identical model was run for emotional support.

3. Results

3.1. Relations between teacher self-efficacy and teacher characteristics

The first question addressed in this study concerned the relations between preschool teachers' level of educational attainment, certification, years of teaching experiences, and self-efficacy. Consequently, prior to examining the relations of teacher self-efficacy and classroom quality to child vocabulary and print awareness gains, correlations among these classroom-level variables were examined. As shown in Table 3, teacher degree was not associated with self-efficacy. In contrast, teacher certification (elementary, but not preschool) was significantly and positively correlated with teacher self-efficacy ($r = .279$, $p < .05$). Interestingly, teachers' years of experience working with children prior to kindergarten entry was negatively correlated with teacher self-efficacy ($r = -.293$, $p < .05$).

Table 3
Correlations among teacher-level variables.

	1	2	3	4	5	6	7	8
1. Teacher self-efficacy	—	.174	.159	.057	.143	.279*	-.293*	.120
2. Instructional support		—	.797**	.513**	.198	.333*	-.118	.382**
3. Emotional support			—	.017	.032	.157	-.196	.416**
4. Degree				—	.171	.594**	-.257*	.321*
5. Certificate-Pre					—	.573**	-.059	.206
6. Certificate-Elem						—	-.296	.354**
7. Teaching experience-Pre							—	-.143
8. Teaching experience-Elem								—

Note. Degree = holding of a bachelors (4-year) degree; Pre = Preschool; Elem = Elementary.

* $p < .05$ ** $p < .01$.

although teachers' years of experience working with children in the elementary grades were not significantly associated with teacher self-efficacy. These findings suggest no appreciable relation between teachers' self-efficacy and level of educational attainment; however, teachers who held elementary certification tended to have higher scores on the self-efficacy measure and teachers who had taught longer in the preschool sector tended to have lower scores.

3.2. Teacher self-efficacy, classroom quality and children's language and literacy gains

Prior to addressing the second and third research questions, the unconditional model for each child outcome (vocabulary knowledge and print awareness) was first tested using HLM as discussed previously. The unconditional model predicting vocabulary knowledge yielded an ICC of .152, indicating that most of the variability in Time 2 vocabulary scores was at the child level. Similarly, the ICC (.324) obtained from the unconditional model predicting print awareness suggested that Time 2 print awareness scores were also mainly attributable to between-child effects despite greater between-classroom variance than seen for vocabulary.

The second research question examined the relations among preschool teachers' self-efficacy, classroom quality, and preschoolers' language and literacy gains over the academic year. HLM results showed that teacher self-efficacy did not significantly predict residualized change in children's vocabulary knowledge ($\gamma_{01} = -.100$, $t(63) = -.727$, $p = .470$), after controlling for treatment condition; however, teacher self-efficacy was a significant predictor of children's print awareness (residualized change) ($\gamma_{01} = .022$, $t(63) = 3.454$, $p = .001$), after controlling for treatment condition.

Prior to exploring potential interactions among teachers' self-efficacy, preschoolers' language and literacy gains, and classroom quality to address the third research question, we examined the relations between children's language and literacy gains and classroom quality – namely, instructional and emotional support. HLM results demonstrated that both instructional support ($\gamma_{02} = 1.005$, $t(63) = 1.912$, $p = .06$) and emotional support ($\gamma_{02} = 1.021$, $t(63) = 1.970$, $p = .05$) exhibited positive trends towards significantly predicting residualized change in children's vocabulary knowledge, after controlling for treatment status. Similarly, both instructional support ($\gamma_{02} = .088$, $t(63) = 2.533$, $p = .014$) and emotional support ($\gamma_{02} = .065$, $t(63) = 17.919$, $p = .021$) predicted the residualized change in children's print awareness, after controlling for treatment status. Teachers' self-efficacy did not relate to instructional and emotional support (Table 3).

In sum, these results showed that teacher self-efficacy had a significant and positive main effect on children's print awareness gains but not vocabulary gains, and that both indices of classroom quality (instructional support, emotional support) appeared to influence children's print awareness and vocabulary knowledge gains.

3.3. Interactions among teacher self-efficacy, classroom quality, and children's language and literacy gains

The third research question considered the extent to which the relation between teachers' self-efficacy and children's language and literacy gains may be moderated by (or dependent upon) classroom quality. Tables 4 and 5 report findings from the HLM models investigating the interplay among these variables, Table 4 showing findings for instructional support and Table 5 for emotional support. For children's vocabulary gains, the interaction between teachers' self-efficacy and classroom instructional support did not significantly predict children's vocabulary knowledge (i.e., residualized change; $\gamma_{05} = .139$, $t(61) = 1.217$, $p = .229$, see Table 4); however, the interaction among teachers' self-efficacy and classroom emotional support significantly predicted children's vocabulary knowledge (i.e., residualized change; $\gamma_{05} = .266$, $t(61) = 2.104$, $p = .039$, see Table 5). Fig. 1 depicts this relation. As shown, higher levels of teacher self-efficacy were associated with higher levels of vocabulary gains within classrooms characterised by high levels of emotional support.

For children's print awareness gains, results for the interaction models are presented in Table 4 for instructional and Table 5 for emotional support. The interaction between self-efficacy and instructional support did not significantly predict children's print awareness outcomes ($\gamma_{05} = -.005$, $t(61) = -.866$, $p = .390$, see Table 4) and the finding was similar for self-efficacy and emotional support ($\gamma_{05} = -.004$, $t(61) = -.730$, $p = .468$, see Table 5).

4. Discussion

The primary purposes of this study were to examine the relation between preschool teacher characteristics and their reports of self-efficacy; to investigate the relations among preschool teachers' self-efficacy, classroom quality and preschoolers' language and literacy gains; and to evaluate whether the relations between teachers' self-efficacy and preschoolers' language and literacy gains may be moderated by classroom quality. The results of this study can be summarised as follows. First, having an elementary teaching certificate is positively associated with teachers' self-efficacy, whereas having more years of preschool teaching experience is

Table 4
HLM results: relations among teacher self-efficacy, instructional support, and children's language and literacy gains.

Variable	Vocabulary knowledge				Print awareness			
	Coefficient	SE	df	p-value	Coefficient	SE	df	p-value
Time 2 score (intercept; γ_{00})	58.213	.602	61	<.001	.332	.031	61	<.001
Child-level variable								
Time 1 scores (γ_{10})	.798	.037	315	<.001	.623	.035	322	<.001
Classroom-level variables								
Teacher self-efficacy (γ_{01})	-.154	.128	61	.235	.019	.006	61	.003
Instructional support (γ_{02})	.924	.547	61	.096	.075	.029	61	.011
Treatment condition								
Treatment 1 (γ_{03})	1.137	1.317	61	.392	.104	.086	61	.231
Treatment 2 (γ_{04})	-1.945	1.540	61	.211	.157	.076	61	.044
Self-efficacy*Instructional support (γ_{05})	.139	.114	61	.229	-.005	.005	61	.390
Random effects	Variance	χ^2	df	p-value	Variance	χ^2	df	p-value
Classroom level (U_0)	1.672	79.171	61	.059	.022	109.247	61	<.001
Child level (R)	106.163				.199			

Note. Results with robust standard errors reported. Time 2 = spring; Print Awareness = composite scores of the Preschool Word and Print Awareness, Alphabet Knowledge, and Name-Writing subtests of the Phonological Awareness and Literacy Screening-PreK.

Table 5

HLM results: relations among teacher self-efficacy, emotional support, and children's language and literacy gains.

Variable	Vocabulary				Print awareness			
	Coefficient	SE	df	p-value	Coefficient	SE	df	p-value
Time 2 scores (intercept; γ_{00})	58.245	.586	61	<.001	.332	.032	61	<.001
Child-level variable								
Time 1 scores (γ_{10})	.794	.037	315	<.001	.631	.036	322	<.001
Classroom-level variables								
Teacher self-efficacy (γ_{01})	-.146	.121	61	.230	.020	.006	61	.003
Emotional support (γ_{02})	.981	.451	61	.034	.044	.027	61	.101
Treatment condition								
Treatment 1 (γ_{03})	1.677	1.122	61	.140	.161	.085	61	.064
Treatment 2 (γ_{04})	-1.799	1.491	61	.233	.181	.079	61	.026
Self-efficacy*Emotional support (γ_{05})	.266	.126	61	.039	.004	.006	61	.468
Random effects	Variance	χ^2	df	p-value	Variance	χ^2	df	p-value
Classroom level (U_0)	1.642	75.434	61	.101	.026	114.147	61	<.001
Child level (R)	106.296				.198			

Note. Results with robust standard errors reported. Time 2 = spring; PPVT = The Peabody Picture Vocabulary Test-III.

negatively associated with teachers' self-efficacy. Second, teachers' self-efficacy is a positive and significant predictor of children's gains in print awareness over the academic year, but not vocabulary knowledge. Third, teachers' self-efficacy is a positive and significant predictor of children's vocabulary gains only within the context of high quality, emotionally supportive classrooms. We describe these findings more thoroughly in turn.

Concerning our first major finding, this study found a significant and positive correlation between teachers' self-efficacy and possession of a certificate to teach in the elementary grades. On the other hand, this relation was not apparent for certification as a preschool teacher. The explanation for this finding perhaps reflects the certification differences between the preschool and elementary sector, in that preschool certification typically requires a two-year degree whereas an elementary teaching certificate typically requires a four-year degree, minimally. The difference in coursework

requirements between four-year and two-year educational training may also explain our null association between certification to teach in preschool and teachers' self-efficacy. Within four-year teacher education programmes, teachers are generally required to have completed 30 credits in educational psychology courses, 30 credits in a specified academic major, and at least 60 additional credits of liberal arts coursework (Lobman, Ryan, & McLaughlin, 2005) as well as completion of supervised student teaching or other direct teaching experience (Darling-Hammond & Youngs, 2002). In contrast, for many two-year education training programmes, teachers are required to complete 18 credits in education methods course, 16 credits of child-related courses, and 13 additional credits of general education courses such as general psychology and English composition (Cassidy, Buell, Pugh-Hoese, & Russell, 1995). Moreover, the difference in field experience between the two certificates might also explain our findings, because authentic teaching experiences during student teaching practicals have been linked to higher levels of pre-service teachers' self-efficacy (Housego, 1992; Hoy & Woolfolk, 1990). To achieve primary-grade certification, teachers are often required to complete a series of observational field experiences and semester-long or year-long student teaching, whereas for preschool certification, field experiences tend to be more limited.

The difference in training requirements for holding such certifications is important to note, however, particularly as simply holding a bachelor degree was not reliably associated with increased levels of self-efficacy. We speculate that increased training in areas specific to early childhood education perhaps increases teachers' feelings of self-efficacy, a finding which will need to be carefully considered in future research given that our correlational methods restrict any interpretation of causality. In fact, it is certainly plausible that teachers' who have higher feelings of self-efficacy (i.e., who perceive themselves as more capable teachers) are more likely to pursue a four-year than a two-year education degree.

Warranting further discussion is that results of this study indicated a negative association between teachers' self-efficacy and their years of experience with children prior to kindergarten entry. Although this may seem paradoxical, in that we might expect teachers with more teaching experience to have higher levels of self-efficacy, it is consistent with prior evidence showing that teachers with more years of teaching experience or at later stages in their career have lower levels of self-efficacy (Brown & Gibson, 1982; Skaalvik & Skaalvik, 2007). Perhaps this finding reflects a circumstance in which teachers who have been in the field longer feel that they have less knowledge about current approaches to

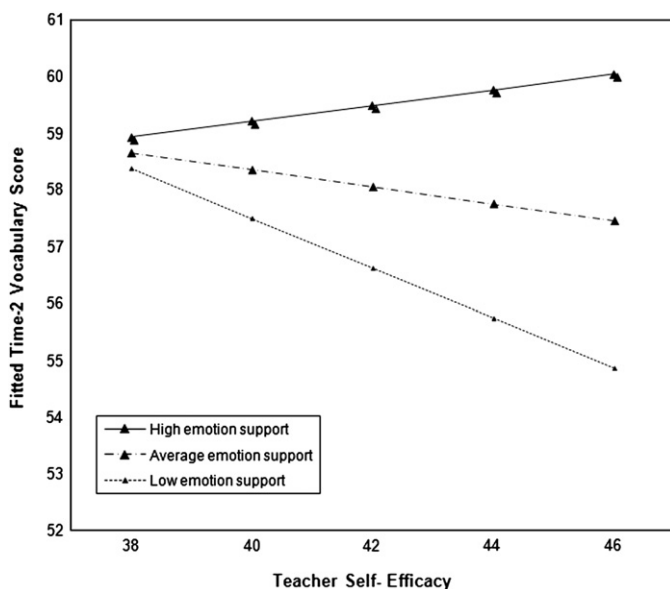


Fig. 1. Interaction between teacher self-efficacy \times emotional support on fitted spring vocabulary scores, adjusting for fall vocabulary score and treatment status. Emotional support scores fall at the 25th (low), 50th (average), and 75th (high) percentiles. Time 2 = Spring.

teaching; this may be particularly true in the area of early language and literacy instruction, in that scientific advances in this area have been particularly prominent in the last decade. Teachers who have been in the field for some time may feel that they have little current knowledge in this area and therefore may have lower levels of self-efficacy. Thus, professional development and continuing education, coupled with a focus on raising efficacy levels among in-service preschool teachers, might help to ensure that tenure in the classroom relates to greater teaching performance and higher level of self-efficacy, which in turn may improve children's achievement.

Concerning our second major finding, in accord with previous research (Armor et al., 1976; Bandura, 1993; Gibson & Dembo, 1984; Goddard et al., 2000; Ross, 1992), we found that teachers' self-efficacy was significantly associated with children's gains in print awareness. Children in classrooms of teachers who reported higher levels of self-efficacy in their ability to bring about change in children's abilities exhibited greater gains on measures of print awareness over the academic year compared to children in classrooms of teachers with lower levels of self-efficacy. While we cannot attribute a causal relationship between these two variables, the association between teachers' self-efficacy and preschoolers' gains on a measure of early literacy is an important contribution to the extant literature, which has shown similar relations when applied to the primary grades (Anderson et al., 1988; Armor et al., 1976; Bandura, 1993; Gibson & Dembo, 1984; Goddard et al., 2000; Ross, 1992).

With respect to vocabulary knowledge, teachers' self-efficacy was predictive of child gains only in specific contexts, namely in classrooms characterised by high levels of emotional support. However, children made less vocabulary gains within the classroom with low level of emotional support, even when teachers reported high level of self-efficacy. This is an interesting finding given considerable evidence showing the positive influence of emotionally supportive relationships between caregivers (e.g., mothers, teachers) and young children, particularly as it relates to children's early language achievements (e.g., Landry, Miller-Loncar, Smith, & Swank, 1997). Landry and colleagues, for instance, showed that a composite measure of maternal affect, sensitivity, and responsiveness served as a positive and unique predictor of young children's language growth from six through 40 months of age. The findings of the present work complement such studies by showing that the potential contribution of teachers' self-efficacy to improving children's vocabulary knowledge is dependent upon classroom conditions characterised by emotional responsiveness. In other words, high levels of teacher self-efficacy within the context of low quality classrooms that are not emotionally supportive may not contribute to gains in children's vocabulary outcomes and even depress children performance. We argued that possibly, teachers with high level of self-efficacy might set high expectations for themselves and their students. High expectations in the absence of high quality of emotional support might be interpreted by children as oppressive, creating negative emotion such as a fear of failure, which could depress children's academic performance.

Although findings of the interaction among teachers' self-efficacy, emotionally supportive classrooms, and children's vocabulary gains cannot be interpreted causally, it is useful to theorise how these relationships manifest themselves within the preschool classroom. Drawing from work concerning teachers' self-efficacy in the primary grades, it is plausible that teachers with higher levels of efficacy set up more warm interpersonal relationships with students and provide more positive and supportive class environment (Ashton & Webb, 1986). In turn, students within these classrooms exhibit higher levels of knowledge gains over the academic year. Interpreting findings in this way suggest that emotionally responsive interactions are the mechanism through which teachers' self-efficacy exerts positive

influence on children's vocabulary gains. Moreover, the findings also imply that, at least for this developmental domain (vocabulary gains), the influence of teachers' self-efficacy on pupil achievement should be considered in the context of the actual classroom quality provided.

Taken together, the findings presented in this study established the importance of preschool teachers' self-efficacy and classroom quality in understanding children's language and literacy gains in the context of preschool, which are consistent with findings obtained from the studies in elementary and secondary schools. These findings may be important for considering how to improve the quality of preschool education through teacher education. Highly qualified teachers are called for in every preschool classroom, accompanying increased public expenditures in preschool education (Barnett, 2003; Darling-Hammond, 2000). Previous research has suggested that teacher education credentials (Bellm & Whitebook, 2003) and classroom quality (Hamre & Pianta, 2007; Howes et al., 2008) are important for ensuring that children develop important language and literacy skills within preschool classrooms. Given the inter-relations among teachers' self-efficacy and child gains in language and literacy achievement as observed in this study, we propose that preschool teachers' self-efficacy needs to receive more attention within in-service and pre-service training.

However, we interpret the finding of the present study cautiously for several reasons. First, our teacher self-efficacy measure was very specific in terms of its content, in that we only assessed teachers' individual sense of self-efficacy. However, there is another type of teachers' self-efficacy, called collective teacher efficacy, which concerns teachers' perceptions of how a school faculty considered as a whole can foster achievement of students within that school (Goddard et al., 2000). Some studies have found that teachers' perceptions of collective efficacy are related to student achievement differences between schools (Bandura, 1993; Goddard et al., 2000). Given limited attention to teachers' self-efficacy within the preschool segment of school, future research should broaden to include additional measures of self-efficacy, including collective efficacy. Second, the teachers in this study were teaching in targeted enrolment preschool programmes that served largely "at-risk" populations. It is unclear whether teachers' reports of self-efficacy would have differed if we had studied a more general population of students that included fewer numbers of students exhibiting risk. Additionally, it is also possible that relations between teachers' report of self-efficacy and student achievement in language and literacy would not be present with a more general population of pupils. The extent to which teachers' self-efficacy is associated with child outcomes for a more representative population must be determined. Lastly, it is important to recognise that results of this study are correlational. We cannot assume that relations observed between teachers' self-efficacy and child gains in print awareness and vocabulary knowledge are causal in nature. Experimental research is needed to determine whether high levels of teachers' self-efficacy have positive effects on preschool children's gains in print awareness and vocabulary knowledge. While results of this study suggest that teachers' self-efficacy is an important area of research given its observed relations with children's gains in high-risk classroom settings, translating these findings in causal terms would be premature.

In conclusion, our findings suggest that teachers' self-efficacy is an important factor to consider within the preschool context. Moreover, associations between teachers' self-efficacy and children's academic gains may not be as straightforward as prior research suggests, requiring greater understanding of the support children receive within the classroom setting. We hope these results set a precedent for considering teacher beliefs in conjunction with classroom practices when further investigating associations between such factors and children's language and literacy development.

Acknowledgement

This research was supported in part by Grant #R305G050057 from the U.S. Department of Education, Institute of Education Sciences. The content of this paper does not necessarily reflect the position or policy of IES, nor does infer any official endorsement. The research was presented at the sixteenth annual meeting of Society for the Scientific Studies of Reading, Boston, MA, June 2009. We are very grateful to the children, families, teachers and administrators who participated in this project.

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