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2022

Joint Contributions of Teacher's Pedagogical Content Knowledge and Book Reading to Preschooler's Growth in Language Skill.

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Abstract

In the context of the critical need to support children's early language development, teacher knowledge may enhance children's opportunities to build linguistic skills. In this study we explored how early childhood teachers' (*n* = 86) pedagogical content knowledge for language and vocabulary, and their book-reading implementation across the school year independently and jointly predicted children's (*n* = 582; mean age = 49.76 months, *SD* = 7.06) growth and spring status on five standardized measures of vocabulary and syntax. Results indicated modest book-reading durations, on average, but also variability across teachers. Whereas there were limited or no main effects for book reading or teacher knowledge there were significant moderation effects in 6 of 10 models when predicting spring status and in 5 of 10 models when predicting growth. Findings suggest that longer fall book readings may be especially beneficial when teachers have low pedagogical knowledge, but that this pattern does not apply later in the school year. We discuss implications for future research, for understanding the constructs of knowledge and their role in authentic classroom practices and for professional development.

KEYWORDS: pedagogical content knowledge, language development, early childhood, book reading

Joint Contributions of Teacher's Pedagogical Content Knowledge and Book Reading to Preschooler's Growth in Language Skill

An ever-growing literature robustly supports the importance of children's early language skills for children's adaptation to school and reading achievement (e.g., Lervåg et al., 2018). The urgency of supporting language during early childhood is heightened by evidence that language skills may be increasingly stable, and therefore less malleable, as children get older (e.g., Rice & Hoffman, 2015). Despite the importance of language development, numerous studies indicate relatively limited attention to supporting vocabulary and other language skills in early childhood education (ECE) classroom environments (Phillips et al., 2018; Pelatti et al., 2014) with substantial variability across teachers (e.g., Dickinson et al., 2014; Turnbull et al., 2009). To improve the effectiveness of language-focused instruction in ECE, the field requires better understanding of what leads to diverse decisions regarding time allocation and instructional priorities.

Pedagogical Content Knowledge

One plausible explanation for instructional decisions that do not match children's needs is teachers' knowledge regarding what and how to teach (e.g., Joshi et al., 2009; Moats, 2009). The theoretical (e.g., Shulman, 1986) and empirical (e.g., Carlisle et al., 2011) literature on teacher knowledge suggests it comprises multiple components. For example, Shulman parses knowledge into, among other aspects, knowledge of content (CK) and knowledge of how to support learning of the content (i.e., pedagogical content knowledge [PCK]).

There are mixed findings in the steadily growing body of literature regarding whether greater teacher CK and PCK predicts children's reading development (e.g., Carlisle et al., 2011; McCutchen et al., 2002; Piasta et al., 2009). Furthermore, most of this research focuses on kindergarten and early elementary grades and on children's development of decoding and spelling. There is less research on links between teacher CK and PCK and children's early literacy within ECE (e.g., Cash et al., 2015). Piasta et al. (2020a) reported associations between multiple aspects of teacher knowledge and children's early literacy gains. They further indicated that the link between ECE teacher knowledge and children's print knowledge development was mediated by instructional time allocated to print-related activities, suggesting a concrete and malleable mechanism (i.e., instructional time on task) by which knowledge could lead to child skill acquisition.

Findings on links between teacher knowledge and child language outcomes are even more limited, inconclusive, and primarily reported within intervention studies (e.g., Gersten et al., 2010). Notably, Piasta et al. (2020) did not report a mediational pathway from ECE teacher knowledge through instructional practices to children's language outcomes. In fact, knowledge was not related to gains in any language outcomes. CK and PCK may not predict all aspects of language-related instructional practices (e.g., Phillips et al., 2020). Neuman and Cunningham (2009) improvements in language-related practices without simultaneous gains in PCK and Schachter et al. (2016) indicated that knowledge was related to language-related instructional practices only when practices were highly frequent.

Schachter et al.'s (2016) findings suggest that a threshold of relevant instructional exposure may be required to reveal the influence of teacher knowledge for language development. Specifically, the link between teacher knowledge and child outcomes may be conditional on the linguistic interaction and intentional instructional opportunities offered to children. Factors that may influence the frequency of instructional opportunities, including time constraints, resource access, or conflicting beliefs, may explain why even knowledgeable teachers might not engage in robust language-focused interactions and instruction (Phillips et al., 2020; O'Leary et al., 2010). Collectively, findings indicate that mediation models insufficiently explain how knowledge supports children's language gains. That is, the association of knowledge to children's outcomes may not, or may not exclusively, represent a process where greater knowledge leads to more time on language-supportive instruction.

An alternative conceptualization is that knowledge modulates the effectiveness of teachers' existing instructional choices. Knowledge, especially PCK, may not be mediated by language-focused instructional practices and interactions but instead may be a moderator of the association between such practices and child language gains. For instance, having greater PCK may enhance the quality of the instruction a teacher provides to children. In this case, two teachers with different levels of PCK who spend equal amounts of time delivering intentional language-related instruction would have children who benefit differentially. Teacher knowledge potentially supports children's language development in less intentional contexts. Specifically, early language might be unique, or at least distinct from code-related skills (which benefit from explicit instruction; e.g., Lonigan et al., 2013) in that language may be robustly supported both through planned activities, like explicit instruction (e.g., Lonigan & Phillips, 2016) and book reading (e.g., Wasik & Hindman, 2020), and through teachers' incidental linguistic interactions with children (e.g., Cabell et al., 2015). Consequently, teachers with greater PCK about vocabulary and language may enhance development through a wider variety of experiences. For example, a teacher with greater PCK-Language may engage in more multi-turn conversations with children and may use more incidental language scaffolding techniques during these conversations. Similarly, a teacher with greater PCK-Vocabulary may infuse her instructional and non-instructional language with more diverse vocabulary words (Phillips et al., 2020). The best way to characterize such linkages between PCK and child language outcomes may be with a direct and moderation model: knowledge may be diffusely filtered through numerous informal interaction types, represented in the direct pathway, and may simultaneously moderate children's benefits from formal instructional activities. As an initial evaluation of this characterization, in this study we evaluated one common aspect of formal instruction in ECE classrooms, time devoted to book reading, and how it may interact with teachers' PCK in predicting child language growth.

Book Reading in Early Childhood Classrooms

Robust research supports the benefits of reading with children (Mol et al., 2009). Swanson et al.'s (2011) meta-analytic review indicated the positive impact of teacher-led read-alouds on vocabulary outcomes across the early to middle childhood age range, although associations with children's learning may depend on child, book, and contextual characteristics (e.g., Hindman et al., 2008). Book reading is an optimal instructional context in which to explore the potential for moderation by teachers' knowledge. Consistent evidence indicates that book reading can support language skills; however, it is particularly potent when teachers use extra-textual conversations, explicit vocabulary instruction, and dialogic interactions with children, including questions, comments, and invitations to talk (e.g., Arnold et al., 1994; Neuman & Kaefer, 2018). More knowledgeable teachers may be more likely to engage in these enhancing behaviors.

Book reading is an important instructional context to explore naturalistically because we may be overestimating how much children experience book reading in ECE settings and presuming the quality, and not also quantity of book reading needs augmentation. Whereas several older studies indicated relatively little reading time (e.g., Dickinson et al., 2003), there are few recent studies of book reading not situated within interventions or where books were provided and reading was prompted (e.g., Pentimonti et al., 2012). Some larger-scale, observational studies include book reading but combine it with other literacy activities or other whole-class activities in calculating ECE teachers' time allocations (e.g., Phillips et al., 2009; Pianta et al., 2018).

In one recent study that catalogued naturally occurring book reading, and therefore provided insight into teachers' choices about allocating time to reading, observation of over 120 ECE classrooms indicated no reading occurred in 25% of the classrooms (Phillips et al., 2018). Even when occurring, time allocation may be minimal; Fuligni et al. (2012) observed that just 4% of a typical child's day was spent being read to in public preschool classrooms. Similarly, Dynia and Justice (2015) collected repeated reading logs from teachers in preschool special education classes and reported that on average children experienced one book and seven minutes of daily reading time. These revealing findings indicate need for additional investigation into whether, and how much, teachers are reading when not prompted. Furthermore, as neither Phillips et al. (2018) nor Dynia and Justice (2015) explicitly linked book-reading experiences to children's language growth, here we sought to fill this gap while investigating how the relation of book reading and child language outcomes may be moderated by teacher knowledge.

This moderation could take several forms. With positive moderation, reading might have greater impact on children's learning when the teacher is more knowledgeable as knowledge may help the teacher activate the potential in the book reading by shaping the way it is enacted (e.g., targeted extratextual questions). Professional development interventions that enhance the impact of book reading are consistent with this possibility (e.g., increasing explicit vocabulary instruction, extension activities, and open-ended questions; Wasik & Hindman, 2020). Piasta et al. (2009) reported results similar to this type of moderation: teachers' implementation of explicit decoding instruction only positively predicted child outcomes when teachers had greater code-related CK. This could indicate that lower knowledge might diminish the benefit of book reading. Alternatively, with negative moderation, the benefit of book reading is greater when knowledge is lower. The routine of book reading could compensate for the lessened ability of a teacher with low PCK to support language development through other activities.

The Present Study

Researchers' evaluation of mediation and moderation models specific to language development in early childhood has been hampered by teacher knowledge measures that primarily address code-related content and instruction with less attention to language. To help fill this gap, Phillips et al. (2020) developed a knowledge measure specifically focused on components of language development. We demonstrated that its structure was best represented by four subscales delineated by the type of knowledge (i.e., CK vs. PCK) and the construct focus (i.e., vocabulary vs. broader language). The measures' two PCK subscales (i.e., PCK-Vocabulary and PCK-Language) were included in this study's initial exploration of their relations to child outcomes.

Within a contextually diverse, naturalistic sample of classrooms serving three- to five-year old children, we explored relations between teachers' PCK for Vocabulary and Language, their instructional decisions regarding book-reading duration, and the growth of vocabulary and syntax skills in children across the preschool year. We evaluated whether a moderation framework would accurately represent the interplay between PCK, book reading, and language development. To this end, we posed four research questions. First, to characterize the opportunities for learning through books afforded to children across the classrooms, we asked: How much time do teachers spend reading books with children during the school year? Although we made no specific a priori hypothesis regarding time allocation, based on previous research we anticipated considerable variability across teachers. Second, we asked: Does book-reading duration predict growth in children's vocabulary and syntax skills? Consistent with the larger literature on the benefits of reading with children (Swanson et al., 2011), we predicted that reading duration would positively relate both to children's spring language skill status and to their rate of skill acquisition for all aspects of language measured.

Third, we asked: Does teachers' PCK predict spring status and growth in children's vocabulary and syntax skills? We explored this question separately for PCK-Vocabulary and PCK-Language. Given limited and mixed previous findings, we tentatively predicted significant associations with both spring status and growth for vocabulary and syntax measures. Finally, reflecting our key aim of exploring how PCK and instructional decision-making interact, we asked: Do PCK-Vocabulary and PCK-Language moderate relations between book-reading duration and children's spring status and growth of vocabulary and syntax skills? We predicted significant, positive moderation across the multiple outcomes, such that children taught by teachers with greater PCK related to vocabulary and language would benefit more from the book reading opportunities than would children taught by less knowledgeable teachers.

Method

Participants

Within a larger multi-cohort study of ECE classroom language environments, we recruited lead teachers in three southeastern U.S. states during three consecutive years from settings serving moderate to high percentages of children from lower SES backgrounds (e.g., Head Start and private childcare sites serving at least 30% children receiving subsidies). Ninety-six teachers were recruited overall; the current study included 86 teachers with relevant videorecorded observations Consistent with the project's goal of recruiting from diverse ECE settings, sites included 37% Head Start, 15% public, and 48% private childcare classrooms. The 86 teachers were 99% female of diverse race and ethnicity. The sample comprised 43.5% non-Hispanic White, 40% non-Hispanic African American, 10.5% Hispanic White and 6% teachers of Asian, Multiracial, or other racial groups, of whom two identified as Hispanic. Although the modal teacher education level was a bachelor's degree (44%), the wide range included 21% with a high school diploma/GED/some college credit, 17% with an associate degree and 18% with a master's degree.

Within participating classrooms, we aimed to consent at least 75% of enrolled children; this target was achieved in most classrooms. One goal for the larger project was to represent the range of initial language skills in each classroom among target children to best characterize both the average level and variability of language skills. To achieve this goal, children were screened on the *Expressive One Word Picture Vocabulary Test--Fourth Edition* (EOWVPT; Martin & Brownell, 2010). We determined the class average EOWPVT score, and children were grouped as being near, above, or below this average. Then, typically two but up to three children from each grouping were randomly selected for further participation, providing a sample of target children (*n* = 582) who were administered measures at waves later in the fall, winter, and spring. The targeted sample included 44% non-Hispanic and 1% Hispanic African American, 29% non-Hispanic and 11% Hispanic White, 8% non-Hispanic other or Multiracial, and 7% Hispanic other or Multiracial. Parents identified 15% of children as dual language learners (DLL); 50.9% were male. Children's average age when initially screened was 49.76 months (*SD* = 7.06).

Measures

Classroom Observations

Trained research assistants (RAs) videotaped approximately 2.5 hours of classroom activities (*M* = 160 minutes*;* *SD* = 25.56) on up to six days across the year (two days each wave), for a cumulative maximum of 18 hours per teacher. For logistical reasons (e.g., delayed class enrollment, teacher extended absence) some classrooms were not observed at all waves. RAs used cameras with wide-angle lenses on moveable tripods and tracked the lead teachers while capturing as much classroom activity as possible; observers followed participants to playgrounds and lunchrooms. Teachers were asked to engage in typical schedules; they were not told exact dates but were advised of approximate observation windows to avoid unusual events and teachers planning special lessons. Inclusion of two days per wave (averaged) increased the reliability of observational data and the likelihood of representing teachers' typical practices.

We used the Observer XT Noldus software (version 12.5; Noldus Information Technology, 2015) to code videos; the software enables continuous, detailed coding of event frequency and duration. We developed a mutually exclusive and exhaustive coding system of each teacher's activity (i.e., a single code applied to every 15-second interval) to characterize typical ECE teacher activities (e.g., circle time, clean-up, book reading). Coders were trained to reliability on the coding system through extensive practice using master coded videos in individual and small-group sessions; kappa was .84 across paired coders.

We applied the book-reading code when the teacher was engaged in any form of book-reading activity with at least one child (e.g., reading aloud, discussing storybook features, completing a scholastic reader, listening to an audio book). The lead teacher did not have to be holding or reading the book to be coded as book reading but must have been monitoring or attending to the activity. We calculated the cumulative book-reading duration as the total number of minutes the book-reading code was applied to each teacher during the day's observation; this coding included even very brief 15-second events. The total number of books read during each book-reading event, and cumulatively for the day, was calculated by counting the number of book titles listed by coders as being actively used by the teacher with one or more child (versus books visible but not read or discussed). Observers noted the number of children present at each book-reading event; videos were used for verification. We categorized each book-reading event into one-on-one (1 child), small group (2–6 children), or large group (≥7 children) for analyses. Total book-reading duration and number of books read were averaged within observation wave, yielding fall, winter, and spring variables.

Teacher Knowledge Measure

Authors and other experts in early childhood language developed an initial large item pool to measure PCK for vocabulary and language. A sample of 248 ECE teachers, including those in the current study, completed this larger set (i.e., 40 items per scale). Iterative item-response theory and factor analytic methods yielded the current versions of the two scales, which are structurally distinct (Phillips et al., 2020). Both demonstrate strong internal consistency at a relatively wide range (i.e., ± 1.0 SD) of underlying latent ability scores. Both scales include primarily multiple choice and some true-false items.

The PCK-Vocabulary scale (α= .80–.89) includes 22 items representing three specification areas (i.e., explicit and implicit instructional strategies; word selection), each with sub-specifications (e.g., for explicit instruction: semantic relations, child-friendly definitions, examples and non-examples, differentiation). Example items include "Which example response to the child statement provided best demonstrates a teacher supporting new vocabulary learning?" and "Which of the following is the best student friendly definition for the adjective *patient*?" The PCK-Language scale (α = .84–.93) includes 24 items representing four specification areas (i.e., explicit, implicit, and incidental instructional strategies; reading-embedded) each with sub-specifications (e.g., for reading-embedded: story grammar, inferential questions). Example items include "Which dialogue sequence represents an example of a teacher using a recast?" and "Which of the following is *not* an example of inferential talk used in shared book reading?" We conducted analyses using each teacher's modeled theta scores, or their latent ability score given their pattern of responses across items on each scale.

Child Language Measures

Trained RAs assessed children individually on five standardized and age-appropriate language measures. Sessions lasted 25–30 minutes in quiet, on-site locations. The lag between waves was approximately nine weeks for each child. Two measures assessed vocabulary. The EOWPVT, a measure of expressive single-word vocabulary, was used to screen and select target children, and administered at subsequent waves. The EOWPVT is normed for ages 2 to 70+ with strong psychometrics, including internal consistency of .94–.97 and significant correlation with other standardized vocabulary measures (e.g., WISC-4 VCI, r = .43). Children were also administered the co-normed *Receptive One-Word Picture Vocabulary Test-Fourth Edition* (ROWPVT; Martin & Brownell, 2010), which has strong psychometrics, including internal consistency of .94 - .98 and significant correlation with other standardized vocabulary measures (e.g., WISC-4 VCI, r = .39; EOWPVT-4, r = .69).

To assess syntax and oral comprehension, children completed three subtests of the *Comprehensive Evaluation of Language Fundamentals-Preschool 2nd Edition* (CELF-P-2; Wiig et al., 2004): receptive Sentence Structure (CFSS), Concepts and Following Directions (CFCD), and expressive Word Structure (CFWS). CFSS measures sentence formulation rules with prompts that increase in length and clausal complexity. Children point to the picture matching the prompt (e.g., “the boy is not climbing”). CFCD measures comprehension of linguistic features such as size, location, and sequence. Children point to the picture matching the prompt (e.g., “point to both elephants”). CFWS measures understanding and use of morphological rules and forms. Children complete cloze items (e.g., ‘She is waving at him. He is waving at__’). Internal consistency for children ages three to six years for each of the subtests ranges from .78–.86.

Overview of Primary Analyses

Analyses addressing Questions 2-4 followed a parallel modeling strategy for all five language outcomes. Whereas standard scores are reported (see Table 2) to characterize the sample, analyses were conducted using raw scores, as this better captures changes in children’s skills across time given that standard scores may not change if children retain their relative rankings (Sullivan et al., 2014). All models accounted for the clustering of children in classrooms, used the robust maximum likelihood (MLR) estimator (Satorra & Bentler, 1994), and used full information maximum likelihood to accommodate missing data. Missing rates for teacher observation data ranged from 5-8% per wave. As not all included children were originally randomly selected to participate in the full assessment battery, and some left classrooms midyear, missing data across measures and waves ranged from less than 1% to 23%, averaging 14%. All growth models centered time, in months, at the spring wave. We evaluated the fit of unconditional models against typical benchmarks (Hu & Bentler, 1999) for four standard indices including Chi-square, root mean square error of approximation (RMSEA), Comparative Fit Index (CFI) and the Tucker Lewis Index (TLI). As there were only three waves of data, we could not fit more complex curvilinear models. However, when the initial model did not fit well, a model with the winter time score freed was also evaluated to see if model fit improved.

Conditional models with predictors of both intercept and slope included child age at the fall screening and child DLL status as covariates. Addressing Question 2, models included the three book-reading duration variables. Addressing Question 3, models included either PCK-Vocabulary or PCK-Language, analyzed separately given the limited number of cluster units and the correlation between the two knowledge scales. Lastly, to address Question 4, we added terms representing the interaction of the PCK variable with each duration variable. Significant interactions were followed up with analyses of the simple slopes for values of the PCK moderator at its mean and at one or more points above and below the mean (e.g., 1 or 1.5 SDs). We created Johnson-Neyman plots to identify regions of significance (i.e., where along the continuum of the moderator the main effect was significant) for all significant interactions (Hayes & Mathes, 2009; see Figure 1 for representative examples). For all outcomes we conducted sensitivity analyses in which predictors were included one wave at a time. Results were not substantively different than for the full models, so these more complete models are presented. We first report results for vocabulary measures and then for syntax measures. Although trends are marked in the tables, only findings meeting conventional standards of significance are discussed.

Results

Frequency and Setting of Book Reading

The initial research question explored whether, and how much, teachers engaged in book reading with children at each observation wave. Consistent with results from a similar sample (Phillips et al., 2018), some teachers did not engage in any book reading in one or more waves (i.e., 9% in fall, 11% in winter, and 18% in spring). Including those who engaged in no reading, the mean book-reading durations for fall and winter were approximately 10 minutes but fell to under eight minutes in the spring; all waves showed a considerable range (see Table 1). When zeros were excluded from calculations, the means only increased by approximately 1–2 minutes in each wave. The 8–10 minutes of reading, on average, may have occurred as a single event or cumulatively across multiple briefer reading events. On average, in fall (M= 1.14, SD = 0.60), winter (M = 1.04, SD = 0.63), and spring (M = 0.96, SD = 0.73) teachers typically engaged in one book-reading event each day. To further characterize children's experiences, we explored group sizes during reading events. Most teachers (60.5%) exclusively engaged in whole-group book reading at all waves. However, some engaged in small-group reading (23%), reading with one child (8%), or both (8%) in one or more wave. Book-reading duration was moderately, but not highly correlated across observation waves (Table 1), supporting our decision to model its contribution to child language development independently for each wave. Notably, teacher PCK-Vocabulary and PCK-Language were significantly correlated only with spring book-reading duration.

Growth in Child Vocabulary

Children averaged standard scores near the normative mean on both measures of vocabulary skills (Table 2); for both, raw and standard scores increased modestly across time. Consistent with the selection plan goal of capturing each classroom's breadth of child language skills, there was substantial variability in fall vocabulary scores. Specifically, the range of raw scores was 0–99 on the EOWPVT and 0–108 on the ROWPVT.

The initial unconditional growth model for the EOWPVT indicated moderately good fit to the data (e.g., CFI = .98; TLI =.94) but the Chi-square for the model was significant (χ^2 = 8.65, p = .003) and the RMSEA was .12. The alternative model with the winter time score allowed to vary provided a better overall fit to the data (e.g., $\chi^2 = 1.14$, $p = .565$, RMSEA =.00 CFI = 1.00, TLI = 1.00); this became the base model for subsequent analyses. Within this unconditional model, intercept and slope were significantly and moderately correlated ($r = .52$, $p < .001$). The model including PCK-Vocabulary (Table 3, Model 1) indicated that age was the only significant predictor of the EOWPVT intercept. Child DLL status was a significant predictor of the slope. We did not conduct follow-up analyses given the lack of statistically significant moderation.

For the model including PCK-Language (Table 3, Model 2), age, DLL status, and fall book-reading duration were significant predictors of the intercept; there was also a significant interaction between PCK-Language and spring book-reading duration. There were no significant predictors of the slope. Follow-up analyses for the significant moderation of spring book-reading duration by PCK-Language on the intercept indicated that prediction from spring book-reading duration was significant when PCK-Language was one SD below the sample mean ($B = -0.52$, SE = 0.26, $p = .044$) but not when it was at ($B = -0.09$, SE = 0.16, $p = .570$) or one SD above the mean ($B = 0.34$, SE = 0.27, $p = .207$). When teacher PCK-Language was especially low the relation between spring book-reading duration and spring status of expressive vocabulary was stronger and negative.

The unconditional growth model for the ROWPVT indicated very good fit (e.g., $\chi^2 = 0.61$, $p = .435$; RMSEA = .00; CFI = 1.00; TLI = 1.00) and was accepted without modification. Within this model, intercept and slope were not significantly correlated ($r = .32$, $p = .189$). For the model including prediction from PCK-Vocabulary, results (Table 3, Model 3) indicated that age and DLL status were significant predictors of the ROWPVT intercept. When predicting the slope, there was a significant, negative, fall book reading by PCK-Vocabulary interaction.

Follow-up analyses indicated that the prediction from fall book-reading duration was significant only when PCK-Vocabulary was one SD below the sample mean (*B* = 0.09, SE = 0.05, *p* = .04) but not when it was at (*B* = 0.02, SE = 0.2, *p* = .30) or one SD above the mean (*B* = -0.05, SE = 0.28, *p* = .10). When teacher PCK-Vocabulary was especially low the relation between fall book-reading duration and the rate of growth for receptive vocabulary skills was stronger and positive.

For the model including PCK-Language (Table 3, Model 4), results indicated that age and DLL status were significant predictors of the intercept, in the context of a significant interaction between spring book reading and PCK-Language. Follow-up analyses for this interaction indicated that prediction from spring book-reading duration was significant when PCK-Language was one SD below the sample mean (*B* = -0.49, SE = 0.23, *p* = .033) but not when it was at (*B* = - 0.09, SE = 0.13, *p* = .472) or one SD above the mean (*B* = 0.31, SE = 0.21, *p* = .132). When teacher PCK-Language was low, the relation between spring book-reading duration and spring receptive vocabulary skill status was stronger, but negative. Age was the only predictor with a significant main effect on the slope, and there was a significant negative interaction between PCK-Language and fall book-reading duration. Follow-up analyses indicated that the association for fall book-reading duration was significant when PCK-Language was one SD below the sample mean (*B* = 0.08, SE = 0.04, *p* = .046) but not when it was at (*B* = 0.02, SE = 0.02, *p* = .283) or one SD above this mean (*B* = -0.03, SE = 0.03, *p* = .184). When PCK-Language was especially low, the association of fall book-reading duration and rate of growth in receptive vocabulary was stronger and positive.

Growth in Child Syntax

As depicted by fall standard score means (Table 2), children exhibited low to below average performance on the three syntax measures from the CELF-P-2. Children demonstrated substantial variability (i.e., fall raw score ranges of 0–21, 0–22, and 0–24 for CFSS, CFCD and CFWS, respectively). Raw and (for all but one) standard scores on all three subtests increased across the year.

The unconditional growth model for CFSS indicated very good fit (e.g., $\chi^2 = 0.32$, $p = .574$; RMSEA = .00; CFI = 1.00; TLI = 1.00) and was accepted. Within this model, intercept and slope were significantly and moderately correlated ($r = .51$, $p = .003$). The model including PCK-Vocabulary indicated that age and DLL status were significant predictors of the intercept (Table 4, Model 1). No variables significantly predicted the slope and as none of the moderation terms were statistically significant we conducted no follow-up analyses.

For the model including PCK-Language (Table 4, Model 2), age and DLL status were significant predictors of the intercept as was the interaction between PCK-Language and spring book-reading duration. Initial follow-up analyses indicated that this predictor was not significant when PCK-Language was at ($B = 0.00$, SE = 0.05, $p = .962$), one SD below ($B = -0.16$, SE = 0.08, $p = .060$) or one SD above ($B = 0.15$, SE = 0.08, $p = .061$) the sample mean. However, the interaction was significant at or beyond 1.5 SDs above ($B = 0.23$, SE = 0.11, $p = .034$) and below ($B = -0.23$, SE = 0.11, $p = .035$) the mean. Figure 1A depicts this interaction with visualization of regions of significance. The adjusted association of fall book reading and CFSS spring status is significant only in the portions of the figure where the confidence interval bands do not include zero, specifically where PCK-Language is well above or below the sample mean of .40.

Age and the interaction of fall book-reading duration with PCK-Language were significant predictors of the CFSS slope. Follow-up analyses of this moderation effect indicated that fall book reading did not significantly predict when PCK-Language was one SD below ($B = 0.03$, SE = 0.02, $p = .056$), at ($B = 0.01$, SE = 0.01, $p = .251$) or one SD above ($B = -0.01$, SE =

0.01, p = .217) the sample mean. Only when teacher PCK-Language was very low (i.e., 1.5 SDs below the mean; B = 0.04, SE = 0.02, p = .034) was the relation between fall book-reading duration and the rate of growth for this child language skill significant.

The unconditional growth model for CFCD indicated good fit (e.g., χ^2 = 2.97, p = .085, RMSEA = .06; CFI = 1.00, TLI = .99) and was accepted. Within this model, intercept and slope were significantly and moderately correlated (r = .49, p < .001). The model including PCK-Vocabulary yielded significant prediction of the CFCD intercept from age and DLL status. Nothing significantly predicted the slope (Table 4, Model 3); because no moderation terms were statistically significant, we did not conduct follow-up analyses. In contrast, the model including PCK-Language yielded significant prediction of the CFCD intercept from age, DLL status, and fall book-reading duration plus a significant interaction of PCK-Language and spring book-reading duration (Table 4, Model 4). Follow-up analyses indicated that prediction from spring book-reading duration was significant when PCK-Language was one SD below (B = -0.17, SE = 0.08, p = .027), but not at (B = -0.02, SE = 0.05, p = .635) or one SD above (B = 0.12, SE = 0.09, p = .165) the sample mean. When teacher PCK-Language was low, the association of spring book-reading duration and spring status for CFCD was significant but negative. Age was the only variable significantly predicting the slope; no follow-up analyses were conducted.

Finally, the unconditional growth model for CFWS indicated very good fit (e.g., χ^2 = 2.26, p = .133; RMSEA = .05; CFI = 1.00; TLI = .99). In this model, the intercept-slope correlation was moderate but not significant (r = .55, p = .255). Results for the model including PCK-Vocabulary indicated that age and the interaction between PCK-Vocabulary and winter book-reading duration were significant predictors of the CFWS intercept (Table 4, Model 5). Despite the significant coefficient, follow-up analyses for this moderation indicated that the effect of winter reading duration was not significant when PCK-Vocabulary was at (*B* = -0.01, SE = 0.04, *p* = .841), one SD below (*B* = -0.10, SE = 0.05, *p* = .072) or one SD above (*B* = 0.08, SE = 0.05, *p* = .103) the sample mean. However, it was significant when PCK-Vocabulary was 1.5 SD above (*B* = 0.13, SE = 0.06, *p* = .039) or below (*B* = -0.14, SE = 0.07, *p* = .032) the sample mean. When predicting the slope, age, DLL status, fall book-reading duration and the interaction of the latter with PCK-Vocabulary were all significant. Follow-up analyses indicated that the effect of fall book-reading duration on growth in CFWS was significant when PCK-Vocabulary was one SD below (*B* = 0.05, SE = 0.02, *p* < .001), and at (*B* = 0.03, SE = 0.01, *p* = .006) but not one SD above (*B* = 0.00, SE = 0.02, *p* = .985) the sample mean of .35 (see Figure 1B).

The model including PCK-Language indicated that age and fall book-reading duration were significant predictors of the CFWS spring intercept (Table 4, Model 6); there also was a significant interaction between spring book-reading duration and PCK-Language. Follow-up analyses revealed that that the association of spring book-reading duration and spring CFWS status was significant when PCK-Language was one SD below (*B* = 0.19, SE = 0.07, *p* = .006), but not when it was at (*B* = -0.03, SE = 0.05, *p* = .537) or one SD above the sample mean (*B* = 0.13, SE = 0.09, *p* = .129). Numerous variables significantly predicted the slope of CFWS, including age, DLL status, fall and winter book-reading durations and the interaction of fall book-reading duration with PCK-Language. Follow-up analyses indicated significant prediction from fall book-reading duration to growth in CFWS when PCK-Language was one SD below (*B* = 0.06, SE = 0.02, *p* < .001), or at (*B* = 0.03, SE = 0.01, *p* = .002) but not one SD above (*B* = 0.01, SE = 0.01, *p* = .391) the sample mean. When teacher PCK-Language was low or average, there was a significant, positive association between fall book-reading duration and growth in this language skill.

In summary, results across the five language measures indicated that PCK often moderated the relation between book-reading practices and language skills development. However, the direction of these moderation effects frequently varied depending on whether spring status or the rate of growth was being predicted. For all five language measures, positive interaction results suggested that teachers with lower PCK-Language who read more in the spring actually had children with lower spring language skills. In contrast, the results of five models suggested a negative interaction where the association of fall book reading with growth in language skills was stronger when PCK was lower; more time spent in fall book reading compensated for teachers' lower knowledge.

Discussion

This study explored how teachers' PCK and book-reading practices jointly predicted growth in multiple critical aspects of child language in a preschool-age sample. We characterized learning opportunities in participating classrooms by determining how much time teachers spent reading with children across the year. As anticipated based on prior research, we observed considerable variability in book-reading duration across teachers. However, overall, teachers engaged in short durations of reading. Our results indicating that teachers engaged in book reading for approximately 8-10 minutes per day are remarkably consistent with limited book-reading durations found in older studies (e.g., 9 minutes; Dickenson et al., 2003) and in more recent instructional logs (e.g., 7 minutes; Dynia & Justice, 2015). The short duration of reading events may indicate less occurrence of the kind of extratextual discussion that support children's language and literacy development (Wasik & Hindman 2020), although a skilled teacher could certainly enrich even brief reading interactions. Instead, teachers allocate instructional time to other contexts (e.g., circle time, center activities, routines), perhaps because they perceive these as more easily managed or more beneficial to children's development (Chen et al., 2021; O'Leary et al., 2010).

In research question two we explored whether book-reading duration predicted children's vocabulary and syntax skills in the spring and rate of growth throughout the year. Contrary to expectations of prediction from all waves, results indicated relatively few main effects of book-reading duration. Specifically, of 30 potential pathways (i.e., three waves across 10 models) only six were statistically significant. Significant prediction primarily involved fall reading duration; moreover, half of the significant associations involved prediction of the slope for CFWS. However, as discussed below, there were numerous significant interactions between teacher PCK and book-reading duration, primarily involving fall and spring reading, that contextualize these less frequent main effects.

In research question 3 we explored prediction from PCK to child outcomes; findings indicated no significant main effects. We anticipated that teacher PCK might predict spring status or growth as a representation of the ways a more knowledgeable teacher might enhance the classroom linguistic environment and children's language learning opportunities. Perhaps this pathway requires highly knowledgeable teachers, or, as the interactions with reading revealed, knowledge may only relate to child outcomes through ways it moderates how teacher behaviors predict child skills. Ongoing coding of multiple instructional settings, and of incidental conversational interactions between teachers and children, will provide robust future opportunities to evaluate this possibility.

Certainly, we must interpret the lack of main effects for PCK in the context of the multiple significant interactions between both PCK scales and book-reading duration.

exemplifying the construct of PCK as coloring and shaping instructional practices (Shulman, 1986). There were two primary patterns observed for these moderation effects. First, consistently across all five language measures, there was a significant positive interaction between spring book-reading duration and PCK-Language in predicting intercepts. More precisely, based on tests of simple slopes and investigation of regions of significance, this moderation indicated that spring book-reading duration was a significant, but negative predictor of intercepts when teachers demonstrated below average PCK-Language. One interpretation is that, specifically in the spring and exclusively when teachers have low language-related knowledge, longer reading sessions may be counterproductive as children may benefit more from other settings. Especially if children just passively listen during reading, other more interactive settings may confer better opportunities to practice language. For example, by the spring, children's language and social skills may be sufficiently advanced that they can benefit from peer interactions (Williford et al., 2013) during child-directed center time. The relation between book reading duration and child skill was not significant when teachers had average or, for most outcomes, above average PCK-Language. Significance in this region would have represented the anticipated pattern of more knowledgeable teachers enriching children's reading experience, comparable to the moderation reported by Piasta et al. (2009) for literacy skills. More research is needed to ascertain the conditions under which the moderation revealed would be significant, and thus accrue to children's greater benefit, at the upper end of the knowledge continuum, and to understand why this moderation occurred primarily for PCK-Language and not comparably for PCK-Vocabulary.

The second pattern we consistently observed represented a negative interaction between fall book-reading duration and both PCK-Vocabulary and PCK-Language in predicting the slope of multiple language skills. Importantly, as was the case with the positive moderation predicting intercepts, these interactions were generally significant only when teacher knowledge was average or below and occurred exclusively with fall reading. For teachers with performance in these regions of the knowledge continuum, the relation between fall book-reading duration and growth in language skills was positive. We interpret these results as suggesting that book reading may be compensatory when teachers have less PCK. That is, regular book readings provided by a teacher with relatively weaker language-related PCK may be more valuable for children because the teacher may not be using PCK to create alternative language-learning opportunities during other interactions (Dickinson et al., 2014).

Book-reading duration may also be more influential for children of teachers with weaker PCK because these teachers have less knowledge of evidence-based techniques to support children's learning during instructional interactions. During book readings, teachers with less PCK may infrequently model diverse vocabulary through extratextual comments or provide explicit vocabulary instruction. However, the text itself may provide exposure to rich vocabulary that supports children's language development (Montag et al., 2015). Even without instructional scaffolding, text read aloud during routine book readings may still support children's language development. This interaction occurring exclusively for fall reading is consistent with this explanation; as children's language skills were less well-developed in the fall, the rarer words and complex phrases to which they were exposed in books may have been more novel, meaningfully adding to children's lexicon and perhaps even potentiating their language growth (e.g., through more efficient fast-mapping or better lexical quality; Saji et al., 2011). Future exploration of language samples recorded during teachers' book readings will illuminate whether longer sessions with more text exposure might influence language development more than briefer but more instructionally-robust book readings. We suspect this may differ depending on a book's content and genre (Pentimonti et al., 2011), a facet currently being explored within the sample.

Limitations and Future Directions

Whereas we incorporated more robust observation than is typical, some teachers may have conducted book readings outside our observational windows. Future studies augmenting observations with reading logs would shed needed light on time-varying implementation patterns and pathways to increase reading frequency. As a first step, we exclusively focused on the duration, rather than the quality of book-reading events; ongoing analyses explore quality and its connections to teacher knowledge and child outcomes. Further coding of videos and teacher language samples will reveal how teachers were allocating the remainder of their time, especially how often they engaged children linguistically, and allow us to better understand how knowledge connects to language modeling and scaffolding provided to children during book reading and in other classroom settings.

This sample reflects three primary settings for ECE in private, Head Start, and public schools but public sites were less well represented than planned; this limitation precluded inclusion of site type in analyses and direct comparisons among types. Public-school classrooms may have administratively-imposed schedules dedicating more time to reading; teachers in those classrooms also typically have post-secondary degrees, although evidence from this and similar samples suggest mixed findings on links among formal education, knowledge, and practice (Phillips et al., 2018, 2020).

Conclusion

Collectively, findings highlight the value of naturalistic observation for understanding how teacher knowledge and instructional decision-making jointly influence critically important early language outcomes outside the context of supportive interventions. Simultaneously, results indicated complex pathways from PCK and book reading to child outcomes. Longer reading durations in the fall may be especially beneficial for children in classrooms with less knowledgeable teachers. In contrast, longer durations in the spring may not be as beneficial, perhaps because other activities may promote more language opportunities. This may be particularly true when teachers do not infuse book reading with higher quality interactions.

Our findings reinforce the need for professional development that both builds knowledge and facilitates its application throughout classroom contexts. Effective strategies will likely integrate teachers' declarative knowledge, tacit practice-based knowledge, and educative curricula to provide children with the language development support required to enhance school readiness (Phillips et al., 2020; Neuman & Cunningham, 2009). When teachers have adequate pedagogical knowledge related to vocabulary and language, they may be better equipped to create and enhance learning opportunities to build children's linguistic skills in authentic classroom settings such as book reading.

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Table 1

Descriptive Statistics and Correlations for Teacher Knowledge and Behavior Variables

	1.	2.	3.	4.	5.
1. PCK-Vocabulary	---				
2. PCK-Language	.56**	---			
3. Book-Reading Duration-Fall	.23†	.05	---		
4. Book-Reading Duration-Winter	.10	-.03	.29*	---	
5. Book-Reading Duration-Spring	.25*	.26*	.27*	.29*	---
Mean	0.35	0.40	9.90	9.45	7.49
SD	0.78	0.69	6.98	6.62	6.43
Range	-1.74-1.66	-1.15-2.02	0-40.10	0-29.21	0-32.69

Note. Teacher knowledge scores are theta scores, equivalent to a standardized score centered on zero. PCK= Pedagogical Content Knowledge.

†$p<.10$; *$p<.05$.

Table 2

Descriptive Statistics for Child Language Measures by Observation Wave

	Fall				Winter				Spring			
	Raw Score		Standard Score		Raw Score		Standard Score		Raw Score		Standard Score	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EOWPVT	42.67	19.25	94.60	18.01	49.79	20.24	96.05	52.45	54.32	21.13	100.25	19.11
ROWPVT	49.93	17.65	97.24	14.58	54.25	18.40	98.49	15.05	58.26	18.04	100.13	14.66
CFSS	10.47	5.08	7.91	3.13	12.06	5.35	8.64	3.40	13.66	5.35	9.34	3.47
CFCD	8.41	4.59	8.12	2.83	9.22	5.17	8.14	3.37	10.70	5.22	8.63	3.39
CFWS	11.91	6.27	8.50	3.64	13.79	6.37	9.43	3.83	15.25	6.38	10.01	3.97

Note. EOWPVT = Expressive One-Word Picture Vocabulary Test; ROWPVT = Receptive One-Word Picture Vocabulary Test;

CFSS = CELF-P-2 Sentence Structure; CFCD = CELF-P-2 Concepts and Following Directions; CFWS = CELF-P-2 Word Structure.

Table 3

Prediction of Final Status and Slope for Vocabulary Measures

	EOWPVT						ROWPVT					
	Model 1			Model 2			Model 3			Model 4		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Prediction of Intercept												
Child Age	1.06***	0.13	0.37	1.05***	0.13	0.36	0.96***	0.12	0.41	0.97***	0.12	0.42
Child DLL	-23.56	2.29	-0.41	-22.30***	2.27	-0.39	-16.05***	2.18	-0.35	-15.73***	2.31	-0.35
PCK-V	-2.04	2.73	-0.08				-0.73	2.60	-0.03			
PCK-L				-0.79	3.25	-0.03				-1.74	3.72	-0.07
BRD-F	0.28	0.22	0.10	0.54**	0.24	0.18	0.22	0.18	0.09	0.33	0.21	0.14
BRD-W	-0.05	0.17	-0.02	-0.14	0.17	-0.05	0.05	0.15	0.02	-0.04	0.16	0.01
BRD -S	-0.25	0.23	-0.08	-0.34	0.20	-0.12	-0.27	0.20	-0.11	-0.32†	0.17	-0.14
PCK-V x BRD-F	-0.07	0.26	-0.04				-0.13	0.19	-0.09			
PCK-V x BRD-W	0.14	0.22	0.07				0.18	0.17	0.11			
PCK-V x BRD-S	0.41	0.29	0.17				0.41	0.25	0.22			
PCK-L x BRD-F				-0.34	0.31	-0.13				-0.16	0.28	-0.08
PCK-L x BRD-W				0.23	0.30	0.08				0.15	0.26	0.07
PCK-L x BRD-S				0.63*	0.31	0.23				0.58*	0.26	0.26
Prediction of Slope												
Child Age	-0.03	0.02	-0.12	-0.03	0.02	-0.14	-0.06†	0.03	-0.19	-0.04*	0.02	-0.22
Child DLL	-1.20*	0.52	-0.23	-1.13	0.52	-0.23	-0.05	0.50	-0.01	-0.05	0.52	-0.02
PCK-V	-0.19	0.54	-0.08				0.76†	0.45	0.44			
PCK-L				-0.07	0.59	-0.03				0.65	0.56	0.35
BRD-F	0.05	0.04	0.20	0.06	0.04	0.24	0.06†	0.03	0.29	0.06†	0.03	0.31
BRD-W	-0.02	0.04	-0.05	-0.03	0.04	-0.09	0.03	0.04	0.14	0.02	0.04	0.12
BRD-S	-0.02	0.05	-0.09	-0.01	0.04	-0.06	0.02	0.05	0.09	0.01	0.04	0.08
PCK-V x BRD-F	-0.04	0.05	-0.23				-0.09*	0.04	-0.72			
PCK-V x BRD-W	0.02	0.04	0.12				0.01	0.04	0.04			
PCK-V x BRD-S	0.05	0.06	0.25				0.02	0.05	0.11			
PCK-L x BRD-F				-0.04	0.05	-0.18				-0.08*	0.04	-0.54
PCK-L x BRD-W				0.04	0.07	0.16				0.02	0.06	0.11
PCK-L x BRD-S				0.03	0.06	0.13				0.02	0.05	0.09

Note. PCK-V= Pedagogical Content Knowledge- Vocabulary; PCK-L = Pedagogical Content Knowledge- Language;

BRD = Book-Reading Duration; F = Fall; W = Winter; S = Spring.

ǂ$p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$.

Table 4

Prediction of Final Status and Slope for Syntax Measures

	CFSS						**CFCD**						**CFWS**					
	Model 1			Model 2			Model 3			Model 4			Model 5			Model 6		
	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β	B	SE	β
Prediction of Intercept																		
Child Age	0.25***	0.04	0.37	0.26***	0.04	0.38	0.27***	0.05	0.39	0.27***	0.04	0.39	0.32***	0.05	0.37	0.32***	0.05	0.38
Child DLL	-4.30***	0.70	-0.32	-4.31***	0.74	-0.32	-3.67***	0.70	-0.26	-3.53***	0.72	-0.27	-7.06***	0.81	-0.41	-7.00***	0.85	-0.41
PCK-V	-0.12	0.62	-0.02				-1.14†	0.69	-0.18				-0.24	0.74	-0.03			
PCK-L				-0.92	1.06	-0.13				-1.23	0.94	-0.17				-0.81	1.13	-0.09
BR-F	0.05	0.06	0.07	0.08	0.06	0.12	0.10†	0.06	0.14	0.12*	0.06	0.17	0.12†	0.06	0.13	0.16*	0.07	0.19
BR-W	-0.00	0.05	-0.00	-0.00	0.06	-0.01	-0.00	0.04	0.00	-0.01	0.04	0.01	-0.05	0.04	-0.05	-0.06	0.05	-0.06
BR-S	-0.03	0.07	-0.05	-0.09	0.06	-0.13	-0.05	0.07	-0.07	-0.11†	0.06	-0.15	-0.07	0.07	-0.08	-0.12*	0.05	-0.14
PCK-V x BR-F	-0.03	0.06	-0.06				-0.02	0.05	0.03				-0.10†	0.08	-0.17			
PCK-V x BR-W	0.05	0.05	0.11				0.05	0.04	0.10				0.12*	0.04	0.18			
PCK-V x BR-S	0.06	0.07	0.11				0.06	0.08	0.11				0.10	0.08	0.14			
PCK-L x BR-F				-0.06	0.09	-0.10				-0.01	0.07	-0.01				-0.13	0.11	-0.17
PCK-L x BR-W				0.03	0.09	0.05				0.02	0.08	-0.02				0.09	0.11	0.11
PCK-L x BR-S				0.22*	0.09	0.34				0.21*	0.10	0.32				0.23**	0.11	0.28
Prediction of Slope																		
Child Age	-0.02†	0.01	-0.19	-0.02*	0.01	-0.20	-0.01	0.01	-0.14	-0.01*	0.01	-0.16	-0.13*	0.01	-0.22	-0.02*	0.01	-0.30
Child DLL	-0.10	0.37	-0.06	-0.11	0.14	-0.07	0.17	0.14	0.11	0.20	0.14	0.13	-0.45**	0.17	-0.37	-0.42*	0.18	-0.42
PCK-V	0.29†	0.15	0.40				-0.13	0.13	-0.17				0.21	0.15	0.35			
PCK-L				-0.00	0.22	-0.00				0.02	0.14	-0.02				0.18	0.16	0.32
BRD-F	0.02	0.01	0.19	0.02†	0.01	0.26	0.02	0.01	0.19	0.03†	0.01	0.31	0.04***	0.01	0.63	0.05***	0.01	0.93
BRD-W	-0.00	0.01	0.00	-0.01	0.01	-0.11	-0.00	0.01	-0.06	-0.01	0.01	-0.08	-0.02	0.01	-0.26	-0.02*	0.01	-0.46
BRD-S	0.02	0.02	0.24	0.01	0.01	0.09	-0.02	0.01	0.26	0.01	0.01	0.16	0.01	0.02	0.20	0.01	0.02	0.09
PCK-V x BR-F	-0.02	0.01	-0.29				-0.00	0.01	-0.03				-0.04*	0.01	-0.85			
PCK-V x BR-W	-0.00	0.01	-0.02				0.01	0.01	0.23				0.01	0.01	0.22			
PCK-V x BR-S	-0.02	0.02	-0.24				-0.01	0.01	-0.20				-0.01	0.02	-0.11			
PCK-L x BR-F				-0.03*	0.01	-0.41				-0.02	0.02	-0.32				-0.05**	0.02	-1.15
PCK-L x BR-W				0.02	0.02	0.25				0.01	0.02	0.14				0.02	0.02	0.43
PCK-L x BR-S				0.01	0.02	0.16				0.00	0.02	0.04				0.01	0.01	0.17

Note. PCK-V= Pedagogical Content Knowledge- Vocabulary; PCK-L = Pedagogical Content Knowledge- Language; BR = Book-

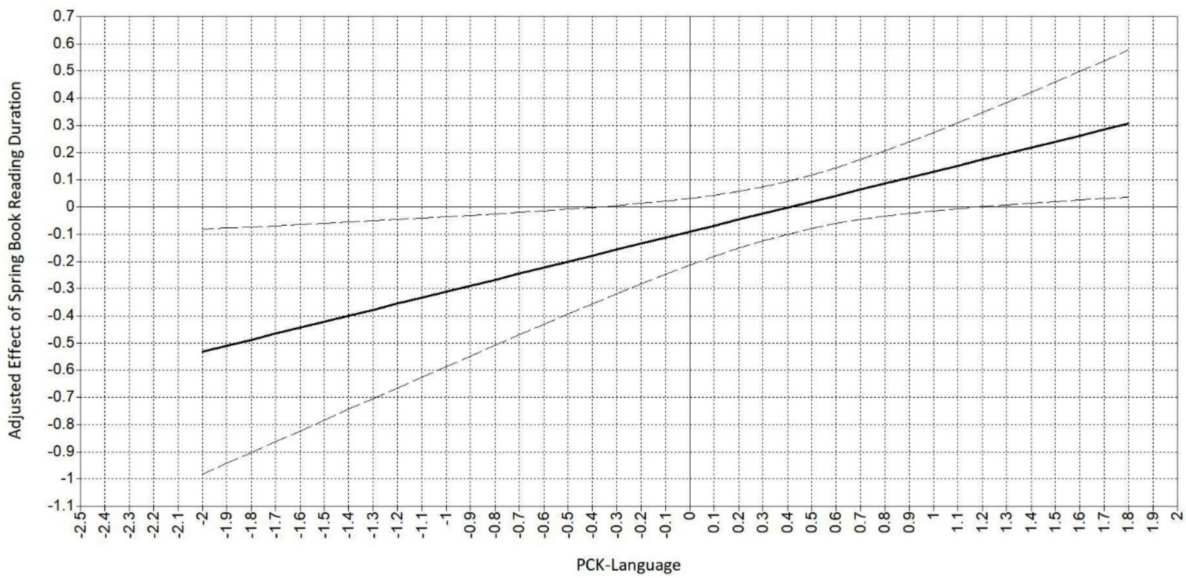
Reading Duration; F = Fall; W = Winter; S = Spring. CFSS = CELF-P-2 Sentence Structure; CFCD = CELF-P-2 Concepts and Following Directions; CFWS = CELF-P-2 Word Structure.

ǂ$p<.10$; *$p<.05$; **$p<.01$; ***$p<.001$.

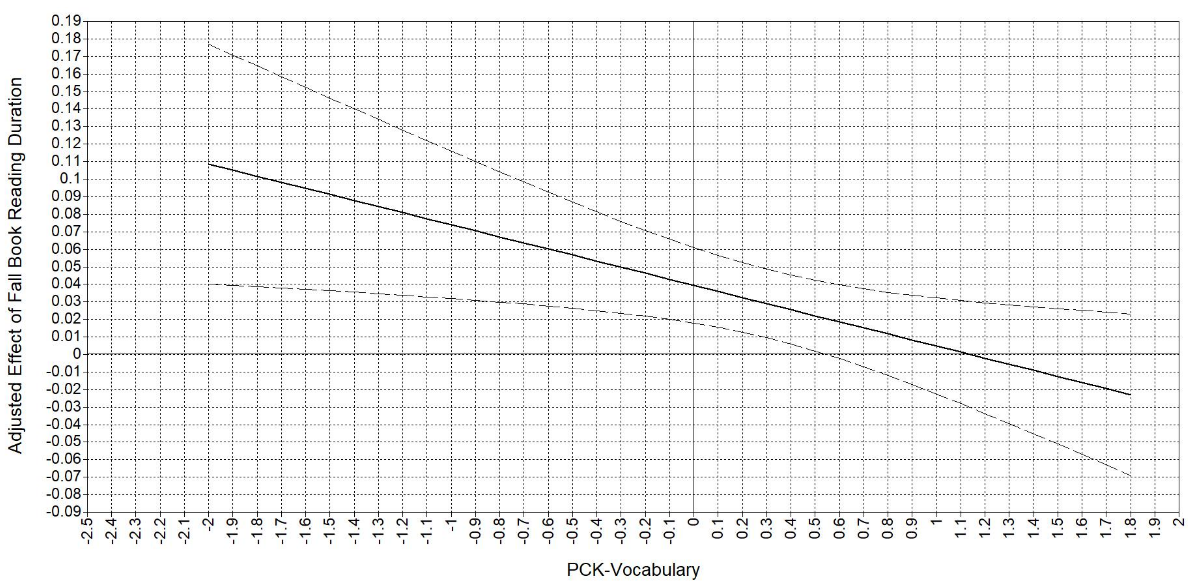
Figure 1

Examples of Moderation Across Regions of Significance

A



B



Note. Panel A: Change in the effect of spring book reading on CFSS intercept across the range of PCK-Language. Panel B: Change in the effect of fall book reading on CFWS slope across the range of PCK-Vocabulary.