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# Early Childhood Learning and Children's Literacy Skills in Kindergarten and Third Grade



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THE OHIO STATE UNIVERSITY

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RESEARCH AND POLICY

*Improving children's well-being through  
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*Children’s code-focused skills, such as letter knowledge and phonological awareness, and language skills during early childhood are key to their later reading success. As such, most states, including Ohio, include both components in their early learning standards. However, little research has examined how these skills predict performance on school-based assessments. Furthermore, how learning gains in these skills during children’s time in early educational settings predicts later success on these assessments is unknown, but key to understanding the role of early childhood education.*

In this white paper, we examine how children’s skills in the fall of their early childhood education (ECE) year and gains in these skills across the year predict their performance on kindergarten and Grade 3 measures of literacy and reading achievement. Relying on data from over 700 children across the state of Ohio, we find that while children’s initial levels of code-focused and language skills predicted their kindergarten literacy skills, only gains in their code-focused skills predicted this outcome. We also find that while initial levels of code-focused and language skills predicted Grade 3 reading achievement, gains in these skills were not predictive. Taken together, these findings suggest that children’s skills and skill development during early childhood education shape their later reading performance but that their influence is stronger in kindergarten than in Grade 3.

# Background & Aim

Both word recognition and language skills are major components of reading achievement (Gough & Tunmer, 1986; Language and Reading Research Consortium, 2015a), and skills related to both of these components are reflected in Ohio’s K-12 English Language Arts learning standards and Plan to Raise Literacy Achievement (Ohio Department of Education, 2017, 2020). However, development of such skills begins well before formal school entry. During early childhood, children develop important code-focused skills foundational for later word reading, such as letter knowledge and phonological awareness, as well as language skills foundational for reading comprehension (see Figure 1; Hjetland et al., 2020; National Early Literacy Panel, 2008).

**Figure 1. Code-focused and Language Skills Developed During ECE**

Letter Knowledge	Phonological Awareness	Language Skills
The ability to identify letters by name and/or sound (Georgiou et al., 2012; Piasta, 2014)	The ability to hear and manipulate sounds in words (Herrera et al., 2021; Phillips et al., 2008)	Vocabulary, syntax, and discourse-level skills that allow children to express and understand spoken language (Language and Reading Research Consortium, 2015b)

In line with K-12 standards, both code-focused and language skills are emphasized in Ohio’s policies related to early childhood education. Both are included in the state Early Learning and Development Standards (Ohio Department of Education, 2012) and assessed as part of its Early Learning Assessment and Kindergarten Readiness Assessment (Ohio Department of Education, 2016; WestEd, n.d.). Strengthening supports for these skills during early childhood is one of the state’s strategies for improving reading achievement and meeting the Third Grade Reading Guarantee (Ohio Department of Education, 2020). Recently, however, there has been debate among researchers, policymakers, and practitioners as to the relative benefits of emphasizing code-focused versus language skills in early childhood education. Some have argued that early boosts in code-focused skills, like letter knowledge, fade out whereas boosts to more complex skills, like language, are more likely to have lasting benefits (Bailey et al., 2017, 2020).

To better understand this issue within the context of Ohio, we examined how letter knowledge, phonological awareness, and language learning demonstrated by children enrolled in Ohio early childhood education programs predicted their later performance on the state Kindergarten Readiness Assessment-Literacy (KRA-L) and the Grade 3 Ohio Achievement Assessment (OAA) Reading subtest<sup>1</sup> (Logan et al., 2022). Although prior studies have shown associations between code-focused and language skills with later reading (Hjetland et al., 2020; National Early Literacy Panel, 2008), this work has typically measured children’s skills at one point during early childhood. In contrast, we also examined the *learning gains* made by children across a year of early childhood education. That is, how much do children learn across the school year, regardless of where they started? This helps us understand how early learning relates to later achievement. Our use of authentic, school-based kindergarten readiness and Grade 3 reading achievement tests are also important, as children’s performance on these tests have real-world implications for children and their families, early childhood professionals, and policymakers (Ansari & Purcell, 2018).

<sup>1</sup> The KRA-L and OAA Reading subtest were the precursors to the current state Kindergarten Readiness Assessment (KRA) and Ohio’s State Test (OST) in English Language Arts and the assessments completed by the children for whom we had early childhood data. Both the KRA-L and currently used KRA (language and literacy domain) measure skills in rhyming, alliteration, letter identification, speaking, and listening. The KRA also includes writing skills which was not a part of the KRA-L. Additionally, a comparability study showed that the two assessments are comparable (Ohio Department of Education, 2016). Both the OAA Reading Achievement Test and OST English Language Arts subtest assess children’s ability to read and comprehend texts.

By looking at initial skills and learning gains, we were able to examine both how children’s starting point at the beginning of the ECE year and changes in skills across the year are independently associated with their later performance on the KRA-L and Grade 3 OAA Reading subtest. We looked at both because some children may start with higher skills but make small gains across the ECE year. Conversely, some children may start with lower skills but make large gains during the ECE year. By examining them separately, we were able to capture how learning gains across one year of ECE shape later reading achievement. By looking at gains, we are better able to understand how the learning children achieve during their time in ECE, in addition to the skills that they bring to their ECE experiences, is associated with their later literacy skills.

## In this work, we asked:

*Do initial levels of and learning gains in code-focused and language skills during early childhood education matter for performance on later school-based assessments?*

# Data & Method

We capitalized on data collected for a [prior, statewide project](#) (Piasta et al., 2020; Piasta, Justice, et al., 2017; see Piasta, Mauck, et al., 2017 for a brief summary). The preregistered study protocol for the current study is available at <https://osf.io/f79ms>, and further details of the study are available at <https://edarxiv.org/sz7tn> (Logan et al., 2022).

The current study involved 725 children who were enrolled in ECE programs within Ohio, matriculated into Ohio public elementary schools, and for whom the Ohio Department of Education could provide KRA-L data<sup>2</sup>. All children had parental consent for study participation and were at least 4 years old when first assessed. Children’s parents reported that children were able to speak and understand English and did not have profound disabilities; these requirements were in place to ensure that assessments were appropriate for participating children. Descriptive information for these children is provided in Table 1.

<sup>2</sup> Descriptive information is provided on the full analytic sample of 725 children, for whom KRA-L data were available. The sample size decreased to 606 children when considering the Grade 3 English Language Arts subtest of the OAA as the outcome.

**Table 1. Descriptive information for children included in the study (as reported by parents during ECE).**

DESCRIPTIVE INFORMATION	% OR MEAN
Gender is boy	51%
<i>Race</i>	
White	76%
Black	12%
Multiracial	6%
Other	3%
<i>Ethnicity</i>	
Hispanic/Latinx	5%
Child has Individualized Education Plan (IEP)	17%
<i>Parent Education</i>	
Less than High School Degree	6%
High School Degree	16%
Technical Training beyond High School	10%
Some College (No Degree)	26%
Associate’s Degree	14%
Bachelor’s Degree	14%
Graduate Degree	13%
Family Income-to-Needs Ratio (range from 0.06 to 6.45)	1.9

Children were enrolled in 253 different ECE classrooms across urban (25%), suburban (31%), and rural (33%) areas of Ohio (note that percentages may not sum to 100% because some information was not reported for all classrooms). Most classrooms were located in public schools (46%) or early childhood centers (49%), and 34% were affiliated with Head Start. Teachers in these classrooms were primarily female (96%), White (83%), and non-Hispanic/Latinx (99%). Teachers' highest education levels included a high school diploma (2%), associate's degree (20%), bachelor's degree (18%), or graduate degree (24%). Teachers had an average of 12 years of teaching experience.

Children completed a battery of assessments in the fall of their early childhood year and again in the spring, so we could measure their learning gains. These included assessments of letter knowledge, phonological awareness, and language skills (see Table 2). We also followed children longitudinally as they matriculated into their public elementary schools. As children completed kindergarten and Grade 3, we requested and received their KRA-L and OAA Reading data from the Ohio Department of Education. The KRA-L, given at the start of kindergarten, assesses children's emergent literacy, speaking, and listening skills. The Grade 3 OAA Reading subtest, also completed in the fall, assesses children's abilities to read and understand literary and informational texts.



**Table 2. Children's Scores on all Assessments**

	<i>M</i>	<i>SD</i>	Min	Max				
<b>Outcomes</b>								
Kindergarten Readiness	21.59	6.17	3	29				
Grade 3 Reading	681.83	48.02	551	830				
<b>FALL</b>								
<b>SPRING</b>								
	<i>M</i>	<i>SD</i>	Min	Max	<i>M</i>	<i>SD</i>	Min	Max
<b>Language: CELF:P2</b>								
Expressive Vocabulary	21.69	7.20	0	39	25.07	7.12	0	40
Sentence Structure	14.50	4.15	0	22	16.50	3.81	0	22
Word Structure	15.06	4.64	0	24	16.94	4.48	0	24
<b>Phonological Awareness: PIPA</b>								
Alliteration Awareness	3.27	2.47	0	12	4.30	3.11	0	12
Rhyme Awareness	4.44	3.13	0	12	5.53	3.42	0	12
<b>Letter Knowledge: PALS</b>								
Upper & Lowercase Letter Recognition	26.82	18.12	0	52	35.67	16.27	0	52

Note. Raw scores are presented in the table; these were converted to z-scores for analysis. CELF:P2 = Clinical Evaluation of Language Fundamentals Preschool-2 (Wiig et al., 2004); PIPA = Pre-Reading Inventory of Phonological Awareness (Dodd et al., 2003); PALS = Phonological Awareness Literacy Screening for Preschool (Invernizzi et al., 2004).

<sup>3</sup> The final structural equation models, from which we derived the key findings below, exhibited good model fit (RMSEA = .054, CFI = .970, SRMR = .047 for KRA-L; RMSEA = .052, CFI = .970, SRMR = .048 for Grade 3 OAA Reading subtest).

Details of our analyses are provided in the [preregistration](#) and [full study report](#) (Logan et al., 2022). In brief, we analyzed the data using structural equation models. We first estimated a latent change model (McArdle & Hamagami, 2001; McArdle & Nesselroade, 2014), which allowed us to examine children's initial levels of letter knowledge, phonological awareness, and language skills (i.e., in fall) as well as their learning gains from fall to spring. We then expanded this model to predict children's KRA-L and Grade 3 OAA Reading outcomes. All models accounted for the non-independence of children nested in early childhood classrooms<sup>3</sup>. We also conducted robustness checks and found the same key findings as reported below after controlling for children's race, gender, age, family income-to-needs ratio, and disability status; classroom child:teacher ratio; and randomly assigned condition from the original statewide project<sup>4</sup>.

<sup>4</sup> In the original statewide project, classrooms were randomly assigned to one of three conditions: language and literacy professional development workshop series, language and literacy professional development workshop series plus coaching, or alternative professional development. The original project showed minimal effects on classroom practices (limited to effects on phonological awareness and emergent writing instruction) and no effects on children's language or literacy learning (Piasta et al., 2020; Piasta, Justice et al., 2017).

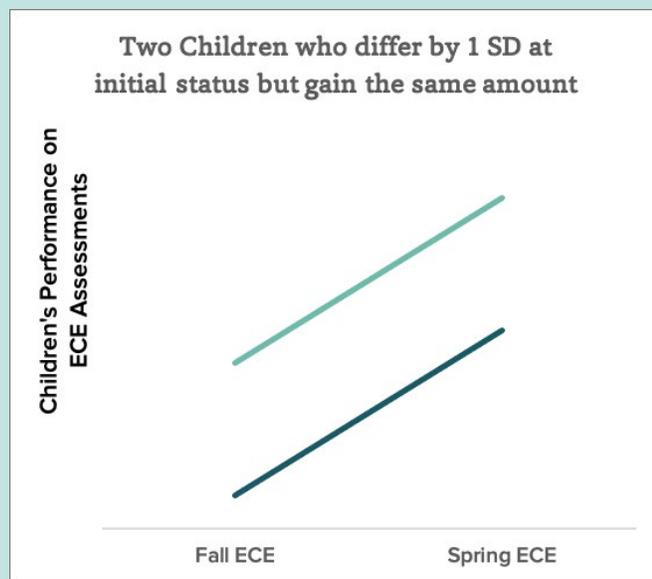
# Key Findings

## *Predicting Children's Performance on the Kindergarten Readiness Assessment-Literacy (KRA-L)*

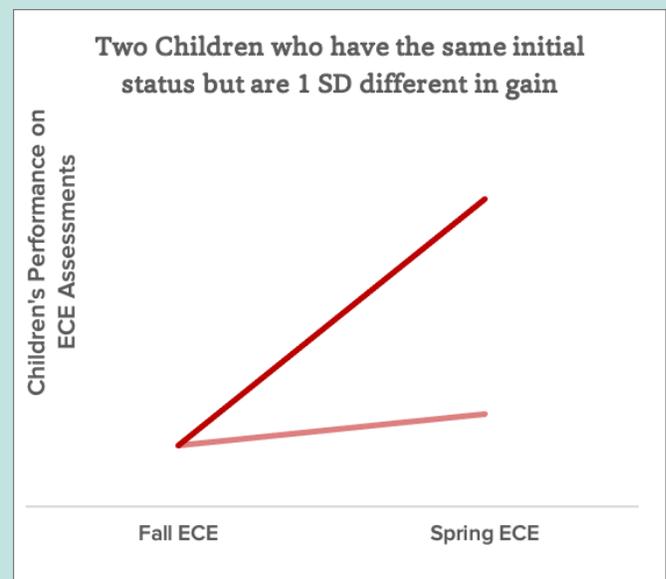
Our findings support the hypotheses that code-focused and language skills during early childhood are associated with children's reading skills in elementary school, as captured by school-based tools in kindergarten and Grade 3. In combination, initial skills and learning gains in letter knowledge, phonological awareness, and language accounted for 68% of the variance in children's KRA-L scores. This supports the models of reading development that emphasize the importance of both early code-focused and language skills. Specifically, we found that children's fall letter knowledge, phonological awareness, and language skills all significantly predicted the KRA-L when included together in one predictive model.

To aid in interpretation of our results, we provide the difference in scores on the KRA-L of children who were one standard deviation apart on the focal predictors. Figure 2 visually depicts scores for these children. The dark and light teal lines in the left panel represent two children who entered the ECE year with a one standard deviation difference in initial skills but made the same gains across the year. In the right panel, the dark and light red lines represent two children who had the same initial skill level at the start of ECE differed by one standard deviation in the gains they make across the year.

**Figure 2. Visual Depiction of Children with Differing Starting Skills in ECE**



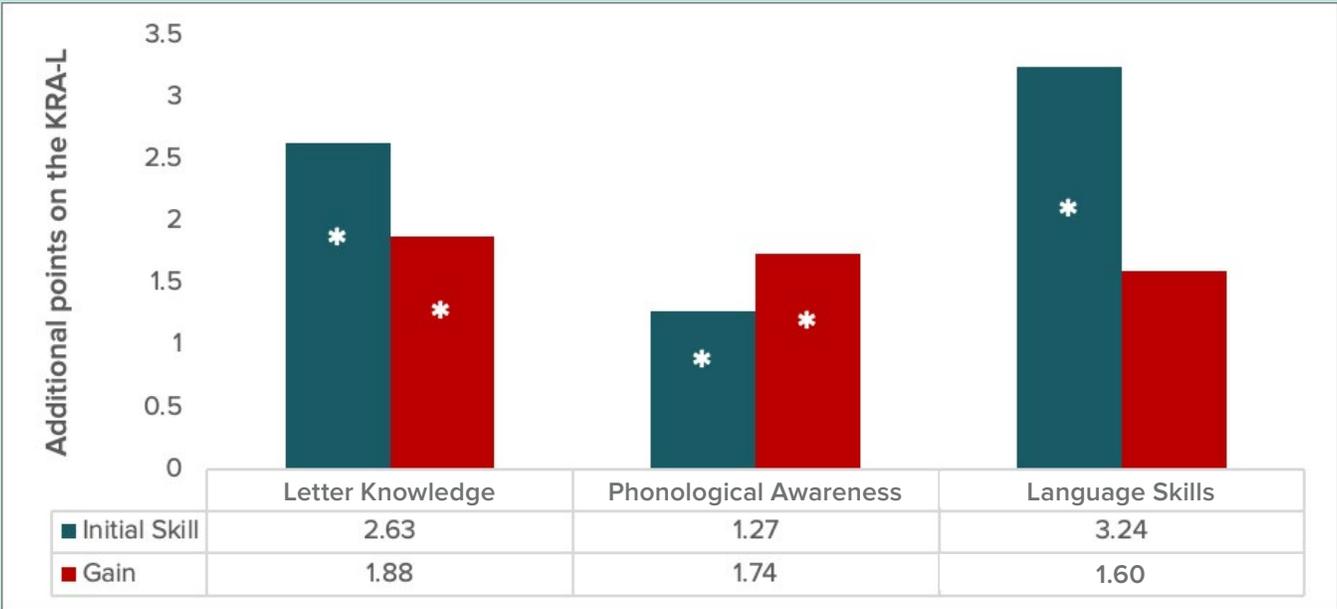
**Figure 3. Visual Depiction of Children with Differing Gains in Skills Across ECE**



In Figure 4, we show the difference in KRA-L points between these children. For two children who were one standard deviation apart in initial letter knowledge (teal lines in Figure 2), the child who scored higher would score 2.63 points higher on the KRA-L. For children who were one standard deviation apart in initial phonological awareness, the child who scored higher would score 1.27 points higher on the KRA-L. Using the same paradigm for fall language, the child with the initially higher language score would score 3.24 points higher on the KRA-L.

When we looked at gains as predictors of KRA-L performance (the red bars), we found that children’s *learning gains* in code-focused skills, but not gains in language, also significantly predicted KRA-L scores. This suggests that children’s gains in these emergent literacy skills, but not their gains in language skills, across the ECE year are predictive of kindergarten literacy performance. For letter knowledge and phonological awareness, KRA-L scores depended not only on children’s initial skills in the fall but also how much they learned during the early childhood year (e.g., an additional 1.88 and 1.74 points, respectively, for every standard deviation more of gain).

**Figure 4. KRA-L Performance as Predicted by Children’s ECE Initial Skills and Skill Gains**



### ***Predicting Children’s Performance on the Ohio Achievement Assessment (OAA) Reading Subtest***

Similar to the findings for the KRA-L, we found that initial code-focused and language skills and learning gains in these skills accounted for 42% of the variance in children’s Grade 3 OAA Reading scores<sup>5</sup>. As shown in the teal bars in Figure 4, we found that children’s initial fall letter knowledge (standardized points = 0.23) and language skills (standardized points=0.29) significantly predicted their OAA Reading scores. However, their initial fall phonological awareness skills did not. This again suggests that children’s emergent literacy and language skills at the start of the early childhood year are predictive of long-term reading achievement.

As depicted in the red bars in Figure 5, we did not find that *learning gains* in these skills significantly predicted OAA Reading scores. This suggests that children’s initial skills, as opposed to changes in those skills, were most associated with long-term achievement.

<sup>5</sup> For this model, we used z-scores of children’s OAA scores instead of raw scores.

**Figure 5. Grade 3 OAA Performance as Predicted by Children’s ECE Initial Skills and Skill Gains**



# Implications

Our findings confirm the key role of early code-focused and language skills in predicting children’s performance on both the KRA-L and Grade 3 OAA Reading subtest. We found that children’s initial skills at the start of the ECE year and the learning gains that they made across the year accounted for over two-thirds of the variance in their performance on the KRA-L and almost half of the variance in their performance on the OAA Reading subtest.

Children’s initial levels of all three skills (letter knowledge, phonological awareness, and language) at the start of the ECE year were predictive of their performance on the KRA-L and two of the three skills (letter knowledge and language) were still predictive of performance on the Grade 3 OAA Reading subtest. This highlights the long-lasting importance of children’s skills as they enter ECE. It also underscores the need for investment in children’s birth to 3 experiences as these shape the initial skill levels children demonstrate at the start of ECE (Love et al., 2005).

Our findings also show that children who make greater gains in code-focused skills (letter knowledge and phonological awareness) during ECE score higher on the KRA-L. This suggests that children’s learning of code-focused skills during ECE continued to be demonstrated on the KRA-L, which was administered in the first few months of kindergarten. Gains in language skills were not predictive but, as noted above, initial language skills were. This may be because there was little growth in language skills across the year: The average amount of children’s language gains in this sample was 0.46 standard deviations. This is less than the typical growth in language for children at this age (Schmitt et al., 2017).

Lastly, and perhaps not surprisingly, children’s ECE skill levels and gains were both more strongly associated with performance on the KRA-L than the Grade 3 OAA Reading subtest. This is consistent with literature that focuses on “fadeout” of preschool effects over time (Bailey et al., 2017). In other words, our findings show that the learning gains children make in ECE are predictive of performance in the short-term (kindergarten) but fadeout over time (Grade 3). This suggests that disconnects between the ECE and elementary school environments may prevent children from successfully building on the gains they made in ECE. Recent research has suggested that focusing on the alignment of children’s experiences in ECE classrooms and early

elementary classrooms may reduce this “fadeout.” For example, increasing the use of small groups and centers in early elementary school may provide more continuity for young learners (McCormick et al., 2020). Additionally, paying attention to the repetitiveness of ECE and kindergarten, and making sure that instruction aligns with children’s skill levels may also maximize children’s learning across the transition from ECE to early elementary school. For example, data from other states has shown as much as 37% of language and literacy content in pre-kindergarten and kindergarten is redundant (Cohen-Vogel et al., 2021).

In conclusion, these results document the enduring associations between children’s code-focused and language skills in early childhood and later performance on school-based assessments of literacy and reading comprehension. However, more attention to children’s opportunities to develop these skills prior to, during, and after ECE is needed to ensure that children are ready and able to experience reading success in elementary school and beyond.



# Recommendations

## *Practitioners/Teachers*

- Provide multiple and wide-ranging literacy and language learning opportunities in early education settings that target both code-focused and language skills.
- Consider additional ways to support language learning in the classroom to promote greater gains, by creating opportunities for children to engage in extended conversations and teaching vocabulary throughout the day.
- Engage in meaningful communication across the transition from ECE to elementary school to ensure that children are receiving instruction that extends, rather than duplicates, their learning opportunities.

## *Policymakers*

- Align early education and early elementary school practices and curricula to ensure learning opportunities match children's skills. Provide professional development programming to be delivered to ECE and early elementary teachers.
- Enact policies that encourage communication across the transition to school so that children are not receiving duplicate instruction.
- Invest in birth to 3 ECE programming as the foundations for later skills are laid there.

## *Researchers*

- Consider including authentic, school-based assessments when examining children's learning and development in school settings to increase the policy relevance of findings.
- Explore practices in ECE classrooms where children experience strong language learning to better understand how to support this skill.
- Pursue more research regarding birth to 3 language and pre-literacy learning in ECE contexts with a focus on how ECE teachers can set the foundation for later literacy and language development.

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