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Defining and Evaluating Quality in Early Childhood Education

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Defining and Evaluating Quality in Early Childhood Education

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In Partnership with The Prichard Committee for Academic Excellence

Capstone Project

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Executive Summary

Quality early childhood education is essential to ensure that children grow into well-adjusted, healthy, and happy adults. Early childhood is considered a child's first five years before kindergarten, and nearly 90% of brain development occurs in these five short years (Brain Development, n.d.). According to the Kentucky Governor's Office of Early Childhood, preschool attendance decreases the likelihood that the child will drop out of high school, be held back a grade, or be placed in special education (Importance of Early, n.d.). Not only does early childhood education benefit the child, but it can also positively influence society. Early childhood education decreases overall government spending on education, public assistance, and the criminal justice system (Importance of Early, n.d.).

Working in partnership with The Prichard Committee for Academic Excellence, our team from the Martin School of Public Policy and Administration worked to help identify what classroom requirements and mandates create a quality early childhood education program. We identified classroom requirements using the National Institute for Early Education Research's annual yearbook, collected state-level spending, poverty, and population data, and collected district-level kindergarten readiness data to determine how effective each state's practices are in preparing students for kindergarten. Our analysis showed that economic conditions, teacher training, and teacher-to-student ratio all influence kindergarten readiness scores with statistical significance. We recommend that Kentucky broaden access requirements to ensure more children can access pre-k programs regardless of income, supplement early childhood education spending with grants to support classroom costs and improve programs and mandate a certification or licensure program for lead teachers to increase the number of highly qualified educators across the state.

Introduction

A child's first five years act as a foundation for the rest of their lives, and early childhood education is a critical part of helping children adjust to the world around them and establish healthy habits, emotional practices, and educational building blocks to help them mature. The Kentucky Governor's Office for Early Childhood Education believes that every child matters, stating that "Every child in the Commonwealth – whether from "a farm or the inner city –deserves a quality education that builds the foundation for a fulfilling life" (Importance of Early, n.d.)." The model of today's early childhood education and care (ECEC) programs in America today can be traced back to two developments that took place in the 1830s: day nurseries that provided childcare without an education component, and nursery schools, which provided both care and education (Kamerman & Gatenio, 2003). These two program types are present today, with some early childhood programs providing only supervisory care for children, known as "daycare," and others providing care with an educational component, known as "prekindergarten" or "preschool."

Interest in day nurseries and nursery schools peaked in the 1920s and 1960s, partially fueled by the increase in women in the workforce and the War on Poverty's focus on disadvantaged children, which revived demands for quality childcare services (Kamerman & Gatenio, 2003). Since the 1970s, there have been failed attempts at national childcare policies, leading to fragmentation in federal and state funding streams that support ECEC programs (Kamerman & Gatenio, 2003). Recent surveys suggest that 58% of Kentuckians perceive the state does too little to ensure affordable, quality access to childcare (Goode, 2023). This perception would align with the finding that 54% of Kentuckians struggle to find childcare (Goode, 2023). Meanwhile, Governor Beshear has made universal preschool part of his 2023 Education First plan (KY.gov,

2022). Thus, there is favorable support from the electorate to explore early childhood education and care programs in Kentucky.

Expanding high-quality early learning in Kentucky should be a priority in Kentucky's policy landscape. The Prichard Committee for Academic Excellence, a Lexington, Kentucky-based educational research and advocacy group, is working tirelessly to determine areas for improvement. While Prichard dedicates some of its efforts to expanding access to early childhood programs, it also wants to ensure Kentucky's early learners receive high-quality pre-k education. The Prichard Committee has requested our research from the Martin School to investigate the benchmarks and requirements for high-quality early childhood education programs. It is a critical time for this exploration as Governor Beshear considers the next steps for early childhood education policy in Kentucky.

Problem Statement

Early childhood programs, like pre-k, support the success of future generations. The accessibility and quality of pre-k programs impact the program's impact on children. Accessible, high-quality programs positively impact child and early adulthood development (Garcia et.al., 2016). Program accessibility is a more easily measured and understood factor than quality. As such, what is a quality pre-k program? How is the quality of Pre-k programs measured? What does an accessible, high-quality Pre-k program look like in Kentucky?

The National Institute for Early Education Research (NIEER) evaluates public preschool programs in the U.S. on measures relating to program structure, faculty and staff, and resources. (About Us: Our Mission, n.d.; About Us, n.d). Our research will use evaluation standards from NIEER to determine what program factors are related to program quality. This study uses a proxy measure to evaluate the quality of Pre-k programs – the percentage of children in each district that

passed a kindergarten readiness assessment (often referred to as KRA). This proxy quality measure will identify how some independent program factors, outlined by NIEER, influence Kindergarten readiness levels.

In essence, this research intends to answer the question: Which program-level benchmarks outlined by the National Institute for Early Education Research engender positive Pre-k outcomes, as measured by kindergarten readiness assessments, over others? Our research will hopefully identify attributes that constitute a "high quality" Pre-k program and how those attributes apply to future policy discussions. Moreover, these research findings will guide our workgroup's policy guidance and recommendations for the Prichard Committee.

Literature Review

Key Attributes and Pedagogical Approaches

Early childhood education and childcare (ECEC) programs fall into two categories: care vs. education. Within these two categories, there are three program types: 1) Preschools [Pre-k], 2) Childcare Centers, and 3) Family Childcare Homes (Kamerman & Gatenio-Gabel, 2007). All three program types strive to impact a child's development positively. Childcare programs, including childcare centers and family childcare homes, provide children with a developmentally appropriate and safe environment while guardians work (Essa & Burnham, 2001). Early childhood education programs are public or private groups that provide age-appropriate education. One of the primary purposes of these programs is to support child development with impactful early educational interventions. While ECEC programs share similar goals, their interventions differ.

Definition of Childcare and Early Childhood Education Programs

The contrast between childcare and education program interventions results in different pedagogical approaches. Pedagogy is a goal-oriented, systematic tool connecting the outcomes of a defined curriculum, guiding documents, and a child's learning (Kangas et al., 2021). Pedagogy relates to program quality because it guides a teacher's decision-making, such as content delivery, instructional environment, and classroom activities. Pedagogy is also sensitive to age. Childcare programs engage a much younger group of children (1-3 years of age), which differs from early education programs like pre-k. The divergence in program focus and age distinctions for pre-k and childcare programs necessitates different priorities for pedagogical approaches, as childcare programs prioritize care and pre-k prioritizes education.

Some argue that the pedagogical approaches for pre-k programs comprise four focus areas: collaboration, metacognitive tasks, scaffolds, and didactic instructions (Nores et al., 2022). The focus areas are similar in their engagement with thought expression, active questioning, using metacognitive skills to develop higher-order thinking, and collaboration with peers (Nores et al., 2022; Fulgigni et al., 2012). The pedagogical practices and activities fit into five categorical approaches: 1) Pedagogy through Interaction, 2) Pedagogy through Scaffolding, 3) Pedagogy through Didactics, 4) Pedagogy through Expertise, 5) Pedagogy through Future Orientation (Kangas et al., 2021). The focus area, practices, and pedagogy category collectively define the program's interaction with the child.

As mentioned above, both public and private programs exist within Pre-k programs. Due to data limitations, our study will look at publicly funded preschools to determine the relationship between quality indicators and Pre-k readiness. Due to reporting standards for Pre-k programs receiving state funding, we can collect the necessary data to evaluate which quality indicators are

significantly related to Pre-k readiness. This approach will allow for an understanding of what benchmark quality indicators (Figure A), measured by NIEER, are most important for policymakers when developing UPK programs for state-funded or mixed delivery systems. A description for each standard is located in Appendix C.

Figure A: NIEER Benchmarks
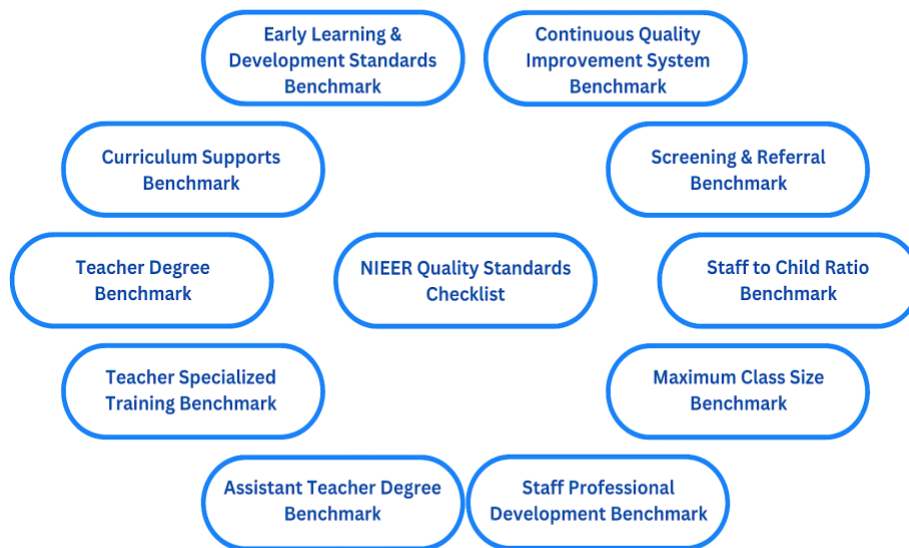
Kentucky's Current Landscape for Childcare and Early Childhood Education Programs

Kentucky's early childhood standards were first developed in 2003 by a workgroup dedicated to early childhood and are now revised annually by the Kentucky Governor's Office of Early Childhood. Early childhood advocacy groups, nonprofits, e.g., Prichard Committee, and government organizations view early childhood education standards as a necessary determinant of quality. The interest among Kentuckians and the Governor's agenda creates the opportunity for restructuring standards for early childhood programs to enhance quality. The Kentucky Governor's Office of Early Childhood states, "Kentucky envisions learning as a continuum, beginning at birth

and continuing throughout life. This [commitment] is reflected in the strong alliances among early childhood educators, public school administrators, higher education institutions, parent associations, and the business community (Early Childhood Standards. (n.d.).”

According to a 2023 report on kindergarten readiness from the Kentucky Center for Statistics, only 43.8% of children who attend preschool are kindergarten-ready, with 49.8% of early education programs being deemed “high quality” by KYSTATS (Kentucky Center for Statistics, 2023). These figures are more concerning when understanding that only 45% of 3rd graders can read proficiently (Kentucky Center for Statistics, 2023). Kentucky’s current All-STARS rating is 2.7. According to the Kentucky Center for Statistics, the KY All STARS program is “the quality rating system used for childcare, public preschool, and Head Start. Ratings score on a scale of 1-5. Kentucky participates in the required STARS program for any licensed childcare program, state-funded preschool, Head Start, or Early Head Start receiving state and federal assistance (Kentucky Center for Statistics, 2023).” Policymakers with a better understanding of pre-k program quality could address these stark figures with more robust pre-k program standards. Early education reform for PRE-K could enable policymakers to understand better and help address these stark figures.

The Existing U.S. Preschool Landscape

There are various methods for providing early childhood education: mixed delivery methods, fully publicly funded, privately funded, community programs, and more. There are debates among stakeholders and policymakers on the long-term impacts of pre-k’s correlation with the program quality and type. As of 2023, only six states do not fund public preschool programs (Friedman-Krauss et al., 2023, p. 12). Most states that have preschool programs operate in a ‘mixed delivery’ system, in which funds from the public and private sector disperse across licensed private

childcare programs, Head Start or Early Head Start, public schools, and community organizations "to ensure access to high-quality, affordable options for children through age five and their families (ECEC, n.d.)." (Garver et al., 2023, p. 25). Several national organizations produce regular reporting on early childhood education standards and quality assessments.

In 2023, the Learning Policy Institute produced a report containing brief case summaries of five states using a mixed-delivery system: Alabama, Michigan, New Jersey, New York, and West Virginia (Garver et al., 2023). Alabama's First Class Pre-k program, in particular, is a mixed delivery program that has produced promising long-term results for children enrolled. While other studies have suggested that improvements in Pre-k attendance compared to non-attending peers tend to fade over time (Bassock et al., 2018), a study in Alabama suggests that benefits from this state's program may persist as far as 7th grade (Preskitt et al., 2020).

West Virginia may be a valuable case for our study, as the state shares many commonalities with Kentucky. Its UPK program relies heavily on collaboration with entities outside the public school system and meets 9 of 10 The National Institute for Early Education Research (NIEER) quality standards. (Garver et al., 2003). NIEER produces an annual yearbook of state programs and ranks each state according to ten benchmarks the organization finds to produce a successful, high-quality program (Friedman-Krauss et al., 2023). A 2005 study found that West Virginia's preschool programs produced strong evidence of a positive impact on children's language, literacy, and math skills development (Lamy et al., 2005). A later longitudinal study of impacts in WV preschool revealed performance advantages in children attending pre-k, with low-income children benefiting the most (Nores & Contreras, 2021).

Also of note is the UPK program in Georgia, a long-running, well-studied mixed-delivery system. One study found that Georgia's UPK program led to lasting benefits in the academic

achievement of children in the state, most notably in the scores of disadvantaged children living in areas of low population density (Fitzpatrick, 2008). Further, a recently released longitudinal study found that improvements in language, literacy, and executive function in children who participated in Georgia's UPK program continued at least as far as 3rd and 4th grade (Soliday Hong et al., 2023). The literature has discussed the Georgia program implementation, with case studies discussing the challenges of implementing such a system (Center for Public Impact, 2018; Henry et al., 2004; Raden, 1999). These will be states to continue to watch as Kentucky develops its own UPK quality standards.

As previously mentioned, inconsistencies within Pre-k program systems lead to varied outcomes. Challenges within the Pre-k space include teacher shortages due to burnout, low pay, resource deficits, limited professional development opportunities for teachers, lack of attendance or equitable student attendance opportunities, and struggles to meet kindergarten readiness benchmarks (Sparks et al., 2023). Florida, Wisconsin, and Tennessee are among the states that have faced such challenges when implementing prekindergarten programs, and these examples are important to remember when looking to improve Kentucky's early childhood education programs.

Florida is one of few states to constitutionally mandate a preschool program for all 4-year-olds in the state, and their program serves children in a mixed variety of educational settings; however, their program meets only two of NIEER's quality benchmarks (Friedman-Krauss, 2023) and as of 2022, only 49.2% of children in the state met state benchmarks for kindergarten readiness (FL Health Charts, 2022). Wisconsin also has a long-running, mixed-delivery preschool program. Similarly, it struggles with gaps in kindergarten readiness, particularly in children from lower socioeconomic backgrounds and underserved minority groups, raising serious equity challenges for the state (Grodsky et al., 2017).

Perhaps even more worryingly, Tennessee's Volunteer Pre-k program results showed an initial positive effect on children who attended versus those who did not attend, but that effect faded by the end of kindergarten (Mongeau, 2015). A subsequent study found that the effects of kindergarten attendance in Tennessee became adverse as children aged, producing the most substantial negative effects by sixth grade (Durkin et al., 2022). A 2014 study evaluating a statewide representative sample of Pre-k classrooms using widely accepted quality evaluation tools found that 85% of the classrooms observed in the study scored less than "Good" quality, and 11 classrooms scored below "Minimum" quality on their scale (Farran et al., 2014). One of the study's principal investigators later commented that "Tennessee doesn't have a coherent vision" and that "Left to their own devices, each teacher is inventing pre-k on [their] own" (Kirp, 2015). Though Tennessee meets 9 of 10 NIEER quality benchmarks (Friedman-Krauss, 2023), NIEER's director, Steven Barnett, has emphasized that there is a difference between writing these guidelines down and putting them into practice (Mongeau, 2015), highlighting the necessity of further study to determine how to match quality benchmarking guidelines with programming that will produce long-term positive educational outcomes.

In our study of these figures and how NIEER benchmarks correlate with kindergarten readiness, we recognize that simply meeting NIEER's benchmarks cannot be an absolute predictor of student success in the Pre-k classroom. External and independent factors at the state, district, school, and family levels can affect students' scores. Factors like socioeconomic class, race and ethnicity, family dynamics, food insecurity, and healthcare access can all influence a child's academic performance, consequently affecting their kindergarten readiness assessment scores.

Data & Research Design

Our model was estimated through an ordinary least squares multivariate regression, employing cluster variance estimation across states. This approach supports our expectation that there may be clusters in variance between states, with no variance within each state that may otherwise be unaccounted for in the variables present in our model. As described further below, our model consisted of various categorical and continuous variables. The model was estimated using the STATA statistical software. Appendix A and B contain the regression equation and a complete table of our results.

Data

Our analysis used publicly available administrative data on early childcare and education programs. The Kentucky Center for Statistics (KYSTATS) provided an early childhood report, and similar state data repositories provided Kindergarten readiness data at the school district level. Ultimately, data from 11 states on Kindergarten Readiness Assessment results was collected (only 46 states have a state-funded preschool program, 35 of which require a Kindergarten Readiness Assessment): Alaska, Connecticut, Florida, Kentucky, Louisiana, Maryland, Ohio, South Carolina, Texas, Vermont, and Virginia. The following states do not have state-funded public preschool programs: Idaho, New Hampshire, South Dakota, Utah, Wyoming, and Montana. A map of states, their kindergarten readiness assessment policies, and the states present in our study are shown in Figure B below.

Figure B: Kindergarten Readiness Assessments Nationwide
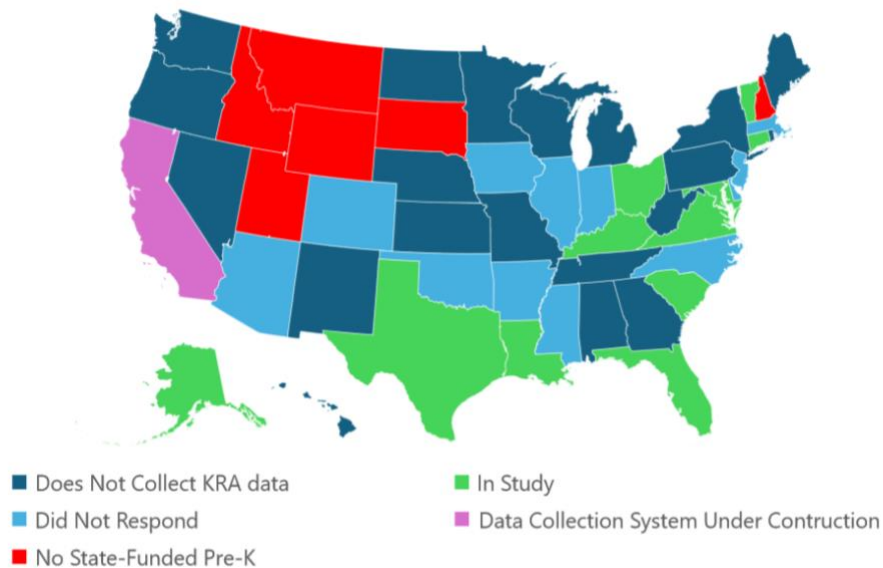
In order to get as broad a cross-section of data as possible across the national preschool landscape, we included data from all 11 states that responded to our data requests and provided usable data while culling specific outlying school districts in areas of poverty, population, and median income in order to make the overall dataset composed of a cross-section of school districts across our 11 states with demographics comparable to Kentucky.

Research Design

The states in our study provide a variety of levels of urbanicity, median incomes, pre-k program types, and policy specifications. Data on median income by school district is from the National Center for Education Statistics from American Community Survey data. Data on the total population and school-age children's poverty estimates came from the U.S. Census and their Small Area Income and Poverty Estimates (SAIPE) Program. Data on which quality markers and classroom characteristics each state ascribes in their state Pre-k policies were derived from the National Institute for Early Education Research's (NIEER) state of Preschool 2022 yearbook

(Friedman-Krauss et al.) and builds on NIEER's annual work of surveying state preschool policies and their implementation.

Data Analysis

This study uses a multiple linear regression, including robust standard error approximation by clustering individual states, to estimate our model. Merging data from the 11 states that provided data, any districts that did not have a Kindergarten Readiness Assessment score available or did not collect such data dropped from the data set (n=370). Dropped districts were often military bases; less often, these districts did not offer a public Pre-k program or may have failed to report their kindergarten readiness scores to their state data repository. Data on median income, total population, and percentage of school-age children in poverty merged from U.S. Census Data; any districts that did not have data on median income or percentage of children in poverty used the state average median income or percentage of children in poverty to estimate respective values.

Summary Statistics

Our dataset consisted of 2,348 districts that provided useable KRA score data, varying in average median income from $20,374 to a maximum of $250,000, compared to Kentucky's range of $24,349 to $109,815. To control for outliers in our median income variable and provide a better comparison to Kentucky, any districts whose median income for the district was greater than 120% of the median value for Kentucky were dropped (n=23). Similarly, the districts with a percentage of children in poverty above 50% dropped (n=4). To account for measurement or reporting errors in the percentage of children in each district who passed their kindergarten readiness assessment and to control for potential outliers, any districts with a pass rate of 0% (n=7) or 100% (n=3) dropped from the data set. The model's final sample included 2,311 U.S. school districts (n = 2,311) during the 2021-2022 academic year.

Independent Variables

Our regression analysis aims to identify how the NIEER benchmarks relate to a student's level of kindergarten readiness. The dependent unit of analysis for kindergarten readiness is the percentage of students who achieved kindergarten readiness at the district level. This dependent variable provides a proxy measure for the quality, assuming that high-quality programs should have a higher percentage of students achieving kindergarten readiness than low-quality programs. As a proxy measure for quality, we can regress the percentage of students achieving kindergarten readiness over the NIEER benchmarks and model controls to identify which benchmarks, or systematic presences, engender higher program quality or programs with higher percentages of students achieving kindergarten readiness.

The ten NIEER benchmarks listed in Figure A above are coded as dichotomous indicator variables—moreover, a district's urbanicity level is coded as a categorical variable. In addition, the state's requirement for classroom size and teacher-per-student ratio variables used the state's allowable maximum classroom size and teacher/student ratio, respectively, as data on actual average class size and actual average teacher/student ratio was not available at the district level. Control variables included district median income, percentage of children in each district in poverty, average state spending per child, and district population. NIEER's research suggests that the ten benchmarks are strong indicators of a high-quality program. These benchmarks and control variables provide a sufficient model for our study's research question. We know a district's median income, spending per child, child poverty rate, level of urbanicity, and total population are related to academic outcomes; however, they vary significantly across districts. These benchmarks, including the model's controls, allow for a proper estimation of what NIEER benchmarks engender

higher levels of Kindergarten readiness while controlling for the difference in a district's wealth, size, and funding for Pre-k.

Research Limitations

Definition of "Quality"

The main threat and limitation to our approach is the definition of "quality," but narrowing our outcome of interest to kindergarten readiness assessment scores helps standardize what a "successful" or "high-quality" program should produce. Others may argue that a student's performance on kindergarten readiness assessments may not be an effective predictor of future academic success, nor can our model capture all factors that impact a program's quality level, such as parental involvement, culture or regional differences, or a student's potential for growth over time. While those factors may relate to a program's overall quality, this study is limited to understanding what benchmarks relate to the desired program outcome: pre-k students meeting the kindergarten readiness assessment benchmark. Therefore, this proxy quality measure can allow for an objective understanding of what systemic preferences correlate with the desired program outcomes.

Fidelity of Implementation

Another limitation of our model is fidelity of implementation information, or the lack thereof. A state may require specific standards of teacher education or classroom size limitations, among other things; however, this does not necessarily mean that these required standards will be implemented with fidelity. Not all school districts or individual preschool programs may be able to comply with these standards to a high level of fidelity. However, data on how closely districts comply with these standards is minimal or unavailable. Any discrepancies at the school or district

level, for example, in whether or not all teachers hired at any single individual school possessed the degree required by their state's policy could not be captured in our current data, given this study's scope and time limitations. This limitation may pose a threat to the validity of our conclusions; however, as Kentucky is likely to face the same struggles with fidelity of implementation as other states, our results should still be generalizable to Kentucky as our goal is to increase understanding of what policy benchmarks at the state level, regardless of implementation differences between districts and states, are the most important for increasing levels of Kindergarten readiness among students. Moreover, our findings still support potential recommendations for consideration in future policy provisions.

Findings and Results

Results

The initial findings of the multivariate analysis across 11 states (n = 2,311) yield valuable insights into the correlation between our dependent variable, Kindergarten Readiness, and our independent variables. These insights highlight three principal themes: economic factors, teacher preparation, and classroom environment. After the estimation, the categorical variables of requiring curriculum support, the presence of a CQIS system, and the requirement for assistants to have TCDA certification were dropped due to multicollinearity, as all districts required early learning support, and all districts lacked any requirements for assistant teachers. While additional data might alter the outcomes of our model's estimation, our results still provide useful information that can help to support policy recommendations for the state. The results found to be statistically significant ($p<0.05$) are displayed in Table 1 below, with the full regression results table found in Appendix A.

Table 1: Regression Results

Variables	% of Children Passing KRA
Estimated % of Children in Poverty in District	**-0.6820117 *** (0.2828031)
Average Per-Child Spending	**-0.0000368 ***** (0.00000149)
State-Specified Minimum Hours per Week	**0.0051131 ***** (.00001921)
Bachelor's Degree Required for Teachers	**-0.2181799 ***** (0.0200803)
Coaching Required for Teachers	**-0.3194949 ***** (0.0093364)
Maximum Allowable Class Size	
22	**0.2400447 ***** (0.031755)
Maximum Staff-to-Child Ratio	
11	**-0.1802573 ***** (0.0219333)
12	**-0.3346056 ***** (0.0081952)
Urbanicity	
1	**-0.013373 **** (0.003921)
2	**-0.0247274 *** (0.0039321)

Robust standard errors shown in parenthesis.
$R^2 = 0.3629$ *** $p < 0.001$ ** $p<0.01$, * $p<0.05$

The variables demonstrating a statistically significant relationship represented above include the estimated percentage of children in the district in poverty, the average per-child spending, state specified minimum hours per week, requiring teachers to have a bachelor's degree and specialized training, requiring coaching for teachers, having a class size no larger than 22 students, the overall staff-to-children ratio, and the urbanicity of the district. While many of our

independent variables demonstrate a statistically significant impact on our dependent variable, in many cases, the overall effect size is small in real-world terms. Our model implies that the percentage of children in poverty has the most significant impact on kindergarten readiness of any of our variables. As illustrated above, a one-percent increase in the total percentage of children living in poverty in the district correlates with more than two-thirds of a percentage point (-0.68) *decrease* in the proportion of students meeting kindergarten readiness benchmarks. This result suggests that the most influential variable on a student's kindergarten readiness may be economic in nature.

Regression Results with Interaction Term

When examining requirements for teacher preparation in our initial model, there was a negative correlation between a state-level requirement for teachers possessing a bachelor's degree (-0.22). This finding contradicts other published literature and prompted further investigation into our model. In order to more fully test these results and how they might interact with poverty levels, a series of additional regression models testing the interaction between teacher education and training requirements and other factors on kindergarten readiness rates were performed. Requiring teachers to have <u>both</u> a bachelor's degree and specialized training was not found to have a statistically significant impact on kindergarten readiness rates, compared to requiring only one or the other. We also tested the interaction between the percentage of children in poverty and requiring teachers to have specialized training and the effect that interaction had on kindergarten readiness rates. However, the interaction is not statistically significant. However, an interesting result was found when testing the interaction between requiring teachers to have a bachelor's degree and the child poverty level in a district on kindergarten readiness rates.

Table 2: Regression Results Including Interaction Term

Variables	% of Children Passing KRA
Bachelor's Degree Required for Teachers	**-0.3574621 ***** (0.0300915)
Estimated % of Children in Poverty in District	**-1.028046 ***** (0.1632582)
(Bachelor's Degree) * (% of Children in Poverty)	**0.7110816 ***** **(0.1743256)**
Average Per-Child Spending	**-0.0000418 ***** (0.00000186)
State-Specified Minimum Hours per Week	**0.0045461 ***** (.00001921)
Specialized Pre-k Training Required for Teachers	**-0.0218491 ***** (0.00415)
Coaching Required for Teachers	**-0.2922738 ***** (0.0093364)
Maximum Allowable Class Size	
22	**0.2390166 ***** (0.0104117)
24	**0.019278 *** (0.0074718)
Maximum Staff-to-Child Ratio	
11	**-0.1815643 ***** (0.0085979)
12	**-0.3817543 ***** (0.0096186)
Health Screenings Required for Students	**0.1570889 ***** (0.00872575)
Urbanicity	
1	**-0.0141478 **** (0.004269)
2	**-0.0272408 ***** (0.0041198)

Robust standard errors shown in parenthesis.
$R^2 = 0.3817$ *** $p < 0.001$ ** $p<0.01$, * $p<0.05$

Holding all other factors equal, for every 1% increase in the percentage of children in
poverty in the district, the passage rate of children in states requiring teachers to have a bachelor's
degree is 0.7% higher than the passage rate of children in similar levels of poverty in states that do

not require teachers to have a bachelor's degree. Interestingly, the R-squared value in the model, including the interaction between poverty and teacher's bachelor's requirements, increased to 0.382 as compared to 0.363 in our original model, implying that an additional 2% of the variance in kindergarten readiness rates in our model may possibly be explained by the interaction between poverty and teacher's educational qualifications together on kindergarten readiness rates.

NIEER explains, "Institute of Medicine/National Research Council reports have also emphasized that preschool lead teachers should have specialized preparation that includes knowledge of learning, development, and pedagogy specific to preschool-age children (NIEER Yearbook, 2021, pp. 27)." Our findings suggest poverty plays such a strong role in a child's early development that the requirement for teachers to have bachelor's degrees is critically essential, specifically in districts and states with high poverty rates. There is a need to investigate this further, as Kentucky ranks in the top 10 poorest states in the nation, per the most recent Census data (DePietro, 2023).

The influence of a state's maximum classroom size varies depending on the conditions found. Students in classes where the maximum allowable class size was 22 students have a very slight (0.24%) increase in their passage rate compared to students in states with differing requirements, both those in states with smaller maximum class size requirements as well as those in states with larger maximum class size requirements. This result may reflect the limitations of our data set, as we could only collect data on the state's allowable maximum classroom size, as data available on the actual average classroom size in each district studied was not available.

Lastly, the ratio of staff to child is less ambiguous but still insightful, as children in states that mandate a teacher/student ratio of 1 teacher per 11 students have a 0.18% lower passage rate than those in states that mandate a ratio of 1 teacher per 10 students. Children in states that mandate

a teacher/student ratio of 1 teacher per 12 students have an even lower passage rate, 0.33% less, than those in states that mandate one teacher per 10 students.

The outcomes reveal that 38% of the variation between the variables can be explained by our final model, including interaction terms (R^2=0.3817). While this indicates a moderate level of explanatory power, it also underscores the presence of other factors not captured in the current analysis. As our analysis comprises disaggregated data, it limits the specificity we can attribute to programs at the district level. Our model is subject to limitations based on the constraints we encountered in data collection and the variability of program implementation across states for pre-k programs. These are discussed more fully in our Limitations section above.

Post-Regression Testing

Scatterplots of residuals versus predicted values tested the linear relationship assumption between our dependent variable (average percent of children in a district that passed the KRA) and our independent variables. Slight issues with non-linearity appear in the residuals versus plots for the independent variables measuring average per-child spending and minimum specified required hours per week. However, there were no other major findings regarding non-linearity for our other independent variables of interest; as such, this model still provides findings. These scatterplots are shown in Figures C and D below:

Figure C
Average Per-Child Spending

Figure D
Specified Maximum Hours/Week
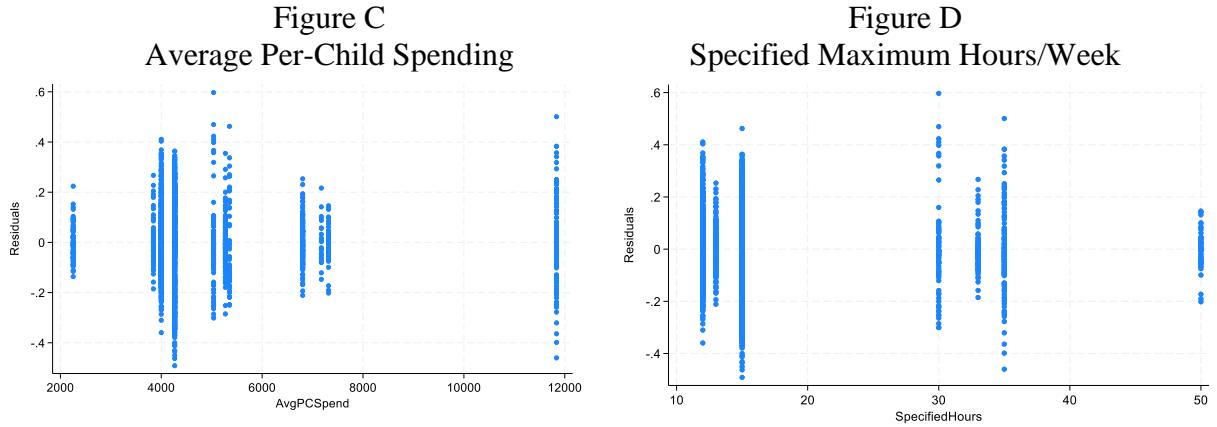
A skewness-kurtosis test for normality was run on the predicted residuals to test whether the residuals were normally distributed. The results (p=0.2441) showed that we cannot reject the null hypothesis that the residuals are normally distributed and that we do not need to be overly concerned about skewness in our results. This finding represents an improvement in the results compared to our initial regression model (without the interaction between bachelor's degree requirements and children in poverty), again suggesting that including this interaction improves the accuracy and fit of our final model.

Table 3: Joint Test					
Variable	*Obs*	*Pr(skewness)*	*Pr(kurtosis)*	*Adj chi2(2)*	*Prob>chi2*
r	2,311	0.8647	0.0944	2.82	0.2441

A test of residuals versus fitted value plot checked for heteroskedasticity. No obvious heteroskedasticity was shown (as we ran our model with robust standard errors), but the plot revealed that our data may still contain some outliers.

Figure E: Residual vs. Fitted Values
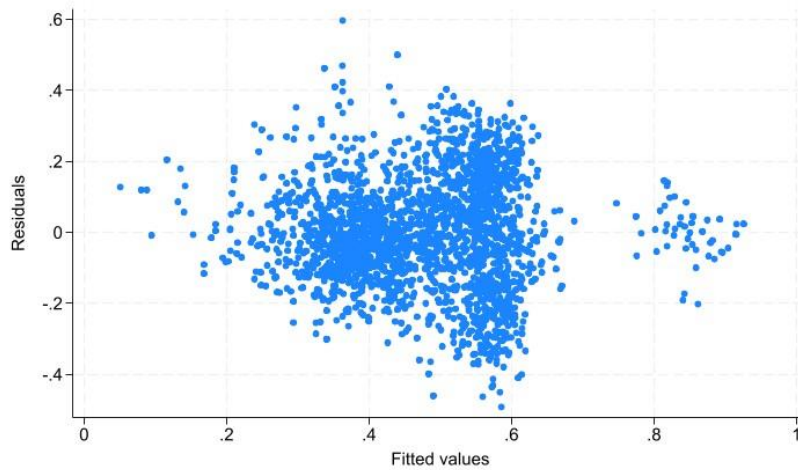
As evidenced through our regression model, three themes appear across the influential variables on kindergarten readiness: economic conditions, including poverty and spending per student; teacher training and its relationship to poverty; and classroom conditions, including class size and teacher ratio. This analysis suggests that Kentucky policymakers, educators, and advocates should consider these three factors when determining early childhood education programs and standards. The most impactful result from our dataset is a proportional increase in the number of children in poverty, resulting in a 0.66% reduction in the proportion of students meeting kindergarten readiness benchmarks, as well as the positive impact that teacher preparedness has on children in poverty versus children who are better off, has significant potential implications for the state of Kentucky. With 22.2% of children living in poverty, according to America's Health Rankings (n.d.), these findings have important policy implications for children across our state.

Conclusion and Recommendations

Through this research project, we sought to answer the question, which program-level benchmarks outlined by the National Institute for Early Education Research engender positive pre-

k outcomes, as measured by kindergarten readiness assessments, over others? Despite the inconsistencies in defining what is "high-quality" or a shared assessment method or unified reporting systems in state-funded Pre-k Programs, utilizing a multivariable regression research method, we were able to identify three major areas of importance that have an impact on Kindergarten Readiness:

- Economic conditions, including poverty levels and spending per child
- Teacher training and the relationship to poverty levels
- Classroom conditions, including teacher/child ratio and class size.

Based on these themes, we made the following considerations for Kentucky in creating and implementing a state-funded pre-k program.

- Increase state-funded pre-k access for more children in the state.
- Increase state early childhood budget with supplemental funding to increase the cost per child spending levels beyond current state levels.
- Develop and provide lead teacher specialized training and certification program.
- Policy mandating smaller teacher/child ratio size

The above recommendations offer the Prichard Committee a starting point for identifying what variables or benchmarks are common among high-achieving state-funded pre-k programs based on district KRA scores. This information can support Kentucky in building its state-funded pre-k program into a more robust service for young children.

Additional research opportunities exist, such as exploring the long-term impact of students attending a state-funded pre-k program on their academic achievement in middle and secondary schooling. Moreover, a study investigating the long-term behavioral outcomes for children from

low-income families who attend state-funded pre-k programs would expand the conversation around quality in the early childhood education policy. Future research may include other control variables of interest, such as parent education level, classroom curriculum, and assessment and screening tools. Finally, conducting a time-series analysis of NIEER quality standards and more on program fidelity with state standards could produce insightful findings for future program review and development of Kentucky's state funded pre-k programs.

Recommendations

These recommendations will focus on three themes found in our analysis - economic conditions, teacher training, and classroom size conditions - and look at five comparison states with the highest average scores, in descending order: Vermont, Texas, Virginia, Florida, and Connecticut. By comparing the states with the highest average scores, we aim to identify classroom practices, policies, and mandates that impact these states' high scores, inferring that these same practices can positively impact Kentucky's pre-k system. We will compare these themes on a state level and explore state policies and mandates related to each topic.

The graph below shows each of our 11 states' average percentage of students achieving Kindergarten Readiness, with Vermont being first with 86% meeting expectations and Arkansas being last with only 30% meeting this benchmark. According to note, two of our 11 comparison states, Vermont and Florida, have "mostly achieved" universal pre-k, according to NIEER, meaning universal pre-k policies have been approved and implemented. However, there may be specific populations that do not yet qualify. For example, Florida's universal pre-k program is available only to four-year-olds, while Vermont's universal pre-k program is available to three, four, and five-year-olds (Families of Prekindergarten Students, n.d.; What is Florida's, n.d). Our remaining nine states offer state pre-k without a specific commitment to universal pre-k (NIEER).

Figure F: Average Percentage of Students Meeting Kindergarten Readiness Expectations
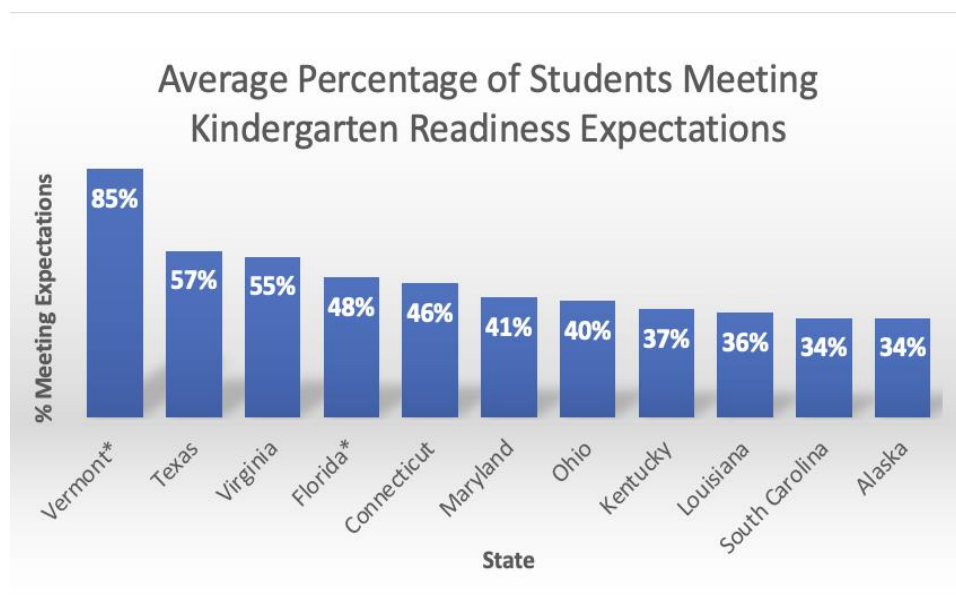
Expanding State-Funded Pre-k Access Requirements

Kentucky, with an average of 24.2% of children living in poverty (HDPulse, 2024), currently offers state-funded preschool education programs to all four-year-old children whose families are at or below 160% of the federal poverty level and to all three and four-year-olds with disabilities (Public Preschool, n.d.). Virginia, a state with an average of 17% of children living in poverty (HDPulse, 2024), offers additional access and considerations for children across the state. According to the Virginia Department of Education, children three and four years old in families at or below 200% of poverty are eligible for participation in their Virginia Preschool Initiative (VPI), which supports early childhood education programs for children "at risk of school failure (Virginia Preschool Initiative (VPI), n.d.)." In addition to income eligibility, children can also qualify if they meet any of the following requirements: special needs; parents or guardians who did not complete high school; experience homelessness; live in foster care; is under a Child Protective Service (CPS) order; lives with a teen parent or has an incarcerated parent; lives in a

family who receives Temporary Assistance for Needy Families (TANF) (Virginia Preschool Initiative (VPI), n.d.).

In Texas, where an average of 56% of students met kindergarten readiness expectations, the requirements for access to free Pre-k programs include unique groups of children from across the state (Prekindergarten Registration and Enrollment, n.d.). Children are eligible for free pre-k if they do not speak or comprehend the English language; are educationally disadvantaged; homeless; the child of an active duty member of the armed forces, including the state military or reserves, ordered to active duty; the child of a member of the armed forces who was injured or killed while on active duty; is or ever has been in the conservatorship of the Texas Dept of Family and Protective Services or has been in foster care in another state or territory but currently lives in Texas; is the child of a personal eligible for the Star of Texas award as a peace officer, firefighter, or emergency medical first responder (Prekindergarten Registration & Enrollment, n.d.) These inclusive eligibility requirements account for situations that are not immediately affected by income or measurable by poverty levels. Our recommendations include Kentucky implementing similar eligibility requirements to include even more children in state-funded preschool education programs.

Connecticut offers two public options for families looking for pre-k: Even Start and the School Readiness Preschool Program. Even Start uses a family literacy model with an early childhood education component. At the same time, the School Readiness Preschool Program provides affordable and high-quality care and education in "high need" communities (School Readiness Preschool, n.d.). This program requires that at least 60% of the children enrolled must be at or below 75% of Connecticut's median income (School Readiness Preschool, n.d.). If looking

to improve education to improve family/parenting outcomes, literacy, and adult education, we recommend Kentucky explore a family literacy model, like Even Start (Even Start, n.d.).

Vermont, the top-performing state from our 11-state sample, implemented universal pre-k in 2014. Legislative Act 166 ensures statewide access to publicly funded pre-k programs. According to the legislative act, all pre-k programs, including Head Start and public programs, are expected to meet specific requirements to operate (Families of Prekindergarten Students, n.d.). Vermont universal pre-k is available to all three- and four-year-old children and five-year-old children not yet enrolled in kindergarten (Prekindergarten Rules, 2014). Florida also offers universal pre-k to all four-year-olds in the state; since the program began in 2005, over 2.6 million children have participated (What is Florida's Voluntary, n.d.).

Boosting Supplementary Funding for Pre-k Programs

The graph below shows the state pre-k spending per child enrolled. Connecticut, a top spender, offers two financial supplements to support early childhood education: Smart Start and state Head Start Supplement (School Readiness Preschool, n.d.). Smart Start is a grant funding program that supplements a new or existing pre-k program by increasing the number of spots available and supporting operational classroom costs (Smart Start, n.d.). School districts should apply for funds if they demonstrate the need to increase funds awarded each school year. There is a limit of $5,000 per student per school year, $75,000 per classroom, and $300,000 per district (Smart Start, n.d.). Between July 1, 2021, and June 30, 2024, twenty-three districts received $3,250,000 in Smart Start funding (Smart Start, n.d.). The other supplemental funding offered by Connecticut is the state Head Start Supplement offered to federally-funded Head Start Programs (State Head Start Supplement, n.d.). These funds can help expand services, such as adding a

summer program, expanding the hours offered for a pre-k program, or for innovative enhancement (state Head Start Supplement, n.d.).

Examples of innovative enhancement provided by the Connecticut Office of Early Childhood include collaborating with homeless shelters to recruit pre-k students, assessing trauma in students, encouraging nature-based play, enhancing dual literacy and learning, and collaborating with communities (State Head Start Supplement, n.d.). In 2022, Kentucky received $36 million from the U.S. Office of Early Childhood Development, Preschool Development Birth through Five following a $10.6 million grant in 2019 (Latek, 2022). Governor Beshear has stated his priority to create universal pre-k in Kentucky, but fully implementing this program may take years (Early Learning & Childcare, n.d.). Using these grant funds to supplement classrooms, expand program offerings, and initiate collaboration between school districts and local nonprofits, like in Connecticut, would benefit students and the community both in the short and the long term.

Figure G: Comparison of State Spending per Pre-k Child
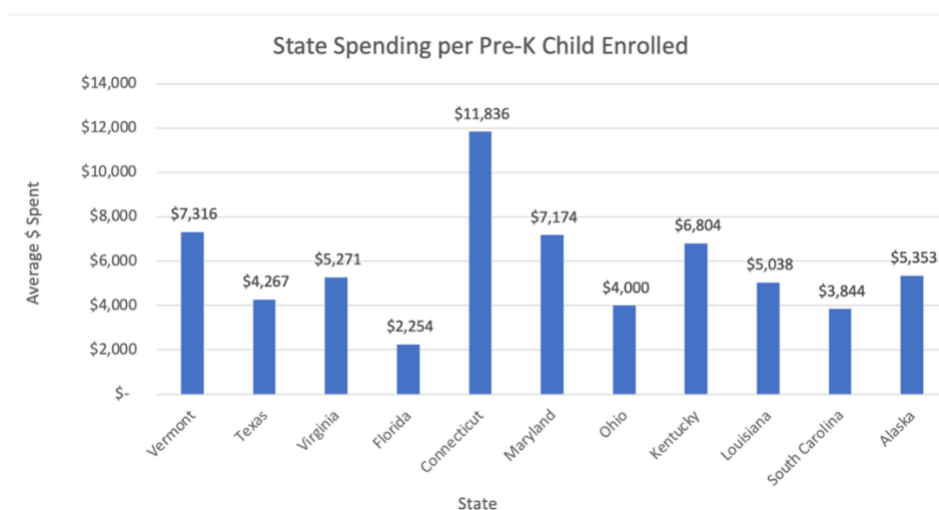
Requiring Bachelor's Degrees and Certifications for Pre-K Teachers

In our five highest "achieving" states since 2019, three states, Connecticut, Texas and Virginia, have enacted legislation outlining licensure-related teacher qualifications. According to

Connecticut House Bill No. 5279, The Office of Early Childhood issues early childhood teacher credentials to any person who either holds an associate degree with a concentration in early childhood education from an institution of higher education that is regionally accredited or an individual with a bachelor's degree with a concentration in early childhood education from an institution of higher education that is regionally accredited. Both options are subject to approval by the Connecticut Board of Regents for Higher Education --under the Office of Higher Education and the Office of Early Childhood.

In Virginia, the state has enacted two workforce and teacher license policies. Although identical, VA House Bill No. 319 and VA Senate Bill No. 616 address the teacher certification requirements for Virginia. Both bills require that a person seeking initial licensure with a certification in early/primary education preschool through grade three, elementary education preschool through grade six, and special education deaf and hard of hearing preschool through grade 12, or particular education blindness/visual impairments preschool through grade 12, must submit a qualifying score from a test of science-based reading research and evidence-based literacy instruction. In addition, licensure candidates must also complete training and study courses on attention deficit disorder and gifted education --including the use of multiple criteria to identify gifted students, child abuse recognition and intervention, methods of improving communication between schools and families, as well as ways of increasing family involvement in student learning at home and school. In addition to these courses, both Virginia bills express evidence of certification or training in emergency first aid, cardiopulmonary resuscitation, and the use of automated external defibrillators for anyone seeking a license to work in "preschool." Through these bills, the state Board of Education also outlines an alternate route to licensure for elementary education in preschool through grade six for outstanding situations.

In 2023, the state of Texas passed House Bill N0. 2729 that each teacher for Pre-k classroom must be certified by state requirements and possess an associate or bachelor's degree in early childhood education or a related field or possess a Child Development Associate credential or possess at least eight years experience of teaching nationally at an accredited child care or a Texas Rising Star Program. This bill places the importance of certification for teachers over earning a bachelor's degree in early childhood alone.

Although this is a small sample, the importance of teacher certification cannot be understated when examining "high-quality" pre-k programs. Despite conflicting research literature on the importance of a bachelor's degree plays for pre-k teachers, in the U.S. over 50% state funded pre-k programs recommending at least a Bachelor of Arts degree for lead teachers in early childhood classrooms (i.e., Georgia, Maine, and New Jersey) accept bachelor's degrees in fields unrelated to early childhood with supplemental early childhood courses shows the greater emphasis states puts on bachelor level degree education compared to certification or licensure. Our model shows the impact that a bachelor's degree has on students in poverty compared to others, and our top-performing states all go a step farther with policies requiring teacher certification as well as a bachelor's degree. These policies reinforce how teacher certifications and education at the postsecondary education level are important components to incorporate when defining "high quality" in early childhood education or developing a state-funded Pre-k program.

Implications for Kentucky.

The commonality with these state guidelines is that the basis for lead teacher employment, certification, or licensure is coursework based on early childhood development at the undergraduate or postgraduate level. States that accept bachelor's degrees in an unrelated field reinforce the expectation for postsecondary training. According to the National Center for

Children in Poverty, a report conducted by the National Research Council (2015) "recommended a BA degree requirement for lead ECE teachers;" however, with the stipulation that when considering licensure or certification for early childhood teachers, "degree preparation should be closely aligned with a set of ECE teacher competencies that would equip teachers to use age-specific practices and professional skills that promote children's optimal development." (National Center for Children in Poverty, n.d.).

Currently, Kentucky is a state that has bachelor-level recommendations, but the most significant difference between Kentucky and the top-performing states mentioned above is that currently Kentucky does not mandate teacher certifications. For the state to build a high-quality pre-k program, we recommend mandating a certification or licensure program for lead teachers. Further, we recommend that the state work to ensure that these standards are implemented with fidelity to ensure that all pre-kindergarten students in the state are taught by highly qualified teachers.

Enforcing Policies on Smaller Teacher-Child Ratios

Based on the data obtained from the NIEER Report, we have identified standard practices among the five states with the highest achievement of our eleven-state sample that connect back to our classroom condition analysis. Of our five states, Vermont, Virginia, Connecticut, and Florida limit their state-funded program classroom ratio at or below 1 teacher per 11 students, with the former three requiring a ratio of 1:10. Research has shown that smaller teacher-child ratios increase the opportunity for individualized educational experiences, leading to higher chances of healthy development and better child outcomes, and this finding is confirmed in our regression model. Kentucky meets this benchmark for their state-funded Pre-k programs with a requirement of 1:10. Based on our research, we recommend that Kentucky maintain this ratio, with procedures to ensure

it is implemented with fidelity, further increasing the state's opportunity to offer high-quality education to its early learners through increased teacher/child interactions.

Overall Recommendations:

Our review of the five comparison states with the highest average scores, as well as the findings from our regression model, formed the basis for the following recommendations for Kentucky's state-funded prekindergarten system. We make these recommendations based on the three themes highlighted in our regression model that appear to impact kindergarten readiness: economic conditions, including poverty and spending per student; teacher training and its relationship to poverty; and classroom conditions, including class size and teacher/child ratio.

Regarding economic conditions, including poverty and spending per student, we recommend a policy that increases the state's early childhood budget through supplemental funding to increase the cost per child spending levels beyond current state levels, allowing for increased access to more children in the state. Regarding teacher training, we recommend qualifications requiring bachelor-level education and a policy that develops and provides lead teacher state licensure and certification programs. As the data and research shows, children exhibit higher levels of development when learning in environments where the educators are highly skilled and competent in techniques and methods to support the development of each child in their classroom. Regarding the teacher/child ratio, we recommend a policy in which teacher-student ratios allow a more individualized focus and improved educational opportunities.

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Appendix A: Initial Regression Results

$$Y_{\%ChildrenKindergartenReady}=b_0 + \beta\chi_{MedianIncome} + \beta\chi_{AveragePerChildSpend} + \beta\chi_{TotalPopulation} + \beta\chi_{\%KidsinPoverty} +$$
$$\beta\chi_{AverageHours/Week} + \beta\chi_{Teacher:StudentRatio} + \beta\chi_{MaximumClassSize} + \beta\chi_{TeachersHaveBachelors} +$$
$$\beta\chi_{TeacherSpecializedTraining} + \beta\chi_{CoachingorContinuingEd} + \beta\chi_{HealthScreen} + + \beta\chi_{Urbanicity} + \varepsilon$$

Variables	% of Children Passing KRA	95% Confidence Interval	
Median Income of District	-0.000000247 (0.000000674)	-0.00000175	0.00000125
Total Population of District	0.0000000258 (0.0000000298)	-0.0000000405	0.0000000922
Estimated % of Children in Poverty in District	-0.6820117 * (0.2828031)	-1.312136	-05.1887
Average Per-Child Spending	-0.0000368 *** (0.00000149)	-0.0000401	-0.0000334
State-Specified Minimum Hours per Week	0.0051131 *** (.00001921)	0.0046852	0.0055411
Bachelor's Degree Required for Teachers	-0.2181799 *** (0.0200803)	-0.2629216	-0.1734383
Specialized Pre-k Training Required for Teachers	-0.0169206 (0.0146392)	-0.495388	0.0156977
Coaching Required for Teachers	-0.3194949 *** (0.0093364)	-0.3402977	-0.298692
Maximum Allowable Class Size			
22	0.2400447 *** (0.031755)	0.1692902	0.3107992
24	-0.00752 (0.0119)	-0.340349	0.0189949
Maximum Staff-to-Child Ratio			
11	-0.1802573 *** (0.0219333)	-0.2291277	-0.1313869
12	-0.3346056 *** (0.0081952)	-0.3528657	-0.3163455
Health Screenings Required for Students	0.1516869 *** (0.00872575)	0.1322408	0.1711329
Urbanicity			
1	-0.013373 ** (0.003921)	-0.0221343	-0.0046117
2	-0.0247274 * (0.0039321)	-0.0428969	-0.0065579
Constant	0.08286936 *** (0.0851835)	0.6388929	1.018494

Robust standard errors shown in parenthesis. $R^2 = 0.3629$ *** $p < 0.001$ ** $p<0.01$, * $p<0.05$

Appendix B: Regression Results, including the Interaction Term

$$Y_{\%ChildrenKindergartenReady}=b_0 + (\beta\chi_{\%KidsinPoverty} * \beta\chi_{TeachersHaveBachelors})\,\beta\chi_{MedianIncome} + \beta\chi_{AveragePerChildSpend} + \beta\chi_{TotalPopulation} + \beta\chi_{\%KidsinPoverty} + \beta\chi_{AverageHours/Week} + \beta\chi_{Teacher:StudentRatio} + \beta\chi_{MaximumClassSize} + \beta\chi_{TeachersHaveBachelors} + \beta\chi_{TeacherSpecializedTraining} + \beta\chi_{CoachingorContinuingEd} + \beta\chi_{HealthScreen} + \beta\chi_{Urbanicity} + \varepsilon$$

Variables	% of Children Passing KRA	95% Confidence Interval	
Median Income of District	-0.000000299 (0.000000429)	-0.000000657	0.00000126
Total Population of District	0.00000000187 (0.0000000284)	-0.0000000445	0.0000000819
Bachelor's Degree Required for Teachers	-0.3574621 *** (0.0300915)	-0.4245103	-0.290414
Estimated % of Children in Poverty in District	-1.028046 *** (0.1632582)	-1.391808	-0.6642846
(Bachelor's Degree) * (% of Children in Poverty)	0.7110816 *** (0.1743256	0.3226599	1.099503
Average Per-Child Spending	-0.0000418 *** (0.00000186)	-0.0000459	-0.0000376
State-Specified Minimum Hours per Week	0.0045461 *** (.00001921)	0.0041131	0.0049792
Specialized Pre-k Training Required for Teachers	-0.0218491 *** (0.00415)	-0.0310958	-0.0126024
Coaching Required for Teachers	-0.2922738 *** (0.0093364)	-0.3130393	-0.2715083
Maximum Allowable Class Size			
22	0.2390166 *** (0.0104117)	0.215818	0.2622153
24	0.019278 * (0.0074718)	0.0026297	0.0359263
Maximum Staff-to-Child Ratio			
11	-0.1815643 *** (0.0085979)	-0.2007216	-0.1624069
12	-0.3817543 *** (0.0096186)	-0.4031858	-0.3603228
Health Screenings Required for Students	0.1570889 *** (0.00872575)	0.1469881	0.1671897
Urbanicity			
1	-0.0141478 ** (0.004269)	-0.0236597	-0.0046359
2	-0.0272408 *** (0.0041198)	-0.0364204	-0.0180613

Constant	0.8947634 *** (0.0464057)	0.7913651	0.9981616

Robust standard errors shown in parenthesis. $R^2 = 0.3817$.   *** $p < 0.001$ ** $p<0.01$, * $p<0.05$

Appendix C: Quality Standards Checklist

Policy	State Pre-k Requirement
Early learning & development standards	Comprehensive, aligned with state infant & toddler and K–3 or college & career ready standards, aligned with child assessments, supported, and culturally sensitive
Curriculum supports	Approval process for selecting curricula and supports in place for curriculum implementation
Teacher degree	Lead teacher must have a BA, at minimum
Teacher specialized training	Lead teacher must have specialized training in a pre-k area
Assistant teacher degree	Assistant teacher must have a CDA or equivalent, at minimum
Staff professional development	Teacher and assistant teacher must receive at least 15 hours/year of in-service professional development and training, individualized annual professional development plans, and coaching
Maximum class size	Maximum number of children per classroom must be 20 or fewer
Staff-child ratio	Lowest acceptable ratio of staff to children in classroom (e.g., maximum number of students per teacher) must be 1:10 or better
Screening & referral	Screenings and referrals for vision, hearing, and health must be required
Continuous quality improvement system	Systematic structured observations of classroom quality and information collected is used for classroom/program improvement at the state and local levels